



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170001

Semester –VII

Subject Name: Summer Internship

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)		
0	0	4	2	0	0	80	20	100

The duration of internship will be two weeks. It will be after completion of 6th Semester and before the commencement of Semester VII.

Following five options can be opted by the students:

1. Offline internship in industry - Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by Government and written consent of the student and parents. Student is supposed to produce joining letter and relieving letter once the internship is over in case of Offline internship in any industry.
2. Online internship in industry / other agencies
3. Seminar by student under mentorship of a faculty. The topic shall be as per UG Syllabus topics
4. Preparation of consolidated report on survey of materials used in the respective branch of the student. The work should include the study of catalogues, price list specifications, properties, usage notes and other technical details and drawings etc, Work shall be carried out under the guidance of faculty. A detailed report shall be submitted. It shall be done by only one student. It is to be completed individually.
5. A Mini Project- on some suitable topic related to respective branch. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc depending on the branch of the student. Preferably a single student should do it.

Other guidelines:

- Student has to prepare detailed report and submit to his/her college. A copy of report can be kept in the departments for record.
- Each student must be assigned a faculty as a mentor from the college and an Industry expert as co-mentor.
- The evaluation of the work done by students will be carried out after 2 weeks by the internal and external examiner.
- External examiner will evaluate for 80 marks and internal examiner will evaluate for 20 marks.
- The presentation by student in the presence of all student is desirable.

Student should produce successful completion certificate in case of offline / online internship in industry.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174017

PROFESSIONAL PRACTICE AND VALUATION OF INFRASTRUCTURE

7th SEMESTER

Type of Course: **Core**

Prerequisite: **NIL**

Rationale:

To make student capable of developing approximate and detailed estimate of buildings and other civil infrastructures.

To make students understand various contracts, their suitability and the procurement process involved in construction projects

To carry out valuation of real estate and other infrastructure properties

Teaching and Examination Scheme

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	PA(M)	Viva	PA (I)		
3	0	2	4	70	30	30	20	150

Course Contents

Sr. No.	Topics	Hrs.
1	Introduction to estimates: Computation of areas and volumes of special solid shapes, Purpose of estimates, Type of estimates: Approximate estimate, Detailed estimate, Revised Estimate, Repair & Maintenance estimates, Contractors & Owners estimates, Construction cost index, Approximate estimation of buildings & other infrastructures	4
2	Detailed Estimates: Data required for detailed estimate, Quantity sheet, Quantity analysis of building and other important civil structures, Steel Quantity analysis of RCC elements/structures, Quantity analysis of structural steel truss and other elements, Quantity analysis of infrastructure elements like culverts/minor bridge, Water/Waste water system & roads	14
3	Rate Analysis and Estimate Preparation: BOQs, Rate Analysis of various items of work, Standard rates/SOR, Contingency items in estimates, Estimate preparation, Measurement of items of work (IS1200) and preparation of bills. Productivity Analysis: Factors impacting labour productivity, project documents (progress reports, daily reports, time sheets and labor records, etc.), Productivity analysis for different activities	6
4	Tendering and Contracting: Essentials of Contract, Various types of Civil Engineering contracts, Tendering process & tender documents, prequalification, Tendering: Process of tendering: Tender notice, Bid security, Prequalification process, Tender submission and evaluation, Security deposits/performance guarantee & Defect liability, Contract agreement & contract documents	4



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5	Specification and Conditions of Contract: Specification for material and workmanship, General and special conditions of contract for Time delay, Scope changes, Extra claims, Dispute resolution & arbitration, Termination of contract.	4
6	Valuation: Valuation-Definitions of value, Price and cost, Depreciation, Sinking fund, Different type of values and their significance, Factor affecting value, Rent and standard rent, Years purchase , Valuation tables, Easement, types of easements, Significance of easement in valuation, Estimation of values of different types of buildings, land and other civil infrastructures	10
Total		42

Reference Book(s)

- (1) B. N. Dutta, Estimation and Costing In Civil Engineering, Ubs Publishers Distributors, Ltd.
- (2) S. C. Rangwala, Estimating and Costing, Charotar Publishing House.
- (3) G. S. Birdi, Textbook of Estimating & Costing, Dhanpat Rai and Sons, Delhi.
- (4) M. Chakraborti, Estimating, Costing, Specification and Valuation.
- (5) P.W.D. Handbook and SOR, IS Code – 1200.
- (6) A. S. Kotadia, Professional Practice and Valuation, Mahajan Publications.
- (7) S. C. Rangwala, Valuation of Real Properties, Charotar Publication

Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Preparing approximate estimate and detailed estimate of building and other civil infrastructures	45
CO-2	Develop justified rate of a particular construction item with suitable assumptions.	15
CO-3	To understand tender processing and different contract conditions	15
CO-4	Estimation of values of different types of buildings, land and other civil infrastructures	25

List of Practical

1. Collection of Different Rates & Specifications of construction items
2. Comparative Rate Analysis of selected items
3. Visit of Residential Building and Quantity Analysis
4. Visit of RCC Project site and Steel Quantity Analysis
5. Visit of Steel Structure and Quantity Analysis
6. Measurement & Bill preparation of Building/Civil Infrastructures
7. Specification Preparation



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8. Study of Tender Document & Contractual Risk Assessments
9. Valuation exercises for real estate and civil infrastructures
10. Estimate Preparation Project

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	20	20	25	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above

List of Open Source Software/learning website: www.nptel.iitm.ac.in/courses/



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174018

Semester –VII

Subject Name: Design of Steel Structures

Type of course: Professional Core Course

Prerequisite: Mechanics of solid, Structural Analysis.

Rationale:

Many civil engineering structures are made up of steel. Knowledge of designing and detailing of steel structures is very important for civil engineers to make structures safe and serviceable during its life span. Limit State design philosophy is currently used worldwide for design of steel structures and its various components. Precise and correct detailing of structural drawing is necessary to get the correct behavior of structures and leads to smooth construction of structures. This course will provide detailed knowledge of design and detailing of steel structures as per Indian standards and conceptual understanding and applications of design of steel structures.

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)		
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Steel: Introduction of Steel as construction material. Properties of Structural Steel, Steel Sections, I.S. Specifications	02
2	Design Approach: Design requirements: Strength, Stiffness, Stability, Serviceability Design philosophy: Elastic method, Plastic method and Limit state method.	03
3	Connections: Introduction to type of connections in steel structures i.e. rivet connections, bolted connections and welded connections. Types of joints and its design for strength, efficiency. Mode of failure of connections. Design of rivet connection, bolted connection, and welded connection. Design of eccentric connection.	08
4	Tension Members: Introduction, Types of tension members, Permissible stress in member, Slenderness ratio, Net sectional area, Lug angle, Gusset plate, Basic of current codal provision for tension member design. Design of tension member subjected to axial load, Design of tension member subjected to combine action of axial tension and bending. Concept of shear lags effect.	07



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5	Compression Members: Introduction to theory associated with columns i.e. Euler's Theory, Rankine's Theory etc., and Types of compression members. Mode of failure of column member, Effective length, Slenderness Ratio, Basic of current codal provision for compression member design. Design of axially loaded compression member, of built-up compression members: Laced and Battened Columns, Design of eccentric loaded compression members. Design of Column Bases. Design of Column Splices.	08
6	Flexural Members: Introduction, types of section used in flexural member. Lateral stability of beam, Concept of web buckling, web crippling diagonal buckling. Design of laterally supported and unsupported beams, built up beams, beams subjected to uniaxial and biaxial bending, Design of flange and web splices, Design of plate girder, Design of gantry girder.	08
7	Roof Truss and Pre-Engineered Steel Structures: Introduction to types of roof truss, bracings, purlins, sheeting. Loads and load combinations, Analysis and design of roof members, end bearing. Introduction to Pre-Engineered Steel Structures, Applications, Advantages of PEB over conventional steel buildings.	06
	Total	42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	20	20	20	25	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

- [1] N. Subramanian, Design of Steel Structures, Oxford University Press, 2008.
- [2] Bhavikatti S. S., Design of Steel Structures, Oxford University Press.
- [3] Segui W T, Design of Steel Structures, Cengage Learning.
- [4] S K Duggal, Design of Steel Structures, Tata McGraw Hill
- [5] S. A. Raz, Structural Design in Steel, New Age International Publisher, 2002.
- [6] M. Edwin, J. Gaylord and J. E. Stallmeyer, Design of Steel Structures, McGraw-Hill, 1991.
- [7] P. Dayaratnam, Design of Steel Structures, S. Chand & Co., 2003.
- [8] S. M. A. Kazimi and R. S. Jindal, Design of Steel Structures, Prentice Hall of India Pvt Ltd, 1988.



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Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the behavior and properties of structural steel, various design philosophy to be used in the design of structural steel elements and Use of the relevant codes of practice for design.	10 %
CO-2	Understand the structural behaviour of structural steel elements in tension, compression, flexure, and torsion based on limit state method under various loads and load combinations.	10 %
CO-3	Able to design of various steel structure elements such as Connections, Tension members, Compression members and its base, Flexural members etc. as per IS codal provisions and guidelines.	60 %
CO-4	Able to design a various type of roof trusses and procedure for designing of PEB structures.	20 %

Term-Work:

The students will have to

- Carry out full design of any steel structures and prepare design report & detailed drawings in A2 size drawing sheet
- Solve at least five design examples from remaining topics (not covered in full design) and draw sketches of various structural components with proper detailing in sketch book/A3 size sheet.
- Practical examinations shall consist of oral based on term work and above course. Design based problem/ Open ended problem may also considered as a part of Term-work.

Software based Design problem/ Open ended problem

A group of students must undertake one open ended problem/design problem. Few examples of the same are given below:

1. Development of spread sheets for design of various structural steel elements like connections, tension member, compression member, flexural member, column base etc.
2. Design of any one steel structure from the course using any open-source / professional software and/or self-developed spread sheet/programs.
3. Site visit related to construction stages and report preparation.

Practical examinations shall consist of oral based on term work and above course.

List of Open Source Software/learning website:

1. <http://nptel.ac.in>
2. www.steel-insdag.org
3. www.ocw.mit.edu



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174019

Semester – VII

Subject Name: Pavement Analysis and Design

Type of course: Professional Elective Course

Prerequisite: Highway and Traffic Engineering

Rationale:

The Indian Government has set ambitious plans for upgrading of the National Highways in a phased manner. It is required to upgrade the knowledge of current practices in design of pavement structures. The objective of the course is to introduce the basic concepts of stress analysis and design of flexible and rigid pavement structure as per IRC standards and MORTH specifications. It includes the study of various types of failures of pavement and its remedial measures. It is necessary to reduce the cost of repairs and maintenance. Various evaluation techniques and overlay design are also covered in the course.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Factors Affecting Pavement Design: Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane Distributions & Vehicle Damage Factors, Effect of Transient & Moving Loads.	6
2	Stresses In flexible Pavement: Vehicle-Pavement Interaction: Transient, Random & Damping Vibrations, Steady State of Vibration, Experiments on Vibration, Stress Inducing Factors in Flexible and Rigid pavements; Stress In Flexible Pavements: Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental Design Concepts.	6
3	Stresses in Rigid Pavements: Westergaard's Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, and Stresses in Dowel Bars & Tie Bars.	6
4	Design of Flexible Pavements: Factors affecting Design. Deflection studies in Flexible Pavements. Present Serviceability Index. IRC guidelines and MORTH specifications for Flexible Pavements. Pavement Performance and methods- AASHTO and Asphalt Institute	8



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	Method.	
5	Design of Rigid Pavements: Factors affecting Design - Wheel load & its repetition, subgrade strength & proportion, strength of concrete - modulus of elasticity. Reinforcement in slab. Design of joints. Design of Dowel bars. Design of Tie bars. IRC and AASHTO methods of Rigid Pavement design.	8
6	Pavement evaluation and strengthening: Failures in flexible and rigid pavements, pavement evaluation, deflection survey, serviceability rating techniques, strengthening techniques, maintenance, Need for Overlays, Overlays design methods for Flexible and Rigid pavements, replacements. Surface and sub-surface drainage design.	8
	Total	42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	20	20	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Yoder, E.J., and Witczak, 'Principles of Pavement Design', 2nd ed. John Wiley and Sons, 1975.
2. Yang, 'Design of Functional Pavements', McGraw Hill Book Co.
3. Khanna S. K. and Justo C. E. G., 'Test Book of Highway Engineering' Nemchand brothers, Roorke- 2004.
4. Y. H. Huang, Pavement Analysis and Design. Prentice Hall, Englewood Cliffs, New Jersey, USA, 1993, ISBN-0-13-655275-7
5. AF Stock, Concrete Pavements, Elsevier, Applied Science Publishers.
6. Micheal Sargious, Pavement and Surfacing for Highway & Airports, Applied Science Publishers Limited.
7. Haas and Hudson 'Pavement Management System', McGraw Hill Book Co., New York.
8. HRB/TRB/IRC/International Conference on Structural Design of Asphalt Pavements.
9. IRC- 37, 2001, 2012, IRC - 58-2002, 2011, Relevant IRC and MORTH Publications
10. CMA Hand Book
11. Sharma & Shrama, Principles and Practice of Highway Engg.
12. H. N. Atkins, Highway Construction and Maintenance, Soils, and Concretes, Reston Publishing Company, Reston VA, 1983.



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13. J.P.Watson, Highway Construction and Maintenance, Longman Scientific and Technical, New York, 1989.
14. Relevant BIS, AASHTO and PCA Specifications and Guidelines.
15. Kadiyali L.R.and Lal, N. B., Principles & Practice of Highway Engineering, Khanna Publishers, Delhi.
16. Partho Chakraborty and Animesh Das, Principles of Transportation Engineering, PHI
17. F. L. Mannering, W. P. Kilareski and S. S. Washburn, Principles of Highway Engineering and Traffic Analysis. Wiley India Pvt. Ltd., New Delhi.

Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand various factors affecting pavement design	15
CO-2	Carry out stress analysis in flexible and rigid pavements	30
CO-3	Design flexible and rigid pavements as per IRC and MORTH guidelines	40
CO-4	Evaluate the flexible and rigid pavement condition and design overlays for them.	15

List of Experiments:

1. Plate Bearing Test.
2. Lab and Field CBR Test.
3. Pavement Evaluation by Benkelman Beam/Falling weight deflectometer Method.
4. Road Unevenness Measurement by Bump-Integrator.
5. Evaluation of Pavement Roughness by Roughometer / Profilometer.
6. Marshall Stability Test

Major Equipment:

1. CBR (Lab and Field) testing machine
2. Benkelman Beam / Falling weight deflectometer
3. Bump integrator
4. Marshall stability testing machine

List of Open Source Software/learning website:

1. IITPAVE – IIT Khargpur
2. www.nptel.iitm.ac.in/courses/



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174020

Semester – VII

Subject Name: Analysis and Design of Hydraulic Structures

Type of course: Professional Elective Course

Prerequisite: Water Resource Engineering and Hydrology

Rationale: To develop understanding about irrigation engineering works like weir/barrage, storage and outlet works, distribution works, regulating and cross drainage works and importance of drainage in irrigated areas. To learn how to design irrigation structures, such as headworks (weirs, barrages), canals, falls, cross drainage works and gravity & embankment dams.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Synthetic design storms & Estimation of peak discharge	03
2	Urban storm drainage design, Culvert design, Detention storage design,	04
3	Watershed: management, modeling, system approach, structure, hydrologic models, SCS-CS method, etc.	04
4	Design of water distribution: network-analysis, optimization, Hazen William formula, Hardy Cross method, etc.	03
5	Design of canal head works, distribution works, diversion headworks-weir, barrage, and cross-drainage works	05
6	Investigation for dam-site, Different types of dams, selection of types of dams, Selection of site for dam	03
7	Concrete Dam Engineering: Loading-Concepts and criteria, Gravity dams analysis design features, galleries, joints, keys, water seals, control of cracking, Arch and buttress dams.	05
8	Dam and outlet works: Design of spillways, energy dissipaters, etc	03
9	Canal falls: types, principles of design, design procedures, etc.	05
10	Computer aided design (application of CAD).	07
	Total	42



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Subject Code: 3174020

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	15	20	20	20	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Irrigation Engineering and Hydraulic Structures- Dr S. K. Sharma, S Cahnd Publication
2. Dr.P.N.Modi, Irrigation Water Resources.
3. Dr. B. C. Punmia, Pande B B, Ashok kumar Jain, Arun Kumar Jain, Irrigation & Water Power Engineering, .
4. S. K. Garg, Irrigation and Hydraulic Structures.
5. Varshney & Gupta, Theory and Design of Hydraulic Structures.
6. V. T. Chow, David Maidment, and Larry Mays, Applied Hydrology, Tata McGraw Hill, New Delhi, India.
7. Larry W. Mays, Hydraulic Design Handbook, McGraw Hill.
8. Richard H. McCuen, Hydrologic Analysis and Design, Prentice Hall, New Jersey, USA.
9. Serge Leliavsky, Design text books in Civil Engineering.
10. C.B.I. Publication No.12 of Government of India
11. Bharat singh, Irrigation Engineering.
12. Relevant Indian standards
13. Larry Mays, Water Resources Engineering.
14. Novak, Hydraulic Structure.
15. G. L. Asawa, Irrigation Engineering.

Course Outcomes: After studying this subject, students will be able to design

Sr. No.	CO statement	Marks % weightage
CO-1	Water distribution network	30
CO-2	Canal head works, Distribution works, Drainage system	30
CO-3	Gravity dam, Earthen dam, Spillways and Energy dissipation work	40



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List of Experiments:

- Water distribution network design by Hardy Cross method and validation through Water Hammer (Bentley Software)
- Drainage system design
- Calculation of forces acting on gravity dam as per IS-6512
- Stability analysis of gravity dam
- Design of Gravity dam
- Design of Spillway
- Preliminary section of earth dam and design of earth dam
- Filter design for earth dam
- Stability analysis of earth dam
- Location of phreatic line in earth dam section with horizontal filter and without filter
- Design of canal falls
- Design of diversion headworks

List of Open Source Software/learning website:

- ESRI ArcGIS/QGIS,
- Matlab/Octave,
- Bentley's Haestad Methods
- NPTEL



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174021

Semester – VII

Subject Name: Repair and Rehabilitation of Structures

Type of course: Professional Elective Course

Prerequisite: Concrete technology, Analysis of structures, Design of structures.

Rationale:

Civil engineering structures have always been the first choice for the construction industry world over. Concrete is composite material has proved its robustness and versatility, however concrete structures are subjected to constant deterioration due to effects of ageing, inadequate maintenance, severe environmental exposure, penetration of catalytic agencies such as moisture, gases like CO₂ & oxygen, chloride ions, industrial pollutants, abuse (over-used and misused) etc. This deterioration needs to be timely arrested before it leads to irreversible damage making it imperative to repair and upgrade (retrofit/strengthening) the current stock of deteriorated and deficient structures. This course has been designed with an aim to give the students an insight into the subject of concrete repair, its protection and strengthening. This subject also provides conceptual understanding and applications of repair and retrofitting materials and techniques used in existing undamaged/damaged concrete structures.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	1	0	4	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Introduction of health monitoring of civil structures, Need and objectives of condition assessment of structures, Overview of various evaluation techniques for evaluating performance of structures. Introduction of performance indices or rating system of the structures.	4
2	Durability and serviceability of structures: Construction materials characteristics and properties, Quality assurance criterion of construction materials and construction practices, Factors influencing durability and serviceability of the structures. Stages of distress in structures.	6
3	Condition assessment of structures: Condition Survey: Preliminary Inspection, Planning of condition assessment of the structure, Visual Inspection, Field/Laboratory Testing, damage rating system of the structures, considerations for repair strategy. Evaluation techniques for condition assessment: Concrete Strength Assessment: Rebound hammer test, Ultrasonic pulse velocity test, Penetration resistance, Pullout test, Core sampling and testing. Chemical Tests: Carbonation test, Chloride content, Sulphate attack test	8



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	Corrosion Potential Assessment: Cover meter survey, Half-cell potential survey, Resistivity measurement.	
	Fire Damage Assessment: Differential Thermal Analysis (DTA), X-ray Diffraction (XRD) Structural Integrity/Soundness Assessment: Radiography, Impact-echo test, Dynamic Testing of Structures Present condition of structures: Rating system of the structure.	
4	Selection of repair materials for concrete: Essential parameters for repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials Materials for repair: Premixed cement concrete/mortars, Polymer modified mortars and concrete, Epoxies and epoxy systems including epoxy mortars/concretes, Polyester resins, Surface coatings, Grouting materials, Bonding agents.	5
5	Rehabilitation and retrofitting methods: Introduction, Repair options, Important factors to be considered for selection of repair methods, Performance requirements of repair systems, Repair stages. Repair Methods: Repairs using mortars, Dry pack and epoxy bonded dry pack, Pre-placed aggregate concrete (PAC), Shotcrete, Concrete replacement, Epoxy bonded concrete, Silica fume concrete, Polymer concrete system, Strengthening concrete by surface impregnation using vacuum methods, Thin polymer overlays, Thin epoxy overlay, Resin/polymer modified cement slurry injection, Protective seal coats on the entire surface, Ferrocement, Plate bonding, RCC jacketing, Propping and supporting, Fiber wrap technique, Foundation rehabilitation methods, Chemical and electro-chemical methods of repair	7
6	Repair/Rehabilitation Strategies: Stress reduction, Repair/Strengthening of columns, beams, slabs, cracks, joints, masonry, foundation, base isolation. Structural repair work and its specifications: General, Surface preparation, Crack/Honeycomb area repair, Bonding coats, Structural repair items, Curing, Water proofing & protective coatings, Masonry repairs, Chhajja/sunshades repair, Testing of materials and Pre /Post repair testing of structure.	6
7	Strengthening of Earthquake damaged buildings. Condition assessment of buildings, Retrofit of non-engineered buildings, Retrofit of masonry buildings, Retrofit of historical and heritage structures, Retrofit of steel buildings, Retrofit of foundations, efficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance the seismic resistance of structures, Advanced techniques for making seismic resistant structures.	6
	Total	42



GUJARAT TECHNOLOGICAL UNIVERSITY

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Subject Code: 3174021

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	25	25	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. S. Champion, Failures and repair of concrete structures, John Wiley and Sons, 1961
2. Pankaj Agarwal, Manish Shrikande, "Earthquake resistant design of structures", PHI, 2006.
3. Peter. H. Emmons, Concrete repair and maintenance Illustrated, Galgotia publications Pvt. Ltd., 2001.
4. Noel P. Mailvaganam, Repair and protection of concrete structures, CRC Press, 1991.
5. R. N. Raikar, Diagnosis and treatment of structures in distress, Published by R & D Centre of Structural Designers and Consultants Pvt. Ltd, Mumbai.
6. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India
7. Handbook on SEISMIC Retrofit of buildings, CPWD, Government of India
8. A. Chakrabarti et.al, Handbook on seismic retrofit of buildings, Narosa Publishing House, 2010.

Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand causes of various distress / damages to different structures.	30
CO-2	Assess damage level of structures.	30
CO-3	Select appropriate repair / retrofitting material.	20
CO-4	Select best technique for repair / retrofit the existing structure.	20

Open Ended Projects:

A group of students will take up conditional assessment of different structures such as residential, commercial, industrial, and government buildings, private structures (old & new construction both) etc. Prepare a detailed report of Structural Audit of respective structures, which includes buildings surveyed, visual inspection data sheets, highlighting all the defects/deterioration seen through photographs, proposed repair, or strengthening or rehabilitation strategies and its implementation procedures.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174022

Semester – VII

Subject Name: Airport and Seaport Engineering

Type of course: Professional Elective Course

Prerequisite: Nil

Rationale:

Safe, timely and economic transportation of passengers and goods is necessary for social and economical development of any region or nation. Roads and railways are important for the surface transport, whereas for the long distances, fast movements are possible by airway transport and for the large quantity of cargo movement over long distances; waterway transportation is the most economical mode. Planning, design, construction and maintenance of airport components like runway, taxiway, apron, terminal building and other navigation aids are important for the civil engineering. Similarly, planning, design, construction and maintenance of seaport components like harbor, docks, breakwaters, wharf, quay, jetty, transit sheds, warehouses, loading and un-loading devices, dredging, other navigation aids are also essential for the civil engineering. Therefore, this subject is aimed to provide the clear understanding of the Airport and Seaport components.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	1	0	4	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
A	Airport Engineering	
1	Introduction and Planning: History, development, policy of air transport, air-transport authorities, air crafts and its characteristics, airport classifications, regional planning-concepts and advantages, location and planning of airport elements, estimation of future air traffic, development of new airport, requirements of an ideal airport layout.	3
2	Run Way and Taxiway Design: Wind rose and orientation of runway, factors affecting, geometrics elements, layout, exit taxiway, turn around facility. Aprons, aircraft parking configurations and parking systems ,hanger-site selection, planning and design considerations, Fuel storage area, blast pads, wind direction indicator	6
3	Terminal Area Design: Elements and requirements, terminal building functions, space requirements, location planning concepts, vehicular parking area and Circulation network. passenger requirements at terminal building	4



