TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

4-Year Bachelor of Technology (B.Tech) Curriculum and Syllabus for Civil Engineering (CE)

Seventh Semester

A. THEORY

Sl No.	Code Number	Subject	Contact Hours L	T	P	Total	Credit Point
1	TIU-UCE-T401	Career Advancement & Skill Development #	3	0	0	3	3
2	TIU-UCE-T403	Environmental Engineering – I	3	0	0	3	3
3	TIU-UCE-T405	Foundation Engineering	3	0	0	3	3
4	TIU-UCE-T407	Water Resources Engineering – II	3	0	0	3	3
5	TIU-UCE-E41X*	Elective – I	3	1	0	4	4
6	TIU-UCE-E42Y**	Elective – II	3	1	0	4	4
		Total Theory				20	20

B. PRACTICAL

7	TIU-UCE-L401	Computer Application in Civil Engg. – II	0	0	3	3	2
8	TIU-UCE-L403	Environmental Engineering Lab	0	0	3	3	2
		Total Practical				6	4

C. SESSIONAL

9	TIU-UCE-P499	Project – I	0	0	3	3	3
10	TIU-UCE-S499	Seminar	0	0	3	3	2
11	TIU-UES-S499	Entrepreneurship Skill Development	0	0	0	0	2
		Total Sessional				6	7
Total of Semester						32	31

* ***X to be replaced by 1/3/5/7 or any other number depending upon the subject offered in a particular year (Vide the List of Elective subjects for Elective - I)***

** ***Y to be replaced by 1/3/5/7 or any other number depending upon the subject offered in a particular year (Vide the List of Elective subjects for Elective - II)***

List of Elective Subjects

Elective – I

TIU-UCE-E411 - Prestressed Concrete
TIU-UCE-E413 - Advanced Structural Analysis
TIU-UCE-E415 - Hydraulic Structures
TIU-UCE-E417 - Remote Sensing and GIS

Elective – II

TIU-UCE-E421 - Soil Stabilization and Ground Improvement Techniques
TIU-UCE-E423 - Structural Dynamics and Earthquake Engineering TIU-

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UCE-E425 - Traffic Engineering and Transportation Planning TIU-UCE-
E427 - Finite Element Analysis

List of Departmental Career Advancement & Skill Development (CASD) Subjects

Seventh Semester

TIU-UCE-T401 - CASD (Introduction to Finite Element Method)

Seventh Semester

CAREER ADVANCEMENT & SKILL DEVELOPMENT

(INTRODUCTION TO FINITE ELEMENT METHOD)

TIU-UCE-T401

L-T-P: 3-0-0 **Credits: 3**

Finite Element Method: Basics, History, Comparison with other methods, General steps of FEM, Applications and Advantages.

Stiffness Method: Definition of the Stiffness Matrix, Derivation of the Stiffness Matrix for a Spring Element, Assembling the Total Stiffness Matrix by Superposition, Boundary Conditions, Potential Energy Approach to Derive Spring Element Equations, Examples of a Spring Assemblages.

Development of Beam Equations: Introduction, Beam Stiffness, Example of Assemblage of Beam Stiffness Matrices, Examples of Beam Analysis Using the Direct Stiffness Method, Distributed Loading, Comparison of the Finite Element Solution to the Exact Solution for a Beam.

2D-Elements: Types of 2D-elements, element stiffness matrix, Linear Strain Rectangle, Constant Strain Triangle, Shape functions.

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Isoparametric elements: Concept of Isoparametric elements, Natural co-ordinates, Area co-ordinates, Lagrangean and Serendipity elements, Numerical integration and Gauss Quadrature.

Dynamic analysis: Types of dynamic analysis, General dynamic equation of motion, point and distributed mass, lumped and Consistent mass.

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External Expert	External Expert	HOD	Dean	Vice Chancellor

ENVIRONMENTAL ENGINEERING - I

TIU-UCE-T403

L-T-P: 3-0-0 **Credits: 3**

Water and Wastewater Quantity Estimation: Population forecast; Water demand for various purposes; Estimation of wastewater quantity; Variation in quantity of water and wastewater

Water and wastewater quality parameters.

Water supply and distribution system.

Water/Wastewater Quality Enhancement: Philosophy of treatment; Unit operations and processes; Physical, chemical and biological methods

Domestic Wastewater Treatment: Wastewater characteristics; Primary, secondary and tertiary treatment;Physical Unit Processes; Screening; Commutation; Grit Removal; Equalization; Sedimentation; Biological Unit Processes; Aerobic treatment; Suspended growth aerobic treatment processes; Activated sludge process and its modifications; Attached growth aerobic processes; Tricking filters and Rotating biological contactors; Anaerobic treatment; suspended growth, attached growth, fluidized bed and sludge blanket systems; nitrification, denitrification; Phosphorus removal Sludge Treatment

Thickening; Digestion; Dewatering; Sludge drying;
Composting Chemical Unit Processes

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Coagulation-Flocculation; Filtration; Disinfections; Aeration and Gas transfer; Precipitation; Softening; Adsorption and Ion exchange;

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FOUNDATION ENGINEERING

TIU-UCE-T405

L-T-P: 3-0-0 **Credits: 3**

Stress distribution, Newmark's chart, Boussinesq's theory, pressure bulb. Types of foundations, choice of foundation; rigid and flexible footings; contact pressure. Evaluation of bearing capacity from plate load test, cone penetration, standard penetration test and other tests. Settlement of foundations; immediate and consolidation settlement; allowable settlement; differential settlement. Proportioning of footings for equal settlement in different types of soil. Pile foundations; types of piles, pile capacity, static and dynamic formulae; design of piles groups; pile load test.

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WATER RESOURCES ENGINEERING-II

TIU-UCE-T407

L-T-P: 3-0-0 **Credits: 3**

Introduction to Irrigation: Definition, Advantages of irrigation, Disadvantages and ill-effects of irrigation, Types of irrigation.

Soil-Water Relationship: Types of soil-water, Concepts of Field capacity, Permanent Wilting Point, Available Moisture, Readily Available Moisture.

Water-Requirement for crops: Crop-water needs, Effects of climatic factors on Crop-water needs, Crop seasons, Crop Period, Base Period &Kor Period, Crop Rotation, Delta & Duty, Irrigation Efficiency.

Canal Irrigation System: Classification of Canals, Concept of Gross Command area & Culturable Command Area, Intensity of Irrigation, Time Factor, Capacity Factor & Nominal Duty, Typical Cross-section of a canal, Concept of balancing depth, Losses of water in canals.

Design of Unlined Irrigation Canal: Tractive Force Method, Concept of Regime Channel, Lined & Unlined canals, Kennedy's Method of design of unlined canals, Lacey's Theory, Concepts of true, initial and final regime, Design of unlined canal by Lacey's Theory, Instantaneous Unit Hydrograph, Synthetic Unit Hydrograph.

Lining of Irrigation canals: Advantages of canal lining, Economics of canal lining, Design of lined irrigation canals.

Water Logging Introduction: Salinity, Causes of water logging, Control measures of water logging, Reclamation of saline and alkaline lands, Land drainage, Surface drainage system and different types of surface drainage techniques, Sub-surface drains, Discharge and spacing of sub-surface drains (closed drains) by Hooghoudt's Equation.

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ELECTIVE – I: PRESTRESSED CONCRETE

TIU-UCE-E411

L-T-P: 3-1-0 **Credits: 4**

Introduction of Prestressed concrete: Materials, prestressingsystem, analysis of prestress and bending stress, losses.

Shear and torsional resistance: design of shear reinforcement, design of reinforcement for torsionshear and bending.

Deflections of prestressed concrete members: Importance, factors, short term and long-term deflection

Limit state design criteria: Inadequacy of elasticand ultimate load method, criteria for limit states,strength and serviceability.

Design of sections for flexure: methods by Lin and Magnel

Anchorage Zone stresses in post tensioned members: Stress distribution in end block, anchoragezone reinforcement

Composite construction of prestressed and in-situ concrete: Types, analysis of stresses

Statically Indeterminate structures:advantages of continuous member, effect of prestressing,methods of achieving continuity and method of analysis of secondary moments

Prestressed concrete poles and sleepers: Design of sections for compression and bending

Partial prestressing and non-prestressed reinforcement.

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ELECTIVE – I: ADVANCED STRUCTURAL ANALYSIS

TIU-UCE-E413

L-T-P: 3-1-0 **Credits: 4**

Review of analysis of indeterminate structures:

Force methods:Statically indeterminate structures (method of consistent deformations; theorem of least work)

Displacement Methods: Kinematically indeterminate structures (slope-deflection method; moment distribution method).

Matrix concepts and Matrix analysis of structures: Introduction; coordinate systems; displacement and force transformation matrices; Contra-gradient principle; element and structure stiffness matrices; Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches.

Matrix analysis of structures with axial elements: Plane Truss; Analysis by flexibility method

Space trusses: Matrix analysis of beams and grids:

Flexibility method for fixed and continuous beams:

Stiffness method for grids:

Matrix analysis of plane and space frames:

Flexibility method for plane frames:

Stiffness method for space frames:

Theory of Elasticity:

Three-dimensional stress and strain analysis, stress - strain transformation, stress invariants; equilibrium and compatibility equations, boundary conditions; Two dimensionalproblems in Cartesian, polar and curvilinear co-ordinates, bending of a beam, thick cylinder under pressure, complex variable, harmonic and bi-harmonic functions; Torsion of rectangular bars including hollow sections, bending problems; Energy principles, variational methods and numericalmethods.

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ELECTIVE – I: HYDRAULIC STRUCTURES

TIU-UCE-E415

L-T-P: 3-1-0 **Credits: 4**

Diversion Head works: Necessity, Difference between weir and Barrage, Type of Weirs, Selection of site, layout and description of each part, Effects of construction of a weir on the river regime, causes of failure of weirs on permeable foundation and their remedies

Theories of seepage and Design of weirs and Barrages: Failure of Hydraulic Structures Founded on Pervious foundations: i) By piping ii) By Direct uplift, Bligh's creep theory of seepage flow, Khosla's theory & concept of flow nets, concept of exit gradient and critical exit gradient, Khosla's method of independent variable for determination of pressures and exit gradient for seepage below a weir or a barrage, necessary corrections, examples.

Hydraulic structures for canals: Canal falls – necessity, locations, types and description of Ogee fall, Trapezoidal-notch fall, Syphon well drop. Examples.

Cross-Drainage Works: Necessity, types, selection of a suitable type (Introduction only)

Dam (General): Definition, classification of Dams, factors governing selection of type of dam, selection of suitable site for a dam.

Earthen Dams: Introduction, Types of Earthen Dams, Methods of Construction, Causes of failure, Design Criteria, Determination of line of seepage or phreatic line in Earthen Dam, seepage control in Earthen Dam, Examples.

Gravity Dam: Definition, Typical cross- section, Forces acting on Gravity Dam, Combination of forces for design, Mode of failure and criteria for structural stability of Gravity Dams, Principal and shear stresses. Elementary profile of a Gravity Dam, Concept of High and low Gravity Dam, Examples.

Spillways: Types, Location, Essential requirements, spillway capacity. Components of spillway, Energy Dissipators, Stilling basins (Indian standard).

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ELECTIVE – I: REMOTE SENSING AND GIS

TIU-UCE-E417

L-T-P: 3-1-0 **Credits: 4**

Remote Sensing: Introduction, Definition, Human visual system as remote sensing system, History of Remote sensing, Need for Remote sensing, Energy sources and radiation principles, Principle of Remote sensing.

Classification: Supervised classification and unsupervised classification.

GIS: Definition, Classification, Raster vs. Vector.

Satellite: History of Satellite, Satellite in India.

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ELECTIVE – II: SOIL STABILIZATION AND GROUND IMPROVEMENT TECHNIQUES

TIU-UCE-E421

L-T-P: 3-1-0 **Credits: 4**

Soil Stabilization: Introduction, Stabilization of soil with granular skeleton and soil without granular skeleton, common nomenclature of stabilized soil systems and stabilization methods, specific methods of soil stabilization: Stabilization with cement, lime fly-ash

Insitu densification: Introduction, Compaction: methods and controls Densification of granular soil: Vibration at ground surface, Impact at ground surface, Vibration at depth (Vibroflotation), Impact at depth.

Densification of Cohesive Soils: Preloading and dewatering, Design of Sand drains and Stone columns, Electrical and thermal methods.

Geo-textiles: Over view: Geotextiles as separators, reinforcement. Geotextiles in filtration and drainage, Geotextiles in erosion control.

Grouting: Over view: Suspension and Solution grout, Grouting equipment and methods, Grout design and layout, Grout monitoring schemes.

Soil stability: Reinforced earth fundamentals, Soil nailing, Soil and Rock Anchors, Underpinning.

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ELECTIVE – II: STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

TIU-UCE-E423

L-T-P: 3-1-0 **Credits: 4**

Theory of vibrations: Degrees of freedom, Undamped single degree freedom system, Damped single degree freedom system, Natural frequency, modes of vibration, Introduction to multiple degree freedom system

Response of single degree freedom system due to harmonic loading: Undamped harmonic excitation, Damped Harmonic excitation

Response due to Transient loading: Duhamel's Integral, Response due to constant force, Rectangular load, Introduction to numerical evaluation of Duhamel's integral of undamped system.

Elements of seismology: Fundamentals, Elastic rebound theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc., Seismographs, Seismic zoning, Response of Simple Structural Systems

Principles of earthquake resistant design: 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

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ELECTIVE – II: TRAFFIC ENGINEERING AND TRANSPORTATION PLANNING

TIU-UCE-E425

L-T-P: 3-1-0 **Credits: 4**

Traffic Engineering: Road user and vehicle characteristics; Traffic flow characteristics – Traffic Volume, Speed, Headway, Concentration and Delay; Traffic surveys & studies; Traffic estimation; Statistical applications in traffic engineering analysis; Parking; Road intersections – Basic traffic conflicts, classification of at-grade intersections, channelization, rotaries, traffic signals, signs and marking; Road Safety; Traffic System Management.

Transportation planning: Transportation planning at different levels; Transport Project planning – Planning studies and investigation; Elements of Urban Transportation Planning; Transport Demand Analysis; Preparation of Project Report

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ELECTIVE – II: FINITE ELEMENT ANALYSIS

TIU-UCE-E427

L-T-P: 3-1-0 **Credits: 4**

Introduction to finite element analysis: General steps of Finite element method and application, advantage of the finite element method.

Introduction to the stiffness method: Definition of the stiffness matrix, its derivation, boundary conditions and potential energy approach.

Development of Truss equation: Derivation of the stiffness matrix for a bar element, global stiffness matrix, solution of plane truss, Galerkin's residual method.

Development of beam equations: Beam stiffness, assemblage of beam stiffness matrix, potential energy approach to derive beam element equation, simple plane frame.

Development of plane stress and plane strain: Stiffness equations, development of the linear-strain triangle equations, isoperimetric formulation.

Plate bending element: Basic concept of plate bending, derivation of a plate bending element stiffness matrix and equations.

Introduction to FEM software in Civil Engineering

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COMPUTER APPLICATION IN CIVIL ENGG. – II

TIU-UCE-L401

L-T-P: 0-0-2 **Credits: 2**

Introduction to Matlab; Additional LP Practice (with Matlab); Practice Problem

Matrices in Matlab

Functions in Matlab

Decisions and Loops in Programming

Advanced Functions in Matlab

Numerical Integration

Numerical Differentiation

Solving Differential Equations using Matlab

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ENVIRONMENTAL ENGINEERING LAB

TIU-UCE-L403

L-T-P: 0-0-3 **Credits: 2**

1) Determination of turbidity for a given sample of water
2) Determination of solids in a given sample of water: Total Solids, Suspended Solids and Dissolved Solids
3) Determination of pH for a given sample of water
4) Determination of concentration of Chlorides in a given sample of water
5) Determination of carbonate, bi-carbonate and hydroxide alkalinity for a given sample of water
6) Determination of hardness for a given sample of water
7) Determination of concentration of Fluorides in a given sample of water
8) Determination of concentration of Iron in a given sample of water
9) Determination of the Optimum Alum Dose for a given sample of water through Jar Test
10) Determination of the Residual Chlorine in a given sample of water
11) Determination of the Chlorine Demand for a given sample of water
12) Determination of the Available Chlorine Percentage in a given sample of bleaching powder
13) Determination of amount of Dissolved Oxygen (DO) in a given sample of water
14) Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater
15) Determination of the Chemical Oxygen Demand (COD) for a given sample of wastewater
16) Determination of bacteriological quality of water: presumptive test, confirmative test and Determination of MPN

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