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: 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 Civil and Infrastructure Engineering
Subject Code: 3134002

Semester – III
Subject Name: Building Materials & Construction Engineering

Type of course: Professional Core Course

Prerequisite: No Prerequisite

Rationale: This subject is intended for gaining useful knowledge with respect to facts. Concepts, principles and procedures related to building construction materials and construction system & technologies so that student can effectively able to execute building construction work with safety and quality in construction. Students can Plan effectively various types of buildings according to their utility with reference to different specifications and byelaws.

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	**Introduction to building construction:** Definition, types of building as per national building code, components of the buildings. Overview of various traditional and modern building materials.	2
2	**Foundations and Plinth:** Introduction, definitions, types of foundations and their suitability, causes of failure of foundation and its measures, layout and setting out of foundations, plinth filling and soling, underpinning techniques.	6
3	**Temporary structures:** Purpose, types, suitability, failure case study of temporary structures Formwork: Basic requirements of good formwork, types of formworks for concrete construction, method of sequence order and removal of formwork, modern formwork systems: slip formwork, tunnel formwork etc.	4
4	**Masonry construction:** Introduction, purpose, principal terms, material used in various types of masonry works, brick masonry, stone masonry, block masonry, composite masonry, cavity walls, Tools required for masonry construction, masonry construction procedures and supervision.	6
5	**Arches and Lintels:** Arches: Principle of arch action, types of arches, method of arch construction, sequence order of centring and removal of centring. Lintels: purpose of lintel, types of the lintels, chajja or weather shade.	4

6	**Floors and Roofs:** Floors: Functional requirements, suitability, construction details, types of floorings: timber flooring, cement concrete flooring, mosaic flooring ceramic flooring, terrazzo flooring or cast in situ terrazzo flooring, tiled flooring, rubber flooring, cork flooring, epoxy flooring, asphalt flooring or mosaic asphalt flooring, filler materials, floor specifications, flooring materials Roofs and roof coverings: Functional requirements, suitability, method construction details, types of roofs, trusses structures, shell structures, roof coverings.	**6**
7	**Openings of buildings:** Doors: Principle technical terms, installation of doors frames and their size specifications, fixtures and fastenings, types of doors: glazed or sash doors, plastic doors, flush doors, louvered doors, collapsible doors, revolving doors, rolling steel doors, sliding doors, swing doors, folding doors. Essential requirement of good doors. Windows: Principle technical terms, installation of window frames and their size specifications, fixtures and fastenings, types of windows: casement window, double hung window, pivoted window, sliding windows, louvered or venetian window, metal window, sash or glazed window, bay window, corner window, dormer window, gable window, skylight window, circular window, mosquito proof window, curtain wall window. Ventilators: general purpose and types of ventilators.	**4**
8	**Vertical Circulation:** Introduction, classification of vertical circulation, planning and design consideration, types of vertical circulation. Stairs: components of a stairway, classification of stairs based on materials and geometric designs, size specification for staircase and its components. Elevators: components of an elevators, types of elevators, design consideration of elevators. Escalators: components of an escalators, design consideration of escalators. Ramps: components of ramps, types of ramps, design consideration of ramps. Fire protection of vertical circulations.	**5**
9	**Protective Coatings:** Plasters: purpose, type of application, and its types for wall surface, Pointing: purpose and its types, Dampness & Seepage protection techniques: damp proof course and waterproofing techniques, Paints & Varnishes: Types and their applications,	**5**
10	**Miscellaneous Materials:** Properties, types and uses of following materials: lime, polymers, plastic types, mastic, gypsum, clay tiles and glazed wares, Timber: types and properties, seasoning, testing, Aluminum and Aluminum composite panel, Stainless Steel, Glass, Ceramics.	**3**
11	**Safety in Construction:** Safety on site, storage of materials, construction safety, prevention of accidents, fire proof construction.	**3**
12	**Building Planning:** Introduction to Architectural drawing: Line plan, Developed Plan, Elevation, Section, and Scales for various drawings, dimensioning, abbreviations and conventions as per IS 962. Functional requirements of bungalows, twin bungalows, row houses, and apartments. Developed Plan, Elevation and Sectional Elevation of above mentioned categories.	**5**

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Civil and Infrastructure Engineering
Subject Code: 3134002

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	**25**	**25**	**10**	**10**	**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.

Texts/ Reference Books:

- Building Construction - B.C. Punmia
- Building Materials - S.V.Deodhar, Khanna Publication
- Building Construction - Bindra and Arora
- Civil Engineering Materials - Neil Jackson & Ravindra K. Dhir - Palgrave Macmillan
- Building Materials by S. K. Duggal, New Age International Publishers.
- Civil Engineering Materials by TTTI Chandigrah, Tata McGraw Hill Publications.
- Materials of construction by D.N Ghose, Tata McGraw Hill.
- Building Construction by S.C. Rangwala, Charotdar Publications.
- National Building Code of India 2005.
- The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.
- Building Materials Technology by Ruth T. Brantley & L. Reed Brantley, Tata McGraw Hill.
- Properties of Concrete by A. M. Neville, Pearson Education Limited.
- Mitchell's Advanced Building Construction: The Structure by J. Stroud Foster
- Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill. (5th edition.)
- Building science and planning by Dr. S. V. Deodhar, Khanna Publishers.

e-Resources:

- http://nptel.ac.in/syllabus/105102088/
- http://www.theconstructioncivil.org/types-of-brick-bonds
- http://theconstructor.org/building/types-of-partition-walls/3754
- https://www.osha.gov/Publications/OSHA3252/3252.html

- http://www.engineerwing.com/2012/10/tremix-flooring.html
- http://nptel.ac.in/courses/Webcourse.../Composite%20Materials/.../LNm1.pdf
- https://en.wikipedia.org/wiki/Fibre-reinforced_plastic.
- https://cdn.intechopen.com/pdfs-wm/41941.pdf.
- http://home.iitk.ac.in/~mohite/Composite_introduction.pdf
- http://www.vdfflooring.in/faqs.html.
- http://theconstructor.org/building/buildings/eco-friendly-building-materials/720.
- http://nptel.ac.in/courses/105103093/21.
- http://www.grihaindia.org/
- http://new.usgbc.org/
- http://www.hcd.ca.gov/hpd/green_build.pdf
- http://ncict.net/Examples/Examples1.aspx

Course Outcomes: After successful completion of the course the students shall be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify types of building and basic requirements of building components.	5 %
CO-2	Understand types of masonry, formwork, casting procedure and necessity of underpinning and scaffolding etc.	20 %
CO-3	Elucidate different types of flooring and roofing materials.	15 %
CO-4	Interpret types of doors, windows, arches and lintel and their suitability	15 %
CO-5	Illuminate means of vertical circulation and protective coatings	15 %
CO-6	Measure the suitability of different materials especially eco-friendly materials and safety measures to be adopted at any construction site.	15 %
CO-7	Design a residential building and develop the plan, elevation and section of load bearing and framed structures	15 %

List of Experiments and term works:

- Testing of bricks
- Testing of cements
- Testing of aggregates
- Testing of water

- Term work: Based on syllabus topics
- Technical assignments:

[1]. Two site visits and technical report on the visit of any on-going Construction Site (visit report should contain: details of the project, stage of construction, sketches of components with cross section & dimensions, materials used and site plan, etc.)

[2]. Collection of advertisements of modern construction materials and tools used in construction.

[3]. Visit to a construction related exhibition

[4]. Drawing Assignment: Measurement drawing exercise of an existing residential building (G+1). Draw a detailed plan, elevation and section using suitable scale on drawing sheet. Students should prepare working drawing of Foundation Plan (on tracing paper) for the above Residential Building Plan. It should contain detailed foundation plan with foundation details. (Use suitable scale 1:50 or 1:100).

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Civil and Infrastructure Engineering
Subject Code: 3134003
Semester – III
Subject Name: Geomatics Engineering

Type of course: Professional Core Course

Prerequisite: Understanding of linear and angular measurement, chain and compass survey, leveling, traversing.

Rationale: Knowledge of surveying is essential to execute civil construction work projects. Civil Engineer must have acquaintance of operation of different survey instruments and their applications on the field. To accomplish these requirements, this syllabus is framed to cater understanding and applications of theodolite, total station, aerial camera, satellites, drone, DGPS, LIDAR for the various types of survey works including the theoretical aspects.

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	Plane Table Survey: Introduction, Principle, Instruments, Methods of plane tabling, Advantages, Sources of errors.	**3**
2	Theodolite survey: Introduction, definitions, the vernier transit theodolite, temporary and permanent adjustment of theodolite, measuring horizontal and vertical angles, methods of traversing, closing error, computation of latitudes and departure, check in closed and open traverse, balancing of traverse, Gale's table, traverse area, omitted measurements.	**6**
3	Tacheometric Surveying : Introduction, purpose, principle, instruments, stadia constants, methods of tacheometry, anallatic lens, subtense bar, field work in tacheometry, Tangential method, reduction of readings, errors and precisions.	**5**
4	Trigonometric levelling: Indirect levelling, levelling on steep ground methods.	**3**
5	Geodetic Surveying- Principle and Classification of triangulationsystem- Selection of base lineand stations- Orders of triangulation- Triangulation figures- Station marksand signals- marking signals- Extension of base, Reduction of Centre, Selection and marking of stations	**6**
6	Curve Surveying: Simple Circular Curve, Compound and Reverse curves, Transition curves, Vertical curves, Elements and setting out curves.	**5**

7	Hydrographic Surveying: Introduction, Sounding, Methods of Locating soundings, Tide gauges, Mean Sea Level determination.	**3**
8	Theory of Error: Introduction, Types of errors, Laws of errors, laws of weights, distribution of errors, determination of most probable values.	**3**
9	Field Astronomy: Introduction, astronomical terms, determination of azimuth, latitude and longitude.	**3**
10	Aerial Photogrammetry: Introduction, Aerial camera, Scale of photograph, Ground control, Procedure of aerial survey, Photomaps.	**3**
11	Remote sensing, GIS, GPS: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, Key components of GIS, Functions and applications of GIS, GPS satellite system, principle, applications of GPS.	**3**
12	Modern Surveying Instruments: Introduction, Electromagnetic distance measurement, Total Station Surveying: Introduction, Electromagnetic distance measurement principles, horizontal & vertical angle measurements, setting up the total station, various field applications of total station surveying, data transfer mechanism and further process, advantages. Drone Survey (visual, lidar, multispectral & Thermal), DGPS survey.	**3**
13	Setting Out Works: Building, Culvert, Bridge, Tunnel	**2**

Suggested Specification table with Marks (Theory):

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

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:

- T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Vol-I and Vol-II, Pune VidyarthiGrihaPrakshan, 1972.
- B. C. Punmia, A.K. Jain & A.K. Jain, Surveying, Vol-I and Vol-II, Laxmi Publication Pvt., 1996.
- T.M. Lillesand and R.W. Kiefer, Remote Sensing and Image Interpretation, John Wiley & Sons, 1994.
- G. W. Schofield, Engineering Surveying, Butterworth, Heinemann, New Delhi, 2001.
- G. Joseph, Fundamentals of Remote Sensing, Universities Press, 2003.

- Dr. K.R. Arora, Surveying Vol. I, II and III, Standard Book House. New Delhi
- S. K. Duggal, Surveying Vol. I and II, Tata Mcgraw Hill, New Delhi
- R. Agor, Surveying and Levelling, Khanna Publishers, New Delhi
- R. Agor, Advanced Surveying, Khanna Publishers, New Delhi

Course Outcomes: After successful completion of the course the students shall be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Carry out traversing by plane table	6%
CO-2	Carry out traversing by theodolite	12%
CO-3	Prepare contour sheet by tacheometry survey	10%
CO-4	Understand triangulation and trigonometric levelling survey	12%
CO-5	Set out different types of horizontal and vertical curves on ground	10%
CO-6	Understand hydrographic survey, theory of errors and their applications	10%
CO-7	Fix up latitude and longitude of the place by astronomical observations	6%
CO-8	Understand aerial photogrammetry, remote sensing, GIS, GPS and their applications	14%
CO-9	Carry out survey with Total station	6%
CO-10	Understand the application of drone survey, LIDAR and DGPS	6%
CO-11	Set out foundation plan of building, culvert on ground	4%
CO-12	Fix up alignment of bridge and tunnel on ground.	4%

List of Experiments:

1. Plane Table Survey
2. Theodolite Traverse Survey
3. Tacheometry Contour Survey
4. Tangential and Trigonometric survey
5. Total Station Survey
6. Setting out curve
7. Setting out building foundation plan.

Major Equipment:

1. Vernier Transit Theodolite
2. Total Station
3. DGPS

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

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Civil and Infrastructure Engineering
Subject Code: 3134005
Semester – III
Subject Name: Fluid Mechanics and Hydraulics

Type of course: Engineering Science

Prerequisite: System of units, Laws of motion, Basic idea of force, Concept of centroid

Rationale:

Fluid Mechanics and Hydraulics is conceptual applications in the field of engineering science. With the help of this knowledge students may be able:

1. To understand the fundamentals of fluid mechanics, which is used in the applications of Hydraulics, Infrastructure Engineering, Marine Engineering, etc.
2. To understand the fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
3. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
4. To imbibe basic laws and equations used for analysis of static and dynamic fluids.
5. To understand the importance of fluid flow measurement and its applications in industries.
6. To determine the losses in a flow system, flow through pipes, and flow past immersed bodies.
7. To understand the characteristics of open channel hydraulics and hydraulic machines.

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)	
3	1	0	4	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	**Introduction:** Introduction to fluids and their applications, Concept of continuum, Knudsen number, Properties of fluids: Density, Specific weight, Temperature, Viscosity, Compressibility, Surface Tension, Elasticity, Thermal conductivity, Specific Heat, and Vapour pressure.	4
2	**Fluid Statics:** Pascal law, Hydrostatic law, Pressure and its types, Measurement of pressure using Barometer, Bourdan tube pressure gauge, Pressure transducer, Piezometer Column, U-tube and differential manometers, Hydrostatic forces on surfaces, Buoyancy and floatation.	6
3	**Fluid Kinematics:** Velocity field, Fluid flow methods for analysis of fluid motion, Types of fluid flows- Ideal and real flow, Steady and unsteady flow, Uniform and non-	6

	uniform flow, Compressible and incompressible flow, Laminar and turbulent flow, Rotational and irrotational flow, One, two and three dimensional flow Streamlines, Path lines, Streak lines and Stream tubes, Continuity equation, Circulation and vorticity, Fluid rotation and deformation, Stream function and velocity potential function, Flow net and its characteristics. Vortex flow: free vortex and forced vortex flow.	
4	**Fluid Dynamics:** Concept of control mass and control volume, Reynolds transport theorem, Conservation of mass and momentum equations, Euler's equation, Bernoulli's equation and applications of momentum and energy equations, Energy correction factor, Linear momentum equation, Analysis of free liquid jet, Reynolds experiment, Critical Reynolds number and its determination, Laminar flow through pipes and Hagen-Poiseuille equation, Coquettes flow, Characteristics and factors affecting turbulence, Velocity distribution for laminar and turbulent flow through pipe, Darcy-Weisbach equation for turbulent flow through pipe.	**6**
5	**Fluid Flow Measurements:** Flow measurement devices; Venturimeter, Orifice meter, Pitot tube, Mouth pieces, Nozzle meter, Rotometer, Weirs, Flow under sluice gates.	**6**
6	**Pipe Hydraulics:** Major and minor losses in pipes, Total energy line and hydraulic gradient lines, Siphons, Pipes connected in series and parallel, Branched pipes, Pipe networks, Water hammer analysis, Pipe network, Dimensional analysis, Rayleigh's method and Buckinghum's π-theorem, Dimensionless numbers- Reynold's number, Froude's number, Euler's number, Weber's number and Mach's number.	**7**
7	**Open Channel Hydraulics:** Flow through open channel: Steady-unsteady flow, Uniform and non-uniform flow, Critical flow, Gradually varied flow, Rapidly varied flow, Spatially varied flow, Hydraulic jump.	**5**
8	**Hydraulic Machines:** Turbines: classification of tribunes, Impulse and Reaction turbines, draft tubes, efficiency. Pumps: classification of pumps, centrifugal pump, efficiency and power.	**5**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**20**	**15**	**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. Introduction to Fluid Mechanics and Fluid Machines, S.K.Som, Gautam Biswas and Suman Chakraborty, Mc Graw Hill Education.

2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Flow through Open Channels, R. Srivastava, Oxford University Press.
4. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House.
5. Fluid Mechanics and Hydraulic Machines, Dr. R.K.Bansal, Laxmi Publication.
6. Fluid Mechanics, Douglas, J. Gasiorek, J. Swaffield, L. Jack, Longman Publication.
7. Fluid Mechanics, A.K. Jain, Khanna Publishers.
8. Introduction to Fluid Mechanics, R.W. Fox, and A.T. McDonald, John Wiley.

Course Outcomes:

Sr. No.	CO Statement	Marks % weightage
CO-1	Types of fluid and determine their properties.	**10**
CO-2	Basics of fluid statics and kinematics	**30**
CO-3	Basics of fluid dynamics and fluid flow measuring devices: Venturimeter, Orificemeter, Notches, Rotameter and Mouthpieces.	**30**
CO-4	Concept of various pipe flows, pipe losses, pipe networks, etc. for real life applications.	**15**
CO-5	Characteristics of open channel hydraulics and hydraulic machines.	**15**

List of Assignments:

Sr. No.	Assignment Statement
1	Fluids properties: Density, Viscosity, Capillarity and Surface tension.
2	Type of fluid flows based on Reynolds theorem.
3	Bernoullis equation for an incompressible fluid flow.
4	Coefficient of discharge for Venturimeter and Orificemeter.
5	Force exerted on stationary plate by impact of jet.
6	Major and minor losses in pipe flow.
7	Coefficient of discharge for rectangular, triangular and trapezoidal notch.
8	Concept of fluid velocity using Pitot tube.
9	Surface profile of free and forced vortex flow.
10	Hydraulic jump phenomenon in open channel.
11	Force balancing in fluid statics.
12	Pumps and Turbines.

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