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174022

4	Grading and Drainage: Airport grading, importance, operations, airport drainage aims, functions, special characteristics, basic requirements, surface and subsurface drainage systems.	5
5	Air Traffic Control and Visual Aids: Air traffic control objectives, control system, control network-visual aids-landing information system, airport markings and lighting	3
B	Seaport Engineering	
1	Introduction to Seaport: History and policy, classifications, major ports in India, Seaport components, ship characteristics	2
2	Design of Seaport Structures: Wind, waves, tides formation and currents phenomena, their generation characteristics and effects on marine structures general design aspects, breakwaters - function, types general design principles, wharves, quays, jetties, piers, pier heads, dolphin, fenders, mooring accessories, IS provisions	6
3	Port Planning - Amenities & Operations: Characteristics of good seaport and principles of seaport planning, size of seaport, site selection criteria and layout of seaport, Dry ports, Bulk cargo, Transshipment ports, Port of call, Surveys to be carried out for seaport planning, Ferry, Transfer bridges, floating landing stages, transit sheds, warehouses, cold storage, aprons, cargo handling equipment, purpose and general description: stack area, single point mooring, IS provisions	8
4	Navigational Aids: Channel and entrance demarcation, buoys, beacons, light house electronic communication devices.	2
5	Seaport Maintenance: Coastal protection-purpose and devices, dredging, dredgers-types and suitability	3
		42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	15	20	20	20	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Dr. S. K. Khanna, M.G.Arora and S.S. Jain, Airport Planning & Design, Nem Chand & Bros.,Roorkee
2. G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
3. R. Srinivasan and S. C. Rangwala, Harbour, Dock and Tunnel Engineering, 1995, Charotar



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering Subject Code: 3174022

Pub.House, Anand

4. S. P. Bindra, A Course in Docks and Harbour Engineering, 1992, DhanpatRai & Sons, NewDelhi
5. Airport Engineering, Charotar Publishing House Pvt. Ltd, Anand
6. IS Codes: 4651 (Part I to V), 7314, 9527 (Part I, III, IV, VI), 10020 (Part IV).

Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	understand important planning concepts of airports and sea ports	30%
CO-2	know important functional components of airports and seaports	30%
CO-3	understand important design concepts of airports and sea ports components	40%

Tutorials based on:

1. Forecasting of Cargo, Passengers for the Airport and Seaport
2. Windrose diagram and orientation of runway
2. Lay out planning of Airport and Seaport
3. Components design of Seaport Infrastructure using IS codes
4. Components design of Airport Infrastructure
5. Grading and drainage plan of Airport
6. Earthwork computation for the Airport site

Major Equipment: Nil

List of Open Source Software/learning website: www.nptel.iitm.ac.in/courses/



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174023

Semester – VII

Subject Name: Analysis and Design of Offshore Structures

Type of course: Professional Elective Course

Prerequisite: Structural analysis, Design of steel structures

Rationale: The need for qualified off-shore structural personnel are rapidly increasing as the oil industry moves into deeper water in the search for additional supplies of oil and gas, new technology is emerging at a rapid pace for the development of new concepts for off-shore platforms. It requires large scale planning, design and construction. It requires huge amount of investment. Precise engineering skill is required for the planning, design and construction and maintenance of off-shore structures. To develop understanding of off-shore structures, the subject covers the fundamental knowledge of various important elements like Fixed platforms, Compliant towers, Floating structures, their types, analysis, design, maintenance, etc.

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)	
3	1	0	4	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	Types of offshore structures and conceptual development (Offshore Structural systems – Jacket, gravity, tension leg etc)- Loads on Offshore Structures, Wind Loads; Wave and Current Loads; Calculation based on Maximum base Shear and Overturning Moments; Design Wave heights and Spectral Definition; Hydrodynamic Coefficients and Marine growth; Fatigue Load Definition and Joint Probability distribution; Seismic Loads.	10
2	Concepts of Fixed Platform Jacket and Deck Jacket concepts, redundant framing arrangement; Launch and Lift jackets; Simple Deck configurations for Lift and float-over installations; In-service and Pre-service Loads and analysis	8
3	Steel Tubular Member Design Principles of WSD and LRFD; Allowable stresses and Partial Safety Factors; Tubular Members, Slenderness effects; Column Buckling, Design for Hydrostatic pressure; Design for combined axial and bending stresses (API RP2A guidelines).	10
4	Tubular Joint Design for Static and Cyclic Loads Simple tubular joints, design using allowable loads; stress concentration factors; S-N curves and fatigue damage calculations. Offshore drilling Underwater welding.	6
5	Corrosion - Corrosion mechanism - Types of corrosion - Offshore structure corrosion zones – Biological corrosion - Preventive measures of Corrosion - Principles of cathode protection systems - Sacrificial anode method and impressed current method – Online	8



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174023

	corrosion monitoring - Corrosion fatigue.	
	Total	42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	25	20	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. S.K. Chakrabarti, Hydrodynamics of Offshore Structures, Springer-Verlag
2. S.K. Chakrabarti, Handbook of Offshore Engineering, Elsevier, 2005.
3. B. Gou, S. Song, J. Chacko and A. Ghalambor, Offshore pipelines, GPP Publishers, 2006 Structural Stability
4. Faltinsen, O. M. *Sea Loads on Ships and Offshore Structures*. Cambridge, UK: Cambridge University Press, 1993. ISBN: 9780521458702.
5. Sarpkaya and Issacson - "Fluid loading on offshore structures "
6. DNV – Rules for design, construction and inspection of fixed offshore structures
7. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
8. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.
9. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.
10. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
11. Reddy, D. V & Arockiasamy, M., Offshore Structures Vol.1 & 2, Kreiger Publ. Co.1991.
12. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
13. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.
14. Lewis, E. V., ed. *Principles of Naval Architecture*. Jersey City, NJ: Society of Naval Architects and Marine Engineers, 1988. ISBN: 9789991181417.
15. Paik, Jeom Kee, and Anil Kumar. *Ship-shaped Offshore Installations: Design, Building, and Operation*. Cambridge University Press, 2007. ISBN: 9780521859219.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering Subject Code: 3174023

Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	List and understand the classification of offshore structures	30
CO-2	Develop the conceptual clarity in design of offshore structures	40
CO-3	Comprehend the hydrodynamic studies	10
CO-4	Know about corrosion mechanism and its monitoring.	20

List of Tutorials:

- Determination of Loads:
 - Gravity loads
 - Environmental loads
 - Load combination
- Design of Structural steel members
- Corrosion estimation
- Simulation
 - Geometry simulation
 - Foundation simulation
 - Load simulation
- Dynamic analysis
- Fatigue analysis
- Ship impact analysis

Major Equipment: Nil

List of Open Source Software/learning website:

<http://www.dnv.com/software/systems/sesam/programModules.asp>
<http://www.wamit.com/>
http://oceanworld.tamu.edu/resources/ocng_textbook/PDF_files/book.pdf.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174024

Semester – VII

Subject Name: Computer Aided Structural Design

Type of course: Professional Elective Course

Prerequisite: Mechanics of Solids, Fundamental Structural Analysis, Advance Structural Analysis

Rationale: Computer Aided Structural Design subject provides conceptual understanding of analysis of structures with matrix methods and its applications for development of program/ tools/ software. The course provides an excellent grounding in the fundamentals of structural engineering subjects. It also engages in a comprehensive study of computer science subjects such as programming, databases, graphics, visualization, etc. This is an innovative course focused on the combination of recent advances made in the field of structural engineering and computer science. It also provides the students a clear understanding of the structural response and help for preparing their own programs for analysis of skeletal structures or to learn how that is done.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Principles of Virtual work, Basic concepts of flexibility and stiffness. Types of skeletal structures, Internal forces, and deformations. Introduction and applications of flexibility method and stiffness method to analyze beams, Trusses, and plane frames.	5
2	Matrix concepts and Matrix analysis of structures: Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; eigenvalues and eigenvectors. Coordinate systems; displacement and force transformation matrices, Contra- gradient principle; element and structure stiffness matrices. Element and structure flexibility matrices; equivalent joint loads; Stiffness and flexibility approaches.	5
3	Stiffness Member Approach: Analysis of Continuous beam, Plane truss, Plane frame and Composite structures including secondary effects such as Temperature variations, Pre-strains, and Restrained displacement; Programming direct stiffness method.	18
4	Special Problems: Member discontinuities, Non-prismatic members, curved members, beams on elastic supports, semi-rigid connections, effect of shear deformations by stiffness method, Sub-structure analysis and symmetry concepts.	4
5	Programming: Analysis of structures using C++ Application: Excel spread sheets for the design of (1) Reinforced Concrete members like slabs, beams, columns, isolated, footings etc. (2) Steel members like Beam/Girders, Compression & Tension members, Connections etc.	6



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174024

6	Software Usage: Modeling (Skeletal members, Joints, Material specification, Loadings), analysis (Forces, Deflection, Stability, Displacement, stresses) and design of frame structure using tools/software.	4
Total		42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	25	25	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Weaver W. and Gere J. M., "Matrix Analysis of Framed Structure", CBS Publishers, Delhi.
2. Ghali and Nevelle, "Structural Analysis", Spon Press, London.
3. Aslam Kassimali, "Matrix Analysis of Structures", Cengage Learning, USA.
4. H. Kardestuncer, "Elementary matrix analysis of structures", Mc-Graw Hill, USA.
5. Meghre and Deshmukh, "Matrix Analysis of Structures", Charotar Publication, Anand.
6. Beaufait Rowan, "Computer Methods of Structural Analysis", Hadley and Heckett.
7. Graves Smith, "Linear Analysis of Frame works", Ellis Horwood Ltd.
8. Fleming J.F, "Computer Analysis of Structural Systems", McGraw-Hill Education.
9. McGuire, Gallagher and Ziemian, "Matrix Structural Analysis", John Wiley & Sons, Inc. 2000.
10. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House, 2009.
11. Devdas Menon, "Structural Analysis", Narosa Publishing House, 2008.
12. Amin Ghali, Adam M Neville and Tom G Brown, "Structural Analysis: A Unified Classical and Matrix Approach", Sixth Edition, 2007, Chapman & Hall.
13. E. Balaguruswamy, "Programming in C++".
14. Herbert Schildt, "Teach yourself C++".
15. Robert Lafore, "Object Oriented programming in Turbo C++".
16. Voisinet, "Introduction to Computer Aided Drafting".
17. Syal & Gupta, "Computer programming and engineering analysis".

Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements.	20
CO-2	Understand stiffness matrices to solve problems in beams, frames and trusses.	30
CO-3	Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses and solving problems involving temperature changes and lack of fit.	30
CO-4	Develop computer programs for structure design & structural elements. Use software tool for analysis and design.	20



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3174024

Software based Experiments/Tutorials:

- Analysis of beams with stiffness member approach
- Analysis of trusses with stiffness member approach
- Analysis of frames with stiffness member approach

Open Ended Problems:

- A group of students has to model and analyze one frame structure using open-source/ professional software and design of members on the basis of analysis output and cross check it with software design.
- Development of computer program for design of structure elements such as beam, Column, slab, footing etc.

List of Open-Source Software/learning website:

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

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

www.mastan2.com/ www.scilab.org/

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174025

Semester – VII

Subject Name: Contract Administration and Management

Type of course: Professional Elective course

Prerequisite: Nil

Rationale: In the Civil engineering construction works, it is essential to have understanding of tender processing, analyzing/assessing various contractual provisions in a tender documents and developing estimate and bidding strategy. It is also necessary to familiarize with stake holder & contract management processes involved in construction projects for its timely implementation. Hence, syllabus of this subject is framed to impart the knowledge of types of construction contracts, conditions of contracts i.e. general, specific, breach/void of contracts, penalties, responsibilities and duties of the parties involved in construction, management, arbitration & litigations, prevailing acts, Legal rules, etc.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	0	70	30	00	00	100	

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Contract: Definition and legal issues in contract, Essential requirement of a contract as per Indian Contract Act 1872, Legal enforceability of contract, Characteristics of a good contract, Breach & termination of contracts, Major stake holders in construction contracts.	5
2	Construction Contracts: Type of construction contracts: Lump sum contracts, Fixed price contracts, Percentage rate contracts, Cost plus contracts, Target contracts, Design-Build contracts, Turn-key contracts, BOT contracts.	9
3	Tendering: Process of tendering: Tender notice, EOI, RFQ & RFP, Bid security, Prequalification process, Bidding Models and bidding strategy, Tender submission and evaluation, Tender rejection, Security deposits/performance guarantee & Defect liability, Contract agreement and contract documents.	10
4	Conditions of Contracts: General conditions & special conditions, Contract conditions for payments, Time delay, Scope changes, Extra claims, Dispute resolution & arbitration, Termination of contracts, subcontracting etc. FIDIC Contracts conditions	10
5	Contract Administration: Elements of contract management, Major stake holders in construction contracts, Contract administration; Duties and responsibilities of parties,	8



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174025

	Stake holder agreements, Contract risk management, Contract maintenance and change control, Management reporting, Dispute resolution mechanisms: Negotiation, Mediation, Arbitration and Litigations, Arbitration and Conciliation Act 1996	
	Total	42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	35	35	10	00	00

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Keith Collier, "Construction Contracts" Reston Publishing Company, Inc, Reston, Virginia.
2. Patil, B.S., "Building and Engineering Contracts" Mrs. S.B. Patil, Pune.
3. John Murdoch & Will Hughes, "Construction Contracts - Law and Management" Spon Press, Taylor & Francis Group.
4. Gajera, G.T., "Law relating to Building and Engineering Contracts in India" Butterworths.
5. Govt of India, Central Public Works Department, "CPWD Works Manual 2003."
6. Govt of India, Central Public Works Department, "CPWD 7/8: General Conditions of Contracts."
7. V. K. Raina, Raina's Construction and Contract Management Vol.1 (Second Edition), SPD Publishers, 2009

Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Identify and suggest suitable contracts for a given project scenario	30
CO-2	Understand tender processing and analyses/assess various contractual provisions in a tender documents and develop estimate and bidding strategy	40
CO-3	Familiar with stake holder & contract management processes involved in construction projects for its timely implementation	30

List of Assignments

1. Collection of Evaluation of tender notices/ EOI, RFQ & RFP
2. Tender notice preparation



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3174025

3. Exercise on pre-qualification of contractors

Major Equipment: Nil

List of Open Source Software/learning website:

www.nptel.iitm.ac.in/courses/

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3174026
ADVANCED CONSTRUCTION METHODS AND EQUIPMENT
B.E. 7th SEMESTER

Type of Course: **Elective**

Prerequisite: **NIL**

Rationale:

1. To provide an understanding on engineering fundamentals and operational details of important equipment(s) employed in different sectors of construction.
2. To provide an understanding on major methods of heavy construction related to substructure and superstructure construction work.

Teaching and Examination Scheme

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	PA(M)	Viva	PA (I)		
3	0	0	3	70	30	00	00	100

Course Contents

Sr.No.	Topics	Hrs.
1	Procurement and Planning of Construction Equipment(s): Owning and operating cost, Depreciation, Useful life of equipment, Replacement analysis, Equipment financing methods, Rental and lease contract considerations, Equipment selection criteria, Equipment maintenance and management systems and procedures	8
2	Excavation and Earthmoving Equipment(s): Engineering fundamentals of earthmoving equipment, Operational features and productivity analysis of earth moving equipment, Equipment requirement and planning for earth work projects, Equipment for dredging, trenching, and tunneling, Equipment for drilling and blasting.	11
3	Asphalt and Concrete Plants: Aggregate crushers, feeders and screens, Aggregate handling equipment, Concrete batching, mixing and pumping equipment, Transit Mixers, Asphalt plant, Asphalt pavers, Asphalt compacting equipment.	6
4	Material Handling Equipment: Operation, working and system design of Conveyor belts, Mobile cranes, Tower cranes, Scheduling lifting equipment for vertical construction, Construction pumps.	6
5	Substructure Construction Methods: Vacuum dewatering and well point system for excavation, Box jacking, Pipe jacking, Piling techniques and load testing, Well foundations, Pneumatic caissons, Cofferdams, Diaphragm walls: types, design considerations, construction sequence, , Sheet piles: laying operations for built up offshore system, Slope stabilization: Cable anchoring and grouting, ,	11



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174026

	Superstructure Construction Methods: Concrete Formworks, Slip formwork, Erection techniques of tall structures, Launching techniques for heavy decks, In-situ pre-stressing in high rise structures, Post tensioning techniques, Handling and erecting lightweight components on tall structures.	
	Total	42

Reference Book(s)

- Gransberg, D. G., C. M. Popescu and R. C. Ryan, Construction Equipment Management for Engineers, Estimators, and Owners, Taylor & Francis, New York, 2006.
- Peurifoy R. L., C. J. Schexnayder, A. Shapira and R. Schmitt, Construction planning, equipment, and methods, 8th ed., McGraw Hill, New York, 2010.
- Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 1984
- D. A. Day and N. B. H. Benjamin, Construction equipment guide, 2nd ed., Wiley, New Jersey, 1991.
- Bryan, Construction Technology: Analysis and Choice, 2ed., Wiley India
- Mahesh Varma, Construction Equipment Planning and Applications –
- Roy Chudley and Roger Greeno, Construction Technology, Prentice Hall, 2005.
- Patrick Powers. J., Construction Dewatering: New Methods and applications, John Wiley & Sons, 1992.
- Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995.
- Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi,

Course Outcome

Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Selection, Planning and Utilization of Construction Equipment	65
CO-2	Selection and Planning of Material Handling Equipment	15
CO-3	Understand different construction methods	20

know how engineering fundamentals are applied in the selection, planning and utilization of equipment (s) and methods for various construction activities.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174026

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	35	30	20	00	00

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

List of Assignments

1. Owning and operating costs of equipment
2. Productivity Analysis of Earthmoving equipment
3. Equipment requirement and planning for earthwork projects



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174027

CONSTRUCTION SAFETY AND MATERIALS MANAGEMENT

B.E. 7th SEMESTER

Type of Course: **Elective**

Prerequisite: **NIL**

Rationale:

1. To understand the process of planning, procurement, allocation and control of material resources in construction projects for their optimal use.
2. To understand basic safety hazards and remedial/control measures involved in the construction process

Teaching and Examination Scheme

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	PA(M)	Viva	PA (I)		
3	0	0	3	70	30	00	00	100

Course Contents

Sr.No.	Topics	Hrs.
1	Materials Management: Objective and functions, Supply chain management and material management, Management organization for materials management, Role of material manager, Material requirement planning, Classification and coding of construction materials for MIS, ABC Analysis, XYZ Analysis, Inventory control systems, Inventory Models: fixed order quantity, economic order quantity, Purchase Function, Vendor Rating, Vendor Analysis, Legal aspects of purchase, E-Procurement, Stores management, Value engineering application for materials, Material Wastage.	21
2	Safety Managements: Introduction to construction safety, OSHA Regulations, Planning for safety provisions, HSE plans, Analysis of construction hazards and accidents, Construction hazards and safety guidelines, Occupational health hazards, Prevention techniques for construction accidents; Site management with regard to safety recommendations, Training for safety awareness and implementation, Construction safety and health manual.	21
Total		42

Reference Book(s)

1. Gopalakrishnan, P. & Sundarshan, M, Materials Management: An Integrated Approach, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Jhamb L.C., Inventory Management, Everest Publ.
3. Reese C. D. and J. V. Eidson, Handbook of OSHA construction safety and health, 2nd ed., CRC Press, Boca Raton, 2006.
4. Holt A. S. J., Principles of construction safety, Blackwell Publishing, Oxford, 2008.
5. Kwaku, A., Tenah, Jose. M. Guevara, Fundamentals of Construction Management and Organization, Reston Publishing Co., Inc., Virginia, 2005.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174027

Course Outcome

Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Plan, procure, allocate and control material resources in construction projects for their optimal use.	50
CO-2	Identify various hazards of construction projects and develop & implement effective safety programs as per the safety regulations	50

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	35	30	10	00	00

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174028

Semester – VII

Subject Name: ICT for Infrastructure Engineering

Type of course: Open Elective

Prerequisite: Basic operational understanding of computer system

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Unit I: Basics of IT Infrastructure Introduction: Living in a Network Centered World, Components & types of IT infrastructures. Network Topology: Star, Ring, Mesh, etc, Review of TCP/IP protocol suite and architecture. Basics of Wired and Wireless LAN/MAN and WAN technologies. IP addressing, Class A, Class B and Class C addresses, Subnet, Proxy, OSI layer, Basics of Layered Protocol, Firewall and its importance. Wireless Sensor networks: Introduction, Types of wireless sensor networks, WSN Network Topologies, Issues in WSN: Energy Consumption and Security.	12
2	Unit II: Tracking Systems: RFID and Global Navigation Satellite System RFID and wireless sensor networks, RFID technology, architecture and protocols, RFID applications for the enterprise, RFID problems and concerns. GPS: GPS System Description, Overview and terminology, Principles of operation, Augmentation, Trilateration, Performance overview, Modernization. GPS Policy and Context, Condensed navigation system history, GPS policy and governance. Other satellite navigation systems. GPS Applications- Land, Marine, Aviation, Science.	10
3	Unit III: Internet of Things Overview of IOT concepts, IOT Standards, Components of IOT System, Relevance of IOT for the future, IOT Applications, The role of Artificial Intelligence in Internet of Things with applications, Challenges in IOT implementation	6
4	Unit IV: Smart Infrastructure and User Experience Types of Sensors, How sensor works?, Moisture sensor, tilt sensor, smoke sensor, Temperature Sensor, Pressure Sensor, Level Sensor Fibre Optic Sensors etc, Concept of Smart Home, Smart Meter, Smart Mobility, Smart Public Safety, Smart Sanitation, Smart	10



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3174028

	Security and Surveillance. Basics of Augmented Reality and Virtual Reality, AR in navigation, AR in Search Engine, etc.	
5	Unit IV: Computer Applications in infrastructure development Case Study: IOT in Indian Scenario: Aadhaar	4
	Total	42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
35	45	10	10	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Behrouz A. Forouzan, TCP/IP Protocol Suite
2. Andrew Tanenbaum, Computer Networks, 5th Edition, Pearson Education.
3. Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins. GPS Theory and Practice. Springer, 1994. ISBN: 9780387824772.

Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the basics of Information and communication technology.	30%
CO-2	Explore the applications of ICT for infrastructure	30%
CO-3	Analyze and exploit the merits of ICT to establish more effective infrastructure	25%
CO-4	Explore emerging trends and technologies of IoT, Augmented and Virtual reality for better infrastructure for societal benefits.	15%



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Bachelor of Engineering: Civil and Infrastructure Engineering

Subject Code: 3174029

Semester – VII

Subject Name: Environmental Impact Assessment

Type of course: Open Elective Course

Prerequisite: Environmental Science

Rationale:

With the burgeoning population, the rise in demand for exploration of natural resources, renewable and non-renewable, has increased many folds leading to implementation of projects dealing with industries, dams, roads, buildings etc. The projects help in the economic development of the country and provide resources to the people; however, it comes at the cost of environmental degradation. This necessitates a methodology to assess the impact of these projects to the environment so that these developments do not lead to environmental degradation. *Environmental Impact Assessment* involves the proper study of the impact on the environment which is carried out before taking the final decision of a project. Therefore, *Environmental Impact Assessment* would help in the planning the development process in a sustainable and organized manner with which effective control and mitigation measures can be undertaken.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA	ESE (V)	PA (I)		
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Environmental Management Plan: Introduction; Participants; Ethics and Environment	3
2	Policy and Legal Aspect of Environmental Management: Introduction to environmental policies: Economics, Industries, Agriculture, Ecosystem, Environmental Policy System (EPI); Environmental Laws and Legislations, Private and Public law, Principles of International law, Indian Environmental law, International Institutions; Objectives and principles of legislation; Environmental Legislations in India	4
3	Environmental Impact Assessment (EIA): Introduction- (EIA); Purpose of EIA; Steps in EIA; Environmental Impact Statement	15



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	(EIS); Evolution of EIA worldwide; Evolution of EIA in India; Forecasting Environmental Changes; Strategic Environmental Assessment (SEA)- rationale and scope, SEA process, Benefits and constraints of SEA; Comparison between EIA and SEA; Environmental Clearance Procedure in India	
4	EIA documentation and process: Preliminary Stages of EIA , Screening, Scoping, Examination of alternatives, Impact identification using matrix and network methodologies, Baseline data; Impact Prediction, Impact on Air, Water, Soil, Noise, Socio economic environment; Evaluation and Mitigation; Impact on Decisions; Participation, Requisites and Review	12
5	Environmental Auditing: Introduction to Environmental Auditing; General Audit Methodology; Elements of Audit Process, what to audit, who will audit, why to audit, how to audit;	8
	Total	42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	25	20	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Canter L.W., Environmental Impact Assessment, McGraw-Hill, 1996
2. Peter Morris & Riki Therivel, Methods of Environmental Impact Assessment, Routledge, Taylor and Francis Group, 2001
3. Shrivastava A. K., Environmental Impact Assessment, APH Publishing, 2003
4. Betty Bowers Marriott, Environmental Impact Assessment: A Practical Guide, McGraw-Hill Professional, 1997.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering: Civil and Infrastructure Engineering Subject Code: 3174029

Course Outcomes: After learning this course the students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand environmental management and the policies involved	10
CO-2	Understand the need of EIA and carry out the environmental assessment.	40
CO-3	Understand the processes involved in EIA and the impacts to air, water, soil, noise and socio-economic environment and be able to document EIA in detail.	30
CO-4	Understand the auditing processes and recognize the elements involved	20

List of Open Source Software/learning website:

MIT Open Courseware, NPTEL

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be presented and put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide.