# Bachelor of Technology

(Four Year Full Time Degree Program)

# SYLLABUS

(B. Tech. – CIVIL Engineering)

## School of Civil Engineering

## Shri Mata Vaishno Devi University Katra

**(May 2019)**

| ABBREVIATIONS / CODES / NOMENCLATURE | |
|---|---|
| | |
| | |
| **Course Code Convention** | |
| SCT – LSAY | Course Code for various Courses / Subjects |
| | SC: School Code |
| Example | T: Course Type Code (Lecture/Studio/Practical/Project etc.) |
| CLL 9101 | L: Course Level (1, 2, 3, 4 & 5 for First, Second years …) |
| CLP 9102 | SA: Study Area / Sub Area |
| CLS 9110 | Y: Semester Wise Course Number |
| CE | School Code School of Civil Engg (SoCE) |
| L | Lecture |
| P | Practical |
| U | Studio |
| E | Elective |
| C | Colloquium |
| D | Project Based |
| T | Training |
| S | Self Study |
| N | Non Credit |
| V | Special Lecture Topic |
| **Teaching Scheme Convention** | |
| L | Lecture |
| T | Tutorial |
| S | Studio |
| P | Practical |
| C | Course Credit |
| NC | Non Credit |
| NA | Not Applicable |
| **Evaluation Scheme Convention** | |
| Minor (MI) | (Mid Term Exams / Tests) I & II |
| Major (MA) | Semester End Examination (ESE) |
| FFCS | Fully Flexible Credit System |
| CBCS | Choice Based Credit System |
| Internal / Assignment (ASGN) | Marks awarded on the basis of Report on Theory Contents |
| Internal Assessment (INT) | Marks awarded by Course Coordinator on Practical Component |
| External Assessment / Jury (EXT) | Marks awarded by External Examiner(s) / Jury |
| | |

| MTL1025 | | | | **Engineering Mathematics-I** | | Pre Requisites | | Nil | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Studio / Practical | | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

After successful completion of this course, students shall be able to;

1. Introduce the basic concept of differential calculus to understand the different subjects of engineering as well as basic sciences.
2. Enable the students to develop the concept of partial differentiation to understand their applications in engineering
3. Understand the fundamentals of Integral calculus to understand their applications to length, area, volume, surface of revolution, moments and centre of gravity
4. Understand the improper integrals and Beta and Gamma functions and their applications.

## COURSE CONTENTS

| **Unit-I:** | **Differential Calculus** | 12 Contact periods |
|---|---|---|

Partial differentiation, asymptotes, concavity, convexity, point of inflexion, curvature, radius of curvature, curve tracing, envelopes and evolutes, change of variables, Jacobian, expansion of functions of several variables, chain rule, mean value theorem, Taylor series with remainder term, maxima & minima, saddle point.

| **Unit-II:** | **Integral Calculus** | 12 Contact periods |
|---|---|---|

Fundamental theorem of Integral calculus, reduction formulae, properties of definite integral, applications to length, area, volume, surface of revolution. Moments, centre of gravity, improper integrals, β-γ functions.

| **Unit-III:** | **Matrices** | 12 Contact periods |
|---|---|---|

Elementary row and column transformation, linear dependence, rank of a matrix, consistency of system of linear equations, solution of linear system of equations, characteristic equations, Cayley Hamilton theorem, eigen values and eigen vectors, diagonalization, complex matrices.

## SUGGESTED BOOKS

1. E. Kreysig, Advanced Engineering Mathematics, Wiley 1oth edition, 2011.
2. A . K. Gupta, Engineering Mathematics, Macmillan 7th edition 2013.
3. McQuarri Macmillan, Mathematical Methods by Scientists & Engineers, 1st edition 2003.
4. Shanti Narayan, Differential Calculus, S Chand; 30th Revised edition, 2005.

| CEL 1001 | Introduction to Civil Engineering | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | Theory | | | Studio / Practical | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 1 | 0 | 0 | 1 | NA | NA | NA | NA | 100 | NA | 100 |

**COURSE OUTCOMES**
1. Introduction to what constitutes Civil Engineering
2. Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering
3. Exploration of the various possibilities of a career in this field
4. Providing a foundation for the student to launch off upon an inspired academic pursuit into this branch of engineering.


**COURSE CONTENTS**

| Unit-I: | Basic Understanding | 4 Contact Periods |
|---|---|---|

What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering, Broad disciplines of Civil Engineering,  Importance of Civil Engineering, History of Civil engineering, Early constructions and developments over time, Possible scopes for a career, Basic Areas in Civil Engineering - Surveying, Construction Engineering, Project Management, Transportation Engineering, Fluid Mechanics, Irrigation Engineering, Structural Engineering, Geotechnical and Foundation Engineering, Environmental Engineering, Earthquake Engineering, Infrastructure Development, Town Planning, Remote sensing.


| Unit-II: | Materials and Construction | 3 Contact Periods |
|---|---|---|

Introduction to basic construction materials; cement, bricks, stone, aggregates, reinforcing steel, structural glazing, structural steel; Concrete types: PCC, RCC, Prestressed etc., General concepts related to building. Selection of site, basic functions of buildings, types of buildings – Residential, Public, Commercial and Industrial.


| Unit-III: | Introduction to Surveying, Leveling and Contouring | 2 Contact Periods |
|---|---|---|

Introduction, Objectives, classification and principles of surveying. Leveling and Contouring, Introduction to various survey instruments.  Introduction to Transportation Engineering: Various transportation systems like road, rail, port and harbor and airport sector.


| Unit-IV: | Introduction to Environmental Engineering, Hydraulics and Geotechnical Engineering | 3 Contact Periods |
|---|---|---|

Ecology and Eco System:- Concept of Environment - biotic and abiotic factors, Various types of pollutions like water, air, soil, noise etc., Water treatment systems, Effluent treatment systems, Solid waste management, Sustainability in Construction, Environmental Impact Assessment (EIA). Introduction to Hydraulic & Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems. Introduction to Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations. Job prospects of Civil Engineering in various sectors.

**SUGGESTED BOOKS**

1. Basic Civil Engineering, Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kr. Jain, Laxmi Publications
2. Basic Civil Engineering, S.S.Bhavikatti, New Age International Publishers
3. Concrete Technology: By M.S.Shetty
4. Surveying and Levelling: By Kanetkar and Kulkarni
5. Irrigation and Hydraulic Structures: By S.K.Garg
6. Water Supply and Sanitary Engineering: Including Environmental Engineering, Water And Air Pollution Laws and Ecology: By G. S. Birdie, J. S. Birdie
7. Building Construction: By Sushil Kumar
8. Transportation Engineering: By Khanna & Justo
9. Building Drawing Design: By Shah and Kale

| LNL 1411 | | | **Professional Communication** | | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Studio / Practical | | | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | | TOTAL |
| 2 | 0 | 2 | 3 | 20 | 20 | 50 | 10 | 100 | NA | | 200 |

## COURSE OUTCOMES

Upon successful completion of this course, students will be able to:

1. Have advance knowledge about communication skills, their evolving nature and how to use them effectively.
2. Communicate appropriately and effectively within various organizations, also with global audience in a constantly changing technological ambience and demonstrate the ability to analyze a problem and devise a solution.
3. Employ skills that are necessary for career development and also to demonstrate an ability to work with a variety of personality types.
4. Contribute ethically, responsibly, and effectively as local, national, international, and global citizen and leader.

## COURSE CONTENTS

| **Unit-I:** | **General Communication** | 6 Contact Periods |
|---|---|---|

Purpose of Communication; Process of Communication; Importance of Communication; The Seven C's of the Effective Communication; Differences between Technical and General Communication. Barriers to Communication and Measures to Overcome the Barriers to Communication; Scope and Types of Communication Network; Formal and Informal Communication Network; Upward Communication; Downward Communication; Horizontal Communication; Diagonal Communication.

| **Unit-II:** | **Oral Communication** | 8 Contact Periods |
|---|---|---|

Speaking Skills: Kinds of Speaking Skills, Effective ways of Speaking, Public Speaking Listening Skills: Stages of Listening Process, Strategies of Listening, Types of Listening.
Professional Speaking: Interview Process, Characteristics of Job Interview, Pre Interview Preparation Techniques, Answering Strategies, Frequently asked Interview questions, Projecting a positive image and Body Language,
Group Discussion: Definition, Methodology of Group Discussion, Techniques for Individual Contribution, Group Interaction Strategies, Helpful Expression and Evaluation, Practical Sessions.

| **Unit-III:** | **Written Communication** | 7 Contact Periods |
|---|---|---|

Email: How to write a Formal E-mail, Letter Writing Cover Letter: Format of Letter Writing: Block and Modified, etc.; Formal and Informal Letter Writing; Formal Letter Formats; Reason for a Cover Letter to Apply for a Job-Format of Cover Letter; Different Types of Cover Letters, Resume and CVs: Contents of Good Resume; Guidelines for Writing Resume; Different Types of Resumes; Difference between CVs and Resume.

| **Unit-IV:** | **Official Written Communication** | 7 Contact Periods |
|---|---|---|

Technical Report Writing: Difference between Business Report and Engineering Report; Characteristics of writing a good report; Guidelines for Report Writing; Steps in Report Writing;

Structure of Report; Types of Reports and Different Formats. Note Making and Notice Writing: Purpose; Format; Points to remember while writing a Note and Notice Minutes and Agendas: Difference between Minutes and Agendas; Purpose; Format; Points to remember while drafting Minutes and Agendas.

| Unit-V: | Reading Skills & Enhancing Vocabulary | 7 Contact Periods |
|---------|----------------------------------------|-------------------|

Reading Skills: Enriching Language through Literature; Comprehension.

Enhancing Vocabulary: Antonyms and Synonyms, Phrasal Verbs, One word Substitution, Homophones, Common Errors, Figure of Speech: Metaphor, Personification, Simile, Alliteration, Assonance, Paradox, Imagery, Oxymoron, Onomatopoeia.

**SUGGESTED BOOKS**
1. Choudhury, Soumitra, and Anjana Neira Dev. *Business English.* Pearson Publication, 2008.
2. Mukerjee, Hory S. *Business Communication*. New Delhi: Oxford University Press, 2013.
3. Williams, D. *Communication Skills in Practice: A Practical Guide for Health Professionals*. London, United Kingdom: J.Kingsley, 2007.
4. Pandey, O. N. *Technical Writing*. New Delhi: S.K. Kataria & Sons, 2014.

| PHL 1012 | | | | **Engineering Physics** | | Pre Requisites | | Nil | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Studio / Practical | | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 100 | NA | 200 |

## COURSE OUTCOMES

## COURSE CONTENTS

| **Unit-I:** | | 8 Contact periods |
|---|---|---|

Force and electric field due to continuous charge distribution, Field lines−Flux−Gauss's Law (differential and integral forms) and its applications, Electric potential, Work done in assembling a charge distribution.

| **Unit-II:** | | 10 Contact periods |
|---|---|---|

Force Law−line current, surface current and volume current densities (Equation of Continuity), Biot-Savart law, Properties of B, Magnetic flux−Div B, Curl B, Magnetic vector potential A, Ampere's law (differential and integral forms), Faraday's laws of electromagnetic induction, displacement current, Modified Ampere's law, Four Maxwell's equations in differential and integral forms.

| **Unit-III:** | | 10 Contact periods |
|---|---|---|

Electromagnetic Spectrum, Brief introduction to black body radiation, Photo-electric Effect and Compton Effect, Wave particle duality (de−Broglie waves), Davisson-Germer Experiment, Concept of wave function and its physical significance, Phase and Group velocities, Uncertainty Principle.

| **Unit-IV:** | | 10 Contact periods |
|---|---|---|

Bohr Theory of atom (with finite and infinite nuclear mass), Derivation of time dependent and time independent Schrödinger wave equations, Expectation values and operators (momentum, energy and angular momentum operators) and commutators, Particle in a box of infinite height (One dimensional).

| **Unit-V:** | | 7 Contact periods |
|---|---|---|

Free electron theory−Free electron gas, Energy levels and density of states in one dimension, Band theory of solids, Classification of metals, semiconductors and insulators on the basis of band theory.

## SUGGESTED BOOKS

1. Introduction to Electrodynamics, D. J. Griffiths, Pearson.
2. Electromagnetics, B. B. Laud, New Age International Publisher.
3. Perspectives of Modern Physics , Arthur Beiser, Tata McGraw Hills
4. Introduction to Solid State Physics, Charles Kittel, Wiley
5. Solid State Physics, S.O. Pillai, Wiley
6. Fundamentals of Physics, Resnick Halliday, Wiley.

| EEL 1006 | Fundamental of Electrical Engineering | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | Studio / Practical | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

1. To solve the electrical circuits (DC & AC).
2. Solve and analyze the electrical circuits using network theorems and understand the behavior of AC electrical circuits and resonance.
3. To understand the three phase electrical systems and apply the concepts of measurements in measuring electrical quantities.
4. To study the working principles of basic electrical machines including DC as well as AC machines.

## COURSE CONTENTS

| Unit-I: | Introduction and Electrical Circuit Analysis | |
|---|---|---|

Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation. AC fundamentals: Sinusoidal, square and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasors, Phasor representation of sinusoidally varying voltage and current

| Unit-II: | Steady- State Analysis of Single Phase AC Circuits | |
|---|---|---|

Analysis of series and parallel RLC Circuits, Concept of Resonance in series & parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers, Power factor, Concept of power factor improvement and its improvement (Simple numerical problems). Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem (Simple numerical problems).

| Unit-III: | Three Phase AC Circuits & Measuring Instruments | |
|---|---|---|

Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three-phase power and its measurement (simple numerical problems).  Measuring Instruments: Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters & ammeters, Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers).

| Unit-IV: | Magnetic Circuit and Single Phase Transformer | |
|---|---|---|

Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Magnetic circuit calculations (Series & Parallel). Single Phase Transformer: Principle of operation, Construction, EMF equation, Equivalent circuit, Power losses, Efficiency (Simple numerical problems), Introduction to auto transformer.

| Unit-V: | Machines and Motor | |
|---|---|---|

DC Machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems) Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems

related to slip only). Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications. Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.


**SUGGESTED BOOKS**

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. L.S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
4. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
5. B Dwivedi and A Tripathi, "Fundamentals of Electrical Engineering", Wiley India.
6. Kuldeep Sahay, "Basic Electrical Engineering", New Age International Publishers.
7. J. B. Gupta, "Electrical Engineering", Kataria and Sons.
8. C L Wadhwa, "Basic Electrical Engineering", New Age International.
9. W.H. Hayt and J.E. Kimerly, "Engineering Circuit Analysis", Mc Graw Hill.

| MEP 1115 | Engineering Graphics | | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | Studio / Practical | | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 1 | 0 | 2 | 2 | 20 | 20 | 50 | 10 | 100 | NA | 200 |

**COURSE OUTCOMES**

**COURSE CONTENTS**

| Unit-I: | Introduction of Engineering Graphics | |
|---|---|---|

Drawing instruments and their uses, Orthographic Projections: Planes of projection–Projection of points in different quadrants. Orthographic Projection of Straight Line parallel to one plane and inclined to the other plane–Straight Line inclined to both the planes–True Length and inclination of lines with reference planes–Traces of line–Projection of Planes, Projection of Solids.

| Unit-II: | Section of Solids | |
|---|---|---|

Classification of Solids, Section plane perpendicular to one plane and parallel to other, Section plane inclined to one plane and perpendicular to other plane. Development of Surfaces: Principle, Engineering applications and Methods of development.

| Unit-II: | Introduction to Auto CAD | |
|---|---|---|

Starting AutoCAD, AutoCAD screen components, creating a drawing on AutoCAD, invoking different commands, Dialog boxes, Coordinate Systems, Exercises on Drawing of Line, Circle, Arc, Ellipse, Polygon, etc.

| Unit-III: | Drawing Aids and Editing Commands | |
|---|---|---|

Layers, Drafting Settings, Object Snaps, Function and Control keys, various Editing Commands, Editing the Objects with Grips, Grip Types.

| Unit-IV: | Creating Text, Dimensions and Tolerances in AutoCAD | |
|---|---|---|

Creating Text, Editing Text, Styles of Dimensioning, Dimensioning System Variables, Editing/Updating Dimensions, Adding Tolerances

**SUGGESTED BOOKS**
1. Ellen Filkensten-AutoCAD 2006 & AutoCAD LT2006 Bible, Wiley, New York.
2. Sham Tickoo -AutoCAD 2005,Tata McGraw Hill, New Delhi.
3. George Omura - AutoCAD, Sybex Inc.
4. Bhat, N.D. and Panchal, V. M. - Engineering Drawing, Charotar Publishers, Anand.
5. Narayana, K.L. and Kannaiah, P.-Engineering Graphics, Tata McGrawHill, New Delhi.
6. Gill, P.S-Engineering Drawing, S.K Kataria & Sons, New Delhi.

| CSL 1022 | | | | **Introduction to Programming Using C** | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Studio / Practical | | | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL | |
| 2 | 0 | 4 | 4 | 20 | 20 | 50 | 10 | 100 | NA | 200 | |

## COURSE OUTCOMES

## COURSE CONTENTS

| **Unit-I:** | **Introduction** | |
|---|---|---|

Concept of problem solving, Problem definition, Program design, Techniques of Problem Solving (Flowcharting, algorithms, pseudo code), Structured programming concepts.

| **Unit-II:** | **Fundamentals** | |
|---|---|---|

History of C, Importance of C, C character set, Tokens, identifiers and keywords, constants and variables, Data types, Data Type Modifiers Structure of a C Program, , Types of Statements: declarations, arithmetic statements and arithmetic operations, , Operators: Arithmetic, relational and equality, logical, assignment and compound assignment, Operators classification based on number of operands: Unary, Binary and Ternary (conditional, unary operations), operator's precedence & associativity, library functions, single character input and output, entering and writing data.

| **Unit-III:** | **Control  Statements and Structures** | |
|---|---|---|

Statement and blocks, Decision making structures: if else and its types, Looping. **Structures:** while, for, do while, Case control structures: switch, break and continue statements, nested control structures.

| **Unit-IV:** | **Arrays and Strings** | |
|---|---|---|

Definition, types, initialization, processing an array, 2 Dimension Arrays, Sorting, Searching, Copy, Insertion, Deletion of elements in array. Functions and pointers: Functions definition, prototype, passing parameters, recursion, pointers, pointers and arrays, pointers and Functions. **String:** Operations on String, built in functions, string and functions.

| **Unit-V:** | **User Defined Data Types and Additional Features of C** | |
|---|---|---|

Structures, Array of Structures, Array within Structures, Structures within Structures, Union, Enumerations, Pre-processor Directives.

## SUGGESTED BOOKS
1. Gottfried, Byron S., "Programming with C", Tata McGraw Hill
2. Balagurusamy, E., "ANSI C", Tata McGraw-Hill
3. Yashwant Kanetker, "Let us C", BPB
4. C, The Complete Reference, Scholdt, TMH
5. Programming with C, S. Kaicher, Macmillan
6. C For Yourself, Asian Inst. of Tech  AIT
7. Structured Programming Approach Using C, B. Forouzen, Thomas Learning

| MTL1026 | **Engineering Mathematics–II** | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | | Theory | | Studio / Practical | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**

After successful completion of this course, students shall be able to;

1. Understand the concepts of vector calculus like directional derivative, gradient, divergence and curl, and their applications.
2. Learn and apply the concepts of vector integral calculus for the computation of work done, circulation, and flux.
3. Formulate the differential equations concerning physical phenomena like electric circuits, wave motion, heat equation etc.
4. Learn various methods of solution of ordinary and partial differential equations.

**COURSE CONTENTS**

| Unit-I: | **Vector Calculus** | 12 Contact Periods |
|---|---|---|

Beta & Gamma functions. Differentiation of vector functions of scalar variables. Gradient of a scalar field, Divergence &  Curl of a vector field  and their properties. Line & surface integrals. Green's theorem, Stokes' theorem & Gauss' theorem both in vector &  Cartesian forms (statement only) with simple applications.

| Unit-II: | **Ordinary Differential Equation(ODE):** | 12 Contact Periods |
|---|---|---|

Formation of ODE, definition of order and degree  of ODE and solution, ODE's of first order, method of separation of variables, homogenous and non-homogenous differential equations and their solution, exactness and integrating factor, Bernoulli's equation, linear ODE's of $n^{th}$ order, operator method, method of undetermined coefficients, method variation of parameters, solution of simple simultaneous ODE's.

| Unit-III: | **Partial Differential Equation(PDE)** | 12 Contact Periods |
|---|---|---|

Formation of (PDE), Solution of PDE by direct integration, Lagrange's linear equation, Non-linear PDE of first order,  Method of separation of variables, Heat, Wave & Laplace's  equations (Two dimensional Polar & Cartesian Co-ordinates).

**SUGGESTED BOOKS**

1. E. Kreysig,  Advanced Engineering Mathematics, Wiley $10^{th}$ edition 2011.
2. Frank Ayres , Vector Analysis, Mc Graw Hills, $6^{th}$ edition 2011.
3. T. Marsden and W.H. Freeman,VectorCalclus, Freeman, $6^{th}$  edition  2011.
4. G. Simons, Differential Equations with Applications, TMH**,** McGraw-Hill Higher Education; $2^{nd}$  edition 1991.
5. S.L. Ross,  Differential Equations, Wiley $3^{rd}$  edition 1984.
6. R. Zalman, A Course in Ordinary and PDEs, Academic Press, $1^{st}$ edition 2014.

| MEL1012 / CEP1121 | Engineering Mechanics / Applied Mechanics | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | Theory | | | Studio / Practical | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 1 | 0 | 4 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**
1. To acquire basic knowledge related to Forces and Equilibrium conditions
2. To understand and apply the concepts of Centroid and Moment of Inertia on areas and rigid bodies
3. To analyse various systems existing in static equilibrium, e.g., blocks, wedges, ladders, trusses, etc
4. To acquire basic knowledge related to stress and strain for ductile and brittle materials.

**COURSE CONTENTS**

| Unit-I: | Force and Force Systems | 8 Contact Periods |
|---|---|---|

Coplanar, Concurrent and Non-Concurrent Force Systems, Resultant and Resolutions, Forces in Space, Moment of Force, Varignon's Theorem, Couple and Its Properties, Resultant of a Spatial Force System.

| Unit-II: | Equilibrium | 10 Contact Periods |
|---|---|---|

Equilibrium- Equilibrium of a Particle, External & Internal Forces, Equilibrium of a Rigid Body, Types of Supports, Structural Members and Beams, Reactions of Beams. Areas and Solids: Centre of Gravity, Centroid of Lines (Basic and Composite Areas), Built-Up Sections, Product of Inertia, Mass Moment of Inertia.

| Unit-III: | Trusses and Frames | 8 Contact Periods |
|---|---|---|

Two Force and Three Force Members, Trusses, Method of Joints, Method of Sections, Determinateness of Truss, Rigid and Non Rigid Frames

| Unit-IV: | Friction | 8 Contact Periods |
|---|---|---|

Type of Friction, Characteristics of a Dry Friction, Equilibrium on Rough Inclined Place, Wedge Friction, Ladder Friction.

| Unit-V: | Simple Stress and Strain | 8 Contact Periods |
|---|---|---|

Introduction to stress-strain, Normal and Shear stresses, Stress- Strain Diagrams for ductile and brittle material, Elastic Constants, One Dimensional Loading of members of varying cross-sections

**SUGGESTED BOOKS**
1. Jurnarkar, S.B. and Shah, H.J.–Applied Mechanics, Charotar
2. Merium and Kraige–Engineering Mechanics, John Wiley & Sons.
3. Sharma, S.M.–Engineering Mechanics, Kirti Publications, Jammu.
4. Engineering Mechanics by Huges and Martin, E.L.B.S. and Macmillan.
5. Beer and E.R. Johnstons–Vector Mechanics, McGraw-Hill, New York

| CSL 3029 | | | | Programming in Python | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Studio / Practical | | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 2 | 0 | 4 | 4 | 20 | 20 | 50 | 10 | 100 | NA | 200 |

## COURSE OUTCOMES

After Successful Completion of this Course, students shall be able to;

1. Know the basic syntax and Data Structures in Python.
2. Think and Design solution in Object Oriented way as well as Procedural way.
3. Enjoy coding and compete at online programming sites like CodeChef, HackerEarth etc.

## COURSE CONTENTS

| Unit-I: | Introduction | 9 Contact Periods |
|---|---|---|

Introduction to importance of IDEs like Spyder (Anaconda)/PyCharm for professional programming, explore Python shell as a calculator and for inputting Python expressions directly, HelloWorld program in Python script, Python keyword and Identifiers, Indentation, Comments, Data Types in. Operators in Python: comparison, arithmetic, logical, Boolean, bitwise, assignment. Python: numbers, list, tuple, strings, set, dictionary, conversion between various data types.

| Unit-II: | Basic constructs | 9 Contact Periods |
|---|---|---|

Input and Output in Python, if-else , for loop, while loop, break, pass, continue, creating Functions, functions with arguments, returning values form functions, lambda expressions, recursion, global and local variables, Importing other modules/packages and using their functions, creating random numbers/random-choice to create programs for simple guessing games like Rock –Paper-Scissors. Problems on 1D/2D/3D arrays using list. Problem solving using dictionary as look-up table.

| Unit-III: | Object Oriented Programming | 9 Contact Periods |
|---|---|---|

Basics of Object oriented programming: Class and Object. Defining variables and functions inside class. Creating objects, Inheritance, Multiple and Multi Level Inheritance, Function over-riding, the concept of composing objects of a different class in an object, problems on object composition.

| Unit-IV: | GUI creation in Python | 9 Contact Periods |
|---|---|---|

GUI creation using Python's de-facto GUI package like tkinter or alternative packages like: wxPython, PyQt (PySide), Pygame, Pyglet,  and PyGTK. Creating labels, buttons, entry (textbox), combobox, checkbutton, radiobutton, scrolledText (textarea), spinbox, progressbar, menubar, filedialog, tabs etc. Creating GUI simple games like Tic-Tac-Toe

## SUGGESTED BOOKS

1. Think Python 2nd Edition - How to Think Like a Computer Scientist, Allen B Downey, O'Reilly publication
2. Learn Python 3 the Hard Way, Zed A. Shaw, Pearson publication

3. Head First Programming: A Learner's Guide to Programming using the Python Language, Paul Barry David Griffiths Barry Griffiths, O'Reilly publication

| PCL 1067 | Discourse on Human Virtues | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | Theory | | | Studio / Practical | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

After successful completion of this course, students shall be able to;

1. Learn better ways of understanding and addressing day-to-day moral issues in personal and professional life.
2. Widen the perspectives towards the intricacies of moral decision making.
3. Establish coherence in the spiritual, intellectual, behavioral and material aspects of the students.
4. Enhance clarity, assurance & purposefulness of life.

## COURSE CONTENTS

| **Unit-I:** | | 14 Contact Periods |
|---|---|---|

What is Value Education?. Knowledge and Skill. Value and Virtue. Moral Agency and the Notion of Dharma. Freedom of Will and Determinism.

| **Unit-II:** | | 13 Contact Periods |
|---|---|---|

Understanding Human Existence: Human Being and Human Person. The Basic Human Aspirations: Continuous Happiness and Prosperity. Understanding harmony at the level of Individual, Family and Society.

| **Unit-III:** | | 13 Contact Periods |
|---|---|---|

Understanding harmony at the level of Nature. Cardinal Human Virtues such as Compassion, Wisdom, Justice, Tolerance, Non-violence, Service to Humanity with the help of suitable illustrations

## SUGGESTED BOOK

1. Gurucharan Das, The Difficulty of Being Good. New Delhi: Penguin Books, 1990(Chapter 3)
2. Herry G. Frankfurt (1971). Freedom of the Will and the Concept of a Person. The Journal of Philosophy, 68 (1): 5 – 20.
3. R.R. Gaur et al, A Foundation Course in Human Values and Professional Ethics. New Delhi: Excel Books, 2006.
4. Excerpts from relevant books supplied by the instructor as and when required

| MEL1112 | Material Science and Engineering | | Pre Requisites | | | Nil | | |
|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | Studio / Practical | | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 100 | NA | 200 |

**COURSE OUTCOMES**

**COURSE CONTENTS**

| Unit-I: | Crystallography | |
|---|---|---|

Review of Crystal Structure, Space Lattice, Crystal Planes and Crystal Directions, Coordination Number, Number of Atoms per Unit Cell, Atomic Packing Factor.

| Unit-II: | Imperfection & Deformation of Metal | |
|---|---|---|

Crystal Imperfections, Type of Defects and Effects on Metal Properties, Deformation of Metal. Mechanism, Yield Point Phenomena, Strain Ageing, Work Hardening, Bauschinger Effect, Season Cracking, Recovery, Re-Crystallization and Grain Growth.

| Unit-III: | Solid Solution and Phase Diagram: | |
|---|---|---|

Introduction to Single and Multiphase Solid Solutions and Types of Solid Solution, Importance and Objective of Phase Diagram Systems, Phase and Structure Constituents, Cooling Curves, Unary & Binary Phase Diagrams, Gibbs's Phase Rule, Lever Rule, Eutectic, and Eutectoid Systems, Peritectic and Peritectoid Systems. Iron Carbon Equilibrium Diagram and TTT Diagram.

| Unit-IV: | Heat Treatment | |
|---|---|---|

Principles, Purpose, Classification of Heat Treatment Processes, Annealing, Normalizing, Stress Relieving, Hardening, Tempering, Carburing, Nitriding, Cyaniding, Flame and Induction Hardening, Allotropic Transformation of Iron and Steel, Properties of Austentic, Ferrite, Pearlite and Martensite.

| Unit-V: | | |
|---|---|---|

Creep Concept, Creep Curve, Mechanism, Factors, Testing and Prevention. Corrosion-Type and Prevention of Corrosion. Fracture, Failures of Metals-Failure Analysis. Fatigue-Characteristics, Mechanism and Factors Affecting Fatigue.  Plastic. Composite and Ceramics, Powder Metallurgy Techniques.

**SUGGESTED BOOKS**
1. Elements of Material Science and Engineering Van Vlack. Wesley Pub.
2. Material Science –Narula, Narula and Gupta, New Age Publishers.
3. Material Science and Engineering- V. Raghvan, Prentice Hall of India Pvt.
4. A test Book of Material Science & Metallurgy-O.P Khana, Dhanpat Rai

5.  Material Science and Engineering- an Introduction–Callister; W.D., John Wiley & Sons, Delhi.
6.  Engineering Materials: Kenneth G. Budinski, Prentice Hallof India, and
7.  Essentials of Materials Science & engineering–Donald R. Askeland, Pradeep P. Phale

| CEP1122 | Building Materials and Construction. | | | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 100 | NA | 200 |

**COURSE OUTCOMES**
1. Identify and characterize building materials
2. Understand the manufacturing process of bricks and cement
3. Identify the factors to be considered in planning and construction of buildings.
4. Understand the construction practices and techniques

**COURSE CONTENTS**

| Unit-I: | Introduction | 7 Contact Periods |
|---|---|---|

Definition, types of buildings as per national building code, components of buildings and their functions, Types of structure – load bearing structure & framed structures, load bearing walls and partition walls, HDPE Wall panel. Foundation :- Types of foundation – shallow foundation & deep foundations for buildings, spread footings for walls & columns, Causes of failure of foundations.

| Unit-II: | Stone and Brick Masonry | 8 Contact Periods |
|---|---|---|

Stone Masonry : Technical terms, General principles to be observed during construction, random rubble masonry, coursed and un- coursed rubble masonry, Brick Masonry – Classification of bricks, manufacturing of clay bricks, tests on bricks, properties of burnt bricks. Brick masonry construction – Technical terms, general principles, commonly used types of bonds such as stretcher, header, English bond and Flemish bond, their suitability.

| Unit-III: | Floors and Roofs | 7 Contact Periods |
|---|---|---|

Types of Floors – Basement floor, ground floor and upper floors, Types of flooring material, Sahabad, Kotta, Granite, Ceramic tiles, plain tiles, mosaic tiles, glazed tiles, different types of floor finishes. Roofs – Flat & pitched roof, steel roof trusses – types and suitability, fixing details at supports, types of roof covering, AC & GI sheets, acrylic sheets, fixing details of roof covering.

| Unit-IV: | Doors & Windows | 8 Contact Periods |
|---|---|---|

Different forms of commercial woodsplywood, particle-board, batten-board, block-board, novapan, sunmica, veneer sheets. Doors : Purpose, criteria for location, size of door, door frames & its types, methods of fixing,. Windows – Purpose, criteria for location, no. sizes & shapes of Windows, types of windows & their suitability. Ventilators – Types and their suitability. Fixtures & fastening for doors & windows.

| Unit-V: | Stairs and Plastering & Pointing | 7 Contact Periods |
|---|---|---|

Function, technical terms, criteria for location, types of staircases, their suitability, principle of stair layout design. Plastering & pointing- Necessity, types, processes of different types of plastering, defects in plastered work. Painting & Colouring – Necessity, types, processes of painting & colouring to wall surfaces, wooden surface, iron & steel surfaces, types of paints and their uses..

| Unit-VI: | Special Aspects of Construction | 6 Contact Periods |
|---|---|---|

Damp proofing – causes of dampness, its effects, various methods of damp proofing, Fire proof construction – Points to be observed during planning & construction. Fire protection requirements for a multistoried building.

## SUGGESTED BOOKS

1) Mackay W.B. : Building Construction, Vol. I, II, III, Longmans.
2) Sushilkumar : Building Construction, Standard Publishers Distributors.
3) Deshpande R.S. and Vartak C.V. : A Treatise on Building Construction.
4) Sharma S.K. Kaul B.K. : A. T.B. of Building Construction, S. Chand & Co.
5) Gurucharan Sing : Building Construction Engg., Standard Book House, Delhi-6
6) Sane L.S. : Construction Engg., Manak Talas, Mumbai.
7) Chudley R. : Construction Technology, Vol. I, II, III & IV, Longmans Group Ltd.
8) ISE National Building Code of India, 1970.
9) Punmia B.C. : Building Construction.
10) A Manual of Earthquake Resistant, Non-Engineered Construction Indian Society of Earthquake Tech

## List of Lab Practical:

1. Drawing of following building elements on A-2 size sheet. a) Panelled door, flush door, glazed window. b) Steel truss with details of joints, details & support, details of fixing of roof covering.
2. Planning & drawing of a staircase for the given data. [On A-2 size sheet, Design calculations, plan & section.]
3. Preparation of foundation plan from the given line plan of a two room building [On a A-2 size sheet.]
4. Layout of the above, in field.
5. Fields visits to building under construction and its report writing including material of construction, construction processes, Human recourses required, construction details.
6. Sketch book containing Free hand sketches of following i) Different types of foundations. ii) Bonds in brick masonry iii) Types of floors. [sections] iv) Types of stairs. [plans and side view] v) Line sketches of different types of steel roof trusses. vi) Details of expansion joints. vii) Details of damp proofing for basement. viii) Fixtures & fastenings of doors & windows.

| MEP 1114 | | | | **Engineering Workshop** | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Studio / Practical | | | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL | |
| 3 | 1 | 0 | 4 | 20 | 20 | 50 | 10 | NA | NA | 100 | |

## COURSE OUTCOMES

## COURSE CONTENTS

**Carpentry shop:** Tools and Equipment, Making of Various Joints, Pattern Making.

**Foundry Shop:** Tools and Equipment's, Preparation of Moulds of Simple Objects Using Single Piece, Two Piece and Match Plate Patterns.

**Fitting Shop:** Tools and Equipment's, Practice in Chipping, Filing and Drilling, Making of V, Dovetail and Square Joints of M.S Flat.

**Welding Shop:** Tools and Equipment's, Making of Various Joints Using Gas Welding and Arc Welding (MIG Welding), Bead Formation in Horizontal, Vertical and Overhead Positions, Brazing and Soldering Operations.

**Sheet Metal Shop:** Tools and Equipment's, Making Tray, Cone, etc. with GI Sheet Metal.

**Machine Shop:** Introduction to Various Lathe Operations and Practice on Milling, Drilling Machines, etc.

## SUGGESTED BOOKS
1. Raghuvanshi, B. S. - Workshop Technology–Vol 1, Dhanpat Rai & Sons, New Delhi.
2. Gupta, R. B. - Production Technology, Satyaprakashan, New Delhi.
3. Swarn Singh - Workshop Practice, Kataria& Sons, New Delhi.
4. Upadhyay, R. – Manufacturing Practice, Kataria& Sons, New Delhi.
5. Narayana, K L Kannaiah P. - Manual on Workshop Practice, Scitech Publishers, Chennai

| LNP 1412 | | | | Language lab | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Studio / Practical | | |
| L | T | P/S | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 1 | 0 | 4 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

## COURSE CONTENTS

| Unit-I: | Oral Communication, Professional Speaking &  Group Discussion | |
|---|---|---|

Oral Communication: Speaking Skills: Kinds of Speaking Skills, Effective ways of Speaking, Public Speaking Listening Skills: Stages of Listening Process, Strategies of Listening, Types of Listening.

Professional Speaking: Interview Process, Characteristics of Job Interview, Pre Interview Preparation Techniques, Answering Strategies, Frequently asked Interview questions, Projecting a positive image and Body Language

Group Discussion: Definition, Methodology of Group Discussion, Techniques for Individual Contribution, Group Interaction Strategies, Helpful Expression and Evaluation, Practical Sessions.

| Unit-II: | Reading Skills &Enhancing Vocabulary | |
|---|---|---|

Reading Skills: Enriching Language through Literature; Comprehension.

Enhancing Vocabulary: Antonyms and Synonyms, Phrasal Verbs, One word Substitution, Homophones, Common Errors, Figure of Speech: Metaphor, Personification, Simile, Alliteration, Assonance, Paradox, Imagery, Oxymoron, Onomatopoeia.

## SUGGESTED BOOKS
1. Choudhury, Soumitra, and Anjana Neira Dev. Business English. Pearson Publication, 2008.
2. Mukerjee, Hory S. Business Communication. New Delhi: Oxford University Press, 2013.
3. Williams, D. Communication Skills in Practice: A Practical Guide for Health Professionals. London, United Kingdom: J.Kingsley, 2007.
4. Pandey, O. N. Technical Writing. New Delhi: S.K. Kataria & Sons, 2014.

| CEP 2021 | | **Strength of Materials** | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 |

**COURSE OUTCOMES**

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

1. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components.
2. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyze solid mechanics problems using classical methods and energy methods.
3. Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wall beams
4. Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members.

**COURSE CONTENTS**

| Unit-I: | Simple Stresses and Strains | (8 Contact Periods) |
|---|---|---|

Concept of stress and strain, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them –Bars of varying section – composite bars – Temperature stresses. principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications..

| Unit-II: | Bending moment and Shear Force Diagrams | (8 Contact Periods) |
|---|---|---|

Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contraflexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

| Unit-III: | Bending and Shear Stresses | (9 Contact Periods) |
|---|---|---|

Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I section, T section, Angle and Channel sections – Design of simple beam sections.
Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections.
Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts

| Unit-IV: | Slope and Deflection | (7 Contact Periods) |
|---|---|---|

Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

| Unit-V: | Columns and struts | (7 Contact Periods) |
|---|---|---|

Eulers theory, End conditions for columns, Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

**SUGGESTED BOOKS**
1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
4. 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
5. Laboratory Manual of Testing Materials - William Kendrick Hall
6. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf TMH 2002.
7. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

**List of Experiments:**

1. Tension test.
2. Bending tests on simply supported beam and Cantilever beam.
3. Compression test on concrete.
4. Impact test.
5. Shear test.
6. Investigation of Hook's law that is the proportional relation between force and stretching in elastic deformation.
7. Determination of torsion and deflection.
8. Measurement of forces on supports in statically determinate beam.
9. Determination of shear forces in beams.
10. Determination of bending moments in beams.
11. Measurement of deflections in statically determinate beam.
12. Measurement of strain in a bar.
13. Bend test steel bar.
14. Yield/tensile strength of steel bar.

| CEL 2022 | | Concrete Technology | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory | | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 |

## COURSE OUTCOMES

Students will be able to understand;
1. The various requirements of cement, aggregates and water for making concrete
2. The effect of admixtures on properties of concrete
3. The concept and procedure of mix design as per IS method
4. The properties of concrete at fresh and hardened state.

## COURSE CONTENTS

| Unit-I: | Constituent Materials | (9 Contact Periods) |
|---|---|---|

Cement - Different types - Chemical composition and Properties – Hydration of cement - Tests on cement - IS Specifications - Aggregates – Classification - Mechanical properties and tests as per BIS - Grading requirements – Water - Quality of water for use in concrete.

| Unit-II: | Chemical And Mineral Admixtures | (9 Contact Periods) |
|---|---|---|

Accelerators – Retarders - Plasticizers - Super plasticizers - Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline - Effects on concrete properties.

| Unit-IIII: | Proportioning of Concrete Mix | (9 Contact Periods) |
|---|---|---|

Principles of Mix Proportioning - Properties of concrete related to Mix Design - Physical properties of materials required for Mix Design - Design Mix and Nominal Mix - BIS Method of Mix Design - Mix Design Examples

| Unit-IV: | Fresh and Hardened Properties of Concrete | (9 Contact Periods) |
|---|---|---|

Workability - Tests for workability of concrete - Segregation and Bleeding - Determination of strength Properties of Hardened concrete - Compressive strength – split tensile strength - Flexural strength - Stress-strain curve for concrete - Modulus of elasticity – durability of concrete – water absorption – permeability – corrosion test – acid resistance.

| Unit-V: | Special Concretes | (9 Contact Periods) |
|---|---|---|

Light weight concretes - foam concrete- self compacting concrete – vacuum concrete - High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete – SIFCON - Shotcrete – Polymer concrete - High performance concrete - Geopolymer Concrete

## SUGGESTED BOOKS
1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003
3. Bhavikatti.S.S, " Concrete Technology", I.K.International Publishing House Pvt. Ltd., New Delhi, 2015
4. Santhakumar. A.R., "Concrete Technology", Oxford University Press India, 2006.

**List of Experiment:**

**Test of Cement:**
1. Consistency of standard cement paste.
2. Initial & final setting time of ordinary Portland cement.
3. Soundness test

**Test of Aggregate:**
4. Sieve analysis.
5. Flakiness index.
6. Elongation index.
7. Aggregate impact test.
8. Aggregate crushing test.
9. Specific gravity, water absorption and natural course of fine & course aggregate.

**Test on Design concrete- fresh concrete:**
10. Workability of concrete
11. Compaction factor test

**Test on Designed Concrete – Hardened Concrete:**
12. Compressive strength of concrete
13. Rebound hammer test

**Field Visit:** Visit of any construction Site or RMC or Cement Plant.

| CEL 2041 | Fluid Mechanics -I | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 2 | 1 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 |

## COURSE OUTCOMES

At the end of the course, the student will be able to;
1. Understand the basic terms used in fluid mechanics
2. Understand the broad principles of fluid statics, kinematics and dynamics
3. Understand classifications of fluid flow
4. Define the concepts related to boundary layer theory and drag and lift forces.

## COURSE CONTENTS

| Unit-I: | Introduction | (8 Contact Periods) |
|---|---|---|

Fundamental Concepts Definition of fluids, fluid properties-density, specific weight, specific volume, specific gravity, viscosity, compressibility, surface tension, capillarity, vapor pressure, types of fluids - Newtonian and non-Newtonian fluid, continuum, fluid pressure

| Unit-II: | Fluid Statics | (7 Contact Periods) |
|---|---|---|

Forces on fluid elements, fundamental equation, manometers, hydrostatic thrust on submerged surfaces, buoyancy, stability of unconstrained bodies, fluids in rigid body motion

| Unit-III: | Fluid Kinematics | (7 Contact Periods) |
|---|---|---|

Types of flow, continuity equation, derivation and applications of momentum equation, Euler's equation, Bernoulli's equation

| Unit-IV: | Flow Measuring Instruments | (8 Contact Periods) |
|---|---|---|

Venturimeter, Orificemeter and Pitot Tube, Introduction to Flow through Orifices and Mouthpieces

| Unit-V: | Laminar Flow and Turbulent flow | (9 Contact Periods) |
|---|---|---|

Fully developed laminar flow plates, laminar flow in pipe, Characteristics of Laminar flow through circular pipes, Reynold's Experiment, Stokes' law. Turbulent flow: Shear stress distribution, velocity distribution and shear stresses in turbulent flow, Introduction to Boundary Layer Theory

## SUGGESTED BOOKS

1. Fox. R. W. and Mc-Donald. A. T., "Introduction to Fluid Mechanics", John Wiley and Sons, Fifth Edition
2. Modi and Seth, "Fluid Mechanics and Hydraulic Machinery", Standard Book House, Tenth Edition , 1991
3. Kumar K. L., "Fluid Mechanics"
4. Bansal R. K., "Fluid Mechanics"
5. Jain A.K, "Fluid Mechanics including Hydraulic Machines" ISBN: 978-81-7409-194-7
6. Streeter V. L., Bedford K. W. and Wylie E. B., "Fluid Dynamics", New York, McGraw-Hill, Ninth Edition, 1998

7. Biswas G., "Introduction to Fluid Mechanics & Fluid Machines", Tata McGraw-Hill, 2nd Edi., 2003.

## List of Experiment:

1. To calculate discharge through pipes
2. Study of pressure measuring device
3. Study  of U-tube manometer
4. Study of inverted Manometer
5. Study of Pitot tube
6. Verification of bernoulii's energy equation.
7. Determine the coefficient of discharge by venturimeter.
8. Determine the coefficient of discharge by orifice meter.
9. Determine the velocity distribution in pipes.
10. To study measurement of viscosity.

**Note:** Any 8 practical mentioned below shall be performed by each student.

| CEL 2061 | Geotechnical Engineering-I | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 200 |

**COURSE OUTCOMES**

Students will able to;

1. Find the index and engineering properties of the soil.
2. Determine properties & demonstrate interaction between water and soil.
3. Analyze and compute principles of compaction and consolidation of soil.
4. Evaluate the stresses in the soil mass

| Unit-I: | Physical Properties of Soil | (7 Contact Periods) |
|---|---|---|

Soil formation, Soil types, composition, three phase relations, Specific gravity, water content, shape and size, grain size distribution curves, relative density, consistency of soils, Unified soil classification system, IS soil classification system, field identification tests

| Unit-II: | Compaction | (6 Contact Periods) |
|---|---|---|

Clay minerals, Clay water relations, General principles of compaction, compaction tests, factors affecting compaction, field compaction, compaction techniques.

| Unit-III: | Capillarity, Permeability and Seepage | (8 Contact Periods) |
|---|---|---|

Darcy's law, determination of permeability, equivalent permeability in stratified soils, in-situ permeability test, 1-D flow, flow nets, seepage, uplift pressure, confined and unconfined flows, piping, filter criteria.

| Unit-IV: | Compressibility and Consolidation | (8 Contact Periods) |
|---|---|---|

Fundamentals, 1-D consolidation, normally and over-consolidated clays, void ratio – pressure relationships, compressibility characteristics, time rate of consolidation, coefficient of consolidation, curve fitting techniques, settlement, secondary consolidation, vertical sand drains.

| Unit-V: | Shear Strength of Soil | (9 Contact Periods) |
|---|---|---|

Principle of effective stress, Mohr-Coulomb failure criterion, direct shear test, unconfined compression test, Triaxial shear test : consolidated drained, consolidated undrained, unconsolidated undrained, vane shear test, shear strength of clays and sands, critical void ratio, stress path, pore-pressure coefficient.

**SUGGESTED BOOKS**

1. Couduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India.
2. Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers.
3. Murthy, V.N.S., "Text Book of Soil Mechanics and Foundation Engineering", CBS Publishers.
4. Das, B.M., "Principles of Geotechnical Engineering", Thomson Asia.
5. Lambe, T.W. and Whitman, R.V., "Soil Mechanics", John Wiley and Sons.

| CEL 2023 | | | Structural Analysis-I | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

1. To acquire the understanding of free body diagram, indeterminacy and determinacy of the structure.
2. To find out the deflection of the beams by different methods and analysis of the structure under combined bending and axial loads.
3. Understand the concept of moving loads and influence lines to find out reactions, shear force and bending moment.
4. Know the behavior of two hinged arches, three hinged arches, cables and suspension bridge under different loading conditions.

## COURSE CONTENTS

| Unit-I: | Introduction | (10 Contact Periods) |
|---|---|---|

Need of analysis, techniques of structural idealization, basic tools of analysis, reactions in structure, notations and sign conventions, free – body diagrams, static determinacy, stability of structures, principle of superposition, loads on structures.

Plane Trusses: Introduction, member arrangement in a truss, stability and determinacy, roof and bridge trusses, analysis of trusses, notations and sign conventions, equations of condition, zero load test, classification of trusses.

| Unit-II: | Deflection of Beams | (8 Contact Periods) |
|---|---|---|

Introduction, direct integration method, moment – area method, conjugate beam method, Principle of virtual work, unit load method, Betti"s law, Maxwell"s law, Castigliano"s theorem.

Combined Bending and Axial Loads: Introduction, limit of eccentricity for no tension in the section, core of the section, middle third rule, wind pressure on chimneys, forces on dams.

| Unit-III: | Rolling Loads | (10 Contact Periods) |
|---|---|---|

Introduction to rolling loads and influence lines, Determination of shear force, bending moment at a section and absolute shear force and bending moment due to single point load, uniformly distributed load, several point loads etc.

Influence lines: Introduction, moving loads, influence lines, influence lines for reactions, shear force and bending moment, influence lines for beams, girders with floor beams, Influence lines for forces in members of frames.

| Unit-IV: | Arches and Cables and Suspension Bridges | (9 Contact Periods) |
|---|---|---|

Introduction, Analysis of two hinged and fixed arches, spandrel braced arches, influence lines for horizontal thrust, shear force and bending moment for three hinged and two hinged arches.

Cables and Suspension Bridges: Introduction, shape of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, cable subjected to temperature stresses, suspension bridge with two hinged and three hinged stiffening girders, influence lines.

**SUGGESTED BOOKS**

1. Utku S, Norris C H and Wilbur J B, "Elementary Structural Analysis, McGraw Hill, NewYork, 1990.

2. Jain A K, "Elementary Structural Analysis" Nem Chand & Brothers, Roorkee, 1990.

3. Reddy C S , "Basic Structural Analysis" Tata McGraw Hill, New Delhi, 2003.

4. Hibbeler C, "Structural Analysis" Pearson Publishers, New Delhi, 2002.

5. Punmia B C, Jain A K and Jain A K "Theory of Structures" Luxmi Publications, 2000.

| CEL 2031 | Design of Concrete Structures-I | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES
Students will able to:
1. Explain the basic concepts of structural design methods of RCC to the practical problem
2. Use the knowledge of the structural properties of materials i.e. steel and concrete in assessing the strength
3. Apply the concepts of concrete structures in real problems.
4. Use the knowledge in structural planning and design of various components of buildings

## COURSE CONTENTS

| Unit-I: | **Properties of Concrete** | (8 Contact Periods) |
|---|---|---|

Compressive strength, tensile strength, stress-strain behavior, modulus of elasticity, shrinkage, creep, characteristic strength, grades of concrete, design stress-strain curve of concrete, reinforcing steel, types and grades, stress-strain behavior, design stress-strain curve , basic properties of concrete constituent materials and fresh concrete , design of concrete mix. Working stress and limit state design methods

| Unit-II: | **Design and detailing of R.C. Beams** | (9 Contact Periods) |
|---|---|---|

Singly and doubly reinforced rectangular/flanged sections, design for shear, bond and anchorage of reinforcement, limit states of deflection and cracking. Design of RC beams subjected to torsion and detailing

| Unit-III: | **Design and Analysis of slabs & staircases** | (8 Contact Periods) |
|---|---|---|

Design and Analysis of One-way and two-way slabs, design of staircases and detailing.

| Unit-IV: | **Compression members** | (7 Contact Periods) |
|---|---|---|

Design and detailing of compression members for axial loads and axial load plus uniaxial moment/ biaxial moments.

| Unit-V: | **Footing** | (7 Contact Periods) |
|---|---|---|

Foundation types, design and detailing of isolated footings, introduction to combined footings.

| Unit-VI: | **Retaining wall** | (6 Contact Periods) |
|---|---|---|

Stability analysis of retaining walls, design of gravity, cantilever type retaining walls.

## SUGGESTED BOOKS
1. Pillai, S.U. and Menon, D., "Reinforced Concrete Design", Tata McGraw- Hill.
2. Sinha, N.C. and Roy, S.K., "Fundamentals of Reinforced Concrete", S. Chand.
3. Jain, A.K., "Reinforced Concrete Limit State Design", 7th Ed., Nem Chand & Bros., Roorkee.
4. Shah, V.L. and Karve, S.R., "Limit State Theory and Design of Reinforced Concrete", Structures Publication

| CEL 2042 | | | | **Fluid Mechanics-II** | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 1 | 0 | 4 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**

Students will able to;

1. Understand the knowledge of theories and equations of open channel flow in analyzing and designing of hydraulic structures.
2. Apply basic concepts related to Turbines & Pumps in Water Resources planning.
3. Demonstrate Gradually Varied Flow & Rapidly Varied Flow analysis and its computation.
4. Utilize the concepts of uniform and critical flow through open channels including design of efficient channel sections. Also apply specific energy concepts in the analysis of open channel flow.

**COURSE CONTENTS**

| **Unit-I:** | **Flow Through Pipes** | (10 Contact Periods) |
|---|---|---|

Introduction, Loss of Energy in pipes, Loss of Energy due to friction, Minor energy losses in pipes, Major energy losses in pipes, Flow through pipes in series, Flow through parallel pipes, Flow through branched pipes

| **Unit-II:** | **Flow in Open Channel and Steady & Uniform Flow** | (18 Contact Periods) |
|---|---|---|

Introduction, difference between pipe flow and open channel flow, types of open channels, types of flows in open channel, geometric elements, velocity distribution, measurement of velocity-(pitot lube, current meter) weir & spillway

Chezy's & Manning's formula, Roughosity coefficient, uniform flow computations, hydraulically efficient section considerations for rectangular, triangular, trapezoidal, circular sections Specific energy: definition & diagram, concept of critical, sub-critical, super-critical flow.

| **Unit-III:** | **Gradually and Rapidly Varied Flow** | (11 Contact Periods) |
|---|---|---|

Gradually Varied Flow in Open channels: Assumptions and Differential equations of GVF, Classification of Bed slopes. Rapidly Varied Flow in Open Channels: Phenomenon of Hydraulic Jump and energy Dissipation, Classification of Hydraulic Jump, Practical Uses of Hydraulic Jump.

| **Unit-IV:** | **Jets & Pumps** | (12 Contact Periods) |
|---|---|---|

Impact of Jet Impulse momentum principle, impact of jet on Vanes-flat, curved, Hydraulic Machines, Turbines: Importance of hydro-power, classification of turbines, description, typical dimensions and working principle of turbines. Pumps: Classification, component parts, working of centrifugal pump, performance characteristics, selection of pump, common pump troubles & remedies, introduction to different types of pumps such as reciprocating, multi-stage, jet, air lift, submersible pump.

**SUGGESTED BOOKS**

1. Fox. R. W. and Mc-Donald. A. T., "Introduction to Fluid Mechanics", John Wiley and Sons, Fifth Edition
2. Modi and Seth, "Fluid Mechanics and Hydraulic Machinery", Standard Book House, Tenth Edition , 1991

3. Kumar K. L., "Fluid Mechanics"
4. Bansal R. K., "Fluid Mechanics"
5.  Jain A.K, "Fluid Mechanics including Hydraulic Machines" ISBN: 978-81-7409-194-7
6. Streeter V. L., Bedford K. W. and Wylie E. B., "Fluid Dynamics", New York, McGraw-Hill, Ninth Edition, 1998
7. Biswas G., "Introduction to Fluid Mechanics & Fluid Machines", Tata McGraw-Hill, 2nd Edi., 2003

| CEL 2081 | | | | Transportation Engineering - I | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL | |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 | |

## COURSE OUTCOMES

1. Exhibit the knowledge of planning, design and the fundamental properties of highway materials in highway engineering.
2. Acquire the knowledge of geometric design and draw appropriate conclusion.
3. Understand and use the concept of different methods in design, construction, inspection and maintenance of the pavement.
4. Undertake various Traffic studies and apply the knowledge in planning and design of pavement and geometrics

## COURSE CONTENTS

| Unit-I: | Highway Development and Planning | (4 Contact Periods) |
|---|---|---|

Historical Development, road patterns, master plans, road development plans, PMGSY, engineering surveys, highway projects.

| Unit-II: | Highway Materials and Testing and Geometric Design | (6 Contact Periods) |
|---|---|---|

Embankment, Sub grade soil, sub base and base course materials, bituminous materials, testing of soil, stone aggregates and bitumen. Cross section elements, camber, super elevation, sight distances, horizontal and vertical alignment, summit and valley curves.

| Unit-III: | Traffic Engineering | (5 Contact Periods) |
|---|---|---|

Traffic characteristics, road user & vehicular characteristics, traffic studies, road traffic safety, traffic operations, traffic control devices, intelligent transport systems, pollution due to traffic.

| Unit-IV: | Design of Highway Pavements | (7 Contact Periods) |
|---|---|---|

Flexible pavements and their design, review of old methods, CBR method, IRC:37-2001, 2012, equivalent single wheel load factor, rigid pavements, stress in rigid pavement, IRC design method (IRC:58-2002).

| Unit-V: | Highway Construction & Maintenance | (7 Contact Periods) |
|---|---|---|

Construction of various layers, earthwork, WBM, GSB, WMM, various types of bituminous layers, joints in rigid pavements, Hot Mix Plants, Construction of Rigid Pavements. Various type of failures of flexible and rigid pavements, evaluation Design of overlays by IRC:81-1997.

## SUGGESTED BOOKS

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.
2. Mannering Fred L., Washburn Scott S. and Kilaresk Walter P.Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd
3. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.
4. Roess Roger P., Prassas, Elena S. and McShane, William R., "Traffic Engineering", Prentice Hall.
5. Papacostas, C.S. and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall.

6. Jotin Khisty, C. and Kent Lall, B., "Transportation Engineering – An Introduction", Prentice Hall.
7. Kadiyali, L.R., "Principles of Highway Engineering", Khanna Publishers.
8. Khanna, S.K., Justo, C.E.G. and A Veeraragavan, "Highway Material and Pavement Testing Manual", Nem Chand & Bros.

## List of Experiments:

1. Aggregate Crushing Test
2. Aggregate Impact Test
3. Los Angles Abrasion Test
4. Shape Tests
5. Specific Gravity and Water Absorption Test on Aggregates
6. C.B.R. Test
7. Penetration Test
8. Ductility Test
9. Softening Point Test
10. Flash & Fire Test
11. Specific Gravity Tests on Bitumen
12. Marshall Stability Test

**Note:** Any 8 practical mentioned below shall be performed by each student.

| CEL 2051 | Surveying for Civil Engineering | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 2 | 1 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 |

## COURSE OUTCOMES

1. Calculate angles, distances and levels.
2. Identify data collection methods and prepare field notes.
3. Understand the working principles of survey instruments.
4. Estimate measurement errors and apply corrections.

## COURSE CONTENTS

| Unit-I: | Introduction Surveying | (10 Contact Periods) |
|---|---|---|

Necessity & purpose, Geodetic & plane surveying, classification of survey, principles of surveying. Instruments for measurement of distance, linear measurements, corrections to field measurements, ranging out, direct and indirect ranging. Use of distomat. Chain surveying: basic definition, principle, selection of survey stations, offsets for locating details, limiting length of offsets, degree of accuracy of offsets, use of cross staff, optical square, prism square, obstacles in chaining, plotting of chain survey work, cross staff survey.

| Unit-II: | Instruments for Measurement of Angles and Elevation | (10 Contact Periods) |
|---|---|---|

Prismatic compass, surveyor's compass, their use and adjustments. Traversing with chain and compass, Reference meridians, bearing and azimuths. Local attraction, magnetic declination and its variation. Open & closed traverses.

| Unit-III: | Leveling and Theodolite Surveying | (10 Contact Periods) |
|---|---|---|

Dumpy levels tilting and automatic levels, Temporary and permanent adjustments of Dumpy and tilting levels. Definition of terms, Principle, leveling methods, leveling staves, Booking and reduction of field notes, curvature and refraction. Contouring: Definition, Characteristics and uses of contour maps, methods of contouring.

| Unit-IV: | Leveling and Contouring | (8 Contact Periods) |
|---|---|---|

Measurement of Horizontal and Vertical angles with theodolite by different methods. Other uses of theodolite. Theodolite traverse

| Unit-V: | Plane table Surveying | (7 Contact Periods) |
|---|---|---|

Equipments, methods, two point and three point problems, Advantages & disadvantages of plane tabling, Lehman's rules.

## SUGGESTED BOOKS

1. Anderson, J.M. and Mikhail, E.M., "Surveying: Theory and Practice", McGraw Hill.
2. Arora, K.R., "Surveying", Vol. I, II and III, Standard Book House.
3. Chandra, A.M., "Surveying", New Age Publishers.
4. T.P.Kanetkar & Kulkarni : Surveying and Leveling, Part I & II, Pune Vidharthi Griha Prakashan, Pune
5. B.C.Punmia : Surveying I & II, Standard Book House Delhi.

6. R.C.Brinker and P.R.Wolf, Harper and Row : Elementary Surveying.

**List of Experiments:**

**Note:** Any 8 practicals mentioned below shall be performed by each student.

1. Measurement of length by using Distomat.
2. Chain surveying
3. Compass surveying.
4. L Section of road.
5. Cross-section of road.
6. Plane table survey.
7. Theodolite traverse.
8. Study and use of minor instruments.
9. Measurement of area of an irregular figure by digital Planimeter.
10. To find corrected bearing using prismatic compass (local attraction).
11. To find R.L. of given point (differential levelling).

| CEL 2062 | | | Geotechnical Engineering-II | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 |

## COURSE OUTCOMES

The student should able to;
1) Develop different soil exploration techniques to examine the properties of soil.
2) Ability to analyze the stability of slopes, retaining structures, reinforced earth wall, etc.
3) Perceive knowledge to design shallow and deep foundation.
4) Ability to analyze to calculate bearing capacity, earth pressure and foundation settlement.

## COURSE CONTENTS

| Unit-I: | Introduction | (3 Contact Periods) |
|---|---|---|

Role of civil engineer in the selection, design and construction of foundation of civil engineering structures, brief review of soil mechanics principles used in foundation engineering. Soil Exploration: Methods of soil exploration; boring, sampling, penetration tests, correlations between penetration resistance and soil design parameters.

| Unit-II: | Earth Pressure and Retaining Walls | (6 Contact Periods) |
|---|---|---|

Earth pressure at rest, active and passive earth pressure, Rankine and Coulomb's earth pressure theories, earth pressure due to surcharge, retaining walls, stability analysis of retaining walls.

| Unit-III: | Foundations | (11 Contact Periods) |
|---|---|---|

Types of foundations, mechanism of load transfer in shallow and deep foundations, shallow foundations, Terzaghi's bearing capacity theory, computation of bearing capacity in soils, effect of various factors, stresses below the foundations, settlement of footings.

Pile Foundations: Types and methods of construction, estimation of pile capacity, capacity and settlement of group of piles, proportioning of piles.

Well foundations: Methods of construction, tilt and shift, remedial measures, lateral stability of well foundation.

| Unit-IV: | Slope Stability | (5 Contact Periods) |
|---|---|---|

Mode of failure – mechanism, stability analysis of infinite slopes, methods of slices, Bishop's simplified method.

| Unit-V: | Machine Foundations | (5 Contact Periods) |
|---|---|---|

Types of machine foundations, models, response of foundation – soil system to machine excitation, cyclic plate load test, block resonance test, criteria for design.

## SUGGESTED BOOKS

1. Peck, R.B., Hanson, W.E. and Thornburn, T.H., "Foundation Engineering",John Wiley
2. Couduto, Donald P., "Geotechnical Engineering – Principles and Practices", Prentice-Hall.
3. Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age.
4. Som, N.N. and Das, S.C., "Theory and Practice of Foundation Design",Prentice-Hall.

5.  Das, B.M., "Principles of Foundation Engineering", PWS.


## List of Experiments:

**Note:** Any 8 practical mentioned below shall be performed by each student.

1.  Determination of Moisture Content
2.  Specific Gravity Test
3.  Grain Size Distribution Analysis
4.  Hydrometer Analysis
5.  In-place density test
6.  Consistency Limit
7.  Compaction Test
8.  Consolidation Test
9.  Permeability Test
10. Unconfined Compression Test
11. Direct Shear Test
12. Vane Shear Test
13. Triaxial Test (demonstration)

| CEL 3024 | | | | **Structural Analysis-II** | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL | |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 | |

## COURSE OUTCOMES

1) Understand the concept of degree of indeterminacy of the structure and analysis of the fixed and continuous beam by Clapeyron's theorem.
2) Analysis of statically indeterminate beams and rigid frames by slope deflection method and moment distribution method
3) To understand analysis of indeterminate beams and rigid frames by kani's method and adopt appropriate technique for analysis of frames.
4) Understand the analysis of space frames and concept of plastic analysis of beams and frames.

## COURSE CONTENTS

| **Unit-I:** | **Analysis of Indeterminate Structures & Fixed and Continuous Beams** | (10 Contact Periods) |
|---|---|---|

Analysis of Indeterminate Structures: Degree of static and kinematic indeterminacies, analysis of indeterminate beams, pin jointed frames, rigid frames and trusses by method of consistent deformation, effect of lack of fitness, temperature, method of least work, induced reactions on statically indeterminate beams, pin jointed frames, rigid frames and trusses due to yielding of supports.

Fixed and Continuous Beams: Analysis of fixed beams, continuous beams and propped cantilevers by moment-area theorem, fixed end moments due to different types of loadings, effects of sinking and rotation of supports, bending moment and shear force diagrams for fixed beams and propped cantilevers, slope and deflection of fixed beams, analysis of continuous beams by the three moment theorom (Clapeyron's theorem) due to different types of loadings.

| **Unit-II:** | **Slope and Deflection** | (9 Contact Periods) |
|---|---|---|

Slope and Deflection Method: Introduction, slope-deflection equations, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements.

Moment Distribution Method: Introduction, absolute and relative stiffness of members, stiffness and carry-over factors, distribution factors, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements, symmetrical beams and frames with symmetrical, skew-symmetrical and general loading.

| **Unit-III:** | **Framed Structure** | (10 Contact Periods) |
|---|---|---|

Kani's Method: Introduction, basic concept, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loadings and yielding of supports, symmetrical beams and frames, general case- storey columns unequal in height and bases fixed or hinged.

Approximate Analysis of Frame: Vertical and lateral load analysis of multistory frames, portal, cantilever and substitute-frame methods and their comparison.

| **Unit-IV:** | **Space Frames and Plastic Analysis** | ( 9 Contact Periods) |
|---|---|---|

Space Frames: Introduction, simple space truss, types of supports, equilibrium and stability conditions, analysis of determinate and indeterminate space frames using tension coefficient method.

Plastic Analysis: Basics of plastic analysis, static and kinematic theorems for plastic analysis of beams and frames.

### SUGGESTED BOOKS

1) Basic structural analysis - C.S. Reddy
2) Theory of Structures, Gupta, S.P., Pandit, G. S., Gupta, R., Tata McGraw Hill
3) Structural Analysis- Thandvamoorthy TS Oxford University Press
4) Structural Analysis - Devdas Menon Narosa Publishing House
5) Indeterminate Structural Analysis C K Wang Tata McGraw Hill

### LIST OF EXPERIMENTS:

**Note:** Any 8 practical mentioned below shall be performed by each student.

1. To verify Betti's Law
2. To find the deflection of a pine connected truss.
3. To determine the flexural rigidity (EI) of a given beam.
4. To verify Moment-Area Theorems for slope and deflection of a beam.
5. To study the behavior of different types of struts.
6. To obtain experimentally the influence line for the horizontal thrust in a two hinged arch.
7. To determine the elastic displacement of curved members.
8. To determine the horizontal displacement of the roller end in a curved beam.

| CEL 3032 | Design of Concrete Structures-II | | | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 2 | 1 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**
1. Understand the general design considerations for continuous beams and slabs.
2. To acquire the knowledge on different types on foundation and their general design considerations.
3. Understand the general design considerations for curved beams and domes.
4. To acquire the knowledge on general design considerations of different types retaining walls and water tanks.

**COURSE CONTENTS**

| Unit-I: | **Continuous Beams and slabs & Flat slabs** | (7 Contact Periods) |
|---|---|---|

Basic assumptions, Moment of inertia, settlements, Modification of moments, maximum moments and shear, redistribution of moments for single and multi-span beams. Flat slabs: Advantages of flat slabs, general design considerations, approximate direct design method, design of flat slabs.

| Unit-II: | **Foundations** | (6 Contact Periods) |
|---|---|---|

Isolated footings, combined footings, rectangular, trapezoidal, strip, strap, raft footings.

| Unit-III: | **Design of curved beams & Domes** | (8 Contact Periods) |
|---|---|---|

Analysis and Design of curved beams fixed at both ends, ring beams. Design of Domes: Meridional and hoop stress in spherical and conical domes

| Unit-IV: | **Retaining walls & Water Tanks** | (7 Contact Periods) |
|---|---|---|

Design of cantilever and counter fort type retaining walls. Water Tanks: Estimation of Wind and earthquake forces, design requirements, rectangular and cylindrical underground, Intze tanks.

**SUGGESTED BOOKS**
1. Reinforced Concrete Structures, P. C. Varghese, Tata McGraw Hill
2. Advanced Reinforced Concrete Structures, P. C. Varghese, Tata McGraw Hill
3. Reinforced Concrete Design, M.L. Gambhir, Macmillan India Ltd., New Delhi
4. Limit State Design of Reinforced Concrete, A.K. Jain, Nem Chand and Bros., Roorkee
5. Behaviour, Analysis and Design of R.C.C. Structural Elements, I.C. Syal and Ummat, A.H. Wheelers, New Delhi

**Reference Books**
1. IS:456 2000
2. IS 3370 2009
3. Plain and Reinforced concrete, Vol. 2, O P Jain and J. Krishna, Nem Chand and Bros., Roorkee
4. Reinforced Concrete Design, S U Pillai and D Menon, Tata McGraw Hill

| CEL 3091 | | Environmental Engineering-I | | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 |

## COURSE OUTCOMES

1. To understand detailed theoretical knowledge about obtaining of quality water for drinking and industry purposes
2. To understand present technologies, processes and facilities, equipment for water treatment
3. To understand new methods used in water treatment, materials and equipment
4. To understand the air pollution and its preventive measures

## COURSE CONTENTS

| Unit-I: | Quantity Estimation of water | (8 Contact Periods) |
|---|---|---|

Demand of water. Consumption for various purposes. Fire demand, Per capita demand. Factors affecting consumption. Fluctuation in demand. Design period, forecasting population, and design periods for water supply components. Sources: Surface sources, ground water sources, Infiltration Galleries, Relative merits of sources, assessment & suitability, selection. Intake works: Intakes, type, location, requirement & features.

| Unit-II: | Water quality | (6 Contact Periods) |
|---|---|---|

Impurities in water, their effects and significance water borne diseases, collection of water samples. Water analysis physical, chemical and bacteriological. Water quality standards: I.S. & WHO, Flow diagrams and layouts of different water treatment works.

| Unit-III: | Aeration and Filtration | (8 Contact Periods) |
|---|---|---|

Aeration**:** Purpose, type of gravity, aerator & spray aerators. Sedimentation: Plain and with coagulation, different coagulants used, dose of coagulant, Jar test, coagulant, feeding and mixing devices. Flocculation, clarrifloculator. Design criteria and design of sedimentation tanks.

Filtration: Rapid sand and slow sand filters, filter media, Rate of filtration, under drainage system and washing process, pressure filter. Simple design problems on rapid sand filters modifications of filters.

| Unit-IV: | Disinfection | (7 Contact Periods) |
|---|---|---|

Requirement of good disinfectant, methods of disinfection. Chlorination: Methods, prechlorination, post chlorination. Break point chlorination and super chlorination forms of chlorine. Introduction to tertiary treatments like Softening, Ion Exchange, Reverse Osmosis, Defloridation, Desalination.

| Unit-V: | Distribution system | (7 Contact Periods) |
|---|---|---|

Types of supply - Continuous, and intermittent, Types of system - Gravity; Pumping and combined gravity and pumping, Layouts of distributions system, Dead end, Grid iron, Circular system and Radial system. Maintenance of distribution system. Equalising storage, Type of storage reservoirs, capacity

| Unit-VI: | Air pollution | (5 Contact Periods) |
|---|---|---|

Introduction to air pollution, various pollutants their sources and their effects on man and material, prevention or air pollution at sources, introduction to control devices.

**SUGGESTED BOOKS**

1. Steel E. W, Water Supply and Sewerage, Mc-Graw Hill.
2. Kshirsagar S. R, Water Supply Engineering, Roorkee Pub house, Roorkee.
3. Birde G. S, Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, Delhi.
4. Punmia B. C, Water Supply Engineering.

## List of Experiments:

**Note:** Any 8 practical mentioned below shall be performed by each student.

1. Determination of pH
2. Determination of Conductivity
3. Determination of Solid's (Suspended & dissolved)
4. Determination Chlorides
5. Determination of Solid's (Suspended & dissolved)
6. Determination of Turbidity
7. Determination of Acidity
8. Determination of Dissolved Oxygen
9. Determination of Membrane filtration technique.
10. Determination of Available Chlorine
11. Determination of Residual Chlorine
12. Jar Test

| CEL 3082 | Transportation Engineering-II | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

The students will able to;
1) Explain the function of various elements of railways.
2) Plan and design various elements of railway.
3) Explain about layout, design and construction of permanent way, runway and taxiway.
4) Apply the various principles traffic control in airport.

## COURSE CONTENTS

| Unit-I: | Introduction | (5 Contact Periods) |
|---|---|---|

Modes of transportation, universal scenario and Indian railways, railway track development, component parts, gauge, wheel and axle arrangement

| Unit-II: | Resistances and Stresses | (5 Contact Periods) |
|---|---|---|

Various resistances and their evaluation, hauling capacity, tractive effort, locomotives and their classification, stresses in the track and its components.

| Unit-III: | Component parts and design of railway track | (9 Contact Periods) |
|---|---|---|

Rails and their requirements, creep and wear in rails, rail joints, long welding rails and short welded rails, types of sleepers and their merits and demerits, requirements of ballast, design of ballast section, track fastenings, check rails and guard rails, railway cross-section, various types of gradients, design of horizontal curves, transition curves and vertical curves, existing provisions on IR.

| Unit-IV: | Points and Crossings and Signals | (8 Contact Periods) |
|---|---|---|

Working and design of a turnout, types of track junctions, design of crossover and diamond crossing, types of signals and their functions, interlocking, advanced methods of train control. High speed rails.

| Unit-V: | Air Transport | (7 Contact Periods) |
|---|---|---|

Scenario in India, national and international agencies, aircraft characteristics, site selection, airport obstructions, imaginary surfaces.

| Unit-VI: | Design of Airside features | (6 Contact Periods) |
|---|---|---|

Runway orientation, geometric design of runway, taxiway, exit taxiway, apron, holding apron, runway configuration, visual aids.

## SUGGESTED BOOKS

1. Chandra, Satish and Agarwal, M. M.**,** "Railway Engineering"**,** Oxford University Press, New Delhi.
2. Arora, S. P. and Saxena, S. C, "A Textbook on Railway Engineering", Dhanpat Rai Publications (P) Ltd., New Delhi.

3. Mundrey, J. S., "Railway Track Engineering", Tata McGraw-Hill Publishing Company, New Delhi.
4. Khanna, S. K., Arora, S. P. and Jain, S. S., "Airport Planning and Design", Nem Chand and Bros, Roorkee.
5. Kumar, V., Chandra, S., "Air Transportation Planning and Design", Galgotia Publications Pvt. Ltd., New Delhi.
6. Saxena, S. C., "Airport Engineering: Planning and Design", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
7. Horonjeff, R., McKelvey, F. X., Sproule, W. J., Young, S. B., "Planning and Design of Airports", McGraw-Hill Professional Publishing, New York.
8. Ashford, N. J., Mumayiz, S., Wright, P. H., "Airport Engineering: Planning, Design and Development of 21st Century Airports", John Wiley & Sons, New Jersey.

| CEL 3101 | Construction Management Estimating & Costing | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**

On completion of the course, the students will have:
1. An understanding of modern construction practices.
2. An idea of how to optimise construction projects based on costs.
3. Determination of quantities of items and labour requirement of civil engineering works.
4. Preparation of estimate of the civil engineering works.

**COURSE CONTENTS**

| Unit-I: | Basics of Construction and Construction Project Planning | (5 Contact Periods) |
|---|---|---|

Unique features of construction, construction projects- types and features, phases of a project, agencies involved and their methods of execution. Stages of project planning; Techniques of planning- Bar charts, Gantt Charts. Networks, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT, determining three time estimates, analysis, slack computations, calculation of probability of completion.

| Unit-II: | Construction Equipment & Project Monitoring | (4 Contact Periods) |
|---|---|---|

Conventional construction methods Vs Mechanized methods; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.
Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management;

| Unit-III: | Estimating and Valuation | (4 Contact Periods) |
|---|---|---|

Introduction: Purpose of estimating and valuation, Types of estimates. Building Estimate: Main items and their unit of measurement, methods of Measurement-Methods of estimating quantities, Estimating quantities of building. Estimation of quantity of load bearing structure with single room & two rooms, Estimation of quantity single storied residential building, Estimation of quantity Different R.C.C. structures , Estimation of quantity of water supply and sanitary works, Estimation of quantity of culverts and bridges, Road estimating, Estimation of quantity of Trusses. Introduction to estimates of other Civil engineering structures.

| Unit-IV: | Specification | (4 Contact Periods) |
|---|---|---|

Objectives and importance of specification, Specification of materials, specification of works, specification as per building classification, Language of specific writing. Tenders And Contracts: Tender notice, tender document, Contract-contractor and terms and conditions of contract, Agreement, Form of Contract, Responsibility of owner, Architect, Contractor and Engineer

**SUGGESTED BOOKS**
1. Varghese, P.C., "*Building Construction*", Prentice Hall India.
2. *National Building Code,* Bureau of Indian Standards, New Delhi.
3. Chudley, R., *Construction Technology*, ELBS Publishers.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill

5. Nunnally, S.W. Construction Methods and Management, Prentice Hall
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India.
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

| CEL 3033 | Design of Steel Structures-I | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|
| | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES
1. Uses of all loadings and limit state design method for steel structure.
2. Analyze and design the Tension and compression member
3. Explain the behavior of various connections and able to solve the problems various fasters used in steel construction.
4. Analyze and design the plate girder, roof trusses, etc.

## COURSE CONTENTS

| Unit-I: | Introduction and Basic Concepts | (5 Contact Periods) |
|---|---|---|

Properties of structural steel and structural steel sections. Working Stress and Limit State Method

| Unit-II: | Introduction to Joints | (5 Contact Periods) |
|---|---|---|

Riveted, Bolted (Ordinary and HSFG) and Welded connections for axial and eccentric loads.

| Unit-III: | Tension & Compression members | (6 Contact Periods) |
|---|---|---|

Design of members subjected to axial tension. Built up Columns, laced and battened columns including the design of lacing and battens.

| Unit-IV: | Design of Beams & Plate-girders | (8 Contact Periods) |
|---|---|---|

Laterally Supported , Unsupported and Builtup Beams. Plate-girders including stiffeners, Splices and Curtailment of flange and web plates.

| Unit-V: | Footings and Connections | (6 Contact Periods) |
|---|---|---|

Column bases, Slab base, Gusseted base and Grillage footings.  Beam to column connection, Introduction to semi-rigid connections

| Unit-VI: | Roof truss  & Plastic Analysis | (8 Contact Periods) |
|---|---|---|

Design of various components for different loadings (Dead, Live and Wind loads), Purlins, Gantry Girders. Plastic Analysis.

## SUGGESTED BOOKS
1. Arya, A.S. and Ajmani, J.L., "Design of Steel Structures", Nem Chand & Bros.
2. Subramanian, N., "Design of Steel Structures", Oxford University Press
3. Englekirk, R., "Steel Structures –Controlling behavior through design", John Wiley & Sons, New York
4. Trahair, N.S., Bradford, M.A. et al., "The Behavior and Design of Steel Structures to EC3", Taylor and Francis, London
5. Limit state design of steel structures: S K Duggal, Mc Graw Hill
6. Design of steel structures: N Subramanian Oxford Higher Education
7. Design of steel structures (by limit state method as per IS: 800-2007): S S Bhavikatti -K International Publishing House
8. IS 800: 2007, General construction in steel-Code of practice
9. SP: 6(1), Handbook for structural engineers-Structural steel sections.

| CEL 3043 | Water Resource Engineering | | | | Pre Requisites | | | Nil | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 |

## COURSE OUTCOMES

On completion of the course students will be able to:
1. The importance of water and various water resources of India and the world.
2. Understand various Interstate river disputes.
3. Understand various steps involved in water resource planning of engineering projects.
4. Formulation and solving of Linear Programming Problems using Graphical and Simplex methods

## COURSE CONTENTS

| Unit-I: | Introduction | (18 Contact Periods) |
|---|---|---|

Importance of water & water resource engineering, surface & ground water resources, water Resources of World and India. Necessity for Conservation and Development of Country's Water Resources. Different uses of Water Resources. Need for multipurpose and Single Purpose Projects. River systems in India and Environment impacts on water resources, various national water policies. Project Planning for Water Resources, different types of data and their collection. Project formulation. Interstate Water transfer and Interstate River disputes.

| Unit-II: | Techniques, Economics and allocation | (20 Contact Periods) |
|---|---|---|

Optimization Techniques, elementary principles, graphical techniques for single purpose and multipurpose projects. Dynamic programming.

Economics of Water Resource Planning, Principles of Engineering Economics, Mathematics of Economic Analysis, Capital budgeting. Economic Planning for flood control, domestic and Industrial Water Supply, Irrigation and Hydroelectric Power.

Cost allocation in multipurpose projects.

## SUGGESTED BOOKS
1) Water Resource Engineering by Linsley.
2) Economics of Water Resource Planning by James & Lee.
3) A Text Book of Hydrology & Water Resources by Sharma, R.K.
4) Water Resource Project Planning by Kuiper.

## List of experiments:
1. Flow measurement through open channel by notches
2. Cross section, plan, L-section of Earth dam showing all components; details of drainage of downstream casing.
3. Design and Drawing of elementary and practical profile of gravity dam
4. Design and drawing of diversion weir on permeable foundation
5. Computer Aided design of unlined and lined canal
5. Drawing of any Four canal structure (No design)
7. Field visit

| CEL 3092 | **Environmental Engineering-II** | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 |

## COURSE OUTCOMES

The student should able to;

1) Explain the concept related to water & its quality, sewage, sewer, storm water, etc in its hydraulic design.
2) Classify and Compare the different components of sewer in construction, testing & maintenance of sewers.
3) Design various units of conventional sewage treatment plant and the regulation of functional planning.
4) Examine provisions for rural sanitation and perform functional design of septic tank.

## COURSE CONTENTS

| **Unit-I:** | **Sewerage** | (5 Contact Periods) |
|---|---|---|

Quantity of storm water, DWF, variation of sewage, flow systems of sewerage - separate combined and partially combined, layouts of sewerage system, capacity of sewers design of sewers.

| **Unit-II:** | **Waste water Treatment** | (8 Contact Periods) |
|---|---|---|

Waste water characteristic, sampling of sewage, physical chemical and biological examinations, B.O.D. and C.O.D, B.O.D. equation, problems on B.O.D Pollution due to domestic and industrial waste. Treatment of sewage - purpose of treatment, preliminary treatment, primary treatment and secondary treatment. Flow diagram for conventional sewage treatment plant. Preliminary Treatment: Screening, Grit chamber, detritus tank. Primary Treatment: Sedimentation of sewage.

| **Unit-III:** | **Biological treatment** | (7 Contact Periods) |
|---|---|---|

Trickling filters, low rate & high rate tricking filters, construction details, Re- circulation Modification of trickling filters Activated sludge process - Process description, Methods of aeration, loading rates.

| **Unit-IV:** | **Low cost waste treatments** | (7 Contact Periods) |
|---|---|---|

Oxidation ponds, Aerated Lagoon, Treatment and Disposal of sludge - Digestion of sludge, sludge disposal Septic tank, working and design, Disposal of septic tank effluent Disposal of sewage on land and in stream. Effluent standards for disposal on land, into stream and into sewers. MINAS. Self purification capacity of stream

| **Unit-V:** | **Characteristics of solid waste** | (7 Contact Periods) |
|---|---|---|

Physical, chemical, biological Analysis Collection of solid waste:- Types of collection system and services, frequency of collection, methodology involved in setting up collection bins Disposal of solid wastes:- Different methods, sanitary land fill, composting, incineration

| **Unit-VI:** | **Introduction to EIA** | (8 Contact Periods) |
|---|---|---|

Environmental impact analysis- need and importance, step involved methods of EIA, public participation and communication. Environmental Legislation and Acts: Water (prevention and control of pollution) Act1974,Air (prevention and control of pollution) Act 1981, Environmental protection Act (EPA) 1986, Hazardous waste rules1989

**SUGGESTED BOOKS**
1) Kshirsagar S.R.: Sewerage and Sewage Treatment, Roorkee Pub House, Roorkee.
2) Steel E.W. Steel: Water Supply & Sewerage, McGraw Hill Book Co.
3) Birdie G.S.: Water Supply and Sanitary Engineering, Dhanpat Rai & Son's.
4) Garg S.K.: Waste Water Engineering.
5) Dr. Bhide A.D., Sunderson B.B.: Solid Waste Management in Developing Countries.
6) Rao H.V.N.: Air Pollution.
7) Stern, Wohlers, Boobel, Lowry: Fundamentals of Air Pollution, Academic Press, 1973.


**List of Experiments:**

**Note:** Any 8 practical mentioned below shall be performed by each student.

1. Determination of pH
2. Determination of Acidity
3. Determination of Dissolved Oxygen
4. Determination of Alkalinity
5. Demonstration of BOD
6. Demonstration of COD
7. Bacteriological Plate count and MPN tests
8. Estimation of Sulphate
9. Estimation of Phosphate
13. Bacteriological Plate count and MPN tests.

| CEL 3063 | Rock Mechanics and Tunneling Technology | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|
| | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

Students will understand:
1. Site characterization and how to collect, analyse, and report field data using standards in engineering practice
2. The fundamentals of the engineering properties of rock materials.
3. Describe various components of tunnel.
4. Discuss the concept of tunnelling methods and tunnel services

## COURSE CONTENTS

| Unit-I: | Rock Mechanics | (12 Contact Periods) |
|---|---|---|

Determination of physical properties of rocks, failure criterion, rock mass classification, stress around mine openings, strain and displacement of the rock mass, rock reinforcement and support, subsidence. Sub surface investigations in rocks and engineering characteristics or rocks masses;. Classification of rocks, Field & laboratory tests on rocks, Stress deformation of rocks, Failure theories and sheer strength of rocks, Bearing capacity of rocks.

| Unit-II: | Introduction | (18 Contact Periods) |
|---|---|---|

Scope and application, historical developments, art of tunnelling, tunnel engineering, future tunnelling considerations. Types of Underground Excavations: Tunnel, adit, decline, shaft; parameters influencing location, shape and size; geological aspects; planning and site investigations.  Tunnelling Methods: Types and purpose of tunnels; factors affecting choice of excavation technique; Methods - soft ground tunnelling, hard rock tunnelling, shallow tunnelling, deep tunnelling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered and remedial measures. Tunnelling by Drilling and Blasting: Unit operations in conventional tunnelling; Drilling - drilling principles, drilling equipment, drilling tools, drill selection, specific drilling, rock drillability factors; Blasting - explosives, initiators, blasting mechanics, blast holes nomenclature; types of cuts- fan, wedge and others; blast design, tunnel blast performance - powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection.

| Unit-III: | Tunnelling methods | (13 Contact Periods) |
|---|---|---|

Tunnelling by Roadheaders and Impact Hammers: Cutting principles, method of excavation, selection, performance, limitations and problems. Tunnelling by Tunnel Boring Machines: Boring principles, method of excavation, selection, performance, limitations and problems; TBM applications. Supports in Tunnels: Principal types of supports and applicability. Ground Treatment in Tunnelling: Adverse ground conditions and its effect on tunnelling; introduction to ground control. Tunnel Services: Ventilation, drainage and pumping. Methods of Sinking Shafts: Vertical and inclined, decline; shaft/raise boring machines and their application. Tunnelling Hazards: Explosion, flooding, chimney formation, squeezing ground.

**SUGGESTED BOOKS**

1. Engineering Rock Mechanics: An Introduction to the Principles by J. A. Hudson and J. P. Harrison
2. Rock Mechanics: For Underground Mining by Barry H.G. Brady
3. fundamentals of rock mechanics, 4th edition, John Conrad Jaeger, Neville G. W. Cook, Robert zimmerman
4. Rock mass classification, by Bhawani Singh and R.K. Goel
5. Introduction to rock mechanics by Richard E. Goodman
6. Tunnel Engineering by Subhash C Saxena

| CEP 3025 | Computer Aided Design & Drawing | | | | | Pre Requisites | | | Nil | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL | |
| 0 | 0 | 2 | 1 | NA | NA | NA | NA | 50 | 50 | 100 | |

**COURSE OUTCOMES**

The course should enable the students to:
1) To develop graphical skills for communicating concepts, ideas and designs of engineering products graphically/ visually as well as understand another person's designs,
2) Produce and interpret 2D & 3D drawings
3) Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
4) Develop drawings for conventional structures using practical norms.

**COURSE CONTENTS**

| Unit-I: | **Design of Structural Members** | (15 Contact Periods) |
|---|---|---|

Design of various structural members by STADD-PRO like beams, slabs, columns etc.

Design of multistory building by STADD-PRO

**SUGGESTED 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. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd.
4. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New Asian.
5. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria& Sons.

| CEL 4034 | Design of Steel Structures-II | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|
| | | Theory | | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 2 | 4 | 20 | 20 | 50 | 10 | 50 | 50 | 200 |

**COURSE OUTCOMES**
Students will understand:
1. To know about different types of compression and tension members
2. To understand about design of steel stacks and various types of cold formed sections.
3. To know the knowledge about design of towers and water tanks.
4. To understand various components of industrial building and design of roof truss.

**COURSE CONTENTS**

| Unit-I: | (12 Contact Periods) |
|---|---|

Elementary Plastic Analysis and Design: Introduction, Scope of plastic analysis, ultimate load carrying capacity of tension members and compression members, flexural members, shape factor, mechanisms, plastic collapse, plastic analysis and design of simple portal frames.

| Unit-II: | (12 Contact Periods) |
|---|---|

Design of Steel Stacks: Introduction, various loads to be considered for the design of steel stacks, design of steel stacks including foundation. Cold formed Sections: Introduction and brief description of various types of cold formed sections.

| Unit-III: | (10 Contact Periods) |
|---|---|

Towers: Transmission line towers, microwave towers, Design loads, classification, design procedure and specification. Water Tank: Analysis and Design of Water Tank

| Unit-IV: | (8 Contact Periods) |
|---|---|

Industrial Buildings: Loads, general arrangement and stability, design considerations, design of purlins, design of roof trusses, industrial building frames, bracings.

**Books Recommended:**
1. Arya A S and Ajmani J L, "Design of Steel Structures" Nem Chand & Bros, Roorkee,1996.
2. Chandra R, "Design of Steel Structures" Vol. I & II Standard Book House, Delhi, 1991.
3. Raz S A, "Structural Design in Steel" New Age International (P) Ltd., New Delhi, 2002.
4. Raghupathi M, "Design of Steel Structures" Tata McGraw-Hill Publishing Company ltd., New Delhi, 1999.
5. Dayaratnam P, "Design of Steel Structures" Wheeler Publishers, New Delhi, 2000.

**List of Experiments:**
1. Detailed drawing for compression and tension members
2. Detailed drawing for plate girders
3. Detailed drawing for footings and connections
4. Detailed drawing for steel stacks
5. Detailed drawing for towers
6. Detailed drawing for different water tanks
7. Detailed drawing for industrial buildings

## "SCHOOL ELECTIVES"

| CEE 3111 | Advance Construction Practices | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**
1. To know the knowledge of different types of formworks and scaffolding.
2. To understand the various types of concrete and different method of concreting
3. To know the knowledge about fabrication and erections of various structures.
4. To know about different construction methods and practices.

**COURSE CONTENTS**

| Unit-I: | (8 Contact Periods) |
|---|---|

Concrete Construction Methods, Formwork Design and Scaffolding; Slip Forms and other moving forms; Pumping of Concrete; Grouting and Mass Concreting Operations (roller compacted concrete)

| Unit-II: | (8 Contact Periods) |
|---|---|

Ready-Mix Concrete; Various Methods of Handling and Placing Concrete, Accelerated curing, Hot and cold weather concreting, Under water concreting, Prestressing.

| Unit-III: | (5 Contact Periods) |
|---|---|

Steel and Composite Construction Methods, Fabrication and erection of structures including heavy structures, Prefab construction, Industrialised construction and Modular coordination.

| Unit-IV: | (8 Contact Periods) |
|---|---|

Special Construction Methods, Construction in Marine Environments, High Rise Construction, Bridge Construction including Segmental Construction, Incremental Construction and Push Launching Techniques; Safety, Quality Measures and Reliability

**Books Recommended:**
1. Neville A M and Brooks J J "Concrete Technology", Pearson Education Asia, Singapore, 1994.
2. Neville A M "Properties of Concrete", Pearson Education, New Delhi, 2004.
3. Peurifoy R L "Construction Planning, Equipment and Methods" McGraw Hill Ltd., New York, 2002.

| CEE 3064 | Advance Foundation Engineering | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|
| | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**
1. To know the detailed knowledge about shallow foundation and bearing capacity
2. To understand the different types of foundations.
3. To know the knowledge about pile foundation with types and construction techniques.
4. To know about well foundation and about its components and construction method.

**COURSE CONTENTS**

| Unit-I: | (8 Contact Periods) |
|---|---|

Advanced topics in shallow foundations- bearing capacity, settlement and allowable bearing pressure. Allowable bearing pressure from penetration test data. Consolidation settlement of footings.

| Unit-II: | (8 Contact Periods) |
|---|---|

Raft foundations and combined footings. Problems of excavations. Deep foundations –need, Types. Classification of piles. static equation – Single piles -– Critical depth concept. Pile capacity in clay and sand by the I.S. code method. Piles in layered soils. Piles with enlarged base in clays (under reamed piles). Problems. Pile capacity from SPT and CPT values. Problems.

| Unit-III: | (10 Contact Periods) |
|---|---|

Piles for resisting uplift – straight shaft and under reamed piles in clays and sands – Dynamic formulae. Different types of pile load tests. Ultimate load from pile load tests. Pile groups – Negative skin friction of single piles and pile groups – Settlement of pile groups in clays and sands –Equivalent raft approach –Skempton's and Meyerhof's methods- Drilled piers with enlarged base.

| Unit-IV: | (8 Contact Periods) |
|---|---|

Well foundations– Components of a well foundation–Procedure for construction and sinking of wells– Thickness of well steining for sinking under self weight - Grip length- Problems encountered in well sinking–Tilts and Shifts– Causes – Permissible tilts and shifts - Methods to rectify tilts and shifts – Forces acting on a well foundation –Allowable bearing pressure – Lateral stability of well foundations - Terzaghi's analysis.

**Books Recommended:**

1. Murthy, V.N. S. Advanced Foundation Engineering, CBS Publishers, New Delhi, 2007
2. Ranjan G. and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2002
3. Gulhati, S. K. and Datta, M. Geotechnical Engineering, Tata McGraw Hill Education, 2005
4. Tomlinson, M. J. and Booman, R. Foundation Design and Construction, Prentice Hall Publishing, 2001.
5. Tomlinson, M. J. and Woodwrd, J. Pile Design and Construction Practice. CRS Press, 2015.
6. Kurien, N. P. Design of foundation systems: principles and practices. Alpha Science International, 2005

| CEE 3052 | | | Remote sensing and GIS | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**
1. Apply the concepts of Electro Magnetic energy, spectrum and spectral signature curves in the practical problems.
2. Apply the concepts of satellite and sensor parameters and characteristics of different platforms
3. Apply the concepts of DBMS in GIS
4. Analyze raster and vector data and modeling in GIS.

**COURSE CONTENTS**

| Unit-I: | Remote Sensing | (11 Contact Periods) |
|---|---|---|

Definition -Historical Components of Remote Sensing Principles & methods of remote sensing - Active and Passive remote sensing - Remote Sensing platforms -Electromagnetic radiation-Spectrum- Block body radiation – planks law – Stefan – Boltzmann law – satellites classification – based on orbit- sun synchronous and Geosynchronous based on purpose Earth Resources satellites, communication satellite

| Unit-II: | EMR Interactions | (12 Contact Periods) |
|---|---|---|

Interaction with atmosphere Scattering of EMR Raleigh, Mie, Non Selective and Raman Scattering Bach scattering Speckle EMR Interaction with water and Ozone Atmospheric windows and its significance EMR interaction with the earth surface materials Radiance, irradiance,

| Unit-III: | Resources Engineering | (10 Contact Periods) |
|---|---|---|

Characteristics of Digital satellite image enhancement Filtering Applications of Aerial photographs and satellite imageries – merits – Limitations – Water resources – watershed management

| Unit-IV: | Geographic Information System | (8 Contact Periods) |
|---|---|---|

Components of GIS – Hardware, Software and Organisational Context – Data – Spatial and NonSpatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer

**Books Recommended:**

1. Anji Reddy, "Remote Sensing and Geographical Information Systems", BS Publications 2001
2. Anand P.H,"Principles of remote Sensing and Geographical Information Systems", Sri Venkateswara Publishers, 2003.
3. Lillesand T.M and Kiefer R.W. Remote sensing and Image, Interpretation, John Wiley and Sons, INC, New York, 1987.
4. Burrough P A,"Principle of GIS for land resource assessment", Oxford University, 1990

| CEE 3044 | Advance Hydraulic | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**

1. Analyze components of hydrologic cycle
2. Predict hydrologic extreme events for hydraulic and hydrologic design
3. Develop forecasting models for operation of hydrologic systems
4. Assess surface water resources

**COURSE CONTENTS**

| Unit-I: | Flow Through Unsaturated Porous Media Unsaturated flow models | (10 Contact Periods) |
|---|---|---|

Horton's equation, Philips equation and Green-Ampt model Computation of excess rainfall hyetograph from observed flood hydrograph, Green-Ampt infiltration equation and SCS method.

| Unit-II: | Unit Hydrograph Theory | (9 Contact Periods) |
|---|---|---|

Unit hydrograph theory, derivation of instantaneous unit hydrograph and synthetic unit hydrograph. Project hydrology Design flood PMF storm transportation, PMP and PMF for project by using conceptual models

| Unit-III: | Flood Routing | (11 Contact Periods) |
|---|---|---|

Lumped flow routing, distributed flow routing models including kinematic, diffusion and dynamic wave routing models. Hydrologic Statistics Hydrologic statistics, Flood forecasting and flood frequency analysis. Hydrologic Design Storm Water Drainage Design

| Unit-IV: | Planning of Water Resources Engineering | (8 Contact Periods) |
|---|---|---|

Project Planning and investigations of reservoir and dam sites, Choice of dams, preparation and protection of foundation and abutments

**Recommended books:**

9. Chow V T, Maidment David R. and Mays Larry W. "Applied Hydrology", McGraw Hill International editions, New Delhi, 1988.
10. Mutreja K.N. "Applied Hydrology" Tata McGraw-Hill Publishing company Ltd., New Delhi,1990.
11. Subramanya K, Engineering Hydrology, Third Edition - Tata McGraw-Hill Publishing company Ltd., New Delhi, 2012.
12. Singh Vijay. P, Elementary Hydrology Prentice Hall, INDIA,1992. 5. Ojha C S P, Bhunya P and Berndtsson P, "Engineering Hydrology" Oxford University Press, Canada, 2008.

| CEE 3027 | Advance Structural Analysis | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|
| | | | Theory | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

1. To impart the principles of elastic structural analysis and behaviour of indeterminate structures.
2. To impart knowledge about various methods involved in the analysis of indeterminate structures.
3. To apply these methods for analyzing the indeterminate structures to evaluate the response of structures
4. To enable the student get a feeling of how real-life structures behave

## COURSE CONTENTS

| Unit-I: | Basic concepts of structural analysis | (10 Contact Periods) |
|---|---|---|

Static and kinematic indeterminacies of beams, rigid-jointed plane and space frames, pin-jointed plane and space frames and hybrid structures, actions and displacements, action and displacement equations, generalized system of coordinates, slope-deflection equations in generalized coordinates, relation between flexibility and stiffness matrices, Basic definitions and types of matrices, matrix operations, matrix inversion, solution of linear simultaneous equations, matrix partitioning.

| Unit-II: | Flexibility matrix & stiffness matrix | (10 Contact Periods) |
|---|---|---|

**Flexibility matrix (physical approach):** Development of flexibility matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using physical approach.

**Stiffness matrix (physical approach):** Development of stiffness matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using physical approach, reduced stiffness matrix, total stiffness matrix, translational or lateral stiffness matrix.

| Unit-III: | | (10 Contact Periods) |
|---|---|---|

**FLEXIBILITY MATRIX (ELEMENT APPROACH):** Transformation of system forces to element forces through force transformation matrix, Development of flexibility matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using Element Approach.

**STIFFNESS MATRIX (ELEMENT APPROACH):** Transformation of system displacements to element displacements through displacement transformation matrix, Development of stiffness matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin- jointed plane frames using Element Approach.

| Unit-IV: | | (10 Contact Periods) |
|---|---|---|

**FLEXIBILITY METHOD OF ANALYSIS:** Analysis of continuous beams, rigid-jointed planeframes and pin-jointed plane frames using the physical and element approaches, effect of support settlements, temperature stresses and lack of fit.

**STIFFNESS METHOD OF ANALYSIS:** Analysis of continuous beams, rigid-jointed plane frames and pin-jointed plane frames using the physical and element approaches, effect of support settlements, temperature stresses and lack of fit, comparison of flexibility and stiffness methods of analysis.

**Recommended Books**

1. G.S. Pandit and S.P. Gupta, 'Structural Analysis, A Matrix Approach'.
2. William Weaver, Jr. James M. Gere, 'Matrix Analysis of Framed Structures'.
3. C.S. Reddy, 'Basic Structural Analysis'.
4. C.S. Krishnamurthy, 'Finite Element Analysis'.

| CEE 3065 | Engineering Geology | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|
| | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**

Students will understand;
1. Site characterization and how to collect, analyze, and report geologic data using standards in engineering practice
2. The fundamentals of the engineering properties of Earth materials and fluids.
3. Rock mass characterization and the mechanics of planar rock slides and topples.
4. The mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability.

**COURSE CONTENTS**

| Unit-I: | Introduction | (12 Contact Periods) |
|---|---|---|

Basic Concepts, Structural Elements, Measurements, Sterographic Projection, Stereographic Projections of linear and planer features.

| Unit-II: | Rocks | (12 Contact Periods) |
|---|---|---|

Concept of Stress, Concept of Strain, Rheology of Rocks, Deformation Mechanism of Rocks.

| Unit-III: | Folds, Faults and Joints | (10 Contact Periods) |
|---|---|---|

Folds and mechanisms, Superposed folds, Foliation and Lineation, Boudinage and related structures, Faults and Joints, Ductile Shear Zone, Structural Mapping.

**Recommended books:**

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

| CEE 3093 | Air and Noise Pollution Control | | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**

1. An understanding of the nature and characteristics of air pollutants
2. Understanding of the concepts of air quality management
3. Ability to identify, formulate and solve air pollution problems
4. Ability to design stacks and particulate air pollution control devices to meet applicable standards

**COURSE CONTENTS**

| Unit-I: | Air Pollution | (15 Contact Periods) |
|---|---|---|

Air pollutants, Sources, classification, Combustion Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects-Smoke, smog and ozone layer disturbance, Greenhouse effect. Air sampling and pollution measurement methods, principles and instruments, Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations, control principles, Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators and other removal methods like absorption, adsorption, precipitation etc. Biological air pollution control technologies, Indoor air quality.

| Unit-II: | Noise Pollution | (15 Contact Periods) |
|---|---|---|

Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods.

**SUGGESTED BOOKS**

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata McGraw Hill, New Delhi, 1996.
4. Heumann. W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New Yark, 1997.

| CEE 3102 | Construction Equipment & Automation | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

1. Student should able to decide which types and capacity of construction equipment can be used for excavating, compacting grading, and dozing, concreting operation.
2. Student should able to prepare mass diagram for excavation particularly useful for various project.
3. Student should able to prepare cost analysis for Excavating and concreting equipment.
4. Students should able to handling and maintenance of construction equipments

## COURSE CONTENTS

| Unit-I: | Introduction | (15 Contact Periods) |
|---|---|---|

Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; plastering machines; Prestressing jacks and grouting equipment; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities; Use of Drones for spread out sites; Use of robots for repetitive activities.

| Unit-II: | Equipment Maintenance | (8 Contact Periods) |
|---|---|---|

Planned, unplanned, preventive, breakdown maintenance, merits and demerits of maintenance.

| Unit-III: | Equipment Management | (8 Contact Periods) |
|---|---|---|

Equipment Management, Costing, Optimum utilization and Equipment selection, depreciation, interest on capital, Manpower, Spare parts etc, Documentation, Log-Books, History Books, Periodical MIS Report.

## SUGGESTED BOOKS

1. Construction Technology: Analysis, and Choice, 2ed,Bryan, Wiley India
2. Construction Planning, Equipment and methods – Peurifoy-Tata McGraw Hill Publication
3. Construction Equipment Planning and Applications – Dr. Mahesh Varma
4. Brochures Published by various agencies associated with construction.
5. Journals such as CE & CR. Construction world, International Construction.
6. Document Reports of actual major works executed.
7. Construction Technology by Roy Chudley and Roger Greeno, Prentice Hall, 2005.
8. Dr. Kumar Niraj Jha, ― Formwork for Concrete Structures‖, Mc Graw Hill Publication.
9. Construction Equipment Planning and Applications – Dr. Mahesh Varma

| CEE 4035 | | | **Earthquake Resistant Design** | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

### COURSE OUTCOMES
1. To impart the information about different aspects related to seismology and terms related to it
2. To impart the knowledge about earthquake loading effect on structures.
3. To impart the different seismic retrofitting techniques and its implementation.
4. To impart the information about various Indian Standard Codal guidelines.

**Note**: IS: 1893, IS: 4326 and IS: 13920 Code of practice is permitted in examination.

| **Unit-I:** | **Introduction to Structural Dynamics:** | (12 Contact Periods) |
|---|---|---|

Theory of vibrations – Lumped mass and continuous mass systems – Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion – Undamped and damped free vibration – Damping – Response to harmonic excitation – Concept of response spectrum. Multi-Degree of Freedom (MDOF) Systems: - Formulation of equations of motion – Free vibration – Determination of natural frequencies of vibration and mode  shapes  – Orthogonal  properties  of  normal  modes  –  Mode  superposition  method of obtaining response.

| **Unit-II:** | **Earthquake  Analysis** | (12 Contact Periods) |
|---|---|---|

Introduction – Rigid base excitation – Formulation of equations of motion for SDOF and MDOF Systems – Earthquake response analysis of single and multistoried buildings – Use of response spectra. Codal Design Provisions: Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy – Assumptions – Design by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion.

| **Unit-III:** | **Earthquake  Engineering** | (12 Contact Periods) |
|---|---|---|

Engineering Seismology – Earthquake phenomenon – Causes and effects of earthquakes – Faults – Structure of earth – Plate Tectonics – Elastic Rebound Theory – Earthquake Terminology –Source, Focus, Epicentre etc - Earthquake size – Magnitude and intensity of earthquakes – Classification of earthquakes– Seismic waves – Seismic zones – Seismic Zoning Map of India – Seismograms and Accelegrams. Codal Detailing Provisions: - Review of the latest Indian Seismic codes IS: 4326 and IS: 13920 provisions for ductile detailing of R.C buildings – Beam, column and joints

| **Unit-IV:** | **Aseismic  Planning** | (12 Contact Periods) |
|---|---|---|

Plan Configurations – Torsion Irregularities – Re-entrant corners – Nonparallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of Adjacent Buildings. Shear walls: Types – Design of Shear walls as per IS:13920 – Detailing of reinforcements.

**Recommended Books**
1. Clough & Penzien, 'Dynamics of Structures', International Edition, McGraw Hill.
2. Pankaj Agarwal & Manish Shrikhande, 'Earthquake Resistant Design of Structures', Prentice Hall of India, New Delhi.

**Reference Books**
1. A.K. Chopra, 'Dynamics of Structures', Pearson Education, Indian Branch, Delhi.
2. C.V.R. Murty, 'Earthquake Tips', I.I.T. Kanpur.
3. Mario Paaz, 'Structural Dynamics', IS Codes: IS:1893, IS:4326 and IS:13920.

| CEE 4094 | Solid and hazardous waste management | | | | Pre Requisites | | | | Nil | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | | Practical | | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL | |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 | |

## COURSE OUTCOMES
1. Understanding of problems of municipal waste, biomedical waste, hazardous waste, e-waste, industrial waste etc.
2. 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 CONTENTS

| Unit-I: | Introduction | (5 Contact Periods) |
|---|---|---|

Solid waste sources – Nature and characteristics – Quantities and Qualities – Generation rates – Potential of disease – Nuisance and other problems.  (10 Hours)

| Unit-II: | Collection And Storage | (10 Contact Periods) |
|---|---|---|

 Solid waste management – Functional elements of solid waste–on–site storage –Collection and separation – Containers and its location – Collection systems and its example – physical , chemical and microbiological characteristics of waste – Vehicle routing – Route balance – Transfer station – Processing – Recovery and reuse.

| Unit-III: | Processing Of Municipal Solid Waste | (13 Contact Periods) |
|---|---|---|

Conveying and compacting waste – Shredding – Types of shredders – Shredders Design– Material separation – Types – Devices for material separation – Thermal processing of municipal solid waste – incinerator and pyrolysis – Refuse drived fuel – Biological process like composting, vermi composting and biomethanation DISPOSAL. Disposal methods – Sanitary land filling – Planning – Site selection – Design – Landfill Process – Monitoring Closure – Post closure monitoring – Other methods like incineration, pyrolysis, and composting, biological digestion.

| Unit-IV: | Hazardous Waste Management | (12 Contact Periods) |
|---|---|---|

Introduction to hazardous waste – Definition – Characterization and composition – TCLP test – Storage and transportation of hazardous waste – Labeling of hazardous waste – Physical, Chemical and Biological treatment of hazardous waste – Bioremediation of hazardous waste – Treatment of Bio medical – Nuclear waste and Radio – Active waste – Fly ash management and E-waste management.

## SUGGESTED BOOKS
1. David Rimbers, Municipal Solid Waste Management: Pollution Technologies Review, Noyes Data Corporation, London. 1990.
2. Charles A. Wentz, Hazardous Waste Management, McGraw Hill, New York. 1995.
3. Tchobanoglous G., Solid Wastes: Engineering principles and Management issues, McGraw Hill Book Company, Delhi. 1977.
4. Michael D. Lagrega, Phillip L. Buckingham, Jeffrey C. Evans, Hazardous Waste Management McGraw Hill, New York. 1994
5. Gaynor W. Dawson, Basil W. Mercer, "Hazardous Waste Management" Wiley Interscience, New York. 1986
6. Solid Waste Management –CPHEEO Manual, New Delhi.

| CEE 4083 | High Speed Rail Engineering | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|
| | | | Theory | | Studio / Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

1. To understand type of high speed rail transport
2. To understand standard of high speed railway that applies worldwide
3. To understand new tracks specially constructed for high speeds
4. To understand existing tracks specially upgraded for high speeds

## COURSE CONTENTS

| Unit-I | Introduction | (12 Contact Periods) |
|---|---|---|

Development, engineering, design and construction of high-speed rail (HSR) passenger transport systems with particular emphasis on the unique engineering elements of HSR technology.

| Unit-II | Infrastructure | (12 Contact Periods) |
|---|---|---|

Key elements of HSR systems and subsystems including: core systems (trains, power, signal, communication and control), track system and civil infrastructure (earthwork, bridges, viaducts and tunnels). Also covered are basic design and construction of HSR stations and rolling stock maintenance facilities.

## SUGGESTED BOOKS

1. Chandra, S. and Agarwal, M. M., "Railway Engineering", Oxford. 2007
2. Arora, S. P. and Saxena, S. C., "A Text Book of Railway Engineering", Dhanpat Rai Publications. 2004
3. Mundrey, J. S., "Railway Track Engineering", Tata Mcgraw Hill. 2000
4. Khanna, S. K., Arora, M. G. and Jain, S. S., "Airport Planning & Design", Nem Chand and Bros. 2000
5. Horonjeff, Robert and McKelvey, Francis X., "Planning & Design of airports', 4th Ed., McGraw Hill. 1993
6. Saxena, S.C., "Airport Engineering – Planning and Design", CBS Publishers. 2008.

| CEE 3102 | Reinforced Earth and Geotextiles | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | 3 | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**

1. To understand the history and mechanism of reinforced soil
2. To know the various types of geosynthetics, their functions and applications.
3. To enable the design of reinforced soil retaining structures
4. Be able to do dimple design of reinforced soil retaining walls and reinforced earth beds.

| Unit-I: | (10 Contact Periods) |
|---|---|

Functions of geosynthetics. Reinforcement action – Mechanism of reinforced soil. Component materials and their properties – fill, various types of reinforcements with advantages, disadvantages, facings.

| Unit-II: | (10 Contact Periods) |
|---|---|

Factors affecting the performance and behaviour of reinforced soil. Design and analysis of reinforced soil retaining walls-General aspects - External stability of vertically faced reinforced soil retaining wall.

| Unit-III: | (10 Contact Periods) |
|---|---|

Tie back wedge analysis or coherent gravity analysis or reinforced soil retaining walls with metallic strip and continuous geosynthetic reinforcements. Assumptions and problems. Construction methods of reinforced retaining walls. Bearing capacity improvement using soil reinforcement – Binquet and Lee's analysis - Simple problems in bearing capacity of reinforced soil foundation.

| Unit-IV: | (8 Contact Periods) |
|---|---|

Concept of Geocells, encased stone columns, prefabricated vertical drains, geocomposites, soil nailing, geotubes, geobags (only basic concepts). Natural geotextiles using coir and jute with relative advantages and disadvantages, application areas.

**SUGGESTED BOOKS:**
1. Jones, C.J.F.P. (1985). Earth reinforcement and soil structures. Butterworth, London.
2. Koerner, R.M. (1999). Designing with Geosynthetics, Prentice Hall, New Jersey, USA, 4th edition.
3. Rao, G.V. (2007). Geosynthetics – An Introduction. Sai Master Geoenvironmental Services Pvt. Ltd., Hyderabad
4. Rao, G.V., Kumar, S. J. and Raju, G.V.S.S. (Eds.). Earth Reinforcement – Design and Construction. Publication No. 314, Central Board of Irrigation and Power, New Delhi, 2012.
5. Sivakumar Babu, G.L. (2006). An introduction to Soil reinforcement and geosynthetics. United Press (India) Pvt. Ltd.

| CEE 4036 | Prestressed Concrete | | | | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | | Studio / Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | NC | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

1. Understanding of the behavior of prestressed concrete structures which is an advanced topic of civil engineering.
2. Knowledge of calculation of effect of prestressing on statically determinate structures and statically indeterminate structures.
3. Design, analysis, detailing and construction of prestressed concrete structural.
4. Develop knowledge of contemporary issues

## COURSE CONTENTS

| Unit-I: | Introduction | (8 Contact Periods) |
|---|---|---|

Study of strength, behavior of pre-stressed reinforced concrete members and structures.

| Unit-II: | Design of structure | (15 Contact Periods) |
|---|---|---|

Design of pre-stressed reinforced concrete members and structures, with primary emphasis on pretensioned, precast construction; emphasis on the necessary coordination between design and construction techniques in prestressing.

## SUGGESTED BOOKS

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012
2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012
3. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
4. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
5. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
6. IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012

| CEE 4045 | Industrial Waste Water Treatment and Management | | | | Pre Requisites | | | Nil | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory | | | | | Studio / Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | NC | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES

1. Identify environmental standards that apply to both direct and indirect industrial discharges.
2. Identify industrial waste stream characteristics from several major industrial categories
3. Design, conduct experiments and the ability to analyse the waste water quality
4. Design a component, system or process to meet desired needs and reduce water pollution

## COURSE CONTENTS

| Unit-I: | Introduction | (10 Contact Periods) |
|---|---|---|

Sources of wastes – Industrial and domestic – Nature and characteristics of wastewater – Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Toxicity of industrial effluents and Bioassay tests – Quality and quantity of industrial wastes.

| Unit-II: | Industrial pollution prevention | (10 Contact Periods) |
|---|---|---|

Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Waste minimization – Source reduction – Techniques – Waste Audit – Mass balance – Evaluation of pollution prevention options – waste volume reduction – Waste strength reduction – Neutralization – Removal of suspended and colloidal solids – Removal of inorganic and dissolved solids – Disposal of sludge solids.

| Unit-III: | Wastewater reuse and residual management | (10 Contact Periods) |
|---|---|---|

Individual and common effluent treatment plants – Zero effluent discharge systems – Wastewater quality requirements for its reuse – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion, conditioning, dewatering and sludge disposal.

| Unit-IV: | Case studies | (15 Contact Periods) |
|---|---|---|

Industrial manufacturing process description– Wastewater characteristics– Source reduction options and waste treatment flow sheet for Textiles, Tanneries, Pulp and paper, metal finishing, Petroleum Refining, Pharmaceuticals, Sugar and Distilleries, Food Processing, fertilizers, Thermal Power Plants and Industrial Estates

## Recommended books:

1. Frank Woodard, Industrial Waste Treatment Handbook, Butterworth–Heinemann, 2001.
2. Rao M.N. and Datta A.K., Wastewater Treatment, Oxford and IBH Publishing Co. Pvt. Ltd.
3. Nemerow N.L., Industrial Waste Treatment, Elsevier Science & Technology Books, 2006.
4. Eckenfelder- "Industrial Water pollution Control"- McGraw hill Company, New Delhi, 2001.
5. Frank Woodard, 'Industrial waste treatment Handbook', Butterworth Heinemann, New Delhi, 2001.

| CEE 4037 | Bridge Engineering | | Pre Requisites | | | Nil | | |
|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | Studio / Practical | | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | NC | 20 | 20 | 50 | 10 | NA | NA | 100 |

**COURSE OUTCOMES**

1. To analyze of different types of bridges
2. To analyze design requirements of different types of bridges
3. To analyze design of different types of bridges
4. To analyze Pre-Stressed Concrete Bridges

**COURSE CONTENTS**

| Unit-I: | Concrete Bridges | (10 Contact Periods) |
|---|---|---|

Introduction-Types of Bridges-Economic span length-Types of loading-Dead loadlive load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loadsFrictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

| Unit-II: | Solid Slab Bridges | (9 Contact Periods) |
|---|---|---|

Introduction-Method of Analysis and Design

| Unit-III: | Girder Bridges | (11 Contact Periods) |
|---|---|---|

Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy

| Unit-IV: | Pre-Stressed Concrete Bridges | (8 Contact Periods) |
|---|---|---|

Basic principles-General Design requirements-Mild steel reinforcement in prestessed concrete member-Concrete cover and spacing of pre-stressing steel Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unproped composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges

**Recommended books:**

1. Essentials of Bridge Engineering by Johnson Victor, Oxford & IBH
2. Design of Bridges by N. KrishnaRaju, Oxford & IBH
3. Design of Concrete Bridges by M.G. Aswani, V.N. Vazirani and M.M. Ratwani.
4. Bridge Deck Behaviour by E.C. Hambly.
5. Design of Bridges by V.V. Sastry, Dhanpat Rai & Co
6. Concrete Bridge Design and Practice by V.K. Raina.

| CEE 4067 | Earth and Earth Retaining Structures | | Pre Requisites | | Nil | |
|---|---|---|---|---|---|---|
| | | | Theory | | Studio / Practical | |
| L | T | P | C | MI-01 | MI-02 | MA | ASGN | INT | EXT | TOTAL |
| 3 | 0 | 0 | NC | 20 | 20 | 50 | 10 | NA | NA | 100 |

## COURSE OUTCOMES
1. To analyze Earth pressure
2. To analyze stability problems Earth Retaining Structures
3. To analyze material and method of Earth Retaining Structures
4. To analyze stability analysis of slope

## COURSE CONTENTS

| Unit-I: | Earth and Earth Retaining Structures | (10 Contact Periods) |
|---|---|---|

Earth pressure, introduction, earth pressure as a stability problems, concept of strain dependence of developed stresses, active, at rest and passive conditions, plastic equilibrium, various theories related with E.P. Distillation, Rankine, Coulomb and Hansen theoretical derivation and graphical construction with different geometric and boundary conditions.

| Unit-II: | Retaining wall | (9 Contact Periods) |
|---|---|---|

Types, material, method of construction, nature of forces acting. Comparison of different earth pressure theories and application in retaining wall. Stability analysis and design aspects, application of theory of elasticity in analysis of earth pressure distribution. Sheet pile and cofferdam.

| Unit-III: | Retaining Structures | (6 Contact Periods) |
|---|---|---|

Type, material, method of construction, distribution of earth pressure and related approximation. Distinction between Sheet Pile and Retaining wall, analysis and design.

| Unit-IV: | Earth structure | (10 Contact Periods) |
|---|---|---|

Definition, Features of an earth dam, stability analysis of slope, total - vs. - effective stress analysis, limit equilibrium method of slices based on circular failure surfaces, introduction to analysis based on general failure surfaces, introduction to analysis based on general failure surfaces. Stability of earth dams during different stages - during and at end of construction, steady seepage, sudden draw down, estimation of pore water pressure - use of stability charts.

### Recommended books:
1. J.L.Sherard, R.J.Woodward, S.F.Gizienski, and W.A. Clevenger, Earth and Earth –Rock Dams Engineering Problems of Design and Construction, John Wiley and Sons, New York, 1963.
2. R F Craig, Soil Mechanics, Chapman and Hall(ELBS)
3. C. Justin and Hinds, Engineering for Dams Vol. 2 & 3.
4. S. Leliavsky, 'Design of Dams for Percolation and Erosion', Chapman and Hall.