



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject code: 3150004

Subject Name: Contributor Personality Development Program

Semester V

Type of course: Work-Personality Development

Rationale: The Contributor Program aims to accomplish the following outcomes in the lives of students–

- Improve the employability of students by giving them the right work ethic and thinking that employers are looking for.
- Build their confidence with which they can go into any job and contribute meaningfully.
- Improve their ability to engage better in the workplace and to be able to handle the challenges that come up there.
- Build their career-worthiness and help them develop into future-ready contributors with ability to navigate a career in a volatile, changing world.
- Widen their choices of career and success, so that they are able to open up more opportunities for themselves and take up unconventional career pathways.
- Enable them to recognize how they, as technical professionals, can participate and make a positive contribution to their communities and to their state.

Towards this goal, the Contributor Program has been designed to awaken and strengthen students from within, in terms of building positive self-esteem, increasing their confidence level and I-can attitude, improving their aspirations, giving them new methods of thinking, building their cognitive capacities, exposing them to the skills and practices associated with being contributors in the workplace (not mere employees).

The Program content is also designed to expose students to real-world workplace scenarios and sensitize them to some of the challenges faced in society around them, especially in the local communities around them and in their own state of Gujarat.

The Contributor Program syllabus has been evolved and fine-tuned over several years, (a) to address the changing need and contemporary challenges being faced by industry and what employers of today are looking for in the people they hire and (b) by working extensively with universities and students building an appreciation of their challenges and concerns. At the core, the program is guided by the higher ideas and principles of practical Vedanta in work.

Teaching and Examination Scheme per semester:

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

Note:

- Weekly 2 hours of Classroom facilitated sessions are planned which include Solutioning and Self-discovery sessions.



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- In addition, there will be individual/ team projects as part of Practicals. Students can do this on their own, with faculty as guide.

Note:

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

Content:

Sr. No.	Content	Total Hrs
1	The Contributor Work Ideal <i>In this topic, students explore what is their “ideal” of work - is the ideal to be a “worker” or to be a “contributor”? For example, an employee who has the ideal of a “worker” goes to work to pass time, earn a living, get benefits; in contrast to an employee with the ideal of a “contributor” who wants to make a difference, get things done well, create value for the company. This enables students to transform their expectation of themselves in work</i>	1.5 hrs Classroom engagement (including self-discovery/ solutioning sessions)
2	Identity & Self-esteem <i>In this topic, students engage with the question “who am I?” or on what basis do they define themselves. Is their identity defined by what others think of them (extrinsic self-esteem) or by what they think of themselves (intrinsic self-esteem)? Further, they discover positive identities that lead to intrinsic self-esteem, such as an I-can identity based on one’s capacity and inner strength. This enables them to build confidence and self-esteem.</i>	Same as above
3	Become a Creator of one’s destiny <i>In a “victim stance”, we see the career environment as full of difficulties and hurdles. We feel powerless or blame our circumstances for not having many opportunities. This makes us fearful of uncertainty and makes us settle for jobs where we remain mediocre. In this topic, students discover the “creator of destiny stance” to challenges and situations. This stance frees them to try out new things, open up new possibilities, take on responsibility, see the opportunity hidden in their environment.</i>	Same as above
4	Achieving Sustainable Success <i>In this topic, students discover how to achieve sustainable or lasting success, by building one’s “engine of success”, making them successful. Where their focus shifts to building one’s “engine of success” rather than being on chasing the “fruits of success”. This is important,</i>	Same as above



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	<i>because over a lifetime of work, all people go through ups and downs – where the fruits are not in their control. People who are focused on the fruits of success, fall prey to disappointment, loss in motivation, quitting too early, trying to find shortcuts – when fruits don't come. Whereas people focused on building their engine of success continue to contribute steadily, irrespective of whether fruits come or not. And with a strong engine of success, fruits come to them in time.</i>	
5	Career Development Models <i>In this topic, students explore a range of diverse “career development models” and the possibilities for contribution each opens up to them (e.g. start-up career model, change-maker career model, etc.). This opens their mind to different and even unconventional career models possible, beyond the usual (such as “stable large company career model” where one gets an engineering degree, then MBA, then get a job in a large company). This frees them from a herd mentality when making career choices.</i>	Same as above
6	Expanding contribution in every role <i>In this topic, students explore the many roles they can play in their life & discover the power they have to expand the contribution possible in any role. (E.g. role of student, role of manager, role of a project site engineer). So, the potential of a role is in the individual's hands. This opens their mind to an alternative way of career growth.</i>	Same as above

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (for B.Pharma)					
R Level	U Level	A Level	N Level	E Level	C Level
-	15	20	-	25	20

Distribution of Theory Marks (for B.E., Diploma, MCA)					
R Level	U Level	A Level	N Level	E Level	C Level
-	15	15	-	20	20

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

Reference resources:

A. Basic reference for both students and teachers

- Contributor Personality Program textbook cum workbook developed by Illumine



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2. Web-based ActivGuide™ for self-exploration of rich media resources to vividly understand many of the ideas, watch role models, learn from industry people, get reference readings – that help them enrich the understanding they gained in the class published by Illumine Foundation

B. Advanced reference for teachers

1. On Contributors, Srinivas V.; Illumine Ideas, 2011
2. Enlightened Citizenship and Democracy; Swami Ranganathananda, Bharatiya Vidya Bhavan, 1989
3. Eternal Values for a Changing Society – Vol I-IV, Swami Ranganathananda; Bharatiya Vidya Bhavan
4. Karma Yoga, Swami Vivekananda; Advaita Ashrama
5. Vivekananda: His Call to the Nation, Swami Vivekananda; Advaita Ashrama
6. Six Pillars of Self Esteem, Nathaniel Branden; Bantam, 1995
7. Mindset: The New Psychology of Success, Carol S. Dweck; Random House Publishing Group, 2007
8. Lasting Contribution: How to Think, Plan, and Act to Accomplish Meaningful Work, Tad Waddington; Agate Publishing, 2007
9. Why not?: how to use everyday ingenuity to solve problems big and small, Barry Nalebuff, Ian Ayres; Harvard Business School Press, 2003
10. The value mindset: returning to the first principles of capitalist enterprise (Ch 8 & 9); Erik Stern, Mike Hutchinson; John Wiley and Sons, 2004
11. The Power of Full Engagement: Managing Energy, Not Time, is the Key to High Performance and Personal Renewal, Jim Loehr, Tony Schwartz; Simon and Schuster, 2003
12. Creating Shared Value, Michael E. Porter and Mark R. Kramer; Harvard Business Review; Jan/Feb2011, Vol. 89 Issue 1/2
13. The Speed of Trust: The One Thing That Changes Everything, Stephen M. R. Covey, Rebecca R. Merrill, Stephen R. Covey; Free Press, 2008
14. The Courage to Meet the Demands of Reality, Henry Cloud; HarperCollins, 2009
15. Responsibility at work: how leading professionals act (or don't act) responsibly, Howard Gardner; John Wiley & Sons, 2007

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
Outcome of theory sessions		
CO-1	Students will be able to recognize & appreciate two alternative ideals of work – ideal of a “worker” and ideal of a “contributor”. And why organizations of today expect people they employ to be contributors and not just workers.	10-12%
CO-2	Students will be able to recognize & appreciate alternative ways in which they could define themselves or “who am I” (their identity) – and which are positive identities that will lead to building intrinsic self-esteem and confidence in oneself; in contrast to identities that will lead to extrinsic self-esteem that makes them	10-12%



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	more dependent on their environment.	
CO-3	Students will be able to recognize & appreciate a “victim” stance as distinct from a “creator of destiny” stance in the way people approach challenges and situations; and how the latter frees individuals to take on challenges and open up opportunities.	10-12%
CO-4	Students will be able to differentiate between two alternative approaches to success - ‘building one’s engine of success’ and ‘chasing the fruits of success’; they also appreciate the payoffs/ consequences of both and which is more likely to lead to sustainable or lasting success in the long run.	10-12%
CO-5	Students will be able to recognize & appreciate different career models and their value; to help them make more informed career-related choices.	10-12%
CO-6	Students will be able to recognize & appreciate how one can expand the contribution possible in any role, thereby opening up an alternative way of career growth to them.	10-12%
Outcome of practical sessions		
CO-7	Students learn to re-interpret their life and college experiences to showcase their contribution affinities which are relevant for employers.	15%
CO-8	Students learn to apply contributor thinking to real-world or career relevant challenges.	15%



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Bachelor of Engineering

Subject Code: 3150005

Semester – V

Subject Name: INTEGRATED PERSONALITY DEVELOPMENT COURSE

Type of Course –

Value-based holistic personality development course for university students.

Rationale -

This course aims to help a person understand and know his / her purpose in life, get a positive thought pattern, gain confidence, improve behaviour, learn better communication and develop a healthy physique with morality and ethics in its core.

Today youth lack the guidance to face insecurity about their health and career, premature relationships and family breakdown, addictions and substance abuse, negative impact of internet and social media etc. This course includes such topics that will cover all aspects and provide solution to the current challenges through creative and interactive activities.

This course will allow students to enjoy, understand and practice invaluable lessons preparing them for a successful future.

Teaching and Examination Scheme:

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

Content:

Lecture No.	Content	Hours
IPDC-1 (Semester-1)		
1	Remaking Yourself - Restructuring Yourself	2
2	Remaking Yourself - Power of Habit	2
3	Learning from Legends - Tendulkar & Tata	2
4	Mass Management - Project Management	2
5	From House to Home - Affectionate Relationships	2
6	Facing Failures - Factors Affecting Failures	2
7	Facing Failures - Failures are not Always Bad	2



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8	Remaking Yourself - Being Addiction-Free	2
9	Soft Skills - Teamwork & Harmony	2
10	Remaking Yourself - Handling the Devil - Social Media	2
11	From House to Home - Forgive & Forget	2
12	From House to Home - Listening & Understanding	2
13	Financial Wisdom - Basics of Financial Planning	2
14	Soft Skills - Networking - Decision Making - Leadership	2
15	Review Lecture - Student Voice-1	2

BASIC STUDY MATERIAL / MAIN COURSE WORK-BOOK -

1. IPDC Workbook-I
2. IPDC Workbook-II

IPDC REFERENCES –

- *These are the reference material for each lectures of IPDC.*

Module No.	Module/ Course Topics	Lectures	References
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1	Facing Failures	Factors Affecting Failures Failures are not Always Bad Insignificance of Failures Power of Faith Practicing Faith	<ol style="list-style-type: none">1. Thomas Edison's factory burns down, New York Times Archives, Page 1, 10/12/19142. Lincoln Financial Foundation, Abraham Lincoln's "Failures": Critiques, Forgotten Books, 20173. J.K. Rowling Harvard Commencement Speech Harvard University Commencement, 20084. Born Again on the Mountain: A Story of Losing Everything and Finding It Back, Arunima Sinha, Penguin, 20145. Failing Forward: Turning Mistakes Into Stepping Stones for Success, John C. Maxwell, Thomas Nelson, 20076. Steve Jobs: The Exclusive Biography Paperback, Walter Isaacson, Abacus, 2015
2	Learning from Legends	Tendulkar & Tata Leading Without Leading	<ol style="list-style-type: none">1. Chase Your Dreams: My Autobiography, Sachin Tendulkar, Hachette India, 20172. Playing It My Way: My Autobiography, Sachin Tendulkar, Hodder & Stoughton, 20143. The Wit and Wisdom of Ratan Tata, Ratan Tata, Hay House, 20184. The Tata Group: From Torchbearers to Trailblazers, Shashank Shah, Penguin Portfolio, 20185. The Leader Who Had No Title, Robin Sharma, Jaico Publishing House, 20106. In the Joy of Others: A Life Sketch of Pramukh Swami Maharaj, Mohanlal Patel and BAPS Sadhus, Swaminarayan Aksharpath, 2013
3	Mass Management	Project Management	<ol style="list-style-type: none">1. Project Management Absolute Beginner's Guide, Gregory Horine, Que Publishing, 20172. The Fast Forward MBA in Project Management, Eric Verzuh, Wiley, 20113. Guide to Project Management: Getting it right and achieving lasting benefit, Paul Roberts, Wiley, 2013



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4	My India My Pride	Glorious Past - Part 1 Glorious Past - Part 2 Present Scenario An Ideal Citizen - 1 An Ideal Citizen - 2 An Ideal Citizen - 3	<ol style="list-style-type: none">1. Hidden Horizons, Dr. David Frawley and Dr. Navaratna S. Rajaram, 20062. Rishis, Mystics and Heroes of India, Sadhu Mukundcharandas, Swaminarayan Aksharpath, 20113. Physics in Ancient India, Narayan Dongre, Shankar Nene, National Book Trust, 20164. The Rise of Civilization in India and Pakistan, Raymond Allchin, Bridget Allchin, Cambridge University Press, 19825. The Āryabhaṭīya of Āryabhaṭa: An Ancient Indian Work on Mathematics and Astronomy (1930), Walter Eugene Clark, University of Chicago Press, reprint, Kessinger Publishing, 2006
5	Remaking Yourself	Restructuring Yourself Power of Habit Being Addiction-Free Begin with the End in Mind Handling the Devil – Social Media	<ol style="list-style-type: none">1. Power of Habit, Charles Duhigg, Random House Trade Paperbacks, 20142. Change Your Habit, Change Your Life, Tom Corley, North Loop Books, 20163. The Seven Habits of Highly Effective People, Stephen Covey, Simon & Schuster, 20134. Seven Habits of Highly Effective Teens, Sean Covey, Simon & Schuster, 20125. Atomic Habits, James Clear, Random House, 20186. How a handful of tech companies control billions of minds every day, Tristan Harris, TED Talk, 2017
6	Financial Wisdom	Basics of Financial Planning Financial Planning Process	<ol style="list-style-type: none">1. Rich Dad Poor Dad, Robert Kiyosaki, Plata Publishing, 20172. The Warren Buffett Way, Robert Hagstrom, Wiley, 20133. The Intelligent Investor, Benjamin Graham, Harper Business, 20064. Yogic Wealth: The Wealth That Gives Bliss, Gaurav Mashruwala, TV18 Broadcast Ltd, 2016
7	From House to Home	Affectionate Relationships Forgive & Forget Listening & Understanding Bonding the Family	<ol style="list-style-type: none">1. “What Makes a Good Life? Lessons from the Longest Study on Happiness”, R. Waldinger, Ted Talks, 20152. Long Walk To Freedom, Nelson Mandela, Back Bay Books, 19953. Outliers, Malcolm Gladwell, Back Bay Books, 2011



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8	Soft Skills	Teamwork & Harmony Networking - Decision Making - Leadership	<ol style="list-style-type: none">1. The 17 Indisputable Laws of Teamwork, John Maxwell, HarperCollins, 20132. Team of Teams: New Rules of Engagement for a Complex World, Stanley McChrystal, Portfolio, 20153. Predictably Irrational, Revised and Expanded Edition: The Hidden Forces That Shape Our Decisions, Harper Perennial, Dan Ariely, 2010
9	Review	Student Voice – 1 Student Voice – 2 Words of Wim	

Course Outcomes:

- To provide students with a holistic education – focused on increasing their intelligence quotient, physical quotient, emotional quotient and spiritual quotient.
- To provide students with hard and soft skills, making them more marketable when entering the workforce.
- To educate students on their social responsibilities as citizens of India and have a greater sense of social responsibility.
- To provide students with a value-based education which will enable them to be successful in their family, professional, and social relationships by improving their moral and ethical values.
- To teach self-analysis and self-improvement exercises to enhance the potential of the participants.
- To have a broader sense of self-confidence and a defined identity.



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Subject Code: 3150610

SUBJECT NAME: CONCRETE TECHNOLOGY

SEM- V

Type of course: Professional core course

Prerequisite: Material Science

Rationale: Concrete is the most widely used construction material in the world made by mixing Portland cement with sand, crushed rocks and water. It plays an important role in Infrastructure and Private building construction. It is heterogeneous and has complex microstructure. Understanding the basic behaviour of concrete is very important for civil engineering students to become efficient civil engineering professionals. The course on Concrete technology acquaints the students with this second largest material in use after water. It will help the students to explore the material, its properties, intrinsic nature and application & also the recent advances in field of concrete technology

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs	% Weightag
1.	General: Historic development, Composition of concrete, Advantages of concrete over other materials, Advances and future trends in concrete, Overview of Sustainability and Concrete development.	2	10
2.	Ingredients of Concrete: Cement: Chemical composition, Hydration of cement, structure of hydrated cement, Tests on cement, Various types of cement Aggregates: Classification of aggregates, IS specifications, Properties of aggregates, Grading, Types of grading, Sampling & Testing of aggregates Water – General requirements & limiting values of impurities Admixtures: Additives & Admixtures, Types of admixtures, Applications, Mineral admixtures – Fly ash, silica fume, GGBS and other pozzolanic materials. Chemical Admixtures: Accelerators, Retarders, Water reducing admixtures, Plasticizers, Super plasticizers, Dosage and application	10	20
3.	Fresh Concrete: Properties of fresh concrete, Definition and Measurement methods of workability as per IS and ASTM standards, factors affecting workability, Segregation & Bleeding, Slump loss, Re-tempering, Site preparations for concreting, Mixing, Conveying, Placing, Compaction, Finishing of	5	20



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	concrete. Curing & various methods of curing.		
4.	<p>Hardened Concrete:</p> <p>Strengths of hardened concrete (Tensile & Compressive strength, Flexural & Bond strength), standard test methods as per IS and ASTM, Failure mechanism under compression & tension, Stress-strain behaviour of concrete, Overview of Modulus of elasticity, Dimensional stability – Creep & Shrinkage</p>	5	20
5.	<p>Durability & Permeability of concrete:</p> <p>Causes of deterioration in concrete and durability problems, Factors affecting durability, Transport mechanism of gases & fluids in concrete, Cracking & causes of cracking, Carbonation induced & corrosion induced cracking, Alkali-aggregate reaction, Degradation by freeze & thaw, Sulphate attack, Durability under sea-water (marine environment).</p>	5	10
6.	<p>Mix design of Concrete:</p> <p>Principles of concrete mix design, Parameters and factors influencing mix design, Indian Standard methods of mix design, Acceptability criteria, variability of results, Various provisions of IS code for sound concrete.</p>	5	10
7.	<p>Special concrete and Concreting methods:</p> <p>High strength concrete, High performance concrete, Fiber reinforced concrete, Polymer modified concrete, Self-compacting concrete, Light weight concrete, , Light-weight & heavy weight concrete, High volume fly ash concrete.</p> <p>Special concreting methods: Pumped concrete, Ready mix concrete, Under-water concreting, Hot & cold weather concreting, Precast concrete, Pre-placed concrete</p>	5	5
8.	<p>Miscellaneous Topics:</p> <p>Non-Destructive testing of concrete – Introduction to Destructive, semi-destructive & Non-destructive testing methodology, Problems faced during Non-destructive evaluation, Test methods like Rebound Hammer test, Ultra-sonic pulse velocity, Penetration tests, Pull out tests.</p> <p>Overview of Fracture Mechanics – Origin of fracture mechanics, Understanding the quassi-brittle nature of concrete, Failure of concrete under low stress, Micro—cracking, crack propagation, stress concentration at openings.</p>	5	5

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	40	5	5	5	5

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



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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.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify the important ingredients of concrete and its role in influencing the behaviour of concrete under different environment conditions	45
CO-2	Infer the results of the various experiments related to different ingredients of concrete, fresh concrete & hardened concrete	25
CO-3	Apply the concepts of Mix design to produce the concrete of adequate strength and durability	20
CO-4	Choose the correct type of concrete and concreting technology required for particular exposure and site condition	5
CO-5	Describe the underlying principle and interpretation of different types of the non-destructive & semi destructive testing methods	5

Term Work:

1. Term work shall consist of tests on cement and aggregate, fresh concrete and hardened concrete.
2. Term work shall include Presentation on the topics assigned by lab faculty member.
3. Term work shall include field visit and students will have to submit a report on it.
4. Oral/Practical marks include viva-voce on practical performed and submitted reports.

Reference Books:

1. A.M.Neville ; Properties of Concrete
2. D.F.Orchard; Concrete Technology
3. P Kumar Mehta, Monteiro; Concrete Technology
4. A R Santhakumar; Concrete Technology
5. M S Shetty; Concrete Technology
6. M L Gambhir; Concrete Technology



GUJARAT TECHNOLOGICAL UNIVERSITY

BE Semester-V
Subject Code: 3150611

Subject Name: TRANSPORTATION ENGINEERING

Type of course: Professional Core Course

Prerequisite:

Rationale:

1. To comprehend basic requirements of Highway, Rail, Water and Air Transportation.
2. To enable the students to apply the basic principles of geometric design, design of highway and traffic engineering in the field.
3. To know the functions and design of water transportation structures.
4. To know basic elements in Airport Engineering.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Importance of Transportation, Different modes of transportation, Overview of Road, Rail, Air and Water Transportation, Comparison of various modes of Transportation. Organizations and their functions - Central Road Research Institute (CRRI), Indian Road Congress (IRC), Railway Board (RB), Inland Waterways Authority of India (IWAI), Airport Authority of India (AAI), International Civil Aviation Organization (ICAO), Directorate General of Civil Aviation (DGCA).	2
2	Highway Transportation: Introduction: Highway planning and development in India, Classification of Rural and Urban roads, Highway alignment and surveys, Preparation of Detailed Project Report. Highway Geometric Design: Importance, highway cross section elements, sight distance, design of horizontal alignment, design of vertical alignment, design of intersection. Highway Materials: Components of highway pavement and materials used. Soil: Importance, Desirable properties, Index properties, Compaction, Strength evaluation tests. Aggregate: Functions, Desirable properties, Tests on road aggregates and quality control. Bituminous binders: Functions, Desirable properties, Tests on bitumen and quality control, Bitumen emulsion functions and classification, Modified bituminous binder	30



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	<p>functions and classification. Bituminous Mix: Desirable properties and requirement of design mix, general approach for design of bituminous mixes and introduction to Marshall Mix Design Method. Design and Construction of Pavement: Pavement component functions, factors affecting pavement design and basic pavement design of Flexible and Rigid pavement as per IRC guidelines, Steps for construction of highway on embankment and in cutting. Construction of embankment and subgrade, soil stabilization. Flexible Pavement: Construction of Granular Sub-Base/Drainage layer, Construction of Granular Base Course-WBM and WMM, Construction of bituminous pavement layers- base course and surface course, prime coat and tack coat. Rigid Pavement: Types of cement concrete pavement, components of cement concrete pavement and its functions, construction of cement concrete pavement, joints in cement concrete pavement-function and construction. Pavement Maintenance: Objective and classification of highway maintenance works. Distresses and maintenance measures in flexible and rigid pavements. Concept of pavement evaluation: Functional and Structural</p> <p>Highway Drainage, Arboriculture and Lighting: Requirements of drainage system, Surface drainage system, Sub-surface drainage system, Road Arboriculture, Highway lighting: Importance, Design factors and lighting layout. Traffic Engineering: Traffic characteristics, Traffic studies: Traffic Volume study, Spot speed studies, Travel time - Delay study, PCU, Origin and Destination studies, Parking studies, Road accident studies. Traffic regulations and control devices. Types of Intersections. Road safety aspect</p>	
3	<p>Rail Transportation: Role of Indian Railways in National Development, Basic requirement of railway alignment and functions of Permanent Way, Types of components and functions: Gauge, Rail, Fittings, Ballast, Embankments, Subgrade. Purpose: Coning of wheel, Super-elevation, points and crossing, signalling and interlocking, yard, junction and terminal.</p>	4
4	<p>Water Transportation: Harbour: Classification, components, site selection. Definitions: Harbour, Port, Plimsoll Line, Beam, Draft, Hull, Structures and functions: Jetty, Breakwater, Wharf, Dock, Lock, Quay, Mole, Dolphin. Mooring, Dredging. Natural Phenomenon: Tides, Waves, Wind, Currents. Navigational Aids: Lighthouse, Lightships, Buoys.</p>	3
5	<p>Air Transportation: Airport: Classification, Master plan, Site selection, Zoning laws, imaginary surfaces. Aircraft Component parts, Importance and Purpose: Wind rose diagram, Runway Orientation, Taxiway, Apron, terminal building, Marking and lighting on Runway, Taxiway and Apron</p>	3



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BE Semester-V
Subject Code: 3150611

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

Sr. No.	CO statement	Marks % weightage
CO-1	Illustrate and demonstrate parameters of highway planning, geometric and pavement design.	20
CO-2	Analyze pavement distresses, failures and suggest prevention measures.	20
CO-3	Describe basics of traffic flow parameters, parking, marking, signal, and signs.	10
CO-4	Solve problems of railway track geometrics and to understand various railway track materials, their properties and use.	20
CO-5	Identify various component parts of dock, harbour and airports and apply ship and aircraft characteristics in planning of harbour and airports.	15
CO-6	Design of pavement for the given for traffic.	15

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%	20%	20%	20%	10%	20%

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:

- Huang Y. H., Pavement Analysis and Design. Prentice Hall, Englewood Cliffs, New Jersey, USA, 1993, ISBN-0-13-655275-7
- Yoder E. J. and Witzak M. W., Principles of Pavement Design, John Wiley and Sons, New York, 1975
- Tang, Pavement Design
- Mannering F. L., Kilareski W. P. and S. S. Washburn, Principles of Highway Engineering and Traffic Analysis. Wiley India Pvt. Ltd., New Delhi.
- Atkins H.N., Highway Construction and Maintenance, Soils, and Concretes, Reston Publishing Company, Reston VA, 1983.
- Watson J. P., Highway Construction and Maintenance, Longman Scientific and Technical, New York, 1989.
- Dr. Sharma S. K., Principles, Practice and Design of Highway Engineering (Including Airports), S. Chand & Company Ltd.
- Chakraborty Partho, Das Animesh, Principles of Transportation Engineering, PHI



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BE Semester-V

Subject Code: 3150611

9. Khanna S.K., Justo C.E.G., Highway Engineering, Nem Chand & Bros., Roorkee.
10. Bindra S.P., A course in Highway Engineering, Dhanpat Rai Publications
11. Kadiyali L. R. and Lal, N. B., Principles & Practice of Highway Engineering, Khanna Publishers, Delhi.
12. Khanna S. K., Arora M. G. and Jain S.S., Airport Planning and Design, Nem Chand and Bros.
13. IRC:58-2015, Guidelines for the Design of Plain Jointed Rigid Pavement for Highways
14. IRC:37-2018, Guidelines for the Design of Flexible Pavements,
15. Specifications for Road and Bridges, Ministry of Road Transport & Highways (MoRTH)
16. Chandra Satish, Agarwal M.M., Railway Engineering, Oxford University Press,
17. Rangwala S. C., Principles of Railway Engg., Charotar publication
18. Bindra S. P., Docks & Harbour Engineering, Dhanpatrai Sons publication.
19. Srinivasan R., Harbour, Dock and Tunnel Engineering, Charotar Publication,
20. Linzodef Quinn A., Design and Construction of Ports & Marine structures, Mcgraw hill publication
21. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, Airport Engineering, Wiley publication
22. Saxena Subhash C, Airport Engineering Planning and Design, CBS Publishers & Distributors
23. Rangwala S. C., Airport Engineering, Charotar publication

List of Experiments:

1. Determination of aggregate crushing Value
2. Determination of aggregate impact value
3. Determination of Los Angeles Abrasion value
4. Determination of shape tests on aggregate
5. Determination of California Bearing Ratio values
6. Determination of viscosity of Bitumen
7. Determination of softening point of bitumen
8. Determination of ductility of the bitumen
9. Determination of flash point and fire point of bitumen
10. Determination of Bitumen content
11. Determination of stripping value of road aggregate
12. Determination of Marshall Stability value for Bituminous mix

Major Equipment:

1. Aggregate crushing value test apparatus
2. Aggregate impact value test apparatus
3. Los Angeles test apparatus
4. Flakiness and Elongation index gauge
5. California bearing ratio test apparatus
6. Kinematic viscometer test apparatus
7. Ring and ball test apparatus
8. Ductility test apparatus
9. Flash and fire point test apparatus



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BE Semester-V
Subject Code: 3150611

10. Marshal test apparatus

List of Open Source learning website:

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

Field Visit :

1. A visit of construction site of Highway and Railway for understanding of construction procedure
2. A visit of an Airport and Harbour / Port site for understanding various components and its function
3. A visit of Ready-Mix Concrete plant for understanding of process of producing concrete

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3150612

SUBJECT NAME: DESIGN OF STRUCTURES

B.E. SEM-V

Type of course: Professional Core course

Prerequisite: Mechanics of Solid, Structural Analysis-I

Rationale: This subject is applications of structural engineering principles to design basic structural elements using of reinforced concrete and steel as materials. The subject is specifically aim to develop understanding of various design philosophy, Indian codal provisions, design basis used in design of basic elements of framed structures and its detailing requirement.

Teaching and Examination Scheme:

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

Note: IS:456(2000), IS:800 (2007), Steel table are permitted in the examination.

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Unit-1: Introduction Objectives, Properties of Reinforced Concrete and Structural Steel, Loads & load combinations, Methods of Analysis, Codes & specifications, Design Philosophies - Working stress Method, Ultimate Load Method, Limit State Method, Plastic Method	04	10%
2	Unit-2: Philosophy of Limit state design for RC structures Limit state of collapse & serviceability, partial safety factors for material & loading. Limit State of Flexure: Stress-strain characteristics of concrete & reinforcing steel, Type of section-under reinforced, over reinforced & balance section, Neutral Axis depth, Moment of Resistance for singly reinforced, doubly reinforced and flanged sections. Limit state of Axial, Shear and Torsion, combined flexure & torsion, Bond & Anchorage, Development length, splicing	10	20%
3	Unit-3: Limit state design of RC structural Element Design of Beams: Simply supported, cantilever and continuous beams Design of Slab: One way, two way simply supported and continuous slabs	16	25%



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	Design of Column: Classifications, Assumptions, Design of Short Columns under axial load Design of Foundations: Design of isolated footing under axial load and uni-axial bending, combined footing.		
4	Unit-4: Philosophy of Limit state design for Steel: Limit state of collapse & serviceability, partial safety factor for material and loading, Type & behavior of sections – Plastic, compact, semi-compact, slender. Connections: Bolted connections – bearing type, behavior of bolted joints, Design strength of ordinary & HSFG bolts. Welded connections-Fillet and Butt weld, design of simple connections such as lap and butt joints, truss joint connections.	10	20%
5	Unit-5: Limit state design of Steel components Axial force design: Tension member: types of tension member, behavior, modes of failure, Design of tension member, splices, lug angle. Compression member: Behaviour, classification of sections, possible modes of failure, elastic buckling of slender member, design of compression member having single & built-up section, lacing & battening, Design for Beams and Beam-Columns: Type of sections, classification, Lateral stability, Design strength of laterally restrained and unrestrained beams, shear strength, deflection, web buckling & crippling, Design of simply supported beam. Combined axial and flexural design of member (Beam-Column) Footing : slab based, gusseted base foundation	16	25%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	20	50	15	05	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:



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Reference Books (RC Design)

1. P. C. Vargheese, Limit State Design of Concrete structure,
2. Shah & Karve; Limit State Theory & Design of Reinforced Concrete; Structure Pub., Pune
2. Dr. H.J. Shah; Reinforced concrete Vol-I; Charotar Pub. Anand
3. A.K.Jain; Design of Concrete Structures, Nemchand Publication
3. IS: 456 - Code of practice for plain and reinforced concrete
4. IS: 875 (Part I to V) - Code of practice for structural safety of Buildings Loading standards
5. IS: 1893 - Criteria for earthquake resistant design of structures
6. IS: 13920 -Code of Practice for ductile detailing of RC structure subjected to seismic force

Reference Books (Steel Design)

1. N.Subramanian; Steel Structures, Oxford Publication
2. Arya & Ajamani.; Design of Steel Structures; Nemchand & Bros., Roorkee
3. Dayaratnam P.; Design of Steel Structures; Wheelor pub. co., Delhi
4. Ramamrutham S. & Narayanan R.; Design of Steel Structures; Dhanpatrai & Sons, Delhi
5. IS: 800 – 2007, Code of practice for General Construction in steel
6. IS: 875 - (Part I to V) - Code of practice for structural safety of building loading standards
7. IS: 226 - Structural steel (Standard Quality)
8. SP: 6(1) - Structural steel section
9. SP: 6(6) - Application of plastic theory in design of steel structures

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Describe different properties of RC and Structural steel, loads & its combinations, method of analysis used in design of structural elements.	10
CO-2	Explain different design philosophy evolved time to time and its applicability in designing structural elements.	20
CO-3	Apply Indian standard codal provisions of Limit state methods for RC and Steel structural components.	25
CO-4	Apply design principles of Limit state methods in RC and steel structural components.	25
CO-5	Appraise capacity of RC and Steel structural elements in different design methods and designing section with appropriate method.	20

List of Experiments/Tutorials:

1. The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.
2. Prepare sketches of structural detailing of RC and steel components in sketch book/A3 size sheet.
3. Experiments may be designed and carried out related to the topics of the course such as
 - a. Design, casting and testing of under reinforced, over reinforced and limiting section.
 - b. Design and testing of steel sections as tie, strut, beam etc.
4. Practical examinations shall consist of oral based on term-work and above course.



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Major Equipment/Software:

1. Any professional software of Structural analysis such as STAAD-pro, SAP, ETABS
2. Universal testing machine/Compression Testing Machine/ loading frame & loading jack, Concrete Mixture

List of Open Source Software/learning website:

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

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

BE Semester-V
Subject Code: 3150613

Subject Name: PAVEMENT DESIGN AND HIGHWAY CONSTRUCTION

Type of course: Professional Elective Course-1

Prerequisite:

Rationale:

1. To Design appropriate Pavement for the roads
2. To enable the construction procedure of roads
3. To know the maintenance of the roads.
4. To know new techniques in the road construction.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	Pavement Materials and Characterization: Soil : Characterization for Earthwork, Subgrade. Effective CBR, Concept of Modulus of resilient of subgrade, Aggregate :Granular Subbase and Base layer - road aggregates used for WBM, WMM, Aggregate used in Bituminous layer, Its characteristics, gradation- Fullers equation, physical properties requirements for rural road and high-volume road., Concept of Modulus of resilient of sub base and base course as per IRC 37, Bituminous material : Bitumen, Emulsion, Modified bitumen, bituminous mix – Volumetrics, concept of modulus of resilient per IRC 37, Quality control and Quality Assurance plan for highway.	5
2	Design of Highway Pavement : Flexible Pavement: Factors affecting pavement design, ESWL, EWLF, VDF, Stress analysis – Boussinesq's theory, Burmister's two- and three-layer theory, Flexible pavement design as performance criteria- subgrade rutting criteria and fatigue cracking criteria for bituminous layer. Pavement design using IITPAVE software for granular base and granular sub base, cementitious base, cementitious sub base. Overview on Pavement design for low volume road using locally available material as per IRC SP-72. Drainage consideration in pavement design	15



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	Rigid Pavement: Design factors, Westergaard's stress analysis, load stress, temperature stress, Design based on fatigue behaviour of concrete, IRC-58 design method – Fatigue concept (using IIT RIGID), Design of joints, Friberg's analysis of dowel bar design, Design of tie bar. Overview on Pavement design for low volume road as per IRC SP-62	
3	Construction of Pavement : Flexible pavement: Construction procedure of embankment, subgrade, Sub base (Granular, sub base), Drainage layer, filter /separation layer, Base course-WBM, WMM, Lime stabilized, cement stabilized (Granular layer), Bituminous mix – Binder course and wearing course, its selection, its gradation, compaction and density requirements. Selection of different bituminous mix treatment as per functional and structural requirements of Construction procedure as per specification of MORTH Rigid pavement: Earthwork, Granular sub base, drainage layer, Dry lean concrete as per IRC-49, Pavement quality concrete construction requirements as per IRC:15 and IRC:58 and MORTH, Importance of joints and its provision Interlocking Concrete Block Pavement (ICBP) and Its procedure of laying, requirements, Pattern of blocks, Strength requirement as per guidelines of IRC SP 63.	10
4	Maintenance of pavement Flexible pavement: IRC-82, need of maintenance, types, planning, system approach, types of defects, symptoms, location, cause, severity level and treatment. Preventive and periodical renewals, its warrants and treatments. Rigid pavement- Maintenance and its methodology as per IRC: SP:83, Design of overlay.	6
5	Introduction to New Technology Recycle aggregate pavement as per IRC: 120 (RAP), Cold in place (CIP), Hot in place (HIP), plant mix technology, Methodology of construction, Cold mix technology as per IRC SP-100, White topping – Conventional, Ultra-thin white topping as per IRC SP-76, , Stone matrix asphalt as per IRC SP-79, Warm mix asphalt as per IRC SP 101, Micro surfacing ,slurry seal as per IRC SP-81.	6

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

Sr. No.	CO statement	Marks % weightage
CO-1	Evaluate the physical properties of highway material	25
CO-2	Design the flexible and rigid pavement.	30
CO-3	Construct the flexible and rigid pavement as per standard specification.	25
CO-4	Evaluate the necessity of required maintenance and suggest suitable treatment	10
CO-5	Adapt new technology in the highway construction.	10



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BE Semester-V

Subject Code: 3150613

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%	20%	20%	20%	15%	15%

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. Huang Y. H., Pavement Analysis and Design. Prentice Hall, Englewood Cliffs, New Jersey, USA, 1993, ISBN-0-13-655275-7
2. Yoder E. J. and Witczak M. W., Principles of Pavement Design, John Wiley and Sons, New York, 1975
3. Dr. Sharma S. K., Principles, Practice and Design of Highway Engineering (Including Airports), S. Chand & Company Ltd.
4. Chakraborty Partho, Das Animesh, Principles of Transportation Engineering, PHI
5. Khanna S.K., Justo C.E.G., Highway Engineering, Nem Chand & Bros., Roorkee.
6. Kadiyali L. R. and Lal, N. B., Principles & Practice of Highway Engineering, Khanna Publishers, Delhi.
7. Martin Rogers, Bernard Enright, Highway Engineering, Willey Blackwell
8. Paul H. Wright, Karen K. Dixon, Highway Engineering, John Wiley & Sons, 7th edition, 2004
9. Specifications for Road and Bridges, Ministry of Road Transport & Highways (MoRTH)
10. Rao G.V. Principles of Transportation and Highway Engineering, Tata McGraw-Hill Publishing Company Ltd., New Delhi, India, 1996.
11. Huang, Y.H. Pavement Analysis and Design, Pearson Prentice Hall, New Jersey, USA, 2004.

IRC Codes

1. IRC 82-2015 Code of practice for maintenance of bituminous surfaces of highways
2. IRC: SP:83 2015 - Maintenance & Rehabilitation of Cement Concrete Pavements
3. IRC : 37-2018 – Guidelines for the design of flexible pavement
4. IRC : 58-2015 - Guidelines for the design of plain jointed rigid pavement for highways
5. IRC :15 -2017: Standard specification and code of practice for construction of concrete roads
6. IRC SP 72-2015 - Guidelines for design and construction of flexible pavement for low volume road
7. IRC SP 63 Guidelines for the Use of Interlocking Concrete Block Pavement
8. IRC –SP-62-2014 – Guidelines for design and construction of cement concrete pavement for low volume road
9. IRC 120 Recycling of Bituminous Pavements
10. IRC SP-100 Use Of Cold Mix Technology In Construction And Maintenance Of Roads Using Bitumen Emulsion
11. IRC SP-81 Specifications For Slurry Seal And Microsurfacing



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12. IRC SP-101 Guidelines for Warm Mix Asphalt
13. IRC SP-76 Guidelines for Conventional Thin White-Topping
14. IRC SP 49-2014 Guidelines Of Use of Dry Lean Concrete as Sub-Base Course For Rigid Pavement

List of Experiments:

1. Bituminous mix design
2. Determination of CBR value of various mix
3. Determination of overlay thickness

Tutorial

1. Examples on stress analysis of flexible pavement for single layer, two layer and multi-layer
2. Problem on case study on design of Flexible pavement for NH/SH using IIT PAVE for granular sub base and base course
3. Problem on design of rural road
4. Problem on stress analysis of rigid pavement as per Westergaard theory
5. Design of dowel bar as per Friberg's analysis and design of tie bar
6. Design of Rigid pavement for fatigue damage as per IRC:58 using IITRIGID

Major Equipment:

1. Marshal Stability Test
2. California Bearing Ration Test
3. Benkelman Beam/Falling weight deflectometer

List of Open Source learning website:

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

Field Visit :

1. A visit of construction site of Highway for understanding of construction procedure of flexible and rigid pavement
2. A visit of Ready-Mix Concrete plant for understanding of process of producing concrete



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3150614

Semester V

SUBJECT NAME: STRUCTURAL ANALYSIS-II

Type of course: Professional Elective course-I

Prerequisite: Structural Analysis-I

Rationale: This subject is conceptual applications of principles of mechanics of rigid and deformable bodies in Engineering. This subject helps in determining statics response of statically indeterminate framed structures. In addition to this, the topics related to applications of Energy Principles, Moving loads will helps the students in developing the basic concepts of structural analysis. Use of professional software in structural analysis is a need of the day and hence it is included in this course.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	<p>Unit-1: Statically Indeterminate structure – Classical methods</p> <p>Slope Deflection Method: Analysis of continuous beams for various loading including settlement/ rotation of support, analysis of simple portal frame with sway.</p> <p>Moment Distribution Method: Analysis of plane frames including sway, use of symmetry of structure up to two storeyed / two bay frames.</p>	10	25%
2	<p>Unit-2 : Statically Indeterminate structures – Matrix methods</p> <p>Matrix Methods: Types of skeletal structures, Internal forces and deformations. Introduction and applications of stiffness method to analyze beams, Trusses and plane frames by system approach.</p> <p>Introduction and applications of Flexibility method to analyze beams, Trusses and plane frames by system approach.</p>	12	25%
3	<p>Unit-3: Energy Principles + Approximate methods</p> <p>Energy Principles:Castigliano's theorems, Application of castigliano's 1st and 2ndtheorm to statically determinate and indeterminate framed</p>	10	25%



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Subject Code: 3150614

	structure – beams, plane truss & plane frames. Approximate methods: Forces in the framed structure subjected to Vertical and lateral loads..		
4	Unit-4: Structure subjected to Moving loads Influence line diagrams ILD for statically determinate beams- I.L.D of support reaction, shear force and moment bending moment for beams subjected to u.d.l and several point loads, criteria for maximum effects, ILD for statically determinate trusses, forces in members for u.d.l and point loads ILD for statically indeterminate beams: Muller-Breslau's principle, steps for obtaining I.L for reaction and internal forces in propped cantilever and continuous beams, qualitative I.L diagram for rigid jointed structures having higher degree of statical indeterminacy.	10	25%
5	Unit-5: Computer Applications in Structural Engg. (for Laboratory only) Use of professional software such as STAAD-Pro, SAP, ETABS etc. for determining response of structure related to the topics of this course.		

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. Junarkar S. B. & Shah H. J.; Mechanics of Structures Vol-II; Charotar publishing house, Anand
2. Wang C. K.; Intermediate Structural Analysis; Tata McGraw Hill book Company, New Delhi
3. Gere & Weaver; Matrix Analysis of framed structures, CBS Publications
4. Ryder G.H.; Strength of Materials; Mcmillan
5. Gere & Timoshenko; Mechanics of Materials; CBS Publishers & Distributors, Delhi



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6. Hibbler R C; Structural Analysis; Pearson Education

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Determine response of statically determinate & indeterminate structure by classical & matrix method.	30
CO-2	Apply energy principles in determining response of statically determinate & indeterminate structures.	10
CO-3	Compute approximate internal forces in framed structure subjected to vertical and lateral loads.	10
CO-4	Determine internal forces and reactions in determinate and indeterminate structures subjected to moving loads.	25
CO-5	Determine response of framed structure using professional software	25

List of Experiments/Tutorials:

1. The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.
2. At least 50% problems will have to solve with professional software and compare results.
3. Experiments may be designed and carried out related to the topics of the course.
4. Practical examinations shall consist of oral based on term-work and above course.

Major Equipment/Software:

1. Any professional software of Structural analysis such as STAAD-pro, SAP, ETABS

List of Open Source Software/learning website:

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



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3150615
Semester - V
Subject Name: Soil Mechanics

Type of course: Program Elective

Prerequisite: Knowledge of Basic Geotechnical Engineering, Strength of Materials (MOS), Basic Geology

Rationale:

Soil Mechanics is fundamental subject consisting of determination of various soil properties based on soil investigation as per need and type of project in conjunction with building byelaws and construction practices. Thorough understanding of *Soil Mechanics* will help an engineer to decide the most optimum design based on rigorous analysis for any infrastructural projects. Further knowledge will act as a key to enter into multi-disciplinary folds of this subject into various other civil engineering schemes. The course/elective on *Soil Mechanics* provides the students in-depth knowledge of soil parameters and its determination, use of parameters in design and analysis, various numerical/analytical approaches using software, through IS codes and construction practices.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	Slope Stability: Infinite and finite slopes, factor of safety, type of slope failure, stability of infinite slopes, finite slopes forms of slip surfaces, limit equilibrium method and critical stage instability analysis, effects of tension crack and submergence, C-analysis-method of slices, Taylor's stability no., use of Bishop's method.	08
2	Stress Distribution of Soils: Causes of stress in soil, geostatic stress, Boussinesque's equation, stress distribution diagrams, Newmark's influence chart Westergard's equation, contact pressure, stresses due to triangular and other loadings.	05
3	Subsurface Investigation: Objectives of exploration, planning of exploration program, soil samples and soil samplers, field penetration tests: SPT, SCPT, DCPT., Introduction to geophysical methods, Bore log and report writing. Tests will be covered in lab sessions.	06
4	Shear Strength: Stress-Strain relationship in soil – Failure criteria – Mohr - Coulomb's failure theory – Shear parameters under different drainage conditions – Pore pressure	06



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	parameters, – Analytical predictions of pore water pressure – stress dilatancy theory – results of plain strain shear tests – Forces on shear parameters – Stress path and its applications – Rheological models. Tests will be covered in lab sessions.	
5	Bearing Capacity of Shallow Foundation : Introduction, significant depth, design criteria, modes of shear failures. Detail study of bearing capacity theories (Prandtl, Rankine, Terzaghi, Skempton), bearing capacity determination using IS Code, Presumptive bearing capacity. Settlement, components of settlement & its estimation, permissible settlement, Proportioning of footing for equal settlement, allowable bearing pressure. Bearing capacity by use of penetration test data and by plate load test. Bearing capacity of raft. Factors affecting bearing capacity including Water-Table. Contact pressure under rigid and flexible footings. Floating foundation. Types of pavements & its design. Tests will be covered in lab sessions.	07
6	Pile foundations : Introduction, load transfer mechanism, types of piles according to their composition, their method of installation and their load carrying characteristics, piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), penetration test data & Pile load test. Pile group: carrying capacity, efficiency and settlement. Negative skin friction. Underreamed pile foundation- its concept, design & field installation.	07
7	Introduction to Geosynthetics : Definition, types of geosynthetics, properties of geosynthetics and various foundation/poor soil/civil engg applications.	03

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
05	10	25	20	05	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:

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.



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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
9. V. N. S. Murthy; Soil Mechanics & Foundation Engineering; CRS Press, Taylor & Francis Group, New York

Course Outcomes: Students will be able to

Sr. No.	CO statement	Marks % weightage
	Students will be able to,	
CO-1	Classify the soil, understand its behavior and will be able to compute/estimate index parameters.	25
CO-2	Interpret soil behavior due to compaction, consolidation, and analyze 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, Settlements and demonstrate its socio-economic feasibility.	15

List of Experiments:

1. Auger boring/sampling
2. Standard/dynamic cone penetration test
3. Static cone penetration test
4. In situ permeability test
5. Free swell and swell potential
6. Swelling pressure test
7. Model pile load test.
8. Planning site investigations for a real life problem- project mode tests.SPT

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: 3150616
Semester –V
Subject Name: Pipeline Engineering

Type of course: Professional Elective

Prerequisite: Basic course in Hydraulic Engineering

Rationale: Any water supply project requires hydraulic as well as structural design of pipeline and major capital cost is involved in water conveyance and distribution system. To make the project economical proper planning and designing is required.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	Hydraulic design of transmission main Design flow, Hydraulic design Formula, head losses in pipes, Minimum pressure in Distribution system, Limiting Velocities, Design of rising main, Design of transmission main (pump and gravity), Types of Pumps and its selection. Techno economic analysis of rising main.	6
2	Water distribution system ESR Mass balance, Peak factor, Continuous and intermittent water supply, Analysis of flow in water distribution systems (pump and gravity), analysis of pipe network by various methods, Software used for design of water distribution system - EPANET, Extended period simulation. Design of pipe wall thickness and orifice.	8
3	Rehabilitation and Water auditing Rehabilitation of pipeline, Water audit, Online monitoring and control system, leak detection in pipeline, burst detection techniques	5
4	Pressure transient Water hammer, Surge analysis, surge pressure and its calculation, Remedial measures for water hammer and devices used to control water hammer, Use of Thrust block.	6
5	Pipes and Appurtenances Selection of pipe material, Factors to consider selection of pipe material, Types of pipe, corrosion, lining and coating, Types of valves and its usage, horizontal and vertical bends, design of miter bends, Flow meters	6



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6	Pipe Laying, Jointing and Testing System test pressure, Excavation, bedding, lowering and handling of pipes, Types of joints, Testing of Pressure Pipes and Non pressure pipes. Welding techniques, design and procedure qualifications. Testing of welded joints by Non destructive testing methods.	6
7	Structural design of pipes Structural design for buried and surface mounted pipes (MS Pipe), Pedestal for pipes, anchors, pipe supports for above ground pipes, design of thrust block, encasing, valve chambers, for underground pipes.	5

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. CPHEEO Manual on water supply and treatment
2. IWWA Manual on Design and Selection of pipes for water supply
3. Analysis of Water Distribution Network by P. R. Bhavé and R. Gupta
4. Water supply and sanitary engineering by G.S. Birdie and J.S. Birdie
5. Environmental engineering by H.S. Peavy, D.R. Row & G. Tchobanoglous
6. ASME section IX
7. API 1104
8. IS 3589 latest edition
9. IS 5504 latest edition
10. Pipe and Pipelines by JAICO publishers

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Design rising main, find out economic diameter and compute power requirement	20
CO-2	Calculate capacity of ESR and analyze and Design water distributions system using EPANET/WATER GEMS	20
CO-3	Explain Rehabilitation of pipeline, requirements of water audit and control system for distribution system.	15



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CO -4	Analyse water hammer pressure and select appropriate surge protection devices.	15
CO-5	Describe different types of materials used for pipe, lining and coating requirements, different types of valves used and its usage	15
CO-6	Explain pipe laying, jointing and testing of pressure and non-pressure pipe. Design buried and surface mounted pipe.	15

List of Tutorial:

1. Design of rising main based on given data and calculation of power requirement
2. Calculate capacity of ESR using mass balance method
3. Design of water distribution system using data given for an area of city using EPANET for extended period simulation.
4. List and Explain leak detection system and burst detection system in pipe line.
5. Calculate water hammer pressure using given data suggest appropriate water hammer control device
6. Calculate the size of thrust block required on pipeline based on given data
7. List different types of pipes and its jointing methods
8. Requirement of coating and lining in the pipe line
9. Differentiate the testing procedure for pressure and non-pressure pipes
10. Structural design of buried pipe and surface pipe (MS Pipe) based on given data. (Find out the minimum thickness required. Used IWWA Manual on Design and Selection of pipes for Water supply)



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Subject Code: 3150617

Semester –V

Subject Name: Remote Sensing and GIS

Type of course: Open Elective-I

Prerequisite: NIL

Rationale:

1. To develop a basic understanding about Geo-Spatial techniques and its applications.
2. To enable the students to apply the tools to solve various problems related to Civil Engineering.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hours
1	FUNDAMENTAL OF REMOTE SENSING: Definition –Components of Remote Sensing –Active and Passive Remote Sensing – Electro Magnetic Spectrum – Interaction of EMR With the Earth's Surface – Interactions with the Atmosphere Energy Sources and Radiation. Active and Passive Remote Sensing. Energy Interaction with the Earth Surface Features. Data Acquisition and Recording. Remote Sensing Data Products.	05
2	IMAGE INTERPRETATION AND DIGITAL IMAGE PROCESSING - Introduction to Digital Image and Imaging Sensors- Data Formats of Digital Image- Display of Digital Image - Image Processing Systems – Strategies – Keys – Equipment – Fundamentals of Image Classification and Analysis.	04
3	GEOGRAPHIC INFORMATION SYSTEM - Introduction to GIS- Definitions of GIS and related terminology - Components of GIS – GIS Data – Georeferenced data – introduction to data input and output in GIS– Fundamentals of data quality and Management	06



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4	SPATIAL DATA ANALYSIS -Characteristics of Map Coordinate systems- Introduction to Map projections- Geo-referencing Frameworks and Reference Coordinate Systems. GIS analysis functions – Retrieval – Reclassification – Buffering and Neighborhood – Overlaying – Data Output – Fundamentals of GIS Analysis functions	06
5	SOFTWARE - GIS and Image interpretation Software – Salient features – Capabilities and Limitations. Data management in public domain GIS software- Attribute Data Management	04
6	APPLICATIONS - Application of Remote Sensing / GIS– Case studies. GIS and Remote Sensing – Usefulness in Civil Engineering.	03

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. Lilliesand T.M. and Kiefer R.W., Remote Sensing and image Interpretation, John Wiley and Sons, New York, 2004.
2. Burrrough P.A and McDonnel R.A., Principles of Geographic Information Systems, Oxford university press, 1998
3. A.M. Chandra and S.K. Ghosh, Remote Sensing and Geographical information System, Narosa Publishing House, New Delhi, 2006
4. Bhatta B., Remote Sensing and GIS, Oxford University Press, New Delhi, 2008
5. Stan Aronoff, "Geographical Information Systems", WDL Publications, Ottawa, Canada, 1989.
6. Agrawal N.K., Essentials of GPS, Spatial Network Pvt. Ltd., Hyderabad, 2004.
7. Bhatta B., Remote Sensing and GIS, Oxford University Press, New Delhi, 2008
8. Manual of Remote Sensing (Edited), Series of volumes.
9. Lo C.P. and Yeung Albert K.W., Concepts and Techniques of Geographical Information Systems, Prentice-Hall of India Pvt. Ltd. New Delhi, 2006



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Course Outcomes:

Sr. No.	CO statement	weightage
CO-1	Observe, Identify and define simple/ complex problems of day to day lives present in Industry/ Society where GIS and Remote Sensing applications can be useful.	20 %
CO-2	Apply knowledge of basic image interpretation and data image processing.	25%
CO-3	Integrate the existing data through various observations from various angles and layer creation.	15%
CO-4	Apply problem-solving methodologies to generate, evaluate and justify innovative solutions by designing and conducting/ analyzing and interpreting the data.	15%
CO-5	Demonstrate the ability to give solutions with an ability which can help communicate effectively for giving better interpretation and solutions.	25%

List of Tutorials/Activities:

1. Projects on Water Resource Mapping and Management.
2. Projects on Land Use Mapping and Land Resource Management.
3. Projects on Site Selection for major infrastructure.
4. Projects on Natural Disaster Mitigation and Management.

List of Open Source Software/learning website:

1. CCRS Canada Centre for Remote Sensing - http://landmap.mimas.ac.uk/ipc/ccrs/fundam_e.html
2. NASA Remote Sensing Tutorial - <http://rst.gsfc.nasa.gov/>
3. TELSAT, Belgium - <http://eoedu.belspo.be/en/guide/index.htm>
4. <http://www.landsat.org/> (Free)
5. SRTM 90m Digital Elevation Data (Free) <http://srtm.csi.cgiar.org/>
6. Freeware MultiSpec (A Multispectral Image Data Analysis System) <http://cobweb.ecn.purdue.edu/~biehl/MultiSpec/>
7. Commercial ERDAS Imagine <http://gi.leica-geosystems.com/LGISub1x33x0.aspx>
8. PCI Geomatics <http://www.pcigeomatics.com/>
9. ENVI <http://rsinc.com/envi/>
10. ER Mapper <http://www.ermapper.com/>
11. IDRISI <http://www.clarklabs.org/>



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Bachelor of Engineering

Subject Code: 3151108

Semester – V

Subject Name: Python Programming

Type of course: Open Elective Subject

Prerequisite: Fundamental knowledge about computer systems and positive aptitude to learn programming, Basic knowledge of C Programming.

Rationale:

Python is general purpose programming language becomes very popular in last decade. In this age, every Electronics, Electrical and Computer engineers must learn Python Programming to build applications in their core domain. Python is becoming popular in artificial intelligence and machine learning. MicroPython is sub-set of Python Programming useful to port in hardware for embedded and IoT applications.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs	% Weight age
1	Introduction, Data Types and Operators: Installation and working with Python, Variables and data types in python, Perform computations and create logical statements using Python's operators: Arithmetic, Assignment, Comparison, Logical, Membership, Identity, Bitwise operators, list, tuple and string operations	6	20%
2	Python Decision making and Loops: Write conditional statements using If statement, if ...else statement, elif statement and Boolean expressions, While loop, For loop, Nested Loop, Infinite loop, Break statement, Continue statement, Pass statement, Use for and while loops along with useful built-in functions to iterate over and manipulate lists, sets, and dictionaries. Plotting data, Programs using decision making and loops.	8	20%
3	Python Functions and Modules: Defining custom functions, Organising Python codes using functions, Create and reference variables using the appropriate scope, Basic skills for working with lists, tuples, work with dates and times, get started with	6	20%



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	dictionaries, Importing own module as well as external modules, Programming using functions, modules and external packages		
4	Python File Operations: An introduction to file I/O, use text files, use CSV files, use binary files, Handle a single exception, handle multiple exceptions, Illustrative programs, Exercises	4	15%
5	MicroPython: Introduction, main difference between MicroPython and Python, Installation of MicroPython on Hardware, MicroPython libraries, GPIO programming on MicroPython Hardware, Sensor Programming using MicroPython	8	25%

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	20	25	15	10	10

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India
2. Python Programming Fundamentals- A Beginner's Handbook by Nischay kumar Hegde
3. Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication
4. Introduction to Python for Engineers and Scientists, By. Sandeep Nagar, Apress
5. MicroPython for the Internet of Things (A Beginner's guide to programming with Python on microcontrollers) By. Charles Bell, Apress

Course Outcomes:

After completion of this course students will be able ...

Sr. No.	CO statement	Marks % weightage
CO-1	To test and debug code written in python	25



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CO-2	To create applications using Python Programming	20
CO-3	To perform file operations to read and write data in files	25
CO-4	To write programs for general purpose I/O devices using MicroPython	30

List of Experiments:

- [1] Write Python programs to understand control structures
- [2] Write Python programs to understand list and tuples
- [3] Use conditional statements and loops in Python programs
- [4] Write python programs to create functions and use functions in the program
- [5] Import module and use it in Python programs
- [6] Write python program to plot data using PyPlot
- [7] To become familiar with MicroPython and NodeMCU. Configure NodeMCU for MicroPython.
- [8] Write program in MicroPython to send digital data on GPIO pins of NodeMCU and glow LED connected with NodeMCU or any other MicroPython supported board.
- [9] Connect Digital/Analog I/O module with NodeMCU and write program to display temperature in MicroPython.
- [10] Connect NodeMCU with with WiFi Access Point and transmit data from NodeMCU to Cloud. Connect Digital/Analog I/O module with NodeMCU and send temperature and light data on cloud (Thingspeak, Firebase or any other cloud service)

Major Equipment/software:

- NodeMCU boards or any other microcontroller board supporting MicroPython firmware
- Digital analog Input Output boards consisting LEDs, Switches, LDR, Temperature sensor, POT

List of Open Source Software/learning website:

- NPTEL Video lecture on Python Programming
- <https://www.coursera.org/learn/python-programming>
- Python Software



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- Turtle - <https://docs.python.org/2/library/turtle.html>
- PyLab - <https://scipy.github.io/old-wiki/pages/PyLab>
- Anaconda software

GTUQuestionPapers.com