GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130004
Semester – III
Subject Name: Effective Technical Communication

Type of course: Communication and ethics

Prerequisite: Zeal to learn the subject

Rationale: The rationale of the curriculum is to help students learn technical communication along with necessary moral and ethical dimensions of engineering.

Teaching and Examination Scheme:

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

Contents:

Sr. No.	Topics	Teaching Hours	Module Weightage
1	**Dynamics of Communication**: Definition and process Kinesics Proxemics Paralinguistic features Importance of Interpersonal and Intercultural Communication in today's organizations	06	20%
2	**Technical Writing**: Report writing Technical proposal Technical description Business letters(sales, order, complaint, adjustment, inquiry, recommendation, appreciation, apology, acknowledgement, cover letter) Agenda of meeting, Minutes of meeting Resume writing	08	25%
3	**Technical Communication**: Public speaking Group discussion Presentation strategies Interview skills Negotiation skills Critical and Creative thinking in communication	06	20%
4	**Ethics in Engineering**: Scope of engineering ethics Accepting and sharing responsibility Responsible professionals and ethical corporations Resolving ethical dilemmas Making moral choices	04	12%
5	**Etiquettes**: Telephone etiquettes Etiquettes for foreign business trips Visits of foreign counterparts Etiquettes for small talks	05	16%

	Respecting privacy Learning to say NO Time management		
6	**Self-development and Assessment:** Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Asses, Think, Communicate, Relate, Dream.	03	7%

Distribution of Theory Marks					
Remember	Understand	Analysis	Application	Evaluation	Creativity
05	**05**	**15**	**15**	**15**	**15**

Language Laboratory Activities:

Sr. No.	**Practical/ Exercise**	**Apprx. Hours required**	**Preferably to be conducted in:**
1	Role Play	02	Classroom/Hall
2	Letter writing: Formal	02	Classroom/Lab
3	Group Discussion	04	Classroom/Hall
4	Presentations	04	Classroom/Hall
5	Book Review(Preferably related to self-development)	04	Classroom/Hall
6	Mock Interview	04	Classroom/Hall
7	Report writing	02	Classroom/Lab
8	Case studies related to unit 4, 5 and 6	06	Classroom/Lab
9	Conducting meetings and minutes of meeting	02	Classroom/Hall
10	Practical assessment	02	Classroom/Lab

Suggested books for review:

1. You Can Win by Shiv Khera
2. How to Win Friends and Influence People by Dale Carnegie
3. Getting Things Done: The Art of Stress Free Productivity by David Allen
4. Quiet: The Power of Introverts in a World That Can't Stop Talking by Susan Cain
5. The Alchemist by Paulo Coelho
6. The 7 Habits of Highly Effective People by Stephen Covey
7. What to Say When You Talk to Yourself by Dr. Shad Helmstetter
8. The Big Leap by Gay Hendricks
9. Thinking Fast and Slow by Daniel Kahneman
10. The Art of Thinking Clearly by Ralf Dobelli
11. Upside Down Key by Sudha Murthy
12. Born to be Happy by Pramod Batra
13. Kiss That Frog by Brian Tracy

14. Build From Scratch by Vineet Bajpai
15. Ten Much by A G Krishnamoorthy
16. Poor Little Rich Slum by Rashmi Bansal
17. Our Ice Berg is Melting by John Paul Cotter
18. Most and More by Mahatria Ra
19. Third Curve by Mansoor Ali Khan
20. Selected Short Stories of Rabindranath Tagore edited by William Radice
21. That Thou Art by Dhruv Bhatt
22. Old Man and the Sea by Ernest Hemingway

Reference Books:

1. Raman and Sharma, *Technical Communications*, OUP, New Delhi, 2017
2. Lata and Kumar, *Communication Skills*, OUP, New Delhi, 2018
3. Mike Martin and Roland Schinzinger, *Ethics in Engineering*, McGraw Hill, New York, 2014
4. Mohapatra and Sreejesh S., *Case Studies in Business Ethics and Corporate Governance*, Pearson, UP, 2013
5. Ramesh and Ramesh, *The Ace of Soft Skills*, Pearson, UP, 2019
6. Sherfield, Montgomery and Moody, *Cornerstone: Developing Soft Skills*, UP, 2009

Open Sources:

https://www.scu.edu/ethics/focus-areas/more/engineering-ethics/engineering-ethics-cases/

Course Outcomes:

At the end of the course students will be able to:

Sr. No.	Course Outcome	Weightage
1	Define and discuss dynamics of Verbal and Non Verbal aspects of Communication	20%
2	Write various formal documents of technical and professional communication	25%
3	Communicate in diverse formal situations taking place in organizations	20%
4	Illustrate and examine the knowledge of ethical aspects of engineering	12%
5	Demonstrate and explain social and professional etiquettes	16%
6	Plan self-development and practice self-assessment	7%

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130007
Semester – III
Subject Name: Indian Constitution

Type of course: Mandatory course

Prerequisite: NA

Rationale: NA.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	0	0	50	0	0	0	50

Contents:

Sr. No.	Topics	Total Hours
1	Meaning of the constitution law and constitutionalism	01
2	History of Indian Constitution	02
3	Salient features and characteristics of the Constitution of India	01
4	Fundamental rights	02
5	Right to Equality under Article – 14	02
6	Right to certain Freedom under Article 19	02
7	Scope of the Right to Life and Personal Liberty under Article 21	02
8	Fundamental Duties and its legal status	02
9	The Directive Principles of State Policy – Its importance and implementation	02
10	Federal structure and distribution of legislative and financial powers between the Union and the States	03
11	Parliamentary Form of Government in India – The constitution powers and status of the President of India	02
12	Powers and Procedure for Amendments in Indian Constitution	01
13	History of amendments in Indian Constitutional	02
14	Emergency Provisions : National Emergency, President Rule, Financial Emergency	03
15	Local Self Government – Constitutional Scheme in India	03

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Enhance human values , create awareness about law enactment and importance of Consitution	10%
CO-2	To Understand the Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsbilities.	30%
CO-3	Create Awareness of their Surroundings, Society, Social problems and their sutaible solutions while keeping rights and duties of the citizen keeping in mind.	20%
CO-4	Understand distribution of powers and functions of Local Self Government.	20%
CO-5	Understand the National Emergency, Financial Emergency and their impact on Economy of the country.	20%

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130007

Reference Books :

1. Constitutional Law of India, Dr. J.N. Pandey, Central Law Agency
2. Introduction to the Consitution of India, Durga Das Basu, LexisNexis.
3. Indian Constitutional Law, M.P. Jain, LexisNexis
4. V.N.Shukla's Constitution of India, Mahndra Pal Singh, Eastern Book Company
5. Constitutional Law – I Structure, Udai Raj Rai, Eastern Book Company

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130008
Semester III
Design Engineering 1 A
Module 1: Understanding Design Thinking

Type of Course: Project Work

Prerequisite: Optimistic mind-set, Enthusiasm of learning new things, Unlearn yourself

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
0	0	2	1	0	0	80	20	100

Relevance

This course is meant for beginners. The course is designed to imbibe Design Thinking understanding and mind-set for the 3rd semester students.

Objective: Understanding Design Thinking

The course aims to expose students to the basic process and framework of Design Thinking and relevant tools & techniques for Creativity & Innovation.

Course Contents

This Course is designed to give very basic understanding of the Design Thinking methodology. In DE-1A, student will select very basic and small, individual or team project irrespective of their branch. This project would be from very general topic/domain like designing something for yourself/parents/Teacher/Friends (Whole class may select single project topic or similar topic in different small groups to have healthy competition among the class). This kind of basic project in 3rd semester would help in understanding of Design Thinking process easily when much technicality is not involve. In this module, student will use whole Design Thinking process as shown in fig.1 of general guideline document to complete their projects but here the learning objective or focus would be more on Observation or Empathy process. So students need to give more time to these phases and then reach up to the rough prototype phase. The content is divided into week-wise activities as shown below to better understand the course and to give enough time to all the learning aspects and students need to follow the same but depending upon the type and nature of projects, students and guide may allocate more/less time to the activities.

Design Thinking Process – with Tools & Techniques			
Module 1 (DE-1A): Understanding Design Thinking			
Broad segment	Week	Description	Operational need
Design Thinking Introduction	1	○ Overview, objective and goal of this course ○ What is Design Thinking? - Its importance, socio-economical relevance ○ Design thinking to foster innovation ○ Relevance of design and design thinking in engineering ○ Systematic problem identification & problem solving approaches	○ Brief lecture/exercise ○ Hands on exercise to understand attributes of Design Thinking
	2	○ Domain Selection (general topic/products in 3rd semester) ○ Team Building Exercise ○ Log book, documentation strategy – introduction, importance, preparation	○ Brief lecture/exercise ○ Hands-on sessions with cases/examples ○ Individual logbook is required
	3	○ Learning tools ✓ Design in nature/Bio-mimicry ✓ Design as a System approach ✓ Design as listening tool for mapping users' unmet needs	○ Brief lecture/exercise ○ Next week Students need to present on the learning from these topics
Empathization Phase	4,5,6	○ Observation: Through AEIOU framework ✓ Orientation to Field Work – Need for field visit? ✓ What/How/Where to Observe ✓ Ethnographic tools and its usage ✓ What difference it will make if the problem solved - partially or fully? ✓ Could solution be worse than the problem? ✓ Key pain and pleasure points ✓ Understanding of User Contexts ✓ Log book exercise ✓ Analysis of Data - Mind Mapping ○ Immerse via Role Playing	○ Students will be introduced to different observation/scouting methods in the theory session in class for all four weeks in different sessions ○ Then during weeks, they need to visit their selected domain/place for getting insights and define problems. ○ Minimum 4-5 field trips will be required to get better insights on users' needs.

		○ Interview: ✓ Formal and Informal interview ✓ Students may use Stanford methods given in below link - http://dschool.stanford.edu/wp-content/uploads/2013/10/METHODCARDS-v3-slim.pdf	
		○ Summary of AEIOU activity/inputs ○ Preparation of Mind Map, Empathy Map	○ Class as well as homework/field activity
Define Phase: Problem Definition by secondary research ,group work and presentation	7	○ Secondary research/Prior art search (prior art search is continuous activity and can be used in any phase to strengthen the idea) ○ Group wise presentation followed by Discussion ○ Define Problem statement (format is given in reference PPT on DE portal ○ Verification of problem identified by team through users/stakeholders	○ After rigorous and systematic field exercises, empathization and Secondary Research activities -student teams need to define their problem here (it can be further validate through Ideation phase)
Ideation Phase	8	○ Preparation of Ideation canvas ✓ Brainstorming (What, Why, How, When, For Whom) ✓ Situation/Context/Location ✓ Props/non-living things/tools/equipment ✓ Opportunity mapping	○ 2 hour – explanation of Ideation canvas to class ○ Then students will work on their Ideation canvas ○ Ideation activities shall be performed in class with team members under guidance of teacher
	9	○ Combination of Ideas from Ideation canvas ○ Sketching of mock concepts in log book ○ Design Thinking is a Convergent-Divergent process	○ Student teams need to discuss their Ideation canvas with other teams, faculty guides and users and take feedbacks
	10	○ Prioritizing and finalizing Idea (After group discussion and consulting with faculty guide, student teams need to select their final problem & idea for further development)	○ Students team need to validate the final Problem & idea/concept with Users/Stakeholders after this activity

Product Development Phase	11	○ Preparation of Product Development Canvas (PDC) ✓ Product Experience ✓ Product Functions ✓ Product Features ✓ Components ○ Discussion on Product Development Canvas (PDC)	○ 2 hour – explanation of product development canvas to class ○ Then students will work on their PD canvas (min 3 hour continuous workshop) ○ Till 12th week of the course, Students team will discuss on their PDC with other groups and guide ○ Refinement of PDC after discussion
	12	○ Customer/User Revalidation (Reject/Redesign/Retain) ○ Refinement	○ Till 13th week of the course, student team will consult the Users/Stakeholders for their inputs for concept finalization after various stages and incorporate necessary changes.
Proof of Concept	13	○ Rough Prototype ○ Here strategy is "to fail fast to succeed faster"	○ Very early & rough prototype ○ Made up of paper, cardboard, thermocol etc. whichever material is available
Feedback & Final Report	14	○ Upload duly signed Continuous Assessment Card ○ Feedback, Online certificate generation through DE portal ○ Final Report	○ As per the feedback received from Users/Stakeholders/other student groups/guide, student teams need to modify their design and further action plan. ○ Report writing should be continuous activity throughout the semester

Submissions by the end of 3rd semester shall be:

A. Process Report comprising:
   a. Introduction (Describe your project in detail including domain – type, place, why and how team selected this domain and why this domain is important in relation to Design Thinking/Human-Centered process etc.)
   b. Preparation of canvases based on different phase of Design Thinking
   c. Feedback analysis with the user shall be clearly included in the report
   d. Summary of findings of Prior Art Search on purpose/project theme (2 summary papers per student)
   e. Summary of the learning from Design Thinking
   f. Summary on validation process and refinement in the rough prototype
   g. Any other important aspects you feel should be included

B. AEIOU framework
C. Mind Map
D. Empathy Map
E. Ideation Canvas
F. Product Development Canvas (PDC)
G. Rough prototype model/Conceptual Plan-Layout for process related branches
H. Individual Log Book (duly signed by faculty guide)
I. Continuous Assessment Card for Internal Evaluation (Document separately available on GTU website)

Note: As per the guidelines and evaluation schemes given in this document, students need to prepare report for their projects. Separate report format will not be provided by University, students and faculty members may create their own creative formats. However, in general guidelines document uploaded on GTU website, there are some report format links are given which may help for report format.

To,

The Principals/Directors of Colleges/Institutes, the Heads of Departments and GTU/Design Engineering coordinators:

Students deserve a proper practical/ viva/project examination of the work that they have done over the semester (or over the year for a 2-semester project). It is the responsibility of the University and Colleges that all its examinations are conducted fairly, sincerely and with due diligence. So please look into the following:

1. Please make proper arrangements so that all the examinations start in-time. If due to any reason, the exam should not start at the scheduled time, please inform the examiners that they should take extra time. But in no case the viva/ practical exam be conducted in a hurry without giving sufficient time for evaluation of every student. If an exam is scheduled to be held over two days, please make the necessary arrangements.

2. The University expects the Deans (and or special teams headed by the Dean or his/ her nominee) to visit the Colleges during the practical/ viva examinations. As it came to University's notice that some examiners and colleges are completing viva exam in 1 or 2 hours' time of entire class which is not acceptable in any case and it's immoral practice for any education institute. So all stakeholders need to take extra care of this issue.

3. Please see that all the necessary help and information is provided to examiner. Please receive them so that they can do their job properly without wasting their time in searching for the place and in contacting the concerned departments and students. If they wish to visit the laboratories/workshops, please make the necessary arrangements.

4. Please inform the examiner that he/she must note down the best 3 projects of the department and convey the details of such projects by uploading the details of the project or/and the complete project report on the University's server or send it to design@gtu.edu.in .

5. In case Internet or the server should not work, please provide the technical help to the examiner for preparing a CD of the reports of the best three projects of every department and please make arrangements to deliver the CD to the examination/BE section of the University.

PROCESS OF EVALUATION: At the ensuing 3rd semester examinations, the work of the students in Design Engineering – 1A is to be evaluated through Internal Viva exam and the evaluation is to be out of 80 marks. Institute may organize inter-department viva or project show case so students would get various expert opinions to motivate them.

For 3rd semester, internal Viva-Voce examination will be conducted at the end of the semester by a team of three examiners - One internal guide, one inter/own departmental faculty, one industry expert (industry expert may be optional but recommended). Internal examiners/teachers must be trained in Design Thinking through the FDP conducted by University.

EVALUATION SCHEME:

Sr. No.	Particular	Sub-Head Weightage
1.	Understanding of Design Thinking methodology/ need ✓ Importance and understanding of Design Thinking for innovation, entrepreneurship, societal solutions with various learning tools	15
2.	Observation towards Empathy ✓ Field Activity/observation and outcome ✓ Mind Mapping - Summarization and data analysis ✓ Observation Technique (AEIOU Framework)	20
3.	Log book (Individual completed log book, duly signed by guide regularly) Continuous Assessment Card for Internal Evaluation (Complete and duly signed by guide regularly)	10
4.	Understanding of Canvases/Framework ✓ AEIOU, Mind Mapping ✓ Empathy mapping ✓ Ideation Canvas ✓ Product development Canvas	15
5.	Design Problem Definition ✓ Prior art search/Secondary research ✓ Diachronic and Synchronic analysis	10
6.	Report: Compilation of work report (process report), Online Certificate generated through DE Portal, Future action plan, Question and Answer, Communication Skill, Attitude	10
		80

Note:

- ✓ Total Marks for the subject: 100 (Internal end semester viva exam – 80 & Internal continuous evaluation – 20)
- ✓ Minimum passing marks: 40/80
- ✓ Examiner essentially needs to evaluate the learning process of the student during the semester, not only the final outcome. As outcome is important for any project but during the student stage, projects are intended for practical learning and "Learning by doing" is the Mantra for Design Engineering subject (One should celebrate the failure also and learn from it to get success). So

please evaluate the Design Thinking process and their learning properly with giving sufficient time for each project.

- ✓ Students need to explain all canvases prepared in hard copy to the panel of examiners.
- ✓ Power point presentation is not mandatory.

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130606
Semester – III
Subject Name: Geotechnical Engineering

Type of course: Core

Prerequisite: Knowledge of Basic Sciences, Strength of Materials, Basic Geology, Fluid Mechanics

Rationale:
Geotechnical engineering is very fundamental subject to study for determination of various soil parameters theoretically and experimentally based on laws of mechanics. Any civil engineering structure needs strong and stable foundation which depends on proper understanding of soil properties and its behavior, determination of stresses and settlements in soil etc. The thorough understanding and implications of geotechnical engineering will play a vital role in strong and economic design of any foundation system for any infrastructural projects. Knowledge of the geotechnical engineering will prepare students to enter into mutli-disciplinary folds of this subject into various other civil engineering schemes.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Type of Soils, Index Properties, Inter-relationships and Soil Characterization** Types of soil and soil formation, Geological cycle, Phase diagrams, Basic terms, Functional relationships based on index properties, Physical characterization of soil-Dry and Wet sieve analysis, Atterberg's Indices, Soil Structures, Soil Water and its types, Standard nomenclature & IS Soil Classification, Numericals. Problems/Numericals/Codes/Lab and Field Tests.	**10**
2	**Permeability and Seepage:** Darcy's law and its validity, Factors affecting permeability, Laboratory permeability tests, Permeability of stratified soil masses, Seepage pressure, Quick condition, Flow nets.	**05**
3	**Compaction & Consolidation of soil:** Definitions, Differentiate between compaction and consolidation, Compaction mechanism and proctor tests, field compactions methods, factors affecting compaction, Consolidation mechanism through spring analogy, fundamental definitions, Terzaghi's one dimensional consolidation theory (only formula), Time factor, pre-consolidation pressure, consolidation	**09**

	settlement, Numericals. Tests will be covered in lab sessions.	
4	**Stress Distribution:** Causes of stresses in soil, Boussinesque's and Westergard's equation, Pressure Bulb, Stress distribution on horizontal and vertical planes, Stresses due to different shapes of footings, New-mark's influence chart, Numericals.	**05**
5	**Shear Strength of Soil :** Mohr's strength theory, Mohr- coulomb's strength theory, Modified Mohr coulomb's theory, shears parameters through lab and field tests based on drainage conditions, Numericals. Tests will be covered in lab sessions.	**08**
6	**Earth Pressure & Stability of Slopes:** Types of lateral earth pressure, Rankine's and Coulomb's earth pressure, Rebhann's/Culmann's Graphical methods, Infinite and finite slopes, Factor of safety, Type of slope failure, Limit equilibrium method, C-analysis-method of slices, Taylor's stability number, Numericals.	**09**
7	**Introduction to Foundations and Bearing Capacity:** Shallow Foundations; Types, Basic terms, SBC computation using IS and Terzaghi methods. Deep Foundations; Pile and Pile capacity, Numericals.	**10**

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
5	**15**	**25**	**15**	**5**	**5**

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. B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., New Delhi
2. Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi
3. Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.
4. Gopal Ranjan, Rao A.S.R.; Basic and applied soil mechanics; New age int. (p) ltd
5. Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi
6. Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai
7. Bowles, J.E., "Foundation Analysis and Design, 5th Edition, McGraw Hill, New York, 1995.
8. Relevant IS Codes

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130606

Course Outcomes: Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Classify the soil and will be able to understand its behaviour and will be able to compute/estimate index parameters.	25
CO-2	Interpret soil behaviour through learning soil compaction, consolidation, and analyise various theories and calculate parameters needed in design.	20
CO-3	Compute earth pressure, stress distributions and FOS for slopes using various graphical and analytical tools for various engineering projects/site.	25
CO-4	Differentiate, compare, formulate, and evaluate soil parameters through performing various tests as per site conditions or project needs ethically and professionally.	15
CO-5	Suggest suitable type of foundation as per soil type, estimate bearing capacity and demonstrate its socio-economic feasibility.	15

List of Experiments:

- In-situ Density Tests
- Sieve analysis
- Atterberg's Limit Test
- Permeability Tests
- Proctor Compaction Test
- Consolidation /Oedometer test
- Direct Box Shear Test
- Unconfined Compression Test
- Triaxial Compression Tests
- Laboratory Vane Shear Test
- SPT
- CBR Test

Major Equipment: Triaxial Compression Test-setup, Standard Penetration Test -setup

Design based Problems (DP)/Open Ended Problem:

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

List of Open Source Software/learning website:

http://nptel.ac.in/

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

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130607
Semester – III
Subject Name: Building Construction Technology

Type of course: Civil Engineering

Prerequisite: Introduction to Civil Engineering Structures, Construction Materials

Rationale: The development of a basic understanding about the construction of different type of Structures and application of the basic principles of Engineering to solve real life problems in construction practices is necessary for civil engineers.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Foundations: Subsurface Investigation Shallow Foundation : Necessity, Types, setting out, excavation, construction, failures of foundation and remedial measures, Deep Foundation: *Pile Foundation:* Introduction, uses, selection of pile, types of piles, pile cap and pile shoe, pile driving/ boring methods, causes of failures of piles, IS Code of piling IS2911 (Part I to IV) ; *Caissons:* Definition, uses, construction material, types of caissons, loads on caisson, design features of caissons, floating of caissons, cutting edges, sinking of caisson, tilting of caisson, shifting of caisson, caisson diseases	13
2	Masonry Construction : a) Stone masonry: Technical terms, joints, Classification of Stone masonry. b) Brick masonry: Technical terms, bonds in brick work. c) Other Masonry: Composite masonry, Hollow blocks masonry, Partition Wall, Cavity walls d) Lintels & arches: Lintels – types, construction. Arches – technical terms, types, construction. e) Wall Finishes: Plastering, pointing and painting	08
3	Plain and Reinforced Concrete Construction: Pre-cast and cast-in-situ Construction, Concrete 3D printing Form work: Form work for R.C.C. Wall, slab, beam and column, centering for arches of large spans, slip formwork – Horizontal & Vertical.	04
4	Building Components: Doors and Windows : a) Doors: Location, technical terms, size, types, construction, suitability.	16

	b) Windows: Factors affecting selection of size, shape, location and no. of windows, types, construction, suitability, fixtures and fastenings, Ventilators Stairs and Staircases: Definition, technical terms, requirements of good stair, fixing of going and rise of a step, types of steps, classification, example – stair design/planning, elevators, escalators. Floorings: Introduction, essential requirements of a floor, factors affecting selection of flooring material, types of ground floors and upper floor, pre cast concrete floor. Roofs and Roof Coverings: Introduction, requirements of good roof technical terms, classification, types of roof coverings for pitched roof. A.C. sheet roofs – fixing of A.C. sheets, G.I. Sheets roofs, slates, flat roof – advantages, dis-advantages, types of flat terraced roofing.	
5	Special Works: Timbering in trenches, Control of Ground water in excavation, types of scaffoldings, shoring, underpinning, Coffer Dams, Diaphragm Walls, Demolition of structures. Special Treatments: Fire resistant, water resistant, thermal insulation, acoustical construction and anti-termite treatment.	10
6	Green Building as a solution to sustainable future, rating system for green building. Principles, Concepts and Case study	05

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	**25%**	**25%**	**10%**	**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. Building Construction by B. C. Punamia
2. Building Construction by S. C. Rangwala
3. Building Construction by Gurucharan Singh
4. Heavy Construction by Vazirani & Chandola
5. Building Construction by Sushil Kumar
6. Building Construction by P.C Varghese,Prentice-Hall of India, New Delhi
7. Hand book of Heavy construction: O'Brien, Havers & Stubb
8. Burea of Indian Standard

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130607

Course Outcomes: At the end of the course, Student will be able

Sr. No.	CO statement	Marks % weightage
CO-1	Develop in- depth understanding about construction materials, building components, its construction process etc., and apply the knowledge to execute normal sized building construction project.	25
CO-2	Recognize the associated entities involved in building construction process.	20
CO-3	Identify the factors to be considered in planning and construction of buildings.	25
CO-4	Understand the practices and techniques for Temporary/Special construction Works.	15
CO-5	Able to apply learning to further research in sustainable civil engineering materials, construction technology and construction management field.	15

List of Practical:

A) Site visit

The student shall visit the construction site under supervision of faculty member /Site In-charge and prepare a brief report containing sketches and photographs of site visits based on the following assignments.

B) **Assignment (Must contain Sketches)**

(1) Assignment -1: Foundations & Setting Out work

(2) Assignment -2: Masonry Construction

(3) Assignment -3: Plain and Reinforced Concrete Construction

(4) Assignment -4: Doors and Windows

(5) Assignment -5: Stairs and Staircases

(6) Assignment -6: Floorings

(7) Assignment -7: Roofs and Roof Coverings

(8) Assignment -8: Temporary/Special Works

(9) Assignment -9: Special Treatments

(10) Assignment -10: Green Building

Major Equipment:

Working models / Chart of various construction Activities.

List of Open Source Software/learning website:

1. http://www.nptel.iitm.ac.in/courses/

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130608
Semester III
Mechanics of Solids

Type of course: Basic Science Course

Prerequisite: Basic understanding of Physics and Mathematics

Rationale:
The branch of Applied science that deals with state of rest or the state of motion is termed as Mechanics. Starting from the analysis of rigid bodies under gravitational force and simple applied forces the mechanics has grown to the analysis of robotics, aircrafts, spacecrafts under dynamic force, atmospheric forces, temperatures forces etc.
The principal of mechanics developed around state of rest and state of motion of the bodies by Sir Issac Newton which is termed as three laws of motion and the laws of gravitation. The mechanics based on these laws is called classical mechanics or Newtonian mechanics.
Engineers are keen to use laws of mechanics to actual field problems. Application of laws of mechanics to field problems is termed as engineering mechanics. Here the students will learn the laws and principals of mechanics along with their applications to engineering problems. As a matter of fact knowledge of mechanics of solids is very essential for an engineer in planning, designing and construction of various types of structures and machines, so that the design is safe and economical. .

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	6	70	30	30	20	150

Content:

Sr. No.	Name of Topic	Teaching Hours	% Weightage
	MODULE 1		
1	**Introduction** Definition of space, time, particle, rigid body, deformable body. Force, types of forces, Characteristics of a force, System of forces, Composition and resolution of forces. Fundamental Principles of mechanics: Principle of transmissibility, Principle of superposition, Law of gravitation, Law of parallelogram of forces, Newton's Laws of Motion	02	25
2	**Fundamentals of Statics** **Coplanar concurrent and non-concurrent force system:** Resultant, Equilibrant, Free body diagrams. **Coplanar concurrent forces:** Resultant of coplanar concurrent force system by analytical and graphical method, Law of triangle of forces, Law of polygon of forces, Equilibrium conditions for coplanar concurrent forces, Lami's theorem. Application of these principles.	12	

	Coplanar non-concurrent forces: Moments & couples, Characteristics of moment and couple, Equivalent couples, Force couple system, Varignon's theorem, Resultant of non-concurrent forces by analytical method and graphical method, Equilibrium conditions of coplanar non-concurrent force system, Application of these principles. Concept of statically determinate and indeterminate problems. **Plane Truss** - assumptions used in the analysis of Truss. Perfect, imperfect and redundant truss, analysis of Truss by method of joints and method of sections.		
MODULE 2			
3	**Applications of fundamentals of statics** **Statically determinate beams:** Types of loads, Types of supports, Types of beams; Determination of support reactions, Relationship between loading, shear force & bending moment**,** Bending moment and shear force diagrams for beams subjected to only three types of loads :i) concentrated loads ii) uniformly distributed loads iii) couples and their combinations; Point of contraflexure, point & magnitude of maximum bending moment, maximum shear force	08	15
4	**Stresses in Beams:** **Flexural stresses –** Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I,T,Angle, channel sections **Shear stresses –** Derivation of formula, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, angle sections.	06	10
MODULE 3			
5	**Centroid and moment of inertia and mass moment of inertia** Centroid: Centroid of lines, plane areas and volumes, Examples related to centroid of composite geometry, Pappus – Guldinus first and second theorems. Moment of inertia of planar cross-sections: Derivation of equation of moment of inertia of standard lamina using first principle, Parallel & perpendicular axes theorems, polar moment of inertia, radius of gyration of areas, section modulus. Examples related to moment of inertia of composite geometry	08	15
6	**Torsion:** Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity	06	10

MODULE 4			
7	**Simple stresses & strains** Basics of stress and strain: 3-D state of stress (Concept only) Normal/axial stresses: Tensile & compressive Tangential Stresses :Shear and complementary shear Strains: Linear, shear, lateral, thermal and volumetric. Hooke's law, Elastic Constants: Modulus of elasticity, Poisson's ratio, Modulus of rigidity and bulk modulus and relations between them with derivation. Application of normal stress & strains: Homogeneous and composite bars having uniform & stepped sections subjected to axial loads and thermal loads, analysis of homogeneous prismatic bars under multidirectional stresses	10	20
8	**Principle stresses:** Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress, ellipse of stress and their applications	04	05
MODULE 5			
9	**Physical & Mechanical properties of materials: (laboratory hours)** Elastic, homogeneous, isotropic materials; Stress –Strain relationships for ductile and brittle materials, limits of elasticity and proportionality, yield limit, ultimate strength, strain hardening, proof stress, factor of safety, working stress, load factor, Properties related to axial, bending, and torsional & shear loading, Toughness, hardness, Ductility ,Brittleness	This portion to be covered in Laboratory	Theory Weightage shall be 0%
10	**Simple Machines: (laboratory hours)** Basics of Machines, Definitions: Velocity ratio, mechanical advantage, efficiency, reversibility of machines. Law of Machines, Application of law of machine to simple machines such as levers, pulley and pulley blocks, wheel and differential axle, Single purchase, double purchase crab, screw jacks. Relevant problems		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**30**	**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. Engineering Mechanics statics by R. C. Hibbeler, McMillan Publication.
2. Engineering Mechanics by R S Khurmi
3. Engineering Mechanics by S S Bhavikatti
4. Mechanics for Engineers - Statics Fourth Edition, by F. P. Beer and E. R. Johnson
5. Engineering Mechanics, 2nd ed. — MK Harbola
6. Introduction to Mechanics — M K Verma
7. An Introduction to Mechanics — D Kleppner & R Kolenkow
8. Principles of Mechanics — JL Synge & BA Griffiths
9. Mechanics — JP Den Hartog
10. Engineering Mechanics - Dynamics, 7th ed. - JL Meriam
11. Engineering Mechanics by Shames I. H., P H I India.
12. Mechanics of Structure Vol. I S. B. Junnarkar & H. J. Shah
13. Mechanics of Materials E. P. Popov
14. Strength of Materials G. H. Ryder
15. Mechanics of Materials Timoshenko and Gere
16. Mechanics of Materials Beer and Johnston.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Apply fundamental principles of mechanics, equilibrium and statics to practical problems of engineering.	25
CO-2	Determine centroid and moment of inertia of a different geometrical shape and its use in engineering problem.	10
CO-3	Determine different types of stresses and strains developed in the member subjected to axial, bending, shear, torsion & thermal loads.	25
CO-4	Determine principal stresses and strains for two dimensional system using analytical and graphical methods.	10
CO-5	Differentiate behaviour and properties of different engineering materials.	20
CO-6	Apply the basics of simple machines and their working mechanism	10

List of Experiments/Tutorials:

The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial. Students will have to perform following experiments in laboratory and prepare the laboratory manual.

Mechanics of rigid body

1. Equilibrium of coplanar concurrent forces
2. Equilibrium of coplanar non-concurrent forces
3. Equilibrium of coplanar parallel forces: Determination of reactions of simply supported beam
4. Verification of principle of moment: Bell crank lever
5. Determination of member force in a triangular truss

6. Determination of parameters of machines (Any two)
   (a) Wheel and differential axles
   (b) Single purchase crab
   (c) Double purchase crab
   (d) System of pulleys

Mechanics of deformable body

1. Determination of hardness of metals: Brinell /Vicker/Rockwell hardness test
2. Determination of impact of metals: Izod/Charpy impact test
3. Determination of compression test on
   a. Metals – mild steel and cast iron
   b. Timber – along and parallel to the grains
4. Determination of tensile strength of metals
5. Determination of shear strength of metals

Major Equipments:

1. Force table
2. Beam set up
3. Truss set up
4. Bell crank lever
5. Friction set up
6. Lifting machine
7. Hardness testing machine
8. Impact testing machine
9. Universal testing machine with shear attachment

List of Open Source Software/learning website:

http://nptel.ac.in/

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130609
Semester – III
Subject Name: Building and Town Planning

Type of course: Civil Engineering

Prerequisite: Elements of drawing, primary knowledge of surveying, leveling and computer

Rationale: A Civil Engineer has to be conversant with building and town planning and their development controls, skill of preparing drawings of various types like, orthographic, perspective, working drawings etc. using software application

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	Introduction to buildings, detailed study of Principles of building planning (with case study), Orientation of building, Principles of architecture composition, Fundamentals of Building Information Modelling (BIM)	05
2	Building by–laws as per National Building Code, Building by–laws of local authority, Standards for Residential, Public, Commercial, Industrial And Institutional Buildings Planning, Planning of Earth Quake Resistant Building, overview of RERA (Real Estate Regulatory Authority) and ODPS (Online Development Permission System)	05
3	Elements of Building Drawing, Planning and Preparing working drawing of Residential Building with scale proportion, Layout of Public Building, Industrial Building etc., Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Provision of Building services (like water supply, drainage, electrification, etc.), software application in building planning and building Drawing for 2D model generation,	05
4	Elements of perspective views, Types of perspective views, software application in building planning and building Drawing for 3D model generation	04
5	Historical aspects and origin of Town Planning in the World and in India, Necessity of Civic surveys for Planning purpose, types, data and its presentation and analysis, Fundamental principles of Town Planning. Use of GIS tools for Town Planning.	04
6	Components of town such as Land use, Zones, Road Network, CBD, Neighbourhood planning, Development controls for new town planning schemes for growth negotiation, Formation of Slums, Causes of Slum formation, remedial measures for avoiding slum	05

	formation, Slum Clearance and Rehabilitation.	

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	40%	30%	5%	5%	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. Planning, designing building by Y. S. Sane, Allies Book Stall
2. Building Drawing by M. G. Shah, C. M. Kale and S. Y. Patki, Tata Mc Graw Hill, New Delhi
3. Building Planning, Designing and scheduling by Gurucharan Singh, Standard Book House, New Delhi
4. Architecture- Form, Space and Order by Francis D.K. Ching
5. Architectural Graphics by Francis D.K. Ching
6. National Building Code of India - 2016: Vol.-1 & Vol.-2, Bureau of Indian Standards, New Delhi
7. General Development Control Regulations published by Development Authority
8. Town Planning by G. K. Hiraskar
9. Town Planning by S.C. Rangwala, Charotar publishing House, Anand
10. Corresponding set of CAD Software Theory and User Manuals.
11. Guide to RERA with RERA check list by Texman publications.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Comprehend local building bye-laws and provisions of National Building Code in respect of building and town planning resulting in functionally efficient, economically viable and legally acceptable buildings.	30 %

CO-2	Discuss and apply various aspects of principles of building planning and town planning	10%
CO-3	Understand and implement various aspects of Principles of Architectural composition	10%
CO-4	Explain the principles of planning and design considerations to construct earthquake resistant building	15%
CO-5	Understand, interpret and prepare working drawings, foundation plans, perspective drawing and other executable drawings and prepare the drawing using software	35%

List of Experiments:

Term Work:

(A) Four A1 Size Drawing sheet (Hand drafted) and one Print of 2D & 3D model:

(1) Residential Planning: Two storied Building: Plans, elevation, section, lay-out plan, key plan, site plan, area table, schedule of opening.Scale-1:100.

(2) Working Drawing: sheet should accommodate min. six types with sectional details of Sheet -1 Planning. (Furniture plan, Drainage lay out, Toilet Detail, Kitchen detail, Electrical plan etc.)

(3) Perspective Drawing: Two point perspective of Sheet -1 Planning.

(4) Public Building: Ground Floor plan, typical floor plan, elevation, section, lay-out plan, key plan, site plan, area table, schedule of opening.

(5) Prepare Building Drawing (2D, 3D model) of Sheet -1 Planning using Software

(B) Assignments:

(1) Assignment -1: Principles of Planning & Architecture

(2) Assignment -2: Building Bye laws

(3) Assignment -3: Town Planning

(4) Assignment -4: Different commands of CAD/Software

List of Open Source Software/learning website:

FreeCAD, Fusion 360, Onshape, nanoCAD, OpenSCAD, 3D Slash. LibreCAD, DraftSight, QCAD, QGIS

List of Software:

AutoCAD, Revit, SketchUp, SketchUp, Civil 3D, SmartDraw, Draft it, Floorplanner, RoomSketcher, PlanningWiz, Roomle, 3D Max, Tekla,