TECHNO INDIA UNIVERSITY
WEST BENGAL

Syllabus for
B.Tech in Civil Engineering
AY 2024-2025

3rd SEMESTER

Program: B. Tech. in Civil Engineering	**Year, Semester:** 2nd Yr., 3rd Sem.
Course Title: Career Advancement & Skill Development (Organizational Behaviour)	**Subject Code:** TIU-UMG-S215
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit:** 1

COURSE OBJECTIVE:

Enable the student to:

1. Understand the fundamental concepts of organizational behavior and its importance in engineering and management.
2. Analyze individual and group behavior in organizations to improve team dynamics and leadership effectiveness.
3. Apply motivation theories, leadership styles, and decision-making processes in workplace scenarios.
4. Evaluate the impact of organizational culture, ethics, and structure on employee performance.
5. Develop essential communication and conflict resolution skills for effective teamwork.
6. Foster an understanding of change management and strategies to handle organizational challenges.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Explain key concepts of organizational behavior, including individual and group dynamics.	K2
CO2	Analyze the role of motivation, leadership, and communication in workplace effectiveness.	K4
CO3	Apply organizational behavior principles to real-world case studies and workplace situations.	K3
CO4	Evaluate the impact of organizational culture, ethics, and structure on decision-making.	K5
CO5	Demonstrate conflict resolution techniques and teamwork strategies in professional settings.	K3
CO6	Develop strategies for adapting to organizational change and innovation.	K6

COURSE CONTENT:

MODULE 1:		**7 Hours**
OB – Overview – Meaning of OB, Importance of OB, Field of OB, Contributing Disciplines, Applications in Industry Organizational Theory – Classical Theories: Scientific Management, Administrative Principles, Theory of Bureaucracy; Human Relations Approach; Modern Theories: Systems Approach, Contingency Approach, Quantitative Approach, Behavioural Approach		
MODULE 2:		**8 Hours**
Work Motivation – Approaches to Work Motivation, Theories of Motivation – Maslow's Hierarchy of Need Theory, Alderfer's ERG Theory, Herzberg's Motivation – Hygiene Theory, McClelland's Achievement – Motivation Theory, McGregor's Theory X &Y, Vroom's Expectancy Theory, Porter and Lawler Expectancy Model Personality and Individual Differences – Meaning of Personality, Determinants of Personality,		

Theories of Personality, Measurement of Personality, Development of Personality	
MODULE 3:	**12 Hours**
The Process of Perception – Process and Principles, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Making Judgements, Social Perception Learning – Concepts and Principles(hybrid team), Theories of Learning, Types, Techniques of Administration, Reinforcement, Punishment, Learning about Self	
MODULE 4:	**12 Hours**
Attitudes and Job Satisfaction – Sources of Attitudes, Types of Attitudes, Attitudes and Consistency, Cognitive Dissonance Theory, Attitude Surveys Work Stress – Understanding Stress, Potential Sources of Stress, Consequences of Stress, Managing stress, Hybrid work challenges.	
TOTAL LECTURES	**39 Hours**

Books:

1. Stephen P. Robbins & Timothy A. Judge, Organisational Behaviour, Pearson Education
2. Fred Luthans, Organizational Behavior: An Evidence-Based Approach, McGraw-Hill Education
3. John W. Newstrom & Keith Davis, Organizational Behavior: Human Behavior at Work, McGraw-Hill
4. K. Aswathappa, Organizational Behaviour, Himalaya Publishing House
5. Edgar H. Schein, Organizational Culture and Leadership, Wiley

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	1	1	1	2	1	2	1	2	1	2			
CO2	2	3	2	2	1	3	2	3	2	3	2	2			
CO3	1	2	2	2	2	2	2	3	3	3	2	2			
CO4	1	2	3	2	2	3	3	3	2	2	3	2			
CO5	1	2	2	2	2	2	2	3	3	3	2	2			
CO6	1	1	3	3	2	3	3	3	2	3	3	3			
	1.33	2.00	2.17	2.00	1.67	2.50	2.17	2.83	2.17	2.67	2.17	2.17			

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Program: B. Tech. in Civil Engineering	**Year, Semester:** 2nd Yr., 3rd Sem.
Course Title: Transform Calculus	**Subject Code:** TIU-UMA-T205
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. provide ideas about different transformations such as Laplace, Fourier transform
2. apply these transformations on solving differential equations such as initial value problem, boundary value problem
3. learn the concept of Fourier series

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	evaluate Laplace transform, inverse Laplace transform of a function.	K4
CO2	apply Laplace transform in solving initial value problems.	K3
CO3	interpret Fourier series representation of a function, sine and cosine series representation.	K4
CO4	deduce the value of an integral with the help of Fourier integral theorem.	K4
CO5	determine Fourier transform, Fourier sine and cosine transform of a function.	K4
CO6	apply Fourier transform in solving various problems.	K3

COURSE CONTENT:

MODULE 1:	**Laplace Transform**	**15 Hours**
Laplace Transform, properties, Inverse, Convolution, Evaluation of some integrals by Laplace Transform, Solution to initial value problems.		
MODULE 2:	**Fourier Series**	**10 Hours**
Fourier Series: Periodic functions, Fourier series representation of a function, half range series, sine and cosine series, Fourier integral formula, Parseval's identity.		
MODULE 3:	**Fourier Transform**	**20 Hours**
Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting and time shifting properties. Self-reciprocity of Fourier Transform, convolution theorem. Applications to boundary value problems.		
TOTAL LECTURES		**45 Hours**

Books:

1. Laplace and Fourier Transforms, *J. K. Goyal, K. P. Gupta, G. S. Gupta*
2. Fourier series and Integral Transforms, *Sreenadh S. et. Al.*

3. Integral Transforms and Fourier Series, *A.N. Srivastava*

Course Articulation Matrix

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	2	2	0	0	0	0	1	0	2			
CO2	3	3	2	2	2	0	0	0	0	1	0	2			
CO3	3	2	2	1	1	0	0	0	0	1	0	2			
CO4	3	3	2	3	2	0	0	0	0	1	0	2			
CO5	3	3	2	2	2	0	0	0	0	1	0	2			
CO6	3	3	2	2	3	0	0	0	0	1	0	3			
	3.00	2.67	1.83	2.00	2.00	0.00	0.00	0.00	0.00	1.00	0.00	2.17			

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Program: B. Tech. in Civil Engineering	**Year, Semester: 2 nd** Yr., 3 rd Sem.
Course Title: Energy, Environment & Ecology	**Subject Code:** TIU-UCE-T221
Contact Hours/Week: 1–1–0 (L–T–P)	**Credit: 2**

COURSE OBJECTIVE:

The objective of the subject is to provide an introduction to the energy system and its relationship with the environment. To provide knowledge about ecology and how it is related to the environment. An introduction to the process of environmental audit through EIA is also incorporated in this course.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Explain the fundamental principles of energy science and its role in societal, environmental, and climate issues.	K2
CO2	Describe various energy systems, sustainability concepts, and environmental impacts of energy consumption.	K2
CO3	Identify the importance of energy efficiency, conservation techniques, and clean energy technologies for sustainable development.	K3
CO4	Apply engineering principles for energy conservation, including Green Building concepts, LEED ratings, and energy audits.	K3
CO5	Explain ecological principles, including ecosystems, community ecology, and energy flow in ecosystems.	K2
CO6	Describe Environmental Impact Assessment (EIA) processes and analyze case studies related to environmental risk analysis.	K2

COURSE CONTENT :

MODULE 1:	***Introduction to Energy Science:***	**8 Hours**
Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment.		
MODULE 2:	***Energy & Environment***	**5 Hours**
Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; How future energy use can be influenced by economic, environmental, trade and research policy.		
MODULE 3:	***Engineering for Energy conservation:***	**5 Hours**
Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Energy Audit of facilities and optimization of energy consumption.		
MODULE 4:	***Ecology:***	**5 Hours**
Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids.		
MODULE 5:	***Environmental Impact Assessment:***	**7 Hours**

Evolution of EIA; EIA at project; Regional and policy levels; Strategic EIA. EIA process; Screening and scoping criteria; Rapid and comprehensive EIA; Specialized areas like environmental health impact assessment; Environmental risk analysis. Case studies on EIA.

Books:

1. Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press.
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press.
3. Larry Canter "Environmental Impact Assessment: Engineering Principles and Management Issues" Second Edition, MGH.
4. Chris Wood "Environmental Impact Assessment: A Comparative Review" 2nd Edition, Pearson Education.
5. M. Dash, "Fundamentals of Ecology" Tata McGraw-Hills, India.
6. Arthur P.J. Mol, David A Sonnenfeld, Gert Spaargaren (Editors) "The Ecological Modernization Reader Environmental Reform in Theory and Practice" Routledge.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	3	3	-	-	-	-	2			
CO2	3	2	-	-	-	3	3	-	-	-	-	2			
CO3	3	3	2	2		2	3	-	-	-	-	2			
CO4	2	3	3	2	2	2	3	-	-	-	2	2			
CO5	3	2	-	-	-	3	3	2	-	-		2			
CO6	3	3	2	3	2	3	3	2	1	2	2	2			
	2.83	2.50	2.33	2.33	2.00	2.67	3.00	2.00	1.00	2.00	2.00	2.00			

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Program: B. Tech. in Civil Engineering	**Year, Semester:** 2nd Yr., 3rd Sem
Course Title: Introduction to Solid Mechanics	**Subject Code:**TIU-UCE-T223
Contact Hours/Week: 3–1–0 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

1. Develop an understanding of deformation, strain, momentum balance, stress states, and their role in material modeling.
2. Apply Thermodynamics in Material Modeling
3. Analyze Mechanical Behavior of Structural Components
4. Integrate Experimental and Analytical Approaches

COURSE OUTCOME:

At the end of the semester Students would be able to

	Course Outcome	Bloom Taxonomy level
CO1	Recall fundamental concepts of stress, strain, elasticity, plasticity, and material properties.	K1
CO2	Identify different types of loads, stresses, and deformations in structural members under axial, shear, bending, and tensional forces.	K1
CO3	Explain the relationship between stress and strain, Hooke's Law, and mechanical behaviour of materials under different loading conditions.	K2
CO4	Interpret shear force and bending moment diagrams and their role in analyzing beam behaviour.	K2
CO5	Apply equilibrium and compatibility conditions to analyze axial, bending, shear, and torsional stresses in beams, shafts, and columns.	K3
CO6	Solve problems related to deflection, thermal stresses, and failure theories to ensure the safe design of structural components.	K3

COURSE CONTENT:

MODULE 1:		**6 Hours**
Deformation and Strain: Description of finite deformation, Infinitesimal deformation; Analysis of statically determinate trusses; Stability of dams, retaining walls and chimneys; Stress analysis of thin, thick and compound cylinder;		
Module 2:		**6 Hours**
Generalized state of stress and strain: Stress and strain tensor, Yield criteria and theories of failure; Tresca, Von-Mises, Hill criteria, Heigh-Westerguard's stress space		
Module 3:		**6 Hours**
Forces and Moments Transmitted by Slender Members, Shear Force and Bending Moment Diagrams, Momentum Balance, Stress States / Failure Criterion		
Module 4:		**6Hours**
Mechanics of Deformable Bodies: Force-deformation Relationships and Static Indeterminacy, Uniaxial Loading and Material Properties, Trusses and Their Deformations, Statically Determinate and Indeterminate Trusses.		

Module 5:		**6 Hours**
Elasticity and Elasticity Bounds: Stress-strain-temperature Relationships and Thin-walled Pressure Vessels, Stress and strain Transformations and Principal Stress, Failure of Materials		
Module 6:		**12Hours**
Bending: Stress and Strains; Deflections*:* Pure Bending, Moment- curvature Relationship, Beam Deflection, Symmetry, Superposition, and Statically Indeterminate Beams, Shear, Thermo elasticity, Energy methods, Variational Methods; Strain energy, elastic, complementary and total strain energy, Strain energy of axially loaded bar, Beam in bending, shear and torsion; General energy theorems, Castigliano's theorem, Maxwell Bettie's reciprocal theorem; Virtual work and unit load method for deflection, Application to problems of beams and frames.		
Module 7:		**3 Hours**
Stability of columns, Euler's formula, end conditions and effective length factor, Columns with eccentric and lateral load.		
TOTAL LECTURES		**45 Hours**

Text/Reference Books

1. Subhash C Sharma &Gurucharan Singh (2005), "Civil Engineering Drawing", Standard Publishers.
2. Ajeet Singh (2002), "Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, New Delhi.
3. Sham TickooSwapna D (2009), "AUTOCAD for Engineers and Designers", Pearson Education.
4. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd., (Corresponding set of) CAD Software Theory and User Manuals.

Course Articulation Matrix

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	1	2	2	2			1						
CO2	3	2	2	2	3	2			1						
CO3	3	2	3	2	3	2			1						
CO4	3	2	3	2	3	1			1						
CO5	3	2	3	2	3	3			1						
CO6	3	2	3	2	3	3			1						
	3	2	2.5	2	2.83	2.17			1						

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Program: B. Tech. in Civil Engineering	**Year, Semester:** 2nd Yr., 3rd Sem
Course Title: Mechanics of Materials	**Subject Code:**TIU-UCE-T241
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 2

COURSE OBJECTIVE:

1. Understand the Fundamentals of Continuum Mechanics
2. Develop Material Modeling Techniques Using Thermodynamics
3. Analyze Structural Behavior Through Mechanics of Materials
4. Bridge Experimental and Analytical Approaches in Material Behavior

COURSE OUTCOME:

	Course Outcome	Bloom Taxonomy level
CO1	Recall fundamental concepts of stress, strain, elasticity, plasticity, and material properties.	K1
CO2	Identify different types of loads, stresses, and deformations in structural members under axial, shear, bending, and tensional forces.	K1
CO3	Explain the relationship between stress and strain, Hooke's Law, and mechanical behaviour of materials under different loading conditions.	K2
CO4	Interpret shear force and bending moment diagrams and their role in analyzing beam behaviour.	K2
CO5	Apply equilibrium and compatibility conditions to analyze axial, bending, shear, and torsional stresses in beams, shafts, and columns.	**K3**
CO6	Solve problems related to deflection, thermal stresses, and failure theories to ensure the safe design of structural components.	**K3**

COURSE CONTENT :

MODULE 1:		**6 Hours**
Deformation and Strain: Description of finite deformation, Infinitesimal deformation; Analysis of statically determinate trusses; Stability of dams, retaining walls and chimneys; Stress analysis of thin, thick and compound cylinder;		
Module 2:		**6 Hours**
Generalized state of stress and strain*:* Stress and strain tensor, Yield criteria and theories of failure; Tresca, Von-Mises, Hill criteria, Heigh-Westerguard's stress space		
Module 3:		**6 Hours**
Forces and Moments Transmitted by Slender Members, Shear Force and Bending Moment Diagrams, Momentum Balance, Stress States / Failure Criterion		
Module 4:		**6Hours**
Mechanics of Deformable Bodies*:* Force-deformation Relationships and Static Indeterminacy, Uniaxial Loading and Material Properties, Trusses and Their Deformations, Statically Determinate and Indeterminate Trusses.		
Module 5:		**6 Hours**
Elasticity and Elasticity Bounds: Stress-strain-temperature Relationships and Thin-walled Pressure Vessels, Stress and strain Transformations and Principal Stress, Failure of Materials		
Module 6:		**12Hours**

***Bending: Stress and Strains; Deflections**:* Pure Bending, Moment- curvature Relationship, Beam Deflection, Symmetry, Superposition, and Statically Indeterminate Beams, Shear, Thermo elasticity, Energy methods, Variational Methods; Strain energy, elastic, complementary and total strain energy, Strain energy of axially loaded bar, Beam in bending, shear and torsion; General energy theorems, Castigliano's theorem, Maxwell Bettie's reciprocal theorem; Virtual work and unit load method for deflection, Application to problems of beams and frames.		
Module 7:		**3 Hours**
Stability of columns, Euler's formula, end conditions and effective length factor, Columns with eccentric and lateral load.		
TOTAL LECTURES		**45 Hours**

Text/Reference Books:

1. Norris, C.H. and Wilber, J. B. and Utku, S. "Elementary Structural Analysis" Mc Graw Hill, Tokyo, Japan.
2. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
3. Kazmi, S. M. A., 'Solid Mechanics" TMH, Delhi, India.
4. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
5. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
6. Gere, J. M., and S. P. Timoshenko. *Mechanics of Materials.* 5th ed. Boston: PWS Kent Publishing, 1970.
7. Ashby, M. F., and D. R. H. Jones. *Engineering Materials, An Introduction to their Properties and Applications.* 2nd ed. Butterworth Heinemann.
8. Collins, J. A. *Failure of Materials in Mechanical Design.* 2nd ed. John Wiley & Sons, 1993.
9. Courtney, T. H. *Mechanical Behavior of Materials.* McGraw-Hill, 1990.
10. Hertzberg, R. W. *Deformation and Fracture Mechanics of Engineering Materials.* 4th ed. John Wiley & Sons, 1996.
11. Nash, W. A. *Strength of Materials.* 3d ed. Schaum's Outline Series, McGraw-Hill, 1994.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	1	2	2	2	-	-	1	-	-	-			
CO2	3	2	2	2	3	2	-	-	1	-	-	-			
CO3	3	2	2	2	3	2	-	-	1	-	-	-			
CO4	3	2	3	2	3	1	-	-	1	-	-	-			
CO5	3	2	3	2	2	3	-	-	1	-	-	-			
CO6	3	2	3	2	3	3	-	-	1	-	-	-			
	3.00	2.17	2.33	2.00	2.67	2.17	-	-	1.00	-	-	-			

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Program: B. Tech. in Civil Engineering	Year, Semester: 2nd Yr., 3 rd Sem.
Course Title: Concrete Technology	Subject Code: TIU-UCE-T243
Contact Hours/Week: 3–0–0 (L–T–P)	Credit: 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand the behaviour of fresh and hardened concrete.
2. Be aware the recent developments in concrete technology
3. Recognize factors affecting the strength, workability and durability of concrete
4. Impart the methods of proportioning of concrete mixtures

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Identify** the properties of concrete ingredients and explain their role in the production, mixing, compaction, and curing of concrete	K1
CO2	**Explain** the properties of fresh and hardened concrete, including defects, behavior under different stresses, and time-dependent effects like creep and shrinkage.	K2
CO3	**Apply c**oncrete mix design principles considering cost, specifications, and environmental conditions.	K3
CO4	**Analyze**quality control measures and the behavior of concrete in extreme environmental conditions.	K3
CO5	**Interpret** the significance of various concrete testing methods, including destructive and non-destructive tests.	K2
CO6	**Identify** the characteristics and applications of special concretes, including fiber-reinforced and polymer concrete, and assess concrete deterioration and repair methods	K1

COURSE CONTENT:

MODULE 1:	**CONCRETE**	**9 Hours**
Properties of ingredients, tests, Production of concrete, different types of concrete-Self healing concrete, fiber reinforced concrete etc, mixing, compaction curing of concrete.		
MODULE 2:	**PROPERTIES OF FRESH CONCRETE**	**9 Hours**
Defects in Concrete, Concrete additives.; Behavior of concrete in tension and compression, shear and bond, Influence of various factors on test results, Time dependent behavior of concrete -creep, shrinkage and fatigue in concrete.		
MODULE 3:	**CONCRETE MIX DESIGN**	**9 Hours**
Proportioning of concrete mixes, basic considerations, cost specifications, factors in the choice of mix proportion, different method of mix design. Assignment on concrete mix design.		

MODULE 4:	QUALITY CONTROL, BEHAVIOR OF CONCRETE IN EXTREME ENVIRONMENT	9 Hours
Temperature problem in concreting, hot weather, cold weather and under water conditions, Resistance to freezing, Sulphate and acid attack, efflorescence, fire resistance in concrete; Inspection and testing of concrete- Concrete cracking, types of cracks, causes and remedies Non-destructive tests on concrete, Chemical tests on cement and aggregates.		
MODULE 5:	**CHEMICAL TESTS ON CEMENT AND AGGREGATES**	**9 Hours**
Special concrete; types and specifications, Fibre reinforced and steel Fiber reinforced concrete, Polymer concrete, Use of admixtures; Deterioration of concrete and its prevention Repair and rehabilitation.		
TOTAL LECTURES		**45 Hours**

Books:

1. Neville A.M. "Properties of Concrete", Trans-Atlantic Publications, Inc.; 5e, 2012.
2. Job Thomas., "Concrete Technology", Cenage learning.
3. R. Santhakumar., "Concrete Technology", Oxford Universities Press, 2006.
4. Shetty M. S., "Concrete Technology", S. Chand & Co., 2006.
5. Mehta and Monteiro, "Concrete-Micro structure, Properties and Materials", McGraw HillProfessional.
6. Neville A. M. and Brooks J. J., "Concrete Technology", Pearson Education, 2010.
7. Lea., "Chemistry of Cement and Concrete"., Butterworth-Heinemann Ltd, 5e, 2017.
8. Bungey, Millard, Grantham "Testing of Concrete in Structures" Taylor and Francis, 2006.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2				-	-	-	-	-	-	1			
CO2	3	2	1			-	-	-	-	-	-	1			
CO3	3	3	2	2	2	-	1	-	-	-	-	2			
CO4	3	3	2	2	2	2	3	-	-	-	-	2			
CO5	3	3	2	2	3	-	-	-	-	-	-	2			
CO6	3	2	2	2	2	2	3	-	-	-	-	2			
	3	2.5	1.8	2	2.25	2	2.3					1.6			

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Program: B. Tech. in Civil Engineering	**Year, Semester:** 2nd Yr., 3rd Sem
Course Title: Introduction to Solid Mechanics Lab	**Subject Code:** TIU-UCE-L245
Contact Hours/Week: 0–0–3 (L–T–P)	**Credit:** 1.5

COURSE OBJECTIVE:

The objective of the lab is to perform experiments which are related to Mechanics of Solid subject in order to understand the behavior of solid materials, especially their motion and deformation under the action of forces, temperature changes, phase changes, and other external or internal agents with the help of different mechanical equipment which students study in theory. We make students to perform different practical like Simple Beam, Different Lifting Machines, Tension and Compression test , Force and Force Systems, Moment of Inertia of Fly Wheel, Coefficient of Static Friction etc.

COURSE OUTCOME:

Sl. No.	Course Outcome	Bloom Taxonomy level
CO1	Recall the fundamental concepts of stress, strain, elasticity, and mechanical properties of materials through experimental observations.	K1
CO2	Identify different testing equipment and procedures for evaluating material behavior under various loading conditions.	K1
CO3	Explain the working principles of testing machines used for tensile, compression, bending, and torsion tests.	K2
CO4	Interpret experimental data to determine mechanical properties such as Young's modulus, Poisson's ratio, and shear modulus.	K2
CO5	Apply experimental methods to analyze the stress-strain response of materials under different loading conditions.	**K3**
CO6	Conduct laboratory experiments, record data systematically, and validate theoretical concepts with practical results.	**K3**

COURSE CONTENT:

Module 1	**Tension and Compression Testing**	**9 Hours**
Tension test on mild steel, Compression test on wood or concrete, Stress-strain behavior, Young's modulus determination.		
Module 2	**Bending and Shear Testing**	**9 Hours**
Bending test on cantilever and simply supported beams (Steel/Wood), Shear test on different materials, Load-deflection behavior.		
Module 3	**Torsion and Hardness Testing**	**9 Hours**
Torsion test on circular shafts, Determination of torsional rigidity, Hardness tests using Brinell and Rockwell methods.		
Module 4	**Impact and Spring Testing**	**9 Hours**

Impact test using Izod/Charpy methods, Spring test for stiffness and energy absorption, Load-deflection analysis of springs.		
Module 5	**Strain Measurement and Advanced Testing**	**9 Hours**
Verification of Maxwell's Reciprocal Theorem, Deflection test on a continuous beam, Use of electrical resistance strain gauges for strain measurement.		
TOTAL		**45 Hours**

Text/Reference Books:

1. Norris, C.H. and Wilber, J. B. and Utku, S. "Elementary Structural Analysis" Mc Graw Hill, Tokyo, Japan.
2. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
3. Kazmi, S. M. A., 'Solid Mechanics" TMH, Delhi, India.
4. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
5. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
6. Gere, J. M., and S. P. Timoshenko. *Mechanics of Materials.* 5th ed. Boston: PWS Kent Publishing, 1970.
7. Ashby, M. F., and D. R. H. Jones. *Engineering Materials, An Introduction to their Properties and Applications.* 2nd ed. Butterworth Heinemann.
8. Collins, J. A. *Failure of Materials in Mechanical Design.* 2nd ed. John Wiley & Sons, 1993.
9. Courtney, T. H. *Mechanical Behavior of Materials.* McGraw-Hill, 1990.
10. Hertzberg, R. W. *Deformation and Fracture Mechanics of Engineering Materials.* 4th ed. John Wiley & Sons, 1996.
11. Nash, W. A. *Strength of Materials.* 3d ed. Schaum's Outline Series, McGraw-Hill, 1994.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	1	2	2	2	0	0	1	0	0	0			
CO2	3	2	2	2	3	2	0	0	1	0	0	0			
CO3	3	2	2	2	3	2	0	0	1	0	0	0			
CO4	3	2	3	2	3	1	0	0	1	0	0	0			
CO5	3	2	3	2	2	3	0	0	1	0	0	0			
CO6	3	2	3	2	3	3	0	0	1	0	0	0			
	3.00	2.17	2.33	2.00	2.67	2.17	0.00	0.00	1.00	0.00	0.00	0.00			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 2nd Yr., 3 rd Sem.
Course Title: Concrete Technology Lab	**Subject Code:** TIU-UCE-L243
Contact Hours/Week: 0–0–3 (L–T–P)	**Credit: 1.5**

COURSE OBJECTIVE:

Enable the student to:

1- Effectively link theory with practice and application and to demonstrate background of the theoretical aspects.
2- Generate and analyze data using experiments and to apply elements of data statistics.
3- Solve problems including design elements and related to their course work.
4- Facilitate the understanding of the behavior of construction materials.
5- Impart the methods of proportioning of concrete mixtures.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Identify** and perform standard tests on cement, including specific gravity, fineness, soundness, consistency, and setting time.	K1
CO2	**Conduct** compressive strength tests on cement mortar cubes and interpret the results.	K2
CO3	**Perform** tests on fine aggregates, including specific gravity, bulking, fineness modulus, and bulk density, and analyze the results.	K3
CO4	**Conduct** sieve analysis, specific gravity, fineness modulus, and bulk density tests on coarse aggregates.	K3
CO5	**Determine** the workability of concrete using Slump, Compacting Factor, and Vee-Bee tests and interpret the findings.	K2
CO6	**Design** concrete mix proportions based on test results and apply mix design principles.	K3

COURSE CONTENT:

MODULE 1:	**TESTS ON CEMENT**	**10 Hours**
Determination of Specific Gravity, Fineness, Soundness, Normal Consistency, Initial and Final setting time on cement. Determination of Compressive Strength on cement mortar cubes.		
MODULE 2:	**TESTS ON FINE AGGREGATE**	**10 Hours**
Determination of Specific Gravity, Bulking, Fineness Modulus, Bulk Density of fine Aggregate.		
MODULE 3:	**TESTS ON COARSE AGGREGATE**	**11 Hours**
Determination of Specific Gravity, Sieve Analysis, Fineness Modulus, Bulk density of Coarse Aggregate.		
MODULE 4:	**TESTS ON CONCRETE**	**14 Hours**
Determination of workability of concrete by Slump Test, Compacting Factor test, Vee-Bee test. Determination of Compressive Strength of Concrete Cube Mould. Concrete mix design.Applicationin incorporating fly ash/ GGBS/ plastic waste/geopolymer concrete trials. NDT tests on cube moulds.		
TOTAL LECTURES		**45 Hours**

Books:

1. H.S.Moondra,RajivGupta , "Laboratory Manual for Civil Engineering" CBS Publishers & Distributors Pvt. Ltd.
2. M.K.Pant , "Laboratory Manual for Civil Engineering Students" S.K.Kataria& Sons.
3. Shetty, M.S., Concrete Technology, Theory & Practice, S.Chand and Co, 2004.
4. Gambhir, M.L., Concrete Technology, Tata McGraw Hill, 2004.
5. Nevile, Properties of Concrete, Longman Publishers, 2004.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	0	0	0	0	0	0	0	0	0	1			
CO2	3	2	0	2	0	0	0	0	0	0	0	1			
CO3	3	3	2	2	2	0	1	0	0	0	0	2			
CO4	3	3	2	2	2	0	0	0	0	0	0	2			
CO5	3	3	2	2	3	0	0	0	0	0	0	2			
CO6	3	2	3	2	3	0	2	0	0	0	0	2			
	3.00	2.50	1.50	1.67	1.67	0.00	0.50	0.00	0.00	0.00	0.00	1.67			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester: 2nd** Yr., 3rd Sem.
Course Title: Building Planning & Valuation	**Subject Code:** TIU-UCE-S219
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit:** 1

OURSE OBJECTIVE:

Enable the student to:

1. Understand the fundamental principles of building planning, design regulations, and standards.
2. Learn about different types of buildings, functional requirements, and space utilization.
3. Develop skills in valuation techniques, cost estimation, and financial assessment of buildings.
4. Gain knowledge of different methods for evaluating land, properties, and depreciation.
5. Apply principles of town planning and building bylaws for sustainable urban development.
6. Understand legal aspects related to property valuation and municipal regulations.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Explain the principles of building planning and design regulations.	K2
CO2	Apply functional requirements and space utilization in building planning.	K3
CO3	Analyze different valuation methods and cost estimation techniques.	K4
CO4	Evaluate land and property values, including depreciation factors.	K5
CO5	Apply town planning concepts and building bylaws for sustainable development.	K3
CO6	Assess legal and municipal regulations related to property valuation.	K5

COURSE CONTENT:

MODULE 1:		**10 Hours**
Real estate valuation: Various Purposes of Valuation, Laws Related to Real Estate, Real Estate Case Laws, Laws General		
MODULE 2:		**10 Hours**
Classification of buildings - Principles of planning - Dimensions of buildings - Building bye-laws for floor area ratio, open spaces.		
MODULE 3:		**10 Hours**
Orientation of buildings - Lighting and Ventilation- Planning and preparing sketches and working drawings of Residential buildings (Flat and sloping roof).		
MODULE 4:		**10 Hours**
Preparing a drawing of non –Residential building like Schools, Hostels, Hospitals buildings, 3D BIM modeling.		
MODULE 5:		**10 Hours**
Detailed working drawings of the component parts - Doors and Windows - Roof Trusses - Staircases-Toilets.		

MODULE 6:		**10 Hours**
Bar Bending Schedule of Beam, Column, Slab, Stirrup, Foundation plan and cross section of isolated footing.		
TOTAL LECTURES		**45 Hours**

Books:

1. Civil Engineering Drawing by M Chakraborty,
2. Civil Engineering Drawing by R.K.Dhawan, S.Chand Publication.
3. Real Estate Laws : Compendium of Indian Real Estate Laws by Dr. Adv. Harshul Savla
4. Real Estate Valuation by Dr. Adv. Harshul Savla (MRICS)
5. Real Estate Investing by Benedetto Manganelli

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	1	2	2	2	1	1	2	2	2			
CO2	2	2	3	2	2	2	2	1	1	2	2	2			
CO3	2	3	2	2	2	2	2	1	1	3	3	2			
CO4	2	3	2	3	2	2	2	2	1	3	3	2			
CO5	2	2	3	2	2	3	3	2	1	3	3	2			
CO6	2	2	3	2	2	3	2	3	1	3	3	2			
	2.17	2.33	2.50	2.00	2.00	2.33	2.17	1.67	1.00	2.67	2.67	2.00			

TECHNO INDIA UNIVERSITY
WEST BENGAL

TIU-UES-S281	Entrepreneurship Skill Development	1 credit

Syllabus

This course is designed to equip students with essential skills for career advancement, focusing on the latest software and technologies relevant to the civil engineering field, such as Building Information Modeling (BIM) and project management tools. Additionally, students will enhance their communication skills through presentations, report writing, and effective teamwork strategies, preparing them to excel in professional environments and collaborate efficiently in multidisciplinary teams. Emphasis will also be placed on networking and personal branding to help students effectively position themselves in the job market.

TECHNO INDIA UNIVERSITY
WEST BENGAL

4TH SEMESTER

Program: B. Tech. in Civil Engineering	**Year, Semester:** 2nd Yr., 4th Sem.
Course Title: CASD-Civil Engineering-Valuation and Societal Impact	**Subject Code:** TIU-UCE-S222
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit:** 1

COURSE OBJECTIVE:

Enable the student to:

1. To focus on principles of insurance and loss assessment
2. To familiarize the students with environmental issues in valuation
3. To create awareness of the importance of Civil Engineering and the impact it has on the society and at global levels
4. To raise awareness of the impact of Civil Engineering for the various specific fields of human endeavor
5. Need to think innovatively to ensure sustainability
6. To enrich students with competitive level knowledge

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Explain** the fundamental causes of structural deterioration, including material degradation, environmental effects, and loading conditions.	K2
CO2	**Describe** various assessment techniques, including non-destructive testing (NDT) and visual inspection, to evaluate structural damage.	K2
CO3	**Apply** appropriate repair and strengthening techniques for different types of structural defects based on engineering standards and best practices.	K3
CO4	**Demonstrate** the use of advanced materials, such as fiber-reinforced polymers (FRP) and high-performance concrete, for structural rehabilitation.	K3
CO5	**Develop** strategies for maintenance, retrofitting, and life-cycle enhancement of existing structures, ensuring safety and durability.	K3
CO6	**Integrate** sustainability concepts into structural rehabilitation, considering cost, environmental impact, and long-term performance.	K3

COURSE CONTENT:

MODULE 1:	Real Estate Valuation	**5 Hours**
Microeconomics (Theory, money and its function, savings and investments and components of economy), Professional and Bussiness Ethics & Standards, Valuation report writing, Book-keeping and accountancy		
MODULE 2:		**5 Hours**
Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and		

Ecological Footprint of India Vs other countries and analysis.		
MODULE 3:		**5 Hours**
Understanding the importance of Civil Engineering in shaping and impacting the world. The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering.		
MODULE 4:		**5 Hours**
Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability.		
MODULE 5:		**3 Hours**
Environment-Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.		
MODULE 6:		**5 Hours**
Built environment–Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability		
MODULE 7:		**2 Hours**
Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development;		
TOTAL LECTURES		**30 Hours**

Books:

1. Macroeconomics by N.Gregory Mankiw
2. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht.
3. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference andExposition
4. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The

Bridge, Vol 34, No.2, Summer2004.
5. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
6. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
7. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
8. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
9. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p129-130
10. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3,May.
11. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2p61-63
12. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN0920-4741.
13. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p 235-244.
14. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. P 199-206.
15. General Studies Engineering Aptitude by R.K. Jain
16. Civil engineering objective types by S. S. Bhavikatti
17. Civil Engineering Thorough Objective Type Questions by Gupta S. P. .

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	2	1	1	2	1	0	1	1	2			
CO2	3	3	2	3	2	1	2	1	0	1	2	2			
CO3	3	3	3	3	3	2	2	1	1	2	3	3			
CO4	2	3	3	3	3	2	2	1	1	2	3	3			
CO5	2	3	3	3	3	3	3	2	1	2	3	3			
CO6	2	2	3	3	3	3	3	2	1	3	3	3			
	2.5	2.67	2.67	2.83	2.5	2	2.33	1.33	0.67	1.83	2.5	2.67			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 2nd Yr., 4th Sem.
Course Title: Probability and Statistics	**Subject Code:**TIU-UMA-T202
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. understand the basics of probability and statistical analysis
2. analyze the nature of problems solved with probability distribution
3. understand basic statistics, dispersion, regression and curve fitting technique

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	To apply the foundational principles of probability and to have an idea of basic statistical features of data	K4
CO2	To derive the probability of events, represent events as random variables and calculate their probabilities	K4
CO3	To formulate and analyze several well-known distributions, including Binomial, Poisson, Normal, Exponential Distributions etc., and understand their scope of application to real world problems	K4
CO4	To calculate Measures of central tendences and analyse data based on them	K4
CO5	To calculate Measures of dispersion – standard deviation, variance	K4
CO6	To analyzeobservations in terms of regression and curve fitting	K4

COURSE CONTENT:

MODULE 1:	**PROBABILITY**	**25 Hours**
Probability: Classical, relative frequency and axiomatic definitions of probability, Mutually exclusive events, Independent events, conditional probability, Bayes' Theorem. Random Variables: Discrete and continuous random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments. Distributions: Uniform, Binomial, Geometric, Poisson, Negative binomial, Exponential, Normal distributions, Joint and marginal distribution.		
MODULE 2:	**STATISTICS**	**20 Hours**
Graphical representation of data, Frequency distributions, Measures of central tendencies – mean, median, mode, Measures of dispersion – standard deviation, variance, Principle of Least Squares, curve fitting, regression analysis.		
TOTAL LECTURES		**45 Hours**

Books:

1. Ravish R Singh, Mukul Bhatt Engineering Mathematics, McGraw-Hill Education
2. N G Das, Statistical Methods, McGraw-Hill

3. Sheldon M. Ross, Introiduction to Prpbability band Statistics for Engineers and Scientists, McGraw-Hill.

Course Articulation Matrix:

.	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	2	2	0	0	0	0	2	1	2			
CO2	3	3	1	3	2	0	0	0	0	1	1	2			
CO3	3	3	2	3	3	1	0	0	0	2	1	3			
CO4	3	3	1	2	2	0	0	0	0	2	1	2			
CO5	3	3	1	2	2	0	0	0	0	2	1	2			
CO6	3	3	2	3	3	1	1	0	0	3	2	3			
	3.00	2.83	1.33	2.50	2.33	0.33	0.17	0.00	0.00	2.00	1.17	2.33			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester: 2nd yr**Yr., 4th Sem.
Course Title: Fluid Mechanics	**Subject Code:**TIU-UCE-T234
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. understand the properties of fluids and fluid statics
2. derive the equation of conservation of mass and its application
3. solve kinematic problems such as finding particle paths and stream lines
4. use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems
5. analyze laminar and turbulent flows
6. understand the various flow measuring devices

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Recall fundamental properties of fluids, types of fluids, and basic fluid statics concepts such as pressure and buoyancy.	K1
CO2	Identify different types of fluid flows, forces acting on fluids, and key principles governing fluid mechanics.	K2
CO3	Explain the concepts of hydrostatics, kinematics, and dynamics of fluid motion, including continuity, momentum, and energy equations.	K1
CO4	Interpret the behavior of fluids under various conditions using Bernoulli's equation, flow measurements, and velocity distributions.	K3
CO5	Apply fundamental fluid mechanics principles to analyze fluid flow in pipes, open channels, and hydraulic structures.	K1
CO6	Solve practical engineering problems related to pressure measurement, flow rate estimation, and hydraulic machinery using fluid mechanics concepts.	K2

COURSE CONTENT:

MODULE 1:	Introduction	**7 Hours**
Dimensions and units – Physical properties of fluids - specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law - atmospheric, gauge and vacuum pressures measurement of pressure. Pressure gauges, Manometers: Differential and Micro Manometers.		
MODULE 2:	Hydrostatics	**7 Hours**
Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure.		
MODULE 3:	Fluid Kinematics	**7 Hours**
Overview: Suspension and Solution grout, Grouting equipment and methods, Grout design and layout, Grout monitoring schemes		
MODULE 4:	Measurement of Flow	**8 Hours**
Pitot tube, Venturi meter and Orifice meter – classification of orifices, small orifice and large orifice, flow over rectangular, triangular, trapezoidal and Stepped notches - –Broad crested weirs		

MODULE 5:	Laminar Flow And Turbulent Flows	**8 Hours**
Reynold's experiment – Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydrodynamically smooth and rough flows.		
MODULE 6:	Boundary Layer Theory	**8 Hours**
Boundary layer (BL) – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarman momentum integral		
TOTAL LECTURES		**45 Hours**

Books:

1. Fluid Mechanics, P. N. Modi and S. M. Seth, Standard book house, New Delhi
2. A text of Fluid mechanics and hydraulic machines, R. K. Bansal - Laxmi Publications (P) ltd., New Delhi

Course Articulation Matrix

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2	1	1	2	3	2	2	1	2	3	1			
CO2	1	1	2	1	1	3	1	2	1	3	2	2			
CO3	2	2	1	2	2	2	2	2	3	2	3	1			
CO4	1	1	2	1	2	3	1	2	1	2	1	2			
CO5	1	1	1	1	2	3	2	2	1	2	3	1			
CO6	2	2	1	2	2	2	1	2	1	2	2	2			
	1.6	1.5	1.3	1.4	2	2.6	1.5	1.6	1.5	2.3	2.5	2			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester: 2n**d Yr., 4th Sem.
Course Title: Structural Analysis-I	**Subject Code:** TIU-UCE-T236
Contact Hours/Week: 3–1–0 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

Enable the student to:

1- Equip the students with the comprehensive methods of structural analysis with emphasis on analysis of elementary structures.
2- Use the force and displacement methods of structural analysis with emphasis on analysis of rigid beams and frames.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Identify** different types of structures and determine their stability by analyzing static and kinematic indeterminacy for trusses, beams, and frames.	K1
CO2	**Explain** the behavior of cables, suspension bridges, and three-hinged arches under different loading conditions.	K2
CO3	**Determine** the effects of moving loads on determinate beams, trusses, and three-hinged arches to find critical loading positions	K2
CO4	**Describe** fundamental principles of materials and structural design criteria for analyzing determinate and indeterminate structural systems	K1
CO5	**Apply** force and displacement methods, such as the theorem of three moments, slope deflection method, and moment distribution method, to analyze beams and frames	K3
CO6	**Perform** laboratory experiments to analyze determinate and indeterminate structures and interpret experimental data for validation of theoretical concepts.	K3

COURSE CONTENT:

MODULE 1:	**INDETERMINACY AND STABILITY**	**5 Hours**
Types of structures, Stability of structures**,** Static and Kinematic Indeterminacy of Trusses, Beams and Frames.		
MODULE 2:	**CABLES AND ARCHES.**	**5 Hours**
Cables and Suspension bridges, three hinged arches.		
MODULE 3:	**INTRODUCTION TO ILD**	**5 Hours**
Moving loads for determinate beams; trusses and three hinged arches.		
MODULE 4:	**MATERIALS AND STRUCTURAL DESIGN CRITERIA**	**5 Hours**

Introduction to the analysis and design of structural systems. Analyses of determinate and indeterminate trusses, beams, and frames, and design philosophies for structural engineering. Laboratory experiments dealing with the analysis of determinate and indeterminate structures;		
MODULE 5:	**FORCE AND DISPLACEMENT METHOD**	**5 Hours**
Use of Force and Displacement method for analysis of beams and frames. (Methods can be taken as: Theorem of three moments, Slope deflection method, moment distribution method and other methods, at least one from each category)		
MODULE 6:	**TWO HINGED ARCH AND APPROXIMATE ANALYSIS**	**5 Hours**
Two hinged arch, Approximate analysis of Multi bay Multistoried Portal frames: Cantilever method, Portal method. Substitute frame analysis. Method of Elastic Centre. Column analogy technique		
MODULE 7:	**ILD FOR INDETERMINATE STRUCTURES**	**5 Hours**
Influence line diagram for Three-hinged and Two-hinged stiffening girders. Influence line diagram for indeterminate structures: Muller Breslau principle.		
MODULE 8:	**MATRIX METHODS OF STRUCTURAL ANALYSIS**	**5 Hours**
Stiffness matrix method; Application to simple problems of beams and frames; Flexibility matrix method; Application to simple problems of beams and frames.		
MODULE 9:	**PLASTIC ANALYSIS OF STRUCTURES**	**5 Hours**
Plastic analysis of Structures: application to Beams and Portal frames.		
TOTAL LECTURES		**45 Hours**

Books:

1. Gere and Timoshenko, Mechanics of materials, CBS. Publishers.
2. Kenneth Leet,Chia M Uang& Anne M Gilbert., Fundamentals of Structural Analysis, McGraw Hill.
3. R.Vaidyanathan and P.Perumal, Comprehensive Structural Analysis Volume I & II, Laxmi Publications (P) Ltd.
4. Wang C.K., Intermediate Structural Analysis, McGraw Hill.
5. Aslam Kassimali., Structural Analysis, Cenage Learning.
6. Chandramouli P N, Structural Analysis I –Analysis of Statically Determinate Structures, Yes DeePublishingPvtLtd.,Chennai,Tamil Nadu.
7. Devdas Menon, Structural Analysis, Narosa Publications.
8. Hibbeler., Structural Analysis, Pearson Education.
9. Kinney S., Indeterminate Structural Analysis, Oxford & IBH.
10. M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Printice Hall India.
11. Reddy C.S., Indeterminate Structural Analysis, Tata McGraw Hill.
12. Timoshenko S.P.& Young D.H., Theory of Structures, McGraw Hill.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1			
CO2	3	2	1	-	-	-	-	-	-	-	-	1			
CO3	3	3	1	-	-	-	-	-	-	-	-	1			
CO4	3	2	2	-	-	-	-	-	-	-	-	1			
CO5	3	3	2	2	1	-	-	-	-	-	-	2			
CO6	3	3	2	3	2	-	-	-	-	-	-	2			
	3	2.5	1.6	2.5	1.5							1.3			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester: 2**nd Yr., 4th Sem.
Course Title: Surveying and Geomatics	**Subject Code:** TIU-UCS-T226
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. understand the human learning aspects and primitives in learning process by computer
2. analyze the nature of problems solved with machine learning techniques
3. design and implement suitable machine learning technique for a given application

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Recall the surveying knowledge for the Civil Engineering construction.	K1
CO2	Tell ideas on linear and angular measurements, levelling, and differential levelling.	K1
CO3	Explain sources of error for accurate and precise measurement to prepare topographic maps.	K2
CO4	Illustrate the procedure to calculate areas, volumes, and earthwork quantities from topographic maps	K2
CO5	Apply the concept of traversing using standard and modern age instruments for Civil Engineering construction.	K3
CO6	Use of the modern software to forecast information related to the Civil Engineering construction.	K3

COURSE CONTENT:

MODULE 1:	**Introduction to Surveying , Triangulation and Trilateration**	**9 Hours**
Definition, classification and principles of surveying; introduction to chain surveying, compass surveying Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, bearing of survey lines, levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes. Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation -network- Signals. Baseline - choices - instruments and accessories - extension of base lines -corrections - Satellite station - reduction to centre – Inter visibility of height and distances - Trigonometric leveling- Axis single corrections.		
MODULE 2:	**Curves**	**9 Hours**
Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves		
MODULE 3:	**Modern Field Survey Systems**	**9 Hours**
Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, COordinate transformation, accuracy considerations.		

MODULE 4:	Photogrammetry Surveying	9 Hours
Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitute		
MODULE 5:	**Remote Sensing**	**9 Hours**
Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.		
TOTAL LECTURES		**45 Hours**

Books:

1. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros,2011.
2. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International,2010.
3. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited,2002.
4. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications,2001.
5. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House,2015.

Course Articulation Matrix

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	3	1	1	1	1	1	1	2	1			
CO2	3	2	2	2	1	1	1	1	1	1	1	1			
CO3	2	2	2	3	1	1	1	1	3	1	3	1			
CO4	2	2	2	2	3	1	2	1	3	2	2	1			
CO5	3	2	2	2	3	2	3	1	2	2	2	1			
CO6	3	2	2	2	3	1	2	2	3	3	3	1			
	2.6	2.2	2.0	2.3	2.0	0.6	1.6	1.2	2.2	1.7	2.2	1			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester: 2**nd Yr., 4th Sem.
Course Title: Transportation Engineering	**Subject Code:** TIU-UCS-T228
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. understand the human learning aspects and primitives in learning process by computer
2. analyze the nature of problems solved with machine learning techniques
3. design and implement suitable machine learning technique for a given application

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Describe highway development and planning, Classification of roads, road development in India.	K1
CO2	Enumerate geometric design of highways, highway cross section elements; sight distance	K1
CO3	Estimate traffic Characteristics and level of service of road for congestion free traffic movement	K2
CO4	Explain the standard properties of pavement materials for Highway Construction	K2
CO5	Predict the critical points of different types of roads sustaining vehicular loads through mechanical analysis.	K3
CO6	Employ the knowledge of design standards for flexible and rigid pavements and its components	K3

COURSE CONTENT:

MODULE 1:	**Highway development and planning**	**9 Hours**
Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.		
MODULE 2:	**Geometric design of highways**	**9 Hours**
Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems. Basic introduction to Railway engineering.		
MODULE 3:	**Traffic engineering & control**	**9 Hours**
Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems.		
MODULE 4:	**Pavement materials**	**9 Hours**
Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements.		
MODULE 5:	**Design of pavements**	**9 Hours**
Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors		

affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC.	
TOTAL LECTURES	**45 Hours**

Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros,2017.
2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.
3. Partha Chakraborty, ' Principles Of Transportation Engineering, PHIL earning,
4. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley.
5. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
6. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	1	1	1	3	1	2	2	1	3	2			
CO2	3	3	2	2	1	1	1	1	3	1	1	1			
CO3	3	2	2	2	3	1	2	3	3	2	3	2			
CO4	3	3	3	3	2	1	1	1	1	1	2	2			
CO5	3	3	3	3	3	1	3	2	2	2	2	1			
CO6	3	3	3	2	2	3	3	3	2	1	2	2			
	2.83	2.50	2.33	2.17	2.00	1.67	1.83	2.00	2.17	1.33	2.17	1.67			

Program: B. Tech. in Civil Engineering	**Year, Semester: 2 nd** Yr., 3 rd Sem.
Course Title:Environmental Engineering	**Subject Code:** TIU-UCE-T230
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit: 3**

COURSE OBJECTIVE:

Enable the student to:

1. Understand the fundamental principles of Environmental Engineering based on Fluid Mechanics, Biological, and Chemical Sciences.
2. Develop and apply basic and empirical equations for solving Environmental Engineering problems.
3. Analyze the interaction between fluid mechanics, biological processes, and chemical reactions in environmental systems.
4. Utilize scientific principles to design and evaluate Environmental Engineering applications.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Explain** the sources, characteristics, and quality requirements of water for different applications, along with water quality standards and indices.	K2
CO2	**Describe** water supply systems, including demand estimation, transmission, distribution, and treatment processes.	K2
CO3	**Identify** the characteristics of wastewater, conveyance methods, sewerage system design, and wastewater treatment processes.	K2
CO4	**Explain** air pollution sources, quantification methods, monitoring techniques, and control measures.	K2
CO5	**Demonstrate** knowledge of noise pollution measurement and control methods.	K3
O6	**Explain** municipal solid waste composition, collection, treatment, and disposal methods along with its environmental effects.	K2

COURSE CONTENT:

MODULE 1:	**Water Supply Engineering**	**12 Hours**
Sources of Water and Characteristic of water, quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment (aeration, sedimentation, coagulation flocculation, filtration, disinfection)		
MODULE 2:	**Waste-water Supply Engineering**	**12 Hours**
Quantity and Characteristics of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.		
MODULE 3:	**Air Pollution:**	**6 Hours**

Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution, automobile pollution, Air quality standards, Control measures for Air pollution, construction and limitations.		
MODULE 4:	**Noise Pollution:**	**7 Hours**
Basic concept, measurement and various control methods for noise pollution.		
MODULE 5:	**Solid Waste Management:**	**8 Hours**
Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Various disposal methods.		
TOTAL LECTURES		**45 Hours**

Books:

1. MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, NewDelhi
2. Integrated Solid Waste Management, Tchobanoglous, Theissen& Vigil. McGraw Hill Publication.
3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw Hill International Editions, New York1985.
4. Air Pollution, Rao & Rao. McGraw Hill Publication.
5. Environmental Engineering (Vol I), Water Supply Engineering, S.K. Garg, Khanna Publishers, New Delhi.
6. Environmental Engineering (Vol II), Wastewater Supply Engineering, S.K. Garg, Khanna Publishers, New Delhi.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	3	3	-	-	-	-	2			
CO2	3	2	2	-	-	3	3	-	-	-	-	2			
CO3	3	3	2	2	-	3	3	-	-	-	-	2			
CO4	2	2	-	2	-	3	3	2	-	-	-	2			
CO5	2	1	-	-	-	3	3	2	-	-	-	2			
CO6	3	3	2	3	2	3	3	2	1	2	2	2			
	3	2.17	2	2.33	2	3	3	2	1	2	2	2			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 2ND Yr., 4th Sem.
Course Title: Transportation Engineering Lab	**Subject Code:**TIU-UCE-L280
Contact Hours/Week: 0–0–3 (L–T–P)	**Credit:** 1.5

COURSE OBJECTIVE:

Enable the student to:

1. derive the equation of conservation of mass and its application
2. solve kinematic problems such as finding particle paths and stream lines
3. use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems
4. analyze laminar and turbulent flows
5. understand the various flow measuring devices

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Recall Tests on highway materials – Aggregates- Impact value, Los-Angeles Abrasion value water absorption, Elongation & Flakiness Index.	K1
CO2	Identify Bitumen & bituminous materials: Specific gravity, penetration value, softening point, loss on heating, Flash & Fire point test	K2
CO3	Explain the concepts of Stripping value test.	K1
CO4	Interpret Design of B.C. & S.D.B.C. Mix.	K3
CO5	Apply CBR Test, Marshal Stability Test	K1
CO6	Solve practical engineering problems related to Benkelman beam Test.	K2

COURSE CONTENT:

MODULE 1:	Tests on highway materials	**7 Hours**
Tests on highway materials – Aggregates- Impact value, Los-Angeles Abrasion value water absorption, Elongation & Flakiness Index.(including recycled aggregates)		
MODULE 2:	Bitumen & bituminous materials	**7 Hours**
Bitumen & bituminous materials: Specific gravity, penetration value, softening point, loss on heating, Flash & Fire point test.		
MODULE 3:	Stripping value test	**7 Hours**
the ratio of the average uncovered or stripped area observed visually to the total area of aggregates in each test, expressed as a percentage.		
MODULE 4:	Design of B.C. & S.D.B.C. Mix	**8 Hours**
the ratio of the average uncovered or stripped area observed visually to the total area of aggregates in each test, expressed as a percentage.		
MODULE 5:	CBR Test	**8 Hours**
CBR test, Correlation of CBR Test with Plate Load Test for Pavement Design		

MODULE 6:	Marshal Stability Test	8 Hours
The basic Marshall test consists essentially of crushing a cylinder of bituminous material between two semi-circular test heads and recording the maximum load achieved (i.e. the stability) and the deflection at which the maximum load occurs (i.e. the flow), Tests on RCA in pavement construction.		
TOTAL LECTURES		**45 Hours**

Books:

1. Principles of Transportation Engineering by Chakroborty& Das, Prentice Hall, India.
2. Highway EnggbyS.K.Khanna& C.E.G. Justo, Nem Chand Bros., Roorkee.
3. Traffic Engg and Transport Planning byL.R.Kadiyali, Khanna Publishers, Delhi.
4. Principles of Transportation and Highway Engineering byG.V.Rao, Tata McGrawHill Publishing Co. Ltd. N.Delhi.
5. Traffic Engg. by Matson, T.M., Smith, W.S. and Hurd, F.W, McGraw- Hill Book Co., New York.

Course Articulation Matrix

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2	1	1	2	3	2	2	1	2	3	1			
CO2	1	1	2	1	1	3	1	2	1	3	2	2			
CO3	2	2	1	2	2	2	2	2	3	2	3	1			
CO4	1	1	2	1	2	3	1	2	1	2	1	2			
CO5	1	1	1	1	2	3	2	2	1	2	3	1			
CO6	2	2	1	2	2	2	1	2	1	2	2	2			
	1.6	1.5	1.3	1.4	2	2.6	1.5	1.6	1.5	2.3	2.5	2			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech Civil Engineering	**Year, Semester:** 2nd Yr., 4th Sem.
Course Title: Environmental Engineering Lab	**Subject Code:** TIU-UCE-L282
Contact Hours/Week: 0–0–3 (L–T–P)	**Credit:** 1.5

COURSE OBJECTIVE:

The objective of this course is to train the students to do practical experiments related to Environmental Engineering. To provide analysis of water and wastewater in terms of its physical, chemical and biological characteristics.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Explain** the physical characteristics of water	K2
CO2	**Classify** different types of solids in water	K2
CO3	**Find** total, calcium, and magnesium hardness and interpret their environmental impact.	K3
CO4	**Find** the optimum coagulant dose for water treatment	K3
CO5	**Examine**the biological characteristics of water	**K3**
CO6	**Apply** laboratory techniques for water quality assessment	**K3**

COURSE CONTENT:

MODULE 1:	**Physical Characterization of water**	6 Hours
Turbidity, Electrical Conductivity, pH		
MODULE 2:	**Analysis of solids content of water**	6 Hours
Dissolved, Settleable, Suspended & Total Solids etc Determination of concentration of Iron in a given sample of water		
MODULE 3:	**Alkalinity and acidity, Hardness**	12Hours
Total Hardness, Calcium and Magnesium Hardness**.** Determination of carbonate, bi-carbonate and hydroxide alkalinity for a given sample of water Determination of acidity for a given sample of water Determination of concentration of Chlorides in a given sample of water		
MODULE 4:	**Optimum coagulant dose**	3 Hours
Jar Test of water sample.		
MODULE 5:	**Biological Characteristics of water**	12 Hours
COD, DO, BOD test, MPN test		
Module 6	**Disinfection test of water**	6 Hours
Determination of the Chlorine Demand and Break-Point Chlorination for a given sample of water, UV disinfection, solar disinfection (SODIS)		
Total		45 Hours

Books:

1. H.S.Moondra,RajivGupta , “Laboratory Manual for Civil Engineering” CBS Publishers & Distributors Pvt. Ltd.

2. M.K.Pant , "Laboratory Manual for Civil Engineering Students" S.K.Kataria& Sons.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	2	1	3	2	1	1	2	1	2			
CO2	3	2	1	2	1	3	2	1	1	2	1	2			
CO3	3	3	2	3	2	3	2	2	2	2	2	3			
CO4	3	3	2	3	2	3	3	2	2	3	2	3			
CO5	3	3	2	3	2	3	3	2	2	3	2	3			
CO6	3	3	3	3	3	3	3	2	2	3	3	3			
	3	2.67	1.83	2.67	1.83	3	2.5	1.67	1.67	2.5	1.83	2.67			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester: 2n**d Yr., 4th Sem.
Course Title: Structural Analysis-I	**Subject Code:** TIU-UCE-T236
Contact Hours/Week: 3–1–0 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

Enable the student to:

1- Equip the students with the comprehensive methods of structural analysis with emphasis on analysis of elementary structures.

2- Train the students with the force and displacement methods of structural analysis with emphasis on analysis of rigid beams and frames.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Identify** different types of structures and determine their stability by analyzing static and kinematic indeterminacy for trusses, beams, and frames.	K1
CO2	**Explain** the behavior of cables, suspension bridges, and three-hinged arches under different loading conditions.	K2
CO3	**Determine** the effects of moving loads on determinate beams, trusses, and three-hinged arches to find critical loading positions	K2
CO4	**Describe** fundamental principles of materials and structural design criteria for analyzing determinate and indeterminate structural systems	K1
CO5	**Apply** force and displacement methods, such as the theorem of three moments, slope deflection method, and moment distribution method, to analyze beams and frames	K3
CO6	**Perform** laboratory experiments to analyze determinate and indeterminate structures and interpret experimental data for validation of theoretical concepts.	K3

COURSE CONTENT:

MODULE 1:	**INDETERMINACY AND STABILITY**	**10 Hours**
Types of structures, Stability of structures**,** Static and Kinematic Indeterminacy of Trusses, Beams and Frames.		
MODULE 2:	**CABLES AND ARCHES.**	**8 Hours**
Cables and Suspension bridges, three hinged arches.		
MODULE 3:	**INTRODUCTION TO ILD**	**8 Hours**
Moving loads for determinate beams; trusses and three hinged arches.		
MODULE 4:	**MATERIALS AND STRUCTURAL DESIGN CRITERIA**	**8 Hours**

Introduction to the analysis and design of structural systems. Analyses of determinate and indeterminate trusses, beams, and frames, and design philosophies for structural engineering. Laboratory experiments dealing with the analysis of determinate and indeterminate structures;		
MODULE 5:	**FORCE AND DISPLACEMENT METHOD**	**11 Hours**
Use of Force and Displacement method for analysis of beams and frames. (Methods can be taken as: Theorem of three moments, Slope deflection method, moment distribution method and other methods, at least one from each category)		
TOTAL LECTURES		**45 Hours**

Books:

1. Gere and Timoshenko, Mechanics of materials, CBS. Publishers.
2. Kenneth Leet,Chia M Uang& Anne M Gilbert., Fundamentals of Structural Analysis, McGraw Hill.
3. R.Vaidyanathan and P.Perumal, Comprehensive Structural Analysis Volume I & II, Laxmi Publications (P) Ltd.
4. Wang C.K., Intermediate Structural Analysis, McGraw Hill.
5. Aslam Kassimali., Structural Analysis, Cenage Learning.
6. Chandramouli P N, Structural Analysis I –Analysis of Statically Determinate Structures, Yes DeePublishingPvtLtd.,Chennai,Tamil Nadu.
7. Devdas Menon, Structural Analysis, Narosa Publications.
8. Hibbeler., Structural Analysis, Pearson Education.
9. Kinney S., Indeterminate Structural Analysis, Oxford & IBH.
10. M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Printice Hall India.
11. Reddy C.S., Indeterminate Structural Analysis, Tata McGraw Hill.
12. Timoshenko S.P.& Young D.H., Theory of Structures, McGraw Hill.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1			
CO2	3	2	1	-	-	-	-	-	-	-	-	1			
CO3	3	3	1	-	-	-	-	-	-	-	-	1			
CO4	3	2	2	-	-	-	-	-	-	-	-	1			
CO5	3	3	2	2	1	-	-	-	-	-	-	2			
CO6	3	3	2	3	2	-	-	-	-	-	-	2			
	3	2.5	1.6	2.5	1.5							1.3			

TECHNO INDIA UNIVERSITY
WEST BENGAL

TIU-UES-S282	Entrepreneurship Skill Development	1 credits

Syllabus

This course is designed to equip students with essential skills for career advancement, focusing on the latest software and technologies relevant to the civil engineering field, such as Building Information Modeling (BIM) and project management tools. Additionally, students will enhance their communication skills through presentations, report writing, and effective teamwork strategies, preparing them to excel in professional environments and collaborate efficiently in multidisciplinary teams. Emphasis will also be placed on networking and personal branding to help students effectively position themselves in the job market.

TECHNO INDIA UNIVERSITY
WEST BENGAL

5TH SEMESTER

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 5th Sem.
Course Title: Carrier Advancement & Skill Development (Disaster Preparedness & Planning)	**Subject Code:**TIU-UTR-S307
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand basic concepts in disaster management.
2. Understand definitions and terminologies used in disaster management.
3. Understand types and categories of disasters.
4. Understand the challenges posed by disasters.
5. Understand impacts of disasters key skills.
6. Endow with knowledge for competitive exams

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Recall Key concepts of disasters, their various types, and the core principles of disaster risk management. Understanding how to classify disasters and manage associated risks effectively.	K1
CO2	Identify Various natural and human-made disasters, their causes, and the effects they have on society and infrastructure. Understanding how these events impact.	K2
CO3	Explain Strategies for disaster preparedness, including early warning systems and emergency response planning. Focusing on proactive measures to reduce risks	K1
CO4	Interpret national and international disaster management frameworks, policies, and mitigation strategies.	K2
CO5	Apply risk assessment techniques and preparedness planning to minimize disaster impacts on communities and infrastructure.	K3
CO6	Develop various scenarios, incorporating safety protocols and sustainable practices. Ensuring resilience through effective planning and long-term solutions.	K1

COURSE CONTENT:

MODULE 1:	**INTRODUCTION**	**7 Hours**
Disasters: Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.		
MODULE 2:	**Disaster Impacts**	**7 Hours**
Classification: Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters. climate change and urban disasters.		
MODULE 3:	**Disaster Risk Reduction**	**7 Hours**

Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions,		
MODULE 4:	**Disasters, Environment and Development**	**8 Hours**
stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.		
MODULE 5:	**Sustainable and environmental friendly recovery**	**8 Hours**
Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.)		
MODULE 6:	**Reconstruction and development methods.**	**8 Hours**
Sustainable and environmental friendly recovery; reconstruction and development methods.		
TOTAL LECTURES		**45 Hours**

Books:

1. http://ndma.gov.in/(Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/(National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.
6. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June2003.
7. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva:IASC.
8. General Studies Engineering Aptitude by R.K. Jain
9. Civil engineering objective types by S. S. Bhavikatti
10. Civil Engineering Thorough Objective Type Questions by Gupta S. P.
11. Civil Engineering: Objective Type by J.K. Gupta and R.S. Khurmi

Course Articulation Matri

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2	1	2	1	1	2	3	1	2	1	2			
CO2	2	1	2	1	2	2	1	2	2	1	2	3			
CO3	1	2	1	2	3	1	2	3	1	2	1	1			
CO4	2	1	2	1	1	2	1	1	2	1	3	2			
CO5	2	2	1	1	2	3	2	2	1	2	1	1			
CO6	1	1	2	2	1	1	1	3	2	1	1	2			
	1.5	1.5	1.5	1.6	1.5	1.65	1.5	2.4	1.5	1.6	1.5	1.9			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 5th Sem.
Course Title: Structural Analysis-II	**Subject Code:** TIU-UCE-T329
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit: 3**

COURSE OBJECTIVE:

Enable the student to:

1- Equip the students with the comprehensive methods of structural analysis with emphasis on analysis of elementary structures.
2- Deliver the students with knowledge of analysis portal frames with approximate methods.
3- Furnish students with the idea of implementation of matrix method of structural analysis.
4- Develop the concept of ILD using qualitative method.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Identify** the fundamental concepts of two-hinged arches, approximate analysis of multi-bay frames, and elastic center method	K1
CO2	**Explain** the influence line diagrams for three-hinged and two-hinged stiffening girders and their application in structural analysis.	K2
CO3	**Apply** the Muller-Breslau principle to derive influence line diagrams for indeterminate structures.	K3
CO4	**Analyze** beams and frames using stiffness and flexibility matrix methods in structural analysis.	K3
CO5	**Interpret** plastic analysis techniques and their application in beams and portal frames to determine collapse load.	K2
CO6	**Use** approximate and matrix methods to evaluate the behavior of multi-storied frames under different loading conditions.	K3

COURSE CONTENT:

MODULE 1:	**TWO HINGED ARCH AND APPROXIMATE ANALYSIS**	**8 Hours**
Two hinged arch, Approximate analysis of Multi bay Multistoried Portal frames: Cantilever method, Portal method. Substitute frame analysis. Method of Elastic Centre. Column analogy technique		
MODULE 2:	**ILD FOR INDETERMINATE STRUCTURES**	**10 Hours**
Influence line diagram for Three-hinged and Two-hinged stiffening girders. Influence line diagram for indeterminate structures: Muller Breslau principle.		
MODULE 3:	**MATRIX METHODS OF STRUCTURAL ANALYSIS**	**14 Hours**
Stiffness matrix method; Application to simple problems of beams and frames; Flexibility matrix method; Application to simple problems of beams and frames.		
MODULE 4:	**PLASTIC ANALYSIS OF STRUCTURES**	**13 Hours**
Plastic analysis of Structures: application to Beams and Portal frames.		
TOTAL LECTURES		**45 Hours**

Books:

1. Gere and Timoshenko, Mechanics of materials, CBS. Publishers.
2. Kenneth Leet,Chia M Uang& Anne M Gilbert., Fundamentals of Structural Analysis, McGraw Hill.
3. R.Vaidyanathan and P.Perumal, Comprehensive Structural Analysis Volume I & II, Laxmi Publications (P) Ltd.
4. Wang C.K., Intermediate Structural Analysis, McGraw Hill.
5. Aslam Kassimali., Structural Analysis, Cenage Learning.
6. Chandramouli P N, Structural Analysis I –Analysis of Statically Determinate Structures, Yes DeePublishingPvtLtd.,Chennai,Tamil Nadu.
7. Devdas Menon, Structural Analysis, Narosa Publications.
8. Hibbeler., Structural Analysis, Pearson Education.
9. Kinney S., Indeterminate Structural Analysis, Oxford & IBH.
10. M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Printice Hall India.
11. Reddy C.S., Indeterminate Structural Analysis, Tata McGraw Hill.
12. Timoshenko S.P.& Young D.H., Theory of Structures, McGraw Hill.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	-	-	-	-	-	-	-	-	-	1			
CO2	3	2	1	-	-	-	-	-	-	-	-	1			
CO3	3	3	1	-	-	-	-	-	-	-	-	1			
CO4	3	2	2	-	-	-	-	-	-	-	-	1			
CO5	3	3	2	2	1	-	-	-	-	-	-	2			
CO6	3	3	2	3	2	-	-	-	-	-	-	2			
	3	2	1.6	2.5	1.5							1.3			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 5th Sem.
Course Title: Design of RCC Structures	**Subject Code:** TIU-UCE-T321
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Be able to perform analysis and design of reinforced concrete members and connections.
2. Be able to identify and interpret the appropriate relevant industry design codes.
3. Become familiar with professional and contemporary issues in the design and fabrication of reinforced concrete members.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Recall and describe fundamental concepts of Reinforced Cement Concrete (RCC), including materials, stress-strain behavior, and IS code provisions.	K1
CO2	Explain and interpret the principles of Working Stress Method (WSM) and Limit State Method (LSM) and their applications in RCC design.	K2
CO3	Differentiate between singly reinforced, doubly reinforced, and T-beam sections, and illustrate their behavior under bending and shear forces.	K2
CO4	Apply IS 456:2000 provisions to analyze and design RCC beams, slabs, staircases, and columns using the Limit State Method.	K3
CO5	Compute the reinforcement detailing, development length, anchorage, and shear reinforcement for various RCC structural elements.	K3
CO6	Design and sketch isolated footings, columns, and slabs for different loading conditions as per IS code guidelines.	K3

COURSE CONTENT :

MODULE 1:	**INTRODUCTION**	**8 Hours**
Principles of design of reinforced concrete members-Working stress, and Limit State method of design, Experimental design. Safety norms as per IS code guidelines		
MODULE 2:	**Working stress method of design**	**8 Hours**
Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment Balanced, under reinforced and over-reinforced rectangular sections; design of singly reinforced sections.		
MODULE 3:	**Limit state method of design**	**17 Hours**
Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces; concepts of bond stress and development length. Analysis, design and detailing of singly reinforced rectangular, 'T' and doubly reinforced beam sections by limit state method. Design and detailing of slab panels as per IS code provisions. Design and detailing of continuous beams and slabs as per IS code provisions.		

Design and detailing of dog-legged staircase as per IS code provisions. Design and detailing of reinforced concrete short columns of rectangular and circular cross-sections under axial load. Design of short columns subjected to axial load with moments (uniaxial and biaxial bending) – using SP 16.		
MODULE 4:	**Shallow foundations**	**12 Hours**
Types; Design and detailing of reinforced concrete isolated square and rectangular footing for columns as per IS code provisions by limit state method.		
TOTAL LECTURES		**45 Hours**

Books:

1. R.C.C. Designs as per IS 456-2000 by Dr. B.C.Punmia, A.K. Jain and A.K.Jain.
2. Design of Reinforced Concrete Structures N.Subramanian.

Course Articulation Matrix

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	0	0	0	1	0	0	1	0	2			
CO2	3	3	2	0	0	0	1	0	0	1	0	2			
CO3	3	3	2	1	1	0	1	0	0	1	0	2			
CO4	3	3	3	2	2	0	2	0	0	1	1	2			
CO5	3	3	3	2	2	0	2	0	0	1	1	2			
CO6	3	3	3	2	2	0	2	0	0	1	1	2			
	3	2.83	2.5	1.16	1.16	0	1.5	0	0	1	0.5	2			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 5th Sem.
Course Title: Design of Steel Structures	**Subject Code:**TIU-UCE-T323
Contact Hours/Week: 3–1–0 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

Enable the student to:

1. Perform analysis and design of steel members and connections based on engineering principles and design standards.
2. Understand the behavior and design of steel structural systems under various loading conditions.
3. Familiarize with professional and contemporary issues related to steel structures, including sustainability and advancements in steel design.
4. Apply knowledge of codes and standards to ensure safety, stability, and serviceability in steel structure design.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Analyze and design steel members and connections** considering strength, stability, and serviceability.	K2
CO2	**Apply design principles for steel structural systems** to ensure safety and efficiency.	K2
CO3	**Evaluate load-carrying capacity and failure modes** of steel structures under different loading conditions.	K3
CO4	**Use relevant design codes and standards** for designing steel structures.	K3
CO5	**Assess the behavior of bolted and welded connections** in structural components.	K3
CO6	**Understand contemporary issues and sustainability** in steel structure design and construction.	K3

COURSE CONTENT:

MODULE 1:	**Introduction Advantages and disadvantages of steel as construction materia**	**5 Hours**
Use of steel table (SP6-Part1); Types of loads on steel structure and its I. S. code specification. Geometrical properties of gross and effective cross sections– Classification of Cross Sections as per IS:800-2007. Safety norms as per IS code guidelines.		
MODULE 2:	**Plastic Analysis:**	**6 Hours**
Methods– Elastic, Plastic and Advanced method of analysis based on IS: 800-2007– Idealized Stress vs. Strain curve– Requirements and Assumptions of Plastic method of analysis–Shape Factors– Collapse load.		
MODULE 3:	**Limit State Design (L.S.M):**	**9 Hours**
Design of Tension Members by L.S.M, Design of Compression Members by L.S.M, Column Bases by L.S.M, Slab base and Gusseted base.		

MODULE 4:	Design of Flexural Members by L.S.M:	9 Hours
Effective span of Beams, Design strength of bending,(Flexure), Limiting deflection of beams– Design of laterally supported Simple beams using single / double rolled steel sections.		
MODULE 5:	**Design of Connections and Detailing:**	**9 Hours**
Types of connections– Bolted, Riveted and Welded connections– Rigid and Flexible connections. Bolted Connection– Types of bolts– Bearing type Bolts– Nominal and Design shear strengths of bolts– Reduction factors for Long joints, Large grip lengths-Nominal and Design bearing strengths of bolts– Reduction factors for oversized and slotted holes– Nominal and Design tensile strengths (tension capacity) of bolts.- Welded Connection- Types of welds– Fillet welds– Minimum and maximum sizes– Effective length of weld- Fillet welds on inclined faces–- Design strengths of shop/site welds– Butt welds– Effective throat thickness and effective length of butt weld.		
MODULE 6:	**Steel Roof Truss:**	**7 Hours**
Types of steel roof truss & its selection criteria, Calculation of panel point load for Dead load; Live load and wind load as per I.S. 875-1987 Analysis and Design of steel roof truss. Design of Angle purlin as per I. S. Arrangement of members at supports.		
TOTAL LECTURES		**45 Hours**

Books:

1. Design of Steel Structures by Limit State Method as per IS 800-2007 by S.S. Bhavikati.
2. Limit State Design of Steel Structures by S.K.Duggal.
3. Design of Steel Structures: Limit State Method by N.Subramanian.
4. Fundamentals of Structural Steel Design (Limit State Method as per IS 800-2007) by M.L.Gambhir.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2	2	1	1	0	1	2	1	2			
CO2	3	3	3	2	2	1	1	0	1	2	2	2			
CO3	3	3	3	3	2	1	1	0	1	2	2	2			
CO4	3	3	3	3	3	1	1	1	1	3	2	3			
CO5	3	3	3	3	3	1	1	1	1	3	2	3			
CO6	3	2	2	2	2	2	3	2	1	3	2	3			
	3.00	2.83	2.83	2.50	2.33	1.17	1.33	0.67	1.00	2.50	1.83	2.50			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 5th Sem.
Course Title: Geotechnical Engineering	**Subject Code:** TIU-UCE-T325
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Learn the basic idea about different types of types of soil, their origin, formations and index properties.
2. Havev basic concepts of fundamental phenomenon like permeability, seepage, compaction, shear strength and consolidation
3. Solve any type slopes stability problems and will be able to know how soil report is prepared by performing soil exploration.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Explain the basic properties of soil and classification systems.	K2
CO2	Determine soil properties through laboratory and field tests.	K3
CO3	Analyze permeability, seepage, and stresses in soil masses.	K4
CO4	Evaluate shear strength and consolidation characteristics of soil.	K5
CO5	Assess the bearing capacity and settlement of shallow and deep foundations.	K5
CO6	Design earth retaining structures and slope stability analysis.	K6

COURSE CONTENT:

MODULE 1:	**Introduction**	**5 Hours**
Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation moisture content, moisture content- specific gravity etc. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method, nuclear method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method.		
MODULE 2:	**Plasticity Characteristics of Soil**	**5 Hours**
Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.		
MODULE 3:	**Permeability of Soil**	**5 Hours**

Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping-out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.		
MODULE 4:	**Effective Stress Principle**	**2 Hours**
Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.		
MODULE 5:	**Compaction of Soil**	**3 Hours**
Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.		
MODULE 6:	**Stresses in soils**	**5 Hours**
Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory.		
MODULE 7:	**Consolidation of Soil**	**5 Hours**
Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.		
MODULE 8:	**Shear Strength**	**5 Hours**
Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses,Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore pressure measurement, computation of effective shear strength parameters, unconfined compression test, vane shear test.		
MODULE 9:	**Stability of Slopes**	**5 Hours**
Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.		
MODULE 10:	**Soil Exploration**	**5 Hours**
Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer tests, analysis of borehole logs, geophysical and advance soil exploration methods.		
TOTAL LECTURES		**45 Hours**

Books:

1. Soil Mechanics by Craig R.F., Chapman & Hall.
2. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy.
3. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons

4. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
5. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	2	1	1	1	0	0	1	1	2			
CO2	3	3	2	3	2	1	1	0	0	2	2	2			
CO3	3	3	3	3	2	1	1	0	1	2	2	3			
CO4	3	3	3	3	3	2	1	0	1	2	2	3			
CO5	3	3	3	3	3	2	2	0	1	2	2	3			
CO6	3	3	3	3	3	3	2	0	1	2	2	3			
	3.00	2.83	2.50	2.83	2.33	1.67	1.33	0.00	0.67	1.83	1.83	2.67			

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3RD Yr., 5th Sem.
Course Title: Ground Improvement Techniques	**Subject Code:**TIU-UCE-T341
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand the need and scope of ground improvement techniques for enhancing soil properties in geotechnical engineering applications.
2. Learn various mechanical, hydraulic, physical, and chemical methods used for soil stabilization and ground improvement.
3. Analyze the suitability of different ground improvement techniques based on soil conditions, project requirements, and environmental considerations.
4. Apply design principles and construction techniques for ground reinforcement, including geosynthetics, deep compaction, grouting, and drainage methods.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Recall fundamental concepts of problematic soils, ground improvement techniques, and soil stabilization methods.	K1
CO2	Identify various ground improvement methods such as mechanical, chemical, and biological stabilization techniques.	K2
CO3	Explain the principles of compaction, soil reinforcement, grouting, and drainage techniques used for ground modification.	K1
CO4	Interpret soil improvement methods for various site conditions, including expansive soils, liquefiable soils, and weak subgrades.	K1
CO5	Apply appropriate ground improvement techniques to enhance soil strength, reduce settlement, and improve load-bearing capacity.	K2
CO6	Design soil stabilization and reinforcement solutions for real-world geotechnical problems, ensuring safety and sustainability.	K2

COURSE CONTENT:

MODULE 1:	**Insitu densification**	**7 Hours**
Introduction, Compaction: methods and controls Densification of granular soil: Vibration at ground surface, Impact at ground surface, Vibration at depth (Vibroflotation), Impact at depth		
MODULE 2:	**Densification of Cohesive Soils**	**7 Hours**
Over view: Geotextiles as separators, reinforcement. Geotextiles in filtration and drainage, Geotextiles in erosion control.		
MODULE 3:	**Grouting:**	**7 Hours**
Over view: Suspension and Solution grout, Grouting equipment and methods, Grout design and layout, Grout monitoring schemes		
MODULE 4:	**Soil stability**	**8 Hours**

Reinforced earth fundamentals, Soil nailing		
MODULE 5:	**In situ densification**	**8 Hours**
Impact at ground surface, Vibration at depth (Vibroflotation), Impact at depth		
MODULE 6:	**Geotextiles.**	**8 Hours**
Geotextiles in filtration and drainage, Geotextiles in erosion control, Use of Recycled Plastics and Natural Fibres in Geotextiles, Case Study: Geotextiles in Major Infrastructure Projects (Indian Context)		
TOTAL LECTURES		**45 Hours**

Books:

1. Foundation Analysis & Design J.E. Bowels McGraw Hill
2. Principles of Foundation Engineering B.M. Das Thomson Book
3. Foundation Design Manual N. V. Nayak Dhanpat Rai Publication Pvt. Ltd
4. Construction and Geotechnical methods in foundation engineering R.M. Koener McGraw Hill
5. Technology in tunnelling and dam construction A.V. Shroff. & D.L. hah Oxford and IBH Publishing Co.Pvt.Ltd
6. Reinforced Earth T S Ingold Thoam Telford
7. Designing with Geosynthetics R M Koerner Prentice Hall

Course Articulation Matrix

	PROGRAM OUTCOMES (PO)													**PROGRAM SPECIFIC OUTCOMES (PSO)**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2	1	2	3	1	2	2	2	1	3	2			
CO2	2	1	1	2	2	1	1	2	1	2	1	1			
CO3	1	2	3	1	3	2	2	1	2	1	3	2			
CO4	2	2	1	2	2	1	1	2	1	2	2	1			
CO5	1	1	2	1	3	2	2	1	2	1	3	2			
CO6	1	2	1	2	3	2	1	1	2	1	3	2			
	1.33	1.67	1.50	1.67	2.67	1.50	1.50	1.50	1.67	1.33	2.50	1.67			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 5th Sem.
Course Title: Fluid Mechanics Lab	**Subject Code:** TIU-UCE-L331
Contact Hours/Week: 0–0–3 (L–T–P)	**Credit:** 1.5

COURSE OBJECTIVE:

Enable the student to:

1. To give the detail information of various devices related with fluids.
2. To deliver the tests related with viscosity and pressure measurement.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Understand** the Bernoulli's theorem for governing fluid flows.	K2
CO2	**Calculate** the buoyancy force.	K1
CO3	**Calculate** the different fluid properties using various type of equipment's like measurement of flow, pressure velocity and head loss.	K3
CO4	**Understand** the basic properties and characteristics of incompressible fluid in laboratory.	K1
CO5	Gain **knowledge** about weirs, notches, design and calculate discharge over barrages	K2
CO6	Gain **knowledge** in hydraulic machineries, pumps and turbines.	K1

COURSE CONTENT

MODULE 1:	**INTRODUCTION**	**3 Hours**
Measurement of viscosity,Study of Pressure Measuring Device		
MODULE 2:	**CONCEPT LEARNING**	**12 Hours**
Stability of Floating Body,Hydrostatics Force on Flat Surfaces/Curved Surfaces, Verification of Bernoulli's Theorem		
MODULE 3:	VENTURIMETER & ORIFICEMETER	**9 Hours**
Venturimeter and Orificemeter, Impacts of jets		
MODULE 4:	**OCF, NOTCH**	**9 Hours**
Velocity Distribution in Open channel flow, Calibration of Notch		
MODULE 5:	**WEIR & GVF**	**6 Hours**
Measurement of water surface profile for flow over Broad crested weir, Gradually Varied Flow		
MODULE 6:	**HYDRAULIC JUMP, GATE**	**6 Hours**
Hydraulic Jump, Flow under Sluice Gate		
TOTAL LECTURES		**45 Hours**

Books:

1. Fuild mechanics and hydraulic machines by R.K.Rajput. S. Chand publication.
2. A text book on fluid mechanics and hydraulic machines by R.K Bansal.

3. Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	1	1	1	1	1	2	1	1	1	3			
CO2	1	1	1	2	1	1	1	1	1	1	2	1			
CO3	3	1	1	1	3	1	1	1	1	3	1	1			
CO4	1	1	1	1	1	1	1	2	1	1	1	3			
CO5	2	3	1	3	3	3	3	1	3	1	1	3			
CO6	2	2	3	3	3	2	3	1	3	1	1	3			
	2.00	1.50	1.33	1.83	2.00	1.50	1.67	1.33	1.67	1.33	1.17	2.33			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	Year, Semester: 3rd Yr., 5th Sem.
Course Title: Surveying & Geomatics Lab	Subject Code: TIU-UCE-L333
Contact Hours/Week: 0–0–3 (L–T–P)	Credit: 1.5

COURSE OBJECTIVE:

Enable the student to:

1. Understand the fundamental principles of surveying and geomatics and their applications in civil engineering projects.
2. Learn to operate various surveying instruments such as theodolites, total stations, GPS, and leveling instruments for accurate measurements.
3. Apply different surveying methods for distance measurement, angle measurement, leveling, and mapping.
4. Develop skills in data collection, processing, and analysis using modern surveying tools and software for real-world applications.

COURSE OUTCOME:

Sl. No.	Course Outcome	Bloom Taxonomy level
CO1	Recall fundamental concepts, principles, and terminology related to surveying and geomantic. Identify various surveying instruments and their uses	K1
CO2	Describe different types of surveying techniques and recognize errors in surveying and methods for minimizing them.	K2
CO3	Explain the working principles, functionalities, and importance of different surveying instruments. Interpret field survey data for mapping and contouring.	K2
CO4	Demonstrate the process of collecting, analyzing, and recording field survey data systematically. Illustrate the importance of coordinate systems and GIS applications.	K2
CO5	Perform field surveys using theodolite, total station, and GPS for distance, angle, and elevation measurements. Compute and adjust survey measurements.	K3
CO6	Develop topographic maps, traverse computations, and layout plans using field data. Apply surveying techniques in real-world applications like land development and construction.	K3

COURSE CONTENT:

Module 1:		**6 Hours**
Introduction to Chain & Compass Survey, Using of various instruments related with it.		
Module 2:		**6 Hours**
Introduction to Plane Table Survey, Temporary adjustment of Plane Table and various methods of Plane Table.		
Module 3:		**6 Hours**
Temporary adjustment of Auto Level, Profile Leveling, Contouring.		

Module 4:		**6 Hours**
Traversing using Theodolite- Preparation of Gale's Table.		
Module 5:		**6 Hours**
Use of Total Station for Leveling and Contouring.		
Module 6:		**6 Hours**
Setting out of Curves.		
Module 7:		**9 Hours**
Introduction to GPS.		
TOTAL LECTURES		**45 Hours**

Books:

1. B. Gottfried, "Programming with C", McGraw-Hill Professional, 1996.
2. Excel 2013 in Simple Steps by Kogent Learning Solutions Inc., Dreamtech Press.
3. Computer Programming in Fortran 77 (With an Introduction to Fortran 90) V Rajaraman.
4. http://csi.csiberkeley.com/etabs9.5/watch-and-learn#page=page-1

Course Articulation Matrix

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	1	2	2	1	0	0	1	0	0	0			
CO2	3	2	2	2	3	2	0	0	1	0	0	0			
CO3	3	2	3	3	3	2	0	0	1	0	0	0			
CO4	3	2	3	2	3	1	0	0	1	0	0	0			
CO5	3	2	3	2	3	3	0	0	1	0	0	0			
CO6	3	2	3	2	3	3	0	0	1	0	0	0			
	3.00	2.17	2.50	2.17	2.83	2.00	0.00	0.00	1.00	0.00	0.00	0.00			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3RD Yr., 5th Sem.
Course Title: Geotechnical Engineering Lab	**Subject Code:** TIU-UCE-L335
Contact Hours/Week: 0–0–3 (L–T–P)	**Credit:** 1.5

COURSE OBJECTIVE:

1. Students can get the fundamental knowledge of different types of soils, their physical properties, grain size distribution of soil and their index properties.
2. To calculate several important properties of soil like: permeability, maximum dry density, shear strength and consolidation

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Recall fundamental concepts of problematic soils, Field Density using Core Cutter method.	K1
CO2	Identify Plan Natural moisture content using Oven Drying method.	K2
CO3	Explain the principles of compaction, Field Density using Sand replacement method.	K1
CO4	Interpret Plan and Design Grain size distribution by Sieve Analysis	K1
CO5	Apply Plan and Develop Compaction test: Standard Proctor test.	K2
CO6	Design soil stabilization and Perform California Bearing Ratio Test and Vane shear test.	K2

COURSE CONTENT:

MODULE 1:	**Insitu densification**	**7 Hours**
Field Density using Core Cutter method.		
MODULE 2:	**Densification of Cohesive Soils**	**7 Hours**
Field Density using Sand replacement method.		
MODULE 3:	**Grouting:**	**7 Hours**
Natural moisture content using Oven Drying method		
MODULE 4:	**Soil stability**	**8 Hours**
Field identification of Fine Grained soils.		
MODULE 5:	**Insitu densification**	**8 Hours**
Specific gravity of Soils.		
MODULE 6:	Geotextiles.	**8 Hours**
Consistency limits by Liquid limit, Linking Liquid Limit Testing with Geotextile Applications		
TOTAL LECTURES		**45 Hours**

Books:

1. Foundation Analysis & Design J.E. Bowels McGraw Hill
2. Principles of Foundation Engineering B.M. Das Thomson Book
3. Foundation Design Manual N. V. Nayak Dhanpat Rai Publication Pvt. Ltd

4. Construction and Geotechnical methods in foundation engineering R.M. Koener McGraw Hill
5. Technology in tunnelling and dam construction A.V. Shroff. & D.L. hah Oxford and IBH Publishing Co.Pvt.Ltd
6. Reinforced Earth T S Ingold Thoam Telford
7. Designing with Geosynthetics R M Koerner Prentice Hall

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2	1	2	3	1	2	2	2	1	3	2			
CO2	2	1	1	2	2	1	1	2	1	2	1	1			
CO3	1	2	3	1	3	2	2	1	2	1	3	2			
CO4	2	2	1	2	2	1	1	2	1	2	2	1			
CO5	1	1	2	1	3	2	2	1	2	1	3	2			
CO6	1	2	1	2	3	2	1	1	2	1	3	2			
	1.33	1.67	1.50	1.67	2.67	1.50	1.50	1.50	1.67	1.33	2.50	1.67			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 5th Sem.
Course Title: Economics, Estimation & Costing	**Subject Code:** TIU-UCE-S321
Contact Hours/Week: 0–1–3 (L–T–P)	**Credit:** 2.5

COURSE OBJECTIVE:

- To provide the detailed idea of Indian economics.
- To provide in principle decision to go ahead with residential or commercial project which is commonly known as administration approval in government departments.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Explain** fundamental economic principles, including demand and supply, market structures, macroeconomic indicators, and fiscal policies.	K2
CO2	**Describe** the role of government in economic welfare, monetary systems, banking, and policy tools affecting inflation and employment.	K2
CO3	**Use** cost control techniques, budgeting, financial statements, and investment analysis to make informed business decisions.	K3
CO4	**Illustrate** economic growth trends, employment patterns, and key challenges in different sectors of the Indian economy.	K3
CO5	**Compute** quantity estimation, rate analysis, and cost-sensitive calculations for various construction components using modern tools.	K3
CO6	**Describe** contract types, bidding processes, legal aspects, and valuation techniques, and apply them in project cost estimation.	K2

COURSE CONTENT :

MODULE 1:	Basic Principles and Methodology of Economics	**5 Hours**
Demand/Supply – elasticity –Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro–economicConcepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes (3 lectures)		
MODULE 2:	Public Sector Economics	**4 Hours**
Welfare, Externalities, Labour Market. Components ofMonetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve. (2 lectures)		
MODULE 3:	Elements of Business/Managerial Economics and forms of organizations	**5 Hours**
Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.		
MODULE 4:	Indian economy*:*	**4 Hours**

Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private.Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors. (2 lectures)		
MODULE 5:	Estimation / Measurements for various items-	**9 Hours**
Introduction to the process of Estimation;Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying (7 lectures)		
MODULE 6:	Specifications	**3 Hours**
Types, requirements and importance, detailed specifications for buildings,roads, minor bridges and industrial structures. (3 lectures)		
MODULE 7:	Rate analysis-	**2 Hour**
Purpose, importance and necessity of the same, factors affecting, taskwork, daily output from different equipment/ productivity. (3 lectures)		
MODULE 8:	Tender	**7 Hours**
Preparation of tender documents, importance of inviting tenders, contract types,relative merits, prequalification. general and special conditions, termination of contracts, extra workand Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, bank guarantee, late delivery charges, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management (6 lectures)		
MODULE 9:	ntroduction to Acts	**2 Hour**
pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights. (1 lecture)		
MODULE 10	Concept of Valuation and Measurement of Depreciation:	**2 Hours**
Concept and purpose of valuation, Function of a Valuer, Concepts of value and cost and its different types, Characteristics of an ideal investment Appreciation, Depreciation, Obsolescence and Amortization, Process and types of depreciation calculation.		
MODULE 11	Techniques of Valuation for Land and property:	**2 Hours**
Rental method, direct comparison method, profit based method, development method, land and building method.		
Total		45 Hours

Books:

1. Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia

2. V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill
3. Misra, S.K. and Puri (2009), Indian Economy, Himalaya
4. PareekSaroj (2003), Textbook of Business Economics, Sunrise Publishers
5. M Chakravarty, Estimating, Costing Specifications & Valuation
6. Joy P K, Handbook of Construction Management, Macmillan
7. B.S. Patil, Building & Engineering Contracts
8. Relevant Indian Standard Specifications.
9. World Bank Approved Contract Documents.
10. FIDIC Contract Conditions.
11. Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration
12. Typical PWD Rate Analysis documents.
13. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations
14. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	2	1	1	1	-	1	2	2	2			
CO2	3	2	2	2	1	2	2	1	1	2	2	3			
CO3	3	3	3	3	2	2	2	1	2	3	2	3			
CO4	2	2	1	2	1	3	2	2	2	3	2	3			
CO5	3	3	3	3	3	3	2	1	2	3	3	3			
CO6	3	3	2	3	2	3	3	3	2	3	3	3			
	2.83	2.5	2	2.5	1.67	2.33	2	1.33	1.67	2.67	2.34	2.83			

TECHNO INDIA UNIVERSITY
WEST BENGAL

TIU-UES-S381	**Entrepreneurship Skill Development**	**1 credit**

Syllabus

This course is designed to equip students with essential skills for career advancement, focusing on the latest software and technologies relevant to the civil engineering field, such as Building Information Modeling (BIM) and project management tools. Additionally, students will enhance their communication skills through presentations, report writing, and effective teamwork strategies, preparing them to excel in professional environments and collaborate efficiently in multidisciplinary teams. Emphasis will also be placed on networking and personal branding to help students effectively position themselves in the job market.

TECHNO INDIA UNIVERSITY
WEST BENGAL

6Th SEMESTER

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 6th Sem.
Course Title: Career Advancement & Skill Development (Grooming –Interpersonal communication & Technical Aptitude)	**Subject Code:** TIU-UTR-S310
Contact Hours/Week: 0–0–2 (L–T–P)	**Credit:** 1

COURSE OBJECTIVE:

Enable the student to:

1. To understand the importance of communication in the professional world.
2. To understand the key features of a good debate and learn how to prepare text for or against a topic.
3. To understand proper etiquette to be used for business communication.
4. To get acquainted with the different flows of communication in an organization.
5. To revise all the technical concepts used in civil engineering.
6. To sharpen skills in civil engineering drawing

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Explain the significance of effective communication in professional and business settings.	K2
CO2	Develop well-structured arguments for or against a debate topic with clarity and coherence.	K3
CO3	Demonstrate proper business communication etiquette in professional interactions.	K3
CO4	Analyze different flows of communication within an organization and their impact.	K4
CO5	Apply technical concepts of civil engineering in discussions and professional communication.	K3
CO6	Create precise and professional civil engineering drawings as per industry standards.	K6

COURSE CONTENT:

MODULE 1:	**Interpersonal communication- Small group and big group**	**5 Hours**
• Business communication- office scenario, Group discussion and debate, Role play • Delivery of speech, Effective presentation. • AI-powered mock interview analysis		
MODULE 2:	**Any programming language**	**5 Hours**
latest- Python/R programming etc		
MODULE 3:	**Aptitude**	**10 Hours**
General aptitude		

MODULE 4:	**Departmental grooming**	**10 Hours**
Technical aptitude - Revision of all theorems, theories and methods used in different subjects of civil engineering. Preparation for MCQ and interview related questions. Any technical software (example revision of AUTOCAD) Internship /Interview		
TOTAL LECTURES		**30 Hours**

Books:

1. Understanding human communication by Ronald B Adler, George Rodman, Oxford University Press.
2. General Studies Engineering Aptitude by IES Master Publication
3. General Studies Engineering Aptitude by R.K. Jain
4. Civil Engineering Objective Type Conventional Questions and Answers by R. Agor

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2	0	1	3	1	2	3	3	2	2			
CO2	1	1	3	0	1	2	1	2	3	3	2	2			
CO3	1	1	3	0	1	2	1	3	3	3	2	2			
CO4	1	2	3	2	2	2	2	2	3	3	3	2			
CO5	3	2	2	2	2	2	2	1	3	3	3	3			
CO6	3	2	3	3	3	2	2	1	3	3	3	3			
	1.67	1.50	2.67	1.17	1.67	2.17	1.50	1.83	3.00	3.00	2.50	2.33			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 6th Sem.
Course Title: Hydrology and Water Resources Engineering	**Subject Code:** TIU-UCE-T310
Contact Hours/Week: 2–0–0 (L–T–P)	**Credit: 2**

COURSE OBJECTIVE:

Enable the student to:

1. To give the detailed information of various devices related with fluids.
2. To deliver the tests related to viscosity and pressure measurement.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO 1	**Understand interactions** between various processes in hydrological cycle.	K1
CO 2	**Apply** concepts of fluid mechanics & use of computers in solving hydraulic & hydrological problems	K1
CO 3	**Design** hydraulic structures and **Study** hydrological simulation models for effective study of flood flows and come up with solutions of mitigations.	K2
CO 4	**Understand** basic aquifer parameters and **estimate** ground water resources for different hydro-geological boundary conditions	K3
CO 5	**Plan and Develop** irrigation systems of optimal efficiency and optimal economic expenditure	K3
CO 6	To give **solutions** to waterlogging problems and **suggest** remedies to agricultural land reclamation from salination	K2

COURSE CONTENT:

MODULE 1:	**Introduction to Rural Water Supply Systems**	**6 Hours**
This module introduces the need for rural water supply systems and the unique challenges faced in rural areas, such as resource limitations and scattered population. It covers the classification of water sources, including surface water, groundwater, and rainwater harvesting. Students will also learn about the basic principles of water demand estimation for rural communities, population forecasting methods, and the design of water distribution systems. The module discusses the role of community involvement in maintaining and managing water supply systems.		
MODULE 2:	**Water Quality and Treatment in Rural Areas**	**6Hours**
This module focuses on water quality parameters and the treatment processes required to ensure safe drinking water in rural settings. It includes an in-depth discussion on common contaminants (such as arsenic, fluoride, and nitrate) found in rural water supplies, along with national and international standards for drinking water quality (BIS, WHO-SODIS (Solar Water Disinfection)) as a Sustainable Method). Students will study various water treatment techniques suitable for rural communities, including filtration, chlorination, and solar disinfection. Additionally, the module introduces low-cost, decentralized water treatment systems that can be effectively used in rural areas.		
MODULE 3:	**Onsite Sanitation Systems**	**6 Hours**
This module explores onsite sanitation technologies and their applications in rural contexts. It covers the different types of sanitation systems, including pit latrines, ventilated improved pit (VIP) latrines, pour-flush toilets, septic tanks, and composting toilets. The design criteria for onsite sanitation systems are		

discussed, with emphasis on factors such as soil conditions, groundwater levels, and user acceptability. The module also covers the safe disposal and management of human waste, focusing on health and environmental impacts, and strategies for sustainable sanitation practices. Students will be introduced to greywater management and its reuse for non-potable applications in rural households.		
MODULE 4:	**Planning and Implementation of Rural Water Supply and Sanitation Project**	**6 Hours**
This module provides an overview of the planning, design, and implementation processes involved in rural water supply and sanitation projects. Students will learn about the key steps in project planning, from initial assessments to feasibility studies, design, construction, and maintenance. The role of local government, NGOs, and community-based organizations in rural water and sanitation projects is explored. The module includes case studies of successful rural water supply and sanitation initiatives, including government programs such as the Jal Jeevan Mission and the Swachh Bharat Mission, and examines the importance of monitoring and evaluation for project success.		
MODULE 5:	**Sustainability and Challenges in Rural Water Supply and Sanitation**	**6 Hours**
In this module, students will explore the long-term sustainability of rural water supply and sanitation systems. Topics include financial sustainability (operation and maintenance costs), institutional frameworks, and capacity building at the local level. The module also addresses the challenges of climate change, water scarcity, and population growth, and how these factors affect rural water supply and sanitation services. Students will study innovative approaches to improving water efficiency, ensuring water security, and promoting community-led sanitation programs. The module concludes with a discussion on future trends and technologies in rural water and sanitation systems.		
TOTAL LECTURES		**30 Hours**

Books:

1. **Manual on Water Supply and Treatment** by CPHEEO, Ministry of Urban Development, Government of India.
2. **Water Supply and Sanitation: Rural and Low-Income Urban Areas** by John Pickford.
3. **Water and Sanitation in the World's Cities: Local Action for Global Goals** by UN-HABITAT.
4. **Rural Water Supply in India: Issues and Challenges** by A.K. Jain.
5. **WHO Guidelines for Drinking-water Quality** by the World Health Organization.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	0	0	1	1	3	1	3	1	1	3			
CO2	3	2	1	1	2	3	3	1	3	1	1	3			
CO3	3	3	3	2	3	3	3	1	3	3	3	3			
CO4	3	2	2	2	2	3	3	1	3	3	3	3			
CO5	3	3	3	2	3	2	3	3	3	3	3	3			
CO6	3	3	3	2	3	2	3	3	3	3	3	3			
	2.67	2.3	2	2	2.33	2.33	3	1.67	3	2.33	2.33	3			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 5th Sem.
Course Title: Design and Detailing of Structures	**Subject Code:** TIU-UCE-S324
Contact Hours/Week: 0–0–4 (L–T–P)	**Credit:** 2

COURSE OBJECTIVE:

Enable the student to:

1. To understand different types of structures, different structural materials and the concept of structural stability.
2. To provide the knowledge of different types of loads on structures.
3. To understand the design steps of various RCC and steel structure units

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Understand the fundamental principles of structural design and detailing as per relevant codes and standards.	K2
CO2	Apply limit state design concepts for beams, columns, slabs, and footings.	K3
CO3	Analyze and design structural components considering stability, strength, and serviceability.	K4
CO4	Evaluate structural behavior under various loading conditions and propose suitable detailing solutions.	K5
CO5	Develop structural drawings and detailing using manual and software-based approaches.	K3
CO6	Demonstrate knowledge of sustainable and economical design practices for structural elements.	K6

COURSE CONTENT:

MODULE 1:		**30Hours**
Design and detailing of RCC structures- GAD for four storied RCC structure with details of slabs, beams, columns, staircases and footings.BIM for structural detailing		
MODULE 2:		**30 Hours**
Design and detailing of Steel structures-Discussion on different loads and load combinations (i.e. wind load, dead load, live load and others) as per IS875. Design and drawing of the various components of a steel factory shed. Advanced wind load analysis and dynamic earthquake-resistant design		
TOTAL LECTURES		**60 Hours**

Books:

1. Design of steel structures- Limit state method by N.Subramanian
2. Design of Reinforced concrete by N.Subramanian
3. IS:456-2000: Plain and Reinforced concrete-code of practice
4. IS:800-2015: General construction in steel-code of practice.
5. IS:875(Part I, II) and IS: 875 (Part III)-2015.
6. SP-16 and SP-6(Part I).

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	2	2	1	1	1	1	2	1	2			
CO2	3	3	3	2	2	1	1	1	1	2	2	2			
CO3	3	3	3	3	3	1	2	1	1	3	2	3			
CO4	3	3	3	3	3	2	2	1	2	3	2	3			
CO5	3	2	3	2	3	1	1	1	2	3	2	3			
CO6	3	2	3	2	3	3	3	2	2	3	2	3			
	3.00	2.50	3.00	2.33	2.67	1.50	1.67	1.17	1.50	2.67	1.83	2.67			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 8th Yr., 8th Sem.
Course Title: Introduction to AI & Machine Learning	**Subject Code:**TIU-UCS-E308A
Contact Hours/Week: 3–0–2 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

Enable the student to:

1. Introduce the fundamental concepts of AI & ML.
2. Explain basic machine learning techniques.
3. Provide hands-on experience with Python and ML libraries.
4. Cover simple algorithms used in AI and ML.
5. Discuss ethical considerations and practical applications.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Explain the fundamental concepts and applications of Artificial Intelligence and Machine Learning.	K2
CO2	Describe various AI problem-solving approaches, including search algorithms, knowledge representation, and expert systems.	K2
CO3	Demonstrate the use of basic Machine Learning algorithms for classification, regression, and clustering.	K3
CO4	Apply feature engineering techniques for dimensionality reduction and performance improvement.	K3
CO5	Evaluate model performance using suitable metrics like accuracy, precision, recall, and explainability.	K4
CO6	Design earth retaining structures and slope stability analysis.	K4

COURSE CONTENT:

Module 1	**Artificial Intelligence - I**	**12 Hours**
Definition, Scope and Foundation of AI, Turing test, Real life application of AI, Agent and its environment, Design of Rational Agent, Learning agent, Search methods – Blind, Heuristic, Adversarial, Constraint-Satisfaction search		
Module 2	**Artificial Intelligence - II**	**12 Hours**
Knowledge Representation system in AI, Problem solving using AI, Expert system, Fuzzy logic		
Module 3	**Machine Learning - I**	**12 Hours**
Definition, Scope and Foundation of ML – evolution of ML, AI and ML – the intersection, Real life application of ML, Generic pipeline of ML algorithms, Types of ML, Mathematical and Statistical foundation to data – issues with high dimensional data, Assessment metrics for performance - Accuracy, Precision, Recall, etc		
Module 4	**Machine Learning - II**	**12 Hours**

Feature engineering – PCA, SVD, LDA, Supervised Learning: Classification: KNN, Decision Tree, RF, SVM, Regression: Linear & Logistic Regression, Polynomial regression, Unsupervised Learning – Clustering: K-means, Hierarchical clustering, Association Rule mining – Apriori algorithm		
Module 5	**AI and ML**	**12 Hours**
AI Ethics and Future Trends, Bias and Fairness in AI, Explainability of AI models, Ethical AI and Responsible AI, Future Trends in AI & ML, Recent trends in various learning techniques of machine learning and classification methods, Hands-on Projects and Case Studies		
TOTAL		**60 Hours**

Books:

Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson
Tom M. Mitchell, Machine Learning, McGraw Hill
Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press
Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly
Ethem Alpaydin, Introduction to Machine Learning, MIT Press

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1	1	1	0	0	1	1	1	1			
CO2	3	3	2	2	1	1	0	0	2	2	1	1			
CO3	3	2	3	3	2	1	0	0	3	2	2	2			
CO4	3	2	3	3	2	2	1	0	3	2	2	2			
CO5	3	3	3	3	2	3	1	1	3	3	3	2			
CO6	2	3	2	2	3	3	2	1	2	3	3	3			
	2.83	2.50	2.33	2.33	1.83	1.83	0.67	0.33	2.33	2.17	2.00	1.83			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 8th Yr., 8th Sem.
Course Title: Advanced Concrete Technology	**Subject Code:**TIU-UCE-E324A
Contact Hours/Week: 3–0–2 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

Enable the student to:

1. Gain in-depth knowledge of cement production, composition, and hydration processes.
2. Understand the properties of aggregates and their influence on concrete performance.
3. Analyze the role of chemical and mineral admixtures in modifying concrete behavior.
4. Design and evaluate high-performance concrete mixes for specialized applications.
5. Assess the properties of fresh and hardened concrete through standard tests.
6. Examine the effects of creep, shrinkage, and durability on concrete structures.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Explain cement production processes, composition, and hydration chemistry.	K2
CO2	Analyze the properties and characteristics of aggregates for concrete.	K4
CO3	Evaluate the effectiveness of chemical and mineral admixtures in concrete.	K4
CO4	Explain the principles of high-performance concrete mix design.	K2
CO5	Describe the properties of fresh and hardened concrete.	K2
CO6	Design earth retaining structures and slope stability analysis.	K4

COURSE CONTENT:

Module 1	**Cement Production and Composition**	**10 Hours**
Overview of the cement industry, Raw materials and manufacturing process, Chemical composition of cement, Hydration reactions, Heat of hydration, Setting and hardening, Microstructure development,GreenCement, Influence of curing.		
Module 2	**Aggregates for Concrete**	**8 Hours**
Types and sources of aggregates, Physical properties of aggregates, Quality requirements, Grading, Shape and texture, Strength of aggregates, Alkali-aggregate reactions and preventive measures, Case studies- RCA, Use of Industrial By-products as Aggregates/Artificial aggregates)		
Module 3	**Chemical and Mineral Admixtures**	**12 Hours**
Types and functions of chemical admixtures, Superplasticizers and their compatibility, Retarders, Accelerators, Air-entraining agents, Mineral admixtures like fly ash, silica fume, and slag, Pozzolanic reactions and influence on concrete properties, Bio-based or ECOfriendly Admixtures (like-natural pozzolans, agricultural ash (e.g., rice husk ash)		

Module 4	**High-Performance Concrete**	**10 Hours**
Definition and objectives, Factors influencing mix design, Design methods for high-performance concrete, Step-by-step procedure, Ultra high performance concrete (UHPC),Case studies and applications.		
Module 5	**Fresh and Hardened Concrete**	**10 Hours**
Workability tests and factors affecting workability, Segregation and bleeding, Placing, compacting, and finishing of concrete, Compressive, tensile, and flexural strength tests, Factors influencing hardened properties, Permeability and water absorption.		
Module 6	**Creep and Shrinkage**	**10 Hours**
Mechanisms of creep, Factors affecting creep, Measurement, and control, Types of shrinkage - plastic, drying, and autogenous, Effects and mitigation methods.		
TOTAL		**60 Hours**

Books:

1. Concrete Technology by M.S. Shetty & A.K. Jain
2. Advanced Concrete Technology by Zongjin Li
3. Properties of Concrete by A.M. Neville
4. Concrete Microstructure, Properties, and Materials by P.K. Mehta & Paulo J.M. Monteiro
5. IS Codes and Standards (IS 456:2000, IS 10262:2019).

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1	1	1	0	0	1	1	1	1			
CO2	3	3	2	2	1	1	0	0	2	2	1	1			
CO3	3	2	3	3	2	1	0	0	3	2	2	2			
CO4	3	2	3	3	2	2	1	0	3	2	2	2			
CO5	3	3	3	3	2	3	1	1	3	3	3	2			
CO6	2	3	2	2	3	3	2	1	2	3	3	3			
	2.83	2.50	2.33	2.33	1.83	1.83	0.67	0.33	2.33	2.17	2.00	1.83			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 8th Yr., 8th Sem.
Course Title: Repairs and Rehabilitation of Structures	**Subject Code:**TIU-UCE-E334A
Contact Hours/Week: 3–0–2 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

Enable the student to:

1. Understand the causes of distress and deterioration in concrete and masonry structures.
2. Learn the importance of maintenance, inspection, and assessment of damaged structures.
3. Study various materials and techniques used for repair and rehabilitation of structures.
4. Develop an understanding of retrofitting methods and strengthening techniques for different structural elements.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Explain** the fundamental causes of structural deterioration, including material degradation, environmental effects, and loading conditions.	K2
CO2	**Describe** various assessment techniques, including non-destructive testing (NDT) and visual inspection, to evaluate structural damage.	K2
CO3	**Apply** appropriate repair and strengthening techniques for different types of structural defects based on engineering standards and best practices.	K3
CO4	**Demonstrate** the use of advanced materials, such as fiber-reinforced polymers (FRP) and high-performance concrete, for structural rehabilitation.	K3
CO5	**Develop** strategies for maintenance, retrofitting, and life-cycle enhancement of existing structures, ensuring safety and durability.	K3
CO6	**Integrate** sustainability concepts into structural rehabilitation, considering cost, environmental impact, and long-term performance.	K3

COURSE CONTENT :

MODULE 1:	**Introduction**	**11 Hours**
Maintenance, rehabilitation, repair, retrofit and strengthening, need for rehabilitation of structures. Cracks in R.C. buildings-Various cracks in R.C. buildings, causes and effects. Maintenance-Maintenance importance of maintenance, routine and preventive maintenance. Damages to masonry structures-Various damages to masonry structures and causes		
MODULE 2:	**Repair materials**	**13 Hours**
Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials, Special mortars and concretes (Self-healing concrete/geopolymer concrete/Polymer Concrete and Mortar), Quick setting compounds, Grouting materials, Gas forming grouts, Sulphoalumate grouts, Polymer grouts, Acrylate and Urethane grouts. Bonding agents-Latex emulsions, Epoxy bonding agents. Protective coatings-Protective coatings for Concrete and Steel, FRP sheets.		
MODULE 3:	**Damage diagnosis and assessment**	**18 Hours**
Visual inspection, Use of Infrared Thermography for Damage Detection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing, Probe test, Pull out		

test, Chloride penetration test, Carbonation, Carbonation depth testing, Corrosion activity measurement Substrate preparation-Importance of substrate/surface preparation, General surface preparation methods and procedure, Reinforcing steel cleaning.		
MODULE 4:	**Crack repair**	**18 Hours**
Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, UHPC Overlays, Repair to active cracks, Repair to dormant cracks. Corrosion of embedded steel in concrete, Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns).Jacketing-Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing. Strengthening-Strengthening, Beam shear strengthening, Flexural strengthening.		
TOTAL LECTURES		**60 Hours**

Books:

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

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1	1	1	0	0	1	1	1	1			
CO2	3	3	2	2	1	1	0	0	2	2	1	1			
CO3	3	2	3	3	2	1	0	0	3	2	2	2			
CO4	3	2	3	3	2	2	1	0	3	2	2	2			
CO5	3	3	3	3	2	3	1	1	3	3	3	2			
CO6	2	3	2	2	3	3	2	1	2	3	3	3			
	2.83	2.50	2.33	2.33	1.83	1.83	0.67	0.33	2.33	2.17	2.00	1.83			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 6th Sem.
Course Title: Structural Dynamics & Earthquake Engineering	**Subject Code:**TIU-UCE-E344A
Contact Hours/Week: 3–0–0(L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. To provide a basic understanding of dynamic loading. Study the effect of earthquake loading on the behaviour of structures.
2. To provide a coherent development to the students for the courses in sector of earthquake engineering.
3. To present the foundations of many basic engineering concepts related earthquake engineering.
4. To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering.
5. To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.
6. Understand the codal provisions to design the structures as earthquake resistant.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Define and describe the fundamental concepts of structural dynamics, including degrees of freedom, damping, resonance, and dynamic response of structures.	K1
CO2	Explain the behavior of single-degree and multi-degree-of-freedom systems under dynamic loading and interpret their responses using mathematical models.	K2
CO3	Illustrate and analyze the effects of seismic forces on structures, including ground motion characteristics, response spectra, and earthquake-resistant design principles.	K2
CO4	Apply dynamic analysis techniques to evaluate structural responses under various dynamic loads, including earthquake and wind forces.	K3
CO5	Compute and design earthquake-resistant structures using IS 1893, IS 13920, and other relevant seismic codes, ensuring safety and stability.	K3
CO6	Develop and assess retrofitting techniques for existing structures to enhance their seismic performance based on modern engineering practices.	K3

COURSE CONTENT:

MODULE 1:	**Theory of vibrations**	**8 Hours**
Degrees of freedom, Undamped single degree freedom system, Damped single degree freedom system, Natural frequency, modes of vibration, Introduction to multiple degree freedom system.		
MODULE 2:	**Response of single degree freedom system due to harmonic loading**	**7 Hours**
Undamped harmonic excitation, Damped Harmonic excitation.		
MODULE 3:	**Response due to Transient loading**	**10 Hours**

Duhamel's Integral, Response due to constant force, Rectangular load, Overview of dynamic response of structures due to impact or explosion loads. Introduction to numerical evaluation of Duhamel's integral of undamped system.		
MODULE 4:	**Elements of seismology**	**10 Hours**
Fundamentals, Elastic rebound theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc., Seismographs, Seismic zoning, Response of Simple Structural Systems.Introduction to GIS and Remote Sensing for Seismic Zoning Maps.		
MODULE 5:	**Principles of earthquake resistant design**	**10 Hours**
Terminology, General principles and Design criteria, Methods of Analysis, Equivalent lateral force method of Analysis for multistoried building as per Indian Standard Code of Practice, Introduction to Response Spectrum Method, Fundamental concepts of ductile detailing.**Case Studies of Recent Earthquakes (e.g., Nepal 2015, Turkey-Syria 2023)** – Analysis of building failure modes and lessons learned.		
TOTAL LECTURES		**45 Hours**

Books:

1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, Mc Graw Hill International Edition, 1995
2. Agarwal.P and Shrikhande.M.,Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2007.
3. Mario Paz, Structural Dynamics – Theory and Computations, Third Edition, CBS publishers, 1990.
4. Humar.J.L, Dynamics of Structures, Prentice Hall Inc., 1990.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	0	0	0	1	0	0	1	0	2			
CO2	3	3	2	0	0	0	1	0	0	1	0	2			
CO3	3	3	2	1	1	0	1	0	0	1	0	2			
CO4	3	3	3	2	2	0	2	0	0	1	1	2			
CO5	3	3	3	2	2	0	2	0	0	1	1	2			
CO6	3	3	3	2	2	0	2	0	0	1	1	2			
	3	2.83	2.5	1.16	1.16	0	1.5	0	0	1	0.5	2			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 3rd Yr., 6th Sem.
Course Title: Project - Structural Engineering	**Subject Code:** TTIU-UCE-P302
Contact Hours/Week: 0–0–6 (L–T–P)	**Credit: 3**

COURSE OBJECTIVE :

Enable the student to:

1. Integrate theoretical knowledge with practical application in addressing real-world structural engineering challenges.
2. Develop critical thinking and problem-solving skills by analyzing complex structural engineering problems and proposing innovative solutions.
3. Enhance research skills through literature review, data collection, and analysis relevant to the project topic.
4. Foster teamwork and communication skills by collaborating effectively with peers and presenting findings to a broader audience.
5. Utilize modern tools and technologies relevant to the specific area of civil engineering for modeling, simulation, and analysis.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Identify key research areas, methodologies, and literature sources relevant to structural engineering.	K1
CO2	Analyze and synthesize research findings to identify research gaps and define a problem statement	K4
CO3	Develop a structured research proposal with appropriate methodology and feasibility analysis.	K5
CO4	Apply computational, experimental, or hybrid techniques for preliminary research work.	K3
CO5	Demonstrate skills in research planning, technical writing, and academic presentations.	K6
CO6	Evaluate ethical considerations and best practices in civil engineering research.	K5

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	2	-	-	2	2	2	3			
CO2	3	3	3	3	3	2	2	2	2	2	2	3			
CO3	3	3	3	3	3	3	2	2	2	2	3	3			
CO4	3	3	3	3	3	3	3	2	2	3	3	3			
CO5	3	3	3	3	3	3	3	3	3	3	3	3			
CO6	3	3	3	3	3	3	3	3	3	3	3	3			
	3	3	3	3	3	2.6	2.6	2.4	2.3	2.5	2.6	3			

TECHNO INDIA UNIVERSITY
WEST BENGAL

TIU-UES-S382	Entrepreneurship Skill Development	1 credit

Syllabus

This course is designed to equip students with essential skills for career advancement, focusing on the latest software and technologies relevant to the civil engineering field, such as Building Information Modeling (BIM) and project management tools. Additionally, students will enhance their communication skills through presentations, report writing, and effective teamwork strategies, preparing them to excel in professional environments and collaborate efficiently in multidisciplinary teams. Emphasis will also be placed on networking and personal branding to help students effectively position themselves in the job market.

TECHNO INDIA UNIVERSITY

WEST BENGAL

7th SEMESTER

Program: B. Tech. in Civil Engineering	**Year, Semester:** 4th Yr., 7th Sem.
Course Title: Career Advancement & Skill Development-(Computer Application in Civil Engineering)	**Subject Code:** TIU-UCE-S403
Contact Hours/Week: 2–0–0 (L–T–P)	**Credit:** 2

COURSE OBJECTIVE :

Enable the student to:

1. Enable students to formulate simple algorithms for arithmetic and logical problems.
2. Develop proficiency in translating algorithms into programs using programming languages such as C, Fortran, or Python.
3. Understand the application of Excel for performing civil engineering calculations efficiently.
4. Utilize civil engineering software (STAAD, ETABS, SAP2000, ANSYS) for structural analysis and design.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Formulate simple algorithms for solving arithmetic and logical problems.	K3
CO2	Develop and translate algorithms into programs using C, Fortran, or Python.	K3
CO3	Apply Excel functions to perform civil engineering calculations.	K3
CO4	Analyze and interpret data using Excel for civil engineering applications.	K4
CO5	Use civil engineering software such as STAAD, ETABS, SAP2000, and ANSYS for structural analysis and design.	K3
CO6	Evaluate the results obtained from civil engineering software for effective decision-making.	K5

COURSE CONTENT :

MODULE 1:		**30 Hours**
Introduction to Civil engineering software (**any of STAAD, ETAB, SAP2000etc**): Familiarization with programming environment- Complete analysis and design using software along with report submission		
TOTAL		**30 Hours**

Books:

1. B. Gottfried, “Programming with C”, McGraw-Hill Professional, 1996.
2. Excel 2013 in Simple Steps by Kogent Learning Solutions Inc., Dreamtech Press.
3. Computer Programming in Fortran 77 (With an Introduction to Fortran 90) V Rajaraman.
4. http://csi.csiberkeley.com/etabs9.5/watch-and-learn#page=page-1

Course Articulation Matrix:

TECHNO INDIA UNIVERSITY
WEST BENGAL

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	2	3	0	0	0	1	1	1	2			
CO2	3	3	2	3	3	0	0	0	1	2	2	2			
CO3	2	2	2	3	3	0	1	0	1	2	2	2			
CO4	2	3	2	3	3	0	1	0	1	2	2	2			
CO5	3	3	3	3	3	0	1	0	1	2	2	3			
CO6	3	3	3	3	3	1	1	0	1	2	2	3			
	2.67	2.67	2.17	2.83	3.00	0.17	0.67	0.00	1.00	1.83	1.83	2.33			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 4th Yr., 7th Sem.
Course Title: Metro Systems & Engineering	**Subject Code:** TIU-UCE-T421
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE :

Enable the student to:

1. To get a thorough overview of metro systems.
2. To understand what is the need of metros in today's world.
3. To learn how basic plannings are done.
4. To get the idea of routine studies in metro systems.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Explain** the fundamental principles of metro rail systems, including their significance, components, and classification.	K2
CO2	**Describe** the design standards, alignment selection, and construction methodologies for metro systems, considering geological and urban constraints.	K2
CO3	**Apply** IS codes, guidelines, and best practices for the planning, design, and implementation of metro rail projects.	K3
CO4	**Analyze** and compare different track structures, traction systems, and signaling technologies used in metro rail operations.	K3
CO5	**Evaluate** metro system performance, including operational efficiency, sustainability, and environmental impact.	K3
CO6	**Demonstrate** the ability to integrate modern tools and project management techniques in metro system planning and execution.	K3

COURSE CONTENT :

MODULE 1:		**15 Hours**
Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings.		
MODULE 2:		**15 Hours**
Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems.		
MODULE 3:		**15 Hours**
Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management.		
TOTAL LECTURES		**45 Hours**

Books:

1. "**Principles of Metro Rail Engineering**" – S. Ponnuswamy
2. **"Urban Transit: Systems and Technology"** – Vukan R. Vuchic
3. **"Tunnel Engineering Handbook"** – Bickel, Kuesel & King
4. **"Railway Bridge and Tunnel Engineering"** – Rangwala
5. **"Railway Track Engineering"** – J.S. Mundrey
6. **"Building Metro Rail Stations"** – Paul Maxwell

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 4th Yr., 7th Sem.
Course Title: Solid and Hazardous Waste Management	**Subject Code:** TIU-UCE-E455
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE :

Enable the student to:

1. understanding of problems of municipal waste, biomedical waste, hazardous waste, ewaste, industrial waste etc.
2. gather knowledge of legal, institutional and financial aspects of management of solid wastes.
3. become aware of Environment and health impacts solid waste mismanagement.
4. understand engineering, financial and technical options for waste management.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Explain** the fundamental causes of structural deterioration, including material degradation, environmental effects, and loading conditions.	K2
CO2	**Describe** various assessment techniques, including non-destructive testing (NDT) and visual inspection, to evaluate structural damage.	K2
CO3	**Apply** appropriate repair and strengthening techniques for different types of structural defects based on engineering standards and best practices.	K3
CO4	**Demonstrate** the use of advanced materials, such as fiber-reinforced polymers (FRP) and high-performance concrete, for structural rehabilitation.	K3
CO5	**Develop** strategies for maintenance, retrofitting, and life-cycle enhancement of existing structures, ensuring safety and durability.	K3
CO6	**Integrate** sustainability concepts into structural rehabilitation, considering cost, environmental impact, and long-term performance.	K3

COURSE CONTENT :

MODULE 1:	**Solid Wastes**	**6 Hours**
Origin, Analysis, Composition and Characteristics.		
MODULE 2:	**Integrated Solid Waste Management System**	**8 Hours**
Collection, Storage, Segregation, Reuse and Recycling possibilities, Transportation, Treatment / Processing and Transformation Techniques, Final Disposal		
MODULE 3:	**Management of Different types of Solid Waste**	**9 Hours**
Municipal, Biomedical, Nuclear, Electronic and Industrial Solid Wastes and the rules and regulations. Introduction to Hazardous wastes, Definition of Hazardous waste, The magnitude of the problem.		
MODULE 4:	**Hazardous waste**	**14 Hours**

Risk assessment, Environmental legislation, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Physical, chemical and biological treatment, Ground water contamination, Landfill disposal, Current Management Practices, Environmental audit, Pollution Prevention, Facility Development and operation		
MODULE 5:	**Site Remediation**	**8 Hours**
Quantitative risk assessment, site and subsurface characterization, Containment, remedial alternatives.		
TOTAL LECTURES		**45 Hours**

Books:

1. Solid and hazardous waste management by S.Bhatia.Atlantic publishers.
2. Solid and hazardous waste management: Science and engineering by A.Shah, M.N.Rao. B.S. Publications.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	2	3	0	0	0	1	1	1	2			
CO2	3	3	2	3	3	0	0	0	1	2	2	2			
CO3	2	2	2	3	3	0	1	0	1	2	2	2			
CO4	2	3	2	3	3	0	1	0	1	2	2	2			
CO5	3	3	3	3	3	0	1	0	1	2	2	3			
CO6	3	3	3	3	3	1	1	0	1	2	2	3			
	2.67	2.67	2.17	2.83	3.00	0.17	0.67	0.00	1.00	1.83	1.83	2.33			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 8th Yr., 8th Sem.
Course Title: Bridge Engineering	**Subject Code:** TIU-UCE-E461
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE :

Enable the student to:

1. understand the background of bridge development, classification of bridges.
2. prepare a thorough understanding of the behavior and design of bridges.
3. understand design equations for different types of bridges.
4. discuss relevant modern research topics from the field of bridge engineering.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Explain** the fundamental causes of structural deterioration, including material degradation, environmental effects, and loading conditions.	K2
CO2	**Describe** various assessment techniques, including non-destructive testing (NDT) and visual inspection, to evaluate structural damage.	K2
CO3	**Apply** appropriate repair and strengthening techniques for different types of structural defects based on engineering standards and best practices.	K3
CO4	**Demonstrate** the use of advanced materials, such as fiber-reinforced polymers (FRP) and high-performance concrete, for structural rehabilitation.	K3
CO5	**Develop** strategies for maintenance, retrofitting, and life-cycle enhancement of existing structures, ensuring safety and durability.	K3
CO6	**Integrate** sustainability concepts into structural rehabilitation, considering cost, environmental impact, and long-term performance.	K3

COURSE CONTENT :

MODULE 1:	**Introduction**	**6 Hours**
Definition and Basic Forms, Component of bridge, classification of bridge, short history of bridge development. IRC Loads. Analysis of IRC Loads, Impact factors, Other loads to be considered, Importance of Hydraulic factors in Bridge Design.		
MODULE 2:	**General Design Considerations**	**6 Hours**
Reinforced concrete solid slab bridge-Introduction, General design features, Effective width method. Simply supported and cantilever Slab Bridge, analysis and design. Box Culvert, Beam and Slab Bridges, Balanced Cantilever Bridge.		
MODULE 3:	**Steel Bridges**	**7 Hours**
General features, types of stress, Design example.		
MODULE 4:	**Plate Girder Bridge**	**7 Hours**
Elements, design, lateral bracing, Box- girder Bridges.		

MODULE 5:	**Composite Bridges**	**9 Hours**
General aspects, method of construction, analysis of composite section, shear connectors, design of composite beam.		
MODULE 6:	**Cable Stayed Bridge:**	**10 Hours**
General features, Philosophy of design.		
TOTAL LECTURES		**45 Hours**

Books:

1. Victor, D.J., Essentials of bridge engineering, Oxford & IBH Publishing.
2. Bindra, S. P., Principles and Practice of Bridge Structures, Dhanpat Rai Publications.
3. Jagadeesh, T. R., and Jayaram, M. A., Design of Bridge Structures, Phi Learning.
4. Ponnuswamy, S., Bridge Engineering, Tata Mcgraw Hill.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	2	1	1	2	1	0	1	1	2			
CO2	3	3	2	3	2	1	2	1	0	1	2	2			
CO3	3	3	3	3	3	2	2	1	1	2	3	3			
CO4	2	3	3	3	3	2	2	1	1	2	3	3			
CO5	2	3	3	3	3	3	3	2	1	2	3	3			
CO6	2	2	3	3	3	3	3	2	1	3	3	3			
	2.5	2.67	2.67	2.83	2.5	2	2.33	1.33	0.67	1.83	2.5	2.67			

TECHNO INDIA UNIVERSITY
WEST BENGAL

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Program: B. Tech. in Civil Engineering	**Year, Semester:** 4th Yr., 7th Sem.
Course Title: Internship I	**Subject Code:** TIU-UCE-P495
Contact Hours/Week: 0–0–0 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE :

Enable the student to:

1. Bridge the gap between classroom learning and real-world application by providing hands-on experience in civil engineering projects.
2. Enhance technical skills, including design, analysis, project management, and the use of engineering software.
3. Familiarize interns with industry standards, practices, and technologies used in civil engineering.
4. Gain insights into the various phases of a project, from planning and design to construction and maintenance.
5. Build connections with industry professionals, peers, and mentors, which can aid in future career opportunities.
6. Provide insights into various career paths within civil engineering, helping interns identify their areas of interest.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Demonstrate an understanding of industry operations, professional work culture, and real-world engineering applications.	K2
CO2	Apply theoretical knowledge gained in academics to solve practical engineering problems in an industrial or research setting.	K3
CO3	Develop technical and analytical skills by engaging in hands-on work, projects, or industrial training.	K3
CO4	Exhibit teamwork, communication, and leadership skills by collaborating with professionals in the industry.	K4
CO5	Identify challenges and gaps in current industrial practices and propose innovative or optimized solutions.	K5
CO6	Prepare technical reports and presentations based on internship experiences, documenting learning outcomes and industry insights.	K6

COURSE CONTENT :

MODULE 1:		**4 weeks**
Introduction to Industry & Work Culture, Technical Learning & Hands-on Exposure, Teamwork & Communication, Identifying Challenges & Solutions, Report Writing & Presentation		
TOTAL		**4 weeks**

Course Articulation Matrix:

TECHNO INDIA UNIVERSITY

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	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	0	0	0	0	2	0	0	2	0	0	2			
CO2	3	2	0	0	2	0	0	0	0	0	0	0			
CO3	3	0	0	0	2	0	0	0	2	0	0	2			
CO4	0	0	0	0	0	0	0	0	3	2	0	0			
CO5	0	2	0	2	0	2	2	0	0	0	0	0			
CO6	0	0	0	0	0	0	0	0	0	3	2	0			
	2.5	2.67	2.67	2.83	2.5	2	2.33	1.33	0.67	1.83	2.5	2.67			

TECHNO INDIA UNIVERSITY
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Program: B. Tech. in Civil Engineering	**Year, Semester:** 4th Yr., 7th Sem.
Course Title: Entrepreneurship Skill Development (Project)	**Subject Code:** TIU-UES-S493
Contact Hours/Week: 0–0–8 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE :

Enable the student to:

6. Integrate theoretical knowledge with practical application in addressing real-world civil engineering challenges.
7. Develop critical thinking and problem-solving skills by analyzing complex engineering problems and proposing innovative solutions.
8. Enhance research skills through literature review, data collection, and analysis relevant to the project topic.
9. Foster teamwork and communication skills by collaborating effectively with peers and presenting findings to a broader audience.
10. Utilize modern tools and technologies relevant to the specific area of civil engineering for modeling, simulation, and analysis.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Identify key research areas, methodologies, and literature sources relevant to civil engineering.	K1
CO2	Analyze and synthesize research findings to identify research gaps and define a problem statement	K4
CO3	Develop a structured research proposal with appropriate methodology and feasibility analysis.	K5
CO4	Apply computational, experimental, or hybrid techniques for preliminary research work.	K3
CO5	Demonstrate skills in research planning, technical writing, and academic presentations.	K6
CO6	Evaluate ethical considerations and best practices in civil engineering research.	K5

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	2	-	-	2	2	2	3			
CO2	3	3	3	3	3	2	2	2	2	2	2	3			
CO3	3	3	3	3	3	3	2	2	2	2-	3	3			
CO4	3	3	3	3	3	3	3	2	2	3	3	3			
CO5	3	3	3	3	3	3	3	3	3	3	3	3			

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO6	3	3	3	3	3	3	3	3	3	3	3	3			
	3	3	3	3	3	2.6	2.6	2.4	2.3	2.5	2.6	3			

TECHNO INDIA UNIVERSITY

WEST BENGAL

8TH SEMESTER

Program: B. Tech. in Civil Engineering	**Year, Semester:** 8th Yr., 8th Sem.
Course Title: Career Advancement & Skill Development-(Professional Practice, Law- Ethics)	**Subject Code:** TIU-UMG-S412
Contact Hours/Week: 0–0–1 (L–T–P)	**Credit:** 1

COURSE OBJECTIVE :

Enable the student to:

1. Understand the roles and responsibilities of various stakeholders in civil engineering practice.
2. Develop knowledge of professional ethics, ethical dilemmas, and decision-making in engineering practice.
3. Learn the principles of contract management, types of contracts, and legal aspects of construction.
4. Gain insights into dispute resolution mechanisms, including arbitration, conciliation, and mediation.
5. Understand labor laws, employment regulations, and legal frameworks affecting construction projects.
6. Develop awareness of intellectual property rights and their relevance to engineering practice.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Explain the roles and responsibilities of stakeholders in professional civil engineering practice.	K2
CO2	Analyze ethical dilemmas in engineering and apply professional ethics to decision-making.	K4
CO3	Interpret various types of contracts, legal provisions, and contract management principles in construction projects.	K3
CO4	Evaluate different dispute resolution methods and legal frameworks applicable to civil engineering.	K5
CO5	Apply labor laws and employment regulations to construction management practices.	K3
CO6	Assess intellectual property rights and their significance in engineering innovation and practice.	K5

COURSE CONTENT :

MODULE 1:	**Professional Practice**	**5 Hours**
Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory		

Acts and Standards).

MODULE 2:	Professional Ethics	3 Hours

Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

MODULE 3:	General Principles of Contracts Management	7 Hours

Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub- contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build- Own-Operate & variations; Public- Private Partnerships; International CommercialTerms.

MODULE 4:	Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system	5 Hours

Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok adalats.

MODULE 5:	Engagement of Labour and Labour& other construction-related Laws	4 Hours

Role of LabourinCivil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC2017.

MODULE 6:	Law relating to Intellectual property	6 Hours

Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents

law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.	
TOTAL LECTURES	**30 Hours**

Books:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts,1974.
2. The National Building Code, BIS,2017
3. RERA Act,2017
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset.
5. Neelima Chandiramani (2000), TheLawof Contract: An Outline, 2nd Edn. Avinash Publications Mumbai.
6. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration.
7. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
8. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.
9. Bare text (2005), Right to Information Act.
10. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers.
11. K.M. Desai(1946), The Industrial Employment (Standing Orders)Act.
12. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House.
13. Vee, Charles &Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2,pp 117-127, MCB UPLtd.
14. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and application.
15. Ethics in Engineering- M.W.Martin&R.Schinzinger, McGraw-Hill.
16. Engineering Ethics, National Institute for Engineering Ethics, USA.
17. www.ieindia.org
18. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard,M.J.Rabins.
19. CONSTRUCTION CONTRACTS,http://www.jnormanstark.com/contract.htm.
20. Internet and Business Handbook, Chap 4, CONTRACTS LAW,http://www.laderapress.com/laderapress/contractslaw1.html.
21. Contract & agrementshttp://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm
22. Contracts,http://206.127.69.152/jgretch/crj/211/ch7.ppt
23. Business & Personal Law. Chapter 7. “How Contracts Arise”, http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
24. Types of Contracts,http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
25. Types of contracts and important provisions., http://www.worldbank.org/html/opr/consult/guidetxt/types.html
26. Contract Types / Pricing Arrangements Guideline- 1.4.G (11/04/02), http://www.sandia.gov/policy/14g.pdf.

Course Articulation Matrix:

TECHNO INDIA UNIVERSITY
WEST BENGAL

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	1	1	1	3	2	3	1	2	2	1			
CO2	1	2	1	1	1	3	2	3	2	2	2	2			
CO3	2	2	2	2	2	2	2	3	1	3	3	2			
CO4	1	2	2	2	1	3	2	3	2	3	3	2			
CO5	1	1	2	1	1	3	3	3	2	2	2	2			
CO6	1	2	2	2	2	3	2	3	2	3	3	2			
	1.33	1.67	1.67	1.50	1.33	2.83	2.17	3.00	1.67	2.50	2.50	1.83			

TECHNO INDIA UNIVERSITY

WEST BENGAL

Program: B. Tech. in Civil Engineering	**Year, Semester:** 8th Yr., 8th Sem.
Course Title: Repairs and Rehabilitation of Structures (Elective-VII)	**Subject Code:** TIU-UCE-E470
Contact Hours/Week: 3–0–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE :

Enable the student to:

1. Understand the causes of distress and deterioration in concrete and masonry structures.
2. Learn the importance of maintenance, inspection, and assessment of damaged structures.
3. Study various materials and techniques used for repair and rehabilitation of structures.
4. Develop an understanding of retrofitting methods and strengthening techniques for different structural elements.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	**Explain** the fundamental causes of structural deterioration, including material degradation, environmental effects, and loading conditions.	K2
CO2	**Describe** various assessment techniques, including non-destructive testing (NDT) and visual inspection, to evaluate structural damage.	K2
CO3	**Apply** appropriate repair and strengthening techniques for different types of structural defects based on engineering standards and best practices.	K3
CO4	**Demonstrate** the use of advanced materials, such as fiber-reinforced polymers (FRP) and high-performance concrete, for structural rehabilitation.	K3
CO5	**Develop** strategies for maintenance, retrofitting, and life-cycle enhancement of existing structures, ensuring safety and durability.	K3
CO6	**Integrate** sustainability concepts into structural rehabilitation, considering cost, environmental impact, and long-term performance.	K3

COURSE CONTENT:

MODULE 1:	**Introduction**	**8 Hours**
Maintenance, rehabilitation, repair, retrofit and strengthening, need for rehabilitation of structures. Cracks in R.C. buildings-Various cracks in R.C. buildings, causes and effects. Maintenance-Maintenance importance of maintenance, routine and preventive maintenance. Damages to masonry structures-Various damages to masonry structures and causes		
MODULE 2:	**Repair materials**	**9 Hours**
Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials, Special mortars and concretes, Polymer Concrete and Mortar, Quick setting compounds, Grouting materials, Gas forming grouts, Sulphoalumate grouts, Polymer grouts, Acrylate and Urethane grouts. Bonding agents-Latex		

emulsions, Epoxy bonding agents. Protective coatings-Protective coatings for Concrete and Steel, FRP sheets.		
MODULE 3:	**Damage diagnosis and assessment**	**14 Hours**
Visual inspection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing, Probe test, Pull out test, Chloride penetration test, Carbonation, Carbonation depth testing, Corrosion activity measurement Substrate preparation-Importance of substrate/surface preparation, General surface preparation methods and procedure, Reinforcing steel cleaning.		
MODULE 4:	**Crack repair**	**14 Hours**
Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks. Corrosion of embedded steel in concrete, Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns).Jacketing-Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing. Strengthening-Strengthening, Beam shear strengthening, Flexural strengthening.		
TOTAL LECTURES		**45 Hours**

Books:

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

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	2	1	1	2	1	0	1	1	2			
CO2	3	3	2	3	2	1	2	1	0	1	2	2			
CO3	3	3	3	3	3	2	2	1	1	2	3	3			
CO4	2	3	3	3	3	2	2	1	1	2	3	3			
CO5	2	3	3	3	3	3	3	2	1	2	3	3			

CO6	2	2	3	3	3	3	3	2	1	3	3	3			
	2.5	2.67	2.67	2.83	2.5	2	2.33	1.33	0.67	1.83	2.5	2.67			

Program: B. Tech. in Civil Engineering	**Year, Semester:** 8th Yr., 8th Sem.
Course Title: Industrial Structures (Elective-VIII)	**Subject Code:** TIU-UCE-E480
Contact Hours/Week: 2–0–0 (L–T–P)	**Credit:** 2

COURSE OBJECTIVE :

Enable the student to:

1. Understand the classification, layout planning, and essential requirements of industrial structures.
2. Analyze and design various industrial components such as gantry girders, machine foundations, and steel connections.
3. Design specialized industrial structures, including reinforced concrete bunkers, silos, chimneys, and cooling towers.
4. Understand the behavior and design principles of folded plates, cylindrical shells, and machine foundations.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Understand the classification, functional requirements, and structural considerations of industrial structures.	K2
CO2	Apply design principles for gantry girders, steel beam connections, and unbraced industrial frames.	K3
CO3	Analyze and design block-type machine foundations as per IS 2974.	K4
CO4	Design reinforced concrete bunkers, silos, chimneys, and cooling towers as per IS codes.	K5
CO5	Evaluate the structural behavior of folded plates, cylindrical shells, and machine foundations.	K5
CO6	Develop innovative and sustainable industrial structural designs considering safety, stability, and functional efficiency.	K6

COURSE CONTENT:

MODULE 1:	**Functional design of industrial buildings**	**8 Hours**
Classification of industrial structures - layout planning requirements – Guidelines from factories act – Lighting - Illumination levels – Natural / Mechanical ventilation – Fire safety requirements – Corrosion protection – Protection against noise – Cladding systems - vibration isolation techniques - Industrial floors. General overview of Thermal power plant / Nuclear power plant structures / Process plant steelwork – conveyor structures – Boiler supporting structures - Substation structures.		

MODULE 2:	**Braced Industrial buildings**	**7 Hours**
Unbraced Industrial frames – Gantry girders – Design of steel beam connections - Flexible & Rigid (Bolted and welded types).Machine foundations – Types - Design Requirements - Analysis and design of block type machine foundations (IS 2974 method).		
MODULE 3:	**Design of Industrial Structures**	**9 Hours**
Design of Reinforced concrete bunkers and silos as per IS:4995. Tall Chimneys (RCC) – Types - Chimney sizing parameters - Overview of wind and temperature effects - Design principles of Reinforced concrete chimneys as per IS:4998. Cooling Towers – Types and functions - Design principles of RC natural draught cooling towers as per IS:11504.		
MODULE 4:	**Concrete Shell Structures**	**6 Hours**
Folded plate and cylindrical shell structures; Introduction, structural behaviour of long and short shells, beam and arch action, analysis and design of cylindrical shell structures, Analysis and design of folded plates; Machine foundations; introduction, machine vibration, structural design of foundation to rotary machines, impact machines, vibration characteristics, design consideration of foundation to impact machine, grillage, pile and raft foundation.		
TOTAL LECTURES		**30 Hours**

Books:

1. Ramamrutham.S., “Design of Reinforced Concrete Structures”, Dhanpat Rai Publishing Company, 2007.
2. Varghese.P.C., ” Limit State Design of Reinforced Concrete”, Prentice Hall of India Eastern Economy Editions, 2nd Edition, 2003.
3. Bhavikatti.S.S., “Design of Steel Structures”, J.K. International Publishing House Pvt.Ltd., 2009.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												PROGRAM SPECIFIC OUTCOMES (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	1	2	1	2	1	2	2	2	2			
CO2	3	3	3	2	3	1	2	1	2	2	2	2			
CO3	3	3	3	2	3	2	2	2	2	2	2	3			
CO4	3	3	3	2	2	3	3	3	2	3	2	3			
CO5	3	2	3	3	3	2	2	1	3	3	2	3			
CO6	3	2	3	3	3	3	3	3	3	3	3	3			
	3.00	2.50	2.83	2.17	2.67	2.00	2.33	1.83	2.33	2.50	2.17	2.67			

TECHNO INDIA UNIVERSITY
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Program: B. Tech. in Civil Engineering	**Year, Semester:** 4th Yr., 8th Sem.
Course Title: Internship II	**Subject Code:** TIU-UCE-P494
Contact Hours/Week: 0–0–8 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE :

Enable the student to:

1. Bridge the gap between classroom learning and real-world application by providing hands-on experience in civil engineering projects.
2. Enhance technical skills, including design, analysis, project management, and the use of engineering software.
3. Familiarize interns with industry standards, practices, and technologies used in civil engineering.
4. Gain insights into the various phases of a project, from planning and design to construction and maintenance.
5. Build connections with industry professionals, peers, and mentors, which can aid in future career opportunities.
6. Provide insights into various career paths within civil engineering, helping interns identify their areas of interest.

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	0	2	0	0	0	0	0	0	0	0	0			
CO2	3	2	0	2	2	0	0	0	0	0	0	0			
CO3	0	2	2	0	0	0	0	0	0	0	0	0			
CO4	0	0	0	2	2	0	0	0	2	0	2	0			
CO5	0	0	0	0	0	2	2	2	0	0	0	0			
CO6	0	0	0	0	0	0	0	0	0	3	2	3			
	1.00	0.67	0.67	0.67	0.67	0.33	0.33	0.33	0.33	0.50	0.67	0.50			

TECHNO INDIA UNIVERSITY
WEST BENGAL

Program: B. Tech. in Civil Engineering	Year, Semester: 4th Yr., 8th Sem.
Course Title: Entrepreneurship Skill Development (Project)	Subject Code: TIU-UES-S496
Contact Hours/Week: 0–0–8 (L–T–12)	Credit: 4

COURSE OBJECTIVE:

Enable the student to:

1. Expertise by focusing on the implementation, testing, and refinement of their proposed engineering solutions.
2. Apply advanced analytical techniques, validate their findings through experimental or simulation-based approaches, and enhance project management skills.
3. Develop professional reporting and presentation abilities to effectively communicate their research outcomes to technical and non-technical audiences.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO1	Implement the research plan by conducting computational modeling and experimental studies.	K3
CO2	Analyze and validate data by comparing research outcomes with existing standards, codes, and literature.	K4
CO3	Evaluate research findings through error analysis, sensitivity studies, and validation techniques.	K5
CO4	Extend the research study by incorporating parametric variations, case studies, or advanced techniques.	K6
CO5	Develop technical documentation and research papers following academic and industry standards.	K5
CO6	Present research findings effectively through seminars, reports, and project defense.	K5

Course Articulation Matrix:

	PROGRAM OUTCOMES (PO)												**PROGRAM SPECIFIC OUTCOMES (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	2	-	-	2	2	2	3			
CO2	3	3	3	3	3	2	2	2	2	2	2	3			
CO3	3	3	3	3	3	3	2	2	2	2-	3	3			
CO4	3	3	3	3	3	3	3	2	2	3	3	3			
CO5	3	3	3	3	3	3	3	3	3	3	3	3			

CO6	3	3	3	3	3	3	3	3	3	3	3	3			
	3.00	3.00	3.00	3.00	3.00	2.67	2.60	2.40	2.33	2.60	2.67	3.00			