Major Core Courses (MCC)

Course Code	Course Name	Level	L	T	P	C	CIE	SEE	Total	Pre-requisite
2501MA01	Linear Algebra & Calculus	FC	2	1		3	50	50	100	-
2501MA02	Differential Equations & Vector Calculus	FC	2	1		3	50	50	100	-
2501MA03	Integral Transforms & Applications of Partial Differential Equations	IC	2	1		3	50	50	100	LAC
2501MA04	Numerical Methods & Statistical Techniques	IC	2	1		3	50	50	100	ITAPDE
2501PH01	Solid State Physics	FC	2		1	3	50	50	100	-
2501CH01	Engineering Chemistry	FC	2		1	3	50	50	100	-
2501IT01	Business Intelligence Lab	FC			2	2	50	50	100	-
2501ME03	Engineering Workshop	FC			1	1	100		100	-
2501ME01	Engineering Graphics	FC	1		2	3	50	50	100	-
2501ME02	Engineering Mechanics	FC	2	1	1	4	50	50	100	-
2501CE01	Construction Materials & Concrete Technology	FC	2		2	4	50	50	100	-
2501CE02	Fluid Mechanics	IC	1	1	1	3	50	50	100	-
2501CE03	Strength of Materials – I	IC	2		2	4	50	50	100	EM
2501CE04	Engineering Geology	IC	2		1	3	50	50	100	-
2501CE05	Geomatics Engineering	IC	1	1	2	4	50	50	100	-
2501CE06	Hydraulics & Hydraulic Machinery	IC	1	1	1	3	50	50	100	FM
2501CE07	Geotechnical Engineering – I	IC	2		2	4	50	50	100	-

2501CE08	Strength of Materials – II	IC	2	1		3	50	50	100	SOM-1
2501CE09	Structural Analysis	IC	2	1		3	50	50	100	SOM-1
2501CE10	Geotechnical Engineering – II	IC	2	1		3	50	50	100	GE-1
2501CE11	Environmental Engineering	IC	2		2	4	50	50	100	-
2501CE12	Transportation Engineering	IC	1	1	1	3	50	50	100	-
2501CE13	Estimating and Costing	IC	3			3	50	50	100	BP&CAD
2501CE14	Design of Reinforced Concrete Elements	AC	2	1		3	50	50	100	SOM
2501CE24	Design of Steel Structures	AC	2	1		3	50	50	100	SOM
2501CE15	Hydrology & Irrigation with ML Techniques	AC	2	1		3	50	50	100	HHM
Total			**44**	**15**	**22**	**81**				

Linear Algebra and Calculus

(Common to CE, EEE, ME, ECE, CSE, IT, AIML, CSE(DS), PT, Min.E.)

	L	T	P	C
Course Code: 2501MA01	**2**	**1**	**0**	**3**

Course Outcomes:

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

CO1: Solve the system of Linear equations
CO2: Calculate Eigen values and Eigen vectors
CO3: Apply differential calculus for one and several variable functions
CO4: Calculate the Maximum value and Minimum value of a function of several variables
CO5: Compute areas and volumes using multiple integrals

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-

UNIT – I

System of linear equations: Vector Space,Linear Independence,Rank of a matrix by echelon form, normal form, Inverse of Non-singular matrices by Gauss-Jordan method, Solutions of Linear Systems: Existence, Uniqueness,Solving the system by Gauss elimination method.

Practice(Using any computational tool)

1. Variables, arithmetic operations, elementary mathematical functions.
2. Defining row vector, column vector, Arithmetic operations on matrices
3. finding transpose of a matrix, inverse of a matrix, determinant of a matrix
4. rank of a matrix, solving system of linear equations.

UNIT – II

Eigenvalues, Eigenvectors : Eigenvalues and properties(without proof), Eigenvectors, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), Quadratic forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation,Nature of Quadratic forms.

Practice(Using any computational tool):

Computing eigen values and eigen vectors, matrix diagonalization.

UNIT – III

One Variable Calculus:Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.
Several Variable Calculus: Limit, Continuity, partial derivatives and their geometrical interpretation.
Practice(Using any computational tool): Basics of plotting, Plot graphs of single variable functions

UNIT – IV

Functions of several variables: Total differential and differentiability, derivatives of composite and implicit functions,derivatives of higher order and their commutativity, Euler's theorem on homogeneous functions , Taylor's and Maclaurin's expansion of functions of two variables. Jacobians, maxima and minima, constrained maxima/minima problems using Lagrange's method of multipliers.
Practice(Using any computational tool): Plot graphs of various multi variable functions

UNIT – V

Multiple Integrals: Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).
Practice(Using any computational tool): Plotting the region of Integration

Students are advised to use any computational / AI Tool like Wolfrum Alpha, Symbolab, Mathway, Desmos, Geogebra etc., for the practice

Text Books:

1	Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 5th Edition (9th reprint), 2021· ISBN 978-8184875607
2	Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 5th Edition, 2018.ISBN-13. 978-1292174341

Reference Books:

1	Advanced Engineering Mathematics, Michael Greenberg, Pearson publishers, 9th edition.ISBN-13. 9788177585469
2	Higher Engineering Mathematics, H. K. Dass, Er. R. Verma, S-Chand publishers, 3rd edition 2023.ISBN 9788121938907

Web Links:

1. https://archive.nptel.ac.in/courses/111/104/111104137/
2. https://archive.nptel.ac.in/courses/111/107/111107108/
3. https://www.khanacademy.org/math/linear-algebra/
4. https://www.khanacademy.org/math/multivariable-calculus

Differential Equations & Vector Calculus

(Common to CE, EEE, ME, ECE, CSE, IT, AIML, CSE(DS), PT, Min.E.)

	L	T	P	C
Course Code:2501MA02	**2**	**1**	**0**	**3**

Course Outcomes:

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

CO1: Solve the linear differential equations of first order and apply in various engineering problems.
CO2: Solve the linear differential equations of higher order and apply in various engineering problems.
CO3: Solve the linear partial differential equations
CO4: Calculate the gradient, divergence and curl.
CO5: Compute work done, flux using vector integration

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-

UNIT – I

Ordinary Differential Equations of First Order and First Degree:

Solution of first order linear differential equations, exact differential equations and equations reducible to exact differential equations, Orthogonal Trajectories, Modelling of RL- circuit.

Practice(Using any computational tool): Solving the first order initial value problems using **odesolver** and plot the solution curves.

UNIT – II

Linear Differential Equations of Higher Order:

Solution of linear differential equations with constant coefficients, method of variation of parameters, solution of simultaneous linear differential equations.

Equations reducible to Linear differential equations with constant coefficients: Cauchy's homogeneous Linear Equations, Legendre's Linear Equations. Study of oscillations arising in LCR circuit (free oscillations and forced oscillations).

Practice(Using any computational tool): Solving the second order initial value problems using **odesolver** and plot the solution curvescurves

UNIT – III

Partial Differential Equations:

Solution of linear PDE of first order by Lagrange's method, solution of homogeneous linear PDE of higher order with constant coefficients.

UNIT – IV

Vector Differentiation:

Gradient of a scalar field, finding angle between two surfaces, directional derivative. Divergence and solenoidal fields. Curl and irrotational fields, Finding Scalar Potential.

Practice(Using any computational tool): Plotting of surfaces, 3D-plots, plotting vector fields

UNIT – V

Vector Integration:

Line integrals, work done by a force, conservative force field, surface integral, flux, volume integral. Green's theorem, Stoke's theorem and Gauss divergence theorem.

Students are advised to use any computational / AI Tool like Wolfrum Alpha, Symbolab, Mathway, Desmos, Geogebra etc., for the practice

Text Books:

1. Advanced Engineering Mathematics, E. Kreyszig, John Willey & Sons,10th Ed., 2018.ISBN 978-0470458365
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 44'th Edition (2021).ISBN 978-9383214204

Reference Books:

1. Advanced Engineering Mathematics, Dennis G. Zill, Jones & Bartlett Learning, 2018, 6th Edition.ISBN978-1284105902.
2. Higher Engineering Mathematics, B.V. Ramana, McGraw-Hill Education, 11'th Ed., 2017.ISBN 978-9339216016.

Web Links:

1. https://www.classcentral.com/course/differential-equations-engineers-13258
2. https://archive.nptel.ac.in/courses/111/106/111106100/
3. https://www.khanacademy.org/math/differential-equations
4. https://archive.nptel.ac.in/courses/111/101/111101153/
5. https://archive.nptel.ac.in/courses/111/105/111105122/

Integral Transforms & Applications of Partial Differential Equations
(Common to CE,ME)

	L	T	P	C
Course Code: 2501MA03	**2**	**1**	**0**	**3**

Course Outcomes:

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

CO1: Compute Laplace transform of a function.
CO2: Apply Laplace transform to solve initial value problems
CO3: Compute the Fourier series of a function
CO4: Compute the Fourier transform of a function
CO5: Apply method of separation of variables for solving Heat and Wave equations.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-

UNIT – I

Laplace Transforms: Laplace transforms of standard functions, Properties of Laplace Transformations, laplace transform of Unit step function, Dirac delta function, Periodic function (without proof), Evaluating improper integrals of the type $\int_0^\infty f(t)\,dt$ using Laplace Transform.

Practice(Using any computational tool): Find Laplace transform of elementary functions.

UNIT – II

Inverse Laplace Transforms: Inverse Laplace transforms of functions, First shifting theorem, Convolution theorem (without proof), Second shifting theorem. Solving initial value problems and integro-differential equations using Laplace transforms.

UNIT – III

Fourier Series: Fourier series of periodic functions, Half-range series, Change of interval and Fourier series in complex form, Parseval's formula and R.M.S Value.
Practice(Using any computational tool): Generating Fourier Series of functions.

UNIT – IV

Fourier Transforms: Fourier integral theorem (without proof), Fourier sine and cosine integral, Fourier Transform, Properties, Fourier sine and cosine transforms and Finite Fourier transforms.

UNIT – V

Applications of PDE : Classification of second order P.D.E - Method of separation of Variables- Solution of One dimensional Wave equation, Heat equation and two-dimensional Laplace equation.

Students are advised to use any computational / AI Tool like Wolfrum Alpha, Symbolab, Mathway, Desmos, Geogebra etc., for the practice

Text Books:

1. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 5th Edition (9th reprint), 2021· ISBN 978-8184875607
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 44'th Edition (2021).ISBN 978-9383214204

Reference Books:

1. Higher Engineering Mathematics, H. K. Dass, Er. R. Verma, S-Chand publishers, 3rd edition 2023.ISBN 9788121938907
2. Advanced Engineering Mathematics, E. Kreyszig, John Willey & Sons,10th Ed., 2018.ISBN 978-0470458365

Web Links:

1. https://nptel.ac.in/courses/111105123/
2. https://nptel.ac.in/courses/111105093/
3. https://www.khanacademy.org

Numerical Methods & Statistical Techniques

(Common to CE & ME)

	L	T	P	C
Course Code:2501MA04	**2**	**1**	**0**	**3**

Course Outcomes:

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

CO1: Apply numerical methods to solve the equations and interpolate the polynomials.

CO2: Apply numerical methods to solve problems involving differentiation, integration and initial value problems.

CO3: Apply various Probability distributions for both discrete and continuous random variables.

CO4: Compute mean and variance of sample means with replacement and without replacement and estimating maximum errors

CO5: Apply various tests to test the hypothesis concerning mean, Proportion, variance.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-

UNIT – I

Solution of Algebraic and Transcendental Equations and Interpolation:

Solution of Algebraic and Transcendental Equations: Errors in Numerical Computation, Bisection method, Method of false position, Secant method and Newton - Raphson method.

Interpolation: Unequal Intervals- Lagrange's interpolation, Newton's divided difference formulae, Equal Intervals-Newton's Forward and Backward difference formlae, Central difference, Relation between operators.

Practice(Using any computational tool): Find solution of equations and Newton's forward interpolation.

UNIT – II

Numerical Differentiation, Integration and Solutions of Ordinary Differential Equations:
Numerical Differentiation: Numerical differentiation using Newton's Forward, Backward and Newton's divided difference formula.
Numerical Integration: Simpson's 1/3rd and 3/8th rule.
Numerical solution of ordinary differential equations: Taylor's series method, Euler's method and Runge-Kutta method (second and fourth order).

Practice(Using any computational tool):Solving problems on above methods.

UNIT – III

Random variables and Distributions:
Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance –Binomial, Poisson and Normal distributions.
Practice(Using any computational tool): Fitting Binomial and Poisson distributions

UNIT – IV

SamplingTheory:
Introduction –Population and Samples–Sampling distribution of Means and Variance – Central limit theorem (without proof) –Point and Interval estimations –Maximum error of estimate.
Practice(Using any computational tool): Plotting of confidence intervals

UNIT – V

Tests of Hypothesis:
Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors –Level of significance – One tail and two-tail tests – tests for large samples (Z - test for single mean, difference of means, single proportion, difference of proportions) – tests for small samples (t-test for single mean and difference of means)– F-test for comparison of variances-Chi Square test for attributes.
Practice(Using any computational tool): F- test and t- test.

Students are advised to use any computational / AI Tool like Wolfrum Alpha, Symbolab, Mathway, Desmos, Geogebra etc., for the practice

Text Books:

1	Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 5th Edition (9th reprint), 2021· ISBN978-8184875607
2	Miller and Freund's, Probability and Statistics for Engineers, 9/e, Pearson, 2020. ISBN 978-9353945237

Reference Books:

1	Fundamentals of Mathematical Statistics, S.C. Gupta and V.K.Kapoor, 12th edition, Sultan Chand & Sons Publications, 2020.ISBN 978-9351611738.
2	Higher Engineering Mathematics, H. K. Dass, Er. R. Verma, S-Chand publishers, 3rd edition 2023.ISBN 9788121938907

Web Links:

1	https://swayam.gov.in/nd1_noc19_ma21/preview
2	https://onlinecourses.nptel.ac.in/noc20_ge20/preview
3	https://onlinecourses.nptel.ac.in/noc21_ma74/preview
4	http://mathworld.wolfram.com/topics/ProbabilityandStatistics.html
5	https://www.khanacademy.org/math/statistics-probability

Solid State Physics

Common to CE, ME, Min.E, PT

	L	T	P	C
Course Code:2501PH01	**2**	**0**	**1**	**3**

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

CO1 Extend basic concepts of Elastic properties and bending of beams.

CO2 Understand the basics of crystals and their structures

CO3 Explain the basic concepts of Semiconductors and identify the type semiconductors using Hall effect.

CO4 Classify the magnetic materials based on behavior of substances

CO5 Summarize various types of electrical polarizations of dielectrics.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	-	-	1	1	-	-
CO2	2	1	-	-	-	-	-	1	1	-	-
CO3	2	1	-	-	-	-	-	1	1	-	-
CO4	2	1	-	-	-	-	-	1	1	-	-
CO5	2	1	-	-	-	-	-	1	1	-	-

Unit–I

Elasticity of Materials:

Stress – strain - Hooke's law – stress - strain curve – generalized Hooke's law with and without thermal strains for isotropic materials – different types of moduli and their relations – bending of beams – Bending moment of a beam – Depression of cantilever.

Practice:

1. Determination of rigidity modulus of a material by using Torsional Pendulum.
2. Determination of Young's Modulus of the material by method of single cantilever beam.
3. Determination of Moment of Inertia of a Fly Wheel.
4. Determination of Acceleration due to Gravity by using Compound Pendulum.

Unit–II

Crystal Structure and X-ray diffraction

Crystal Structure:

Lattice and Basis – Crystal Systems – Bravais Lattice - Unit cell – Packing fraction – coordination number- Miller indices – Separation between successive (h k l) planes- Applications.

X-ray Diffraction:

Bragg's law-Bragg's x-ray spectrometer – crystal structure determination by Laue's and powder method- Applications.

Practice:

1. Determine the crystal structure of the sample using data.

Unit–III

Semi-conductor Physics:

Origin of resistivity - Formation of energy bands in crystalline solids - classification of crystalline solids - Intrinsic semiconductors - Fermi level – extrinsic semiconductors - P-type and N-type -Dependence of Fermi energy on carrier concentration and temperature - Hall effect - Hall coefficient -Applications of Hall effect –Drift and Diffusion currents– Einstein's equation. – P-N junction diode -Zener Diode - Applications

Practice:

1. Study the relation between Temperature and resistance and finding the constants A & B of a thermistor.
2. Determine the resistivity of a semiconductor by four probe method.
3. Determination of V-I characteristics and Breakdown voltage of a Zener diode.
4. Determination of Energy band gap of a semiconductor by using P-N junction diode.
5. Determination of Frequency of electrically maintained tuning fork by Melde's apparatus.

Unit–IV

Magnetic materials:

Introduction –Magnetic dipole moment– Magnetization– Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Bohr magneton – Classification of magnetic materials: Dia, para & Ferro–Domain concept of Ferro magnetism Hysteresis–soft and hard magnetic materials–applications of Ferromagnetic material.

Practice:

1. Study the variation of magnetic field along the axis of a circular coil carrying current by using Stewart and Gee's apparatus.

Unit – V

Dielectric Materials:

Introduction – Dielectric polarization–Dielectric polarizability, Susceptibility, Dielectric constant - Relation between D, E, P- Types of polarizations –Electronic (Quantitative), Ionic(Quantitative) and Orientation polarizations (Qualitative) – Ferro electric materials - Frequency dependence of polarization - Applications.

Practice:

1. Determine dielectric constant of dielectric material using charge-discharge method.

Text Books:

1. A Text book of Engineering Physics, M N Avadhanulu, P G Kshirsagar & T.V.S.Arun Murthy S Chand &Company Ltd, 11th edition. **ISBN**: 81-219-0817-5
2. Engineering Physics, R K Gaur and S L Gupta, Dhanpat Rai Publications, ISBN**:** 978-8189928223
3. Physics for Engineers,T.Vijaya Krishna, Cengage publications, **ISBN**: 978-93-5350-755-8

Reference Books:

1. Engineering Physics,M.R.Srinivasan, New Age international publishers . **ISBN**: 978-1848290501
2. Text book of Engineering Physics, S. O. Pillai, New Age international publishers. **ISBN**: 9788122420753
3. Introduction to Solid State Physics, Charles Kittel, Wiley publications 8th edition) .**ISBN**: 978-1-119-45416-8

Web Links:

1. http://nptel.ac.in/courses/122107035/11
2. http://nptel.ac.in/courses/115102023/
3. https://phet.colorado.edu/en/simulations/category/physics
4. http://physicsgecg.blogspot.in/p/reading-materials.html

Engineering Chemistry

Common to CE, ME, Min.E, PT

	L	T	P	C
Course Code:2501CH01	**2**	**0**	**1**	**3**

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

CO 1 Apply the knowledge of water treatment and specifications of potable water

CO 2 Exemplify the principles of electrochemical cells and apply this knowledge to control corrosion

CO 3 Summarize the essence of polymers and fuels – for sustainable energy solutions

CO 4 Infer the preliminaries of engineering materials for industrial applications

CO 5 Explore the fundamentals of Nano materials and integrate Green Chemistry for promoting sustainability

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	1	-	-	1	-	1	1	-	-
CO2	3	-	-	-	-	-	-	1	1	-	-
CO3	3	-	1	-	-	1	-	1	1	-	-
CO4	3	-	-	-	-	1	-	1	1	-	-
CO5	3	1	-	-	-	2	-	1	1	-	-

UNIT - I

Water Technology:

Soft and hard water, Boiler troubles –Priming, foaming**,** scale and sludge, Caustic embrittlement, Industrial water treatment method (Zeolite and Ion-Exchange Process) – Internal treatment of water: Carbonate conditioning, Phosphate conditioning, Colloidal conditioning, Calgon conditioning.

Specifications of water for domestic use (ICMR and WHO); Domestic water purification – Candle filtration- activated carbon filtration; Disinfection methods- Ultra filtration, UV treatment, Ozonolysis, desalination of brackish water, reverse osmosis(RO)and electro dialysis.

Practice:

1. Determination of Hardness of a ground water sample
2. Determination of Chloride content in given water sample
3. Estimation of dissolved oxygen in given water sample

UNIT - II

Electrochemistry and Corrosion:

Electrodes– electrochemical cell, Nernst equation, cell potential calculations. Primary cells – Zinc-air battery, Secondary cells: Nickel-Cadmium (Ni-Cad), and lithium-ion batteries- Working principle of the batteries including cell reactions; Fuel Cells: Principle and working of hydrogen-oxygen Fuel cell.

Corrosion: Introduction to corrosion, Dry corrosion (Pilling Bed worth rule) electro chemical theory of corrosion (Mechanism), differential aeration cell corrosion, galvanic corrosion, Factors affecting the corrosion**,** cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

Practice

1. Conductometric titration of strong acid vs weak base
2. Potentiometric titration of red-ox
3. P^H-metric titration of Acid-Base

UNIT - III

Polymers and Fuel Chemistry:

Introduction to polymers, functionality of monomers, Thermo plastics and Thermo setting plastics-: Preparation, properties, and applications of PVC, and Bakelite.

Compounding of plastics: Injection molding, and Extrusion molding.

Biodegradable polymers: Introduction and their requirements.

Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels: Refining of petroleum, Octane and Cetane number, Alternative fuels: CNG, Ethanol and biodiesel.

Practice

1. Calorific value determination by Bomb Calorimeter.
2. Preparation of a Polymer (Bakelite)

UNIT - IV

Engineering Materials:

Composites-Definition, Constituents, Fiber reinforced composites, properties, and Engineering applications.
Refractories-Classification, Properties, Failures of Refractories and Applications.
Lubricants-Classification, Functions of lubricants, Properties of lubricating oils (Definition): Viscosity, Viscosity Index, Flash point& Fire point, Cloud point &Pour point and Applications of lubricants.
Building materials- Portland cement, constituents, Setting and Hardening of cement.

Practice

1. Determination of total acid number by potentiometric titration
2. Estimation of Calcium in port land Cement
3. Estimation of Saponification value of Fats/Oils

UNIT - V

Nano materials and Green Chemistry:

Nano Materials: Introduction to Nano materials, chemical synthesis of Nano materials: Sol-gel method, characterization of Nano materials by SEM and TEM (includes basic principle of SEM and TEM), Applications of Nano materials (waste water treatment, lubricants and engines).
Green Chemistry: Principles of Green Chemistry and applications of green chemistry.
Various green chemical approaches – Microwave synthesis, Bio catalyzed reaction (only explanation with examples).

Practice

1. Preparation of Nano particle by Green Synthesis method.

Text Books:

1. Prasanta Rath, S. Aruna Kumari Engineering Chemistry, CENGAGE Learning, 2024. (ISBN 978-93-5350-651-3)(ISBN 93-5350-651-4).

2. Shikha Agarwal , Engineering Chemistry Fundamentals and Applications, Cambridge 2nd Edition(ISBN 978-1-108-72444-9).

Reference Books:

1. H.F.W. Taylor, Cement Chemistry,Thomas Telford Publications, 2nd edition. (978-072-772-5929).
2. Dr S.S. Dara, Dr S.S. Umare, A Textbook of Engineering Chemistry, S. Chand Publication, 2022.(978-935-2-836-068).

Web Links:

1. https://nptel.ac.in/courses/105107207
2. https://nptel.ac.in/courses/113104082
3. https://nptel.ac.in/courses/113108051
4. https://archive.nptel.ac.in/courses/104/105/104105039/
5. https://nptel.ac.in/courses/118102003

Business Intelligence Lab

(Common to CE,EEE, ME, ECE,CSE, IT, AIML, CSE(DS), PT&Min.E)

	L	T	P	C
Course Code:2501IT01			**2**	**2**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Utilize Excel and Power BI for data analysis, visualization, and reporting.

CO2: Apply various data analysis techniques in Excel and Power BI to extract meaningful insights from datasets

CO3: Create clear and compelling visualizations using Excel and Power BI to communicate data-driven insights.

CO4: Develop data models in Power BI to organize and analyze data efficiently.

CO5: Design interactive dashboards in Power BI to facilitate data exploration and decision-making.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	-	-	2	-	-	-	1	1	1
CO2	2	3	-	-	2	-	-	-	1	1	2
CO3	2	2	-	-	2	-	-	-	1	1	2
CO4	1	2	1	-	2	-	-	-	1	1	2
CO5	1	2	1	-	2	-	-	-	1	1	2

Practice

1.Introduction to Excel

a. Overview of Excel and its capabilities for data analysis

b. Basics of Excel: Navigating the interface, entering data, formatting cells

c. Introduction to functions and formulas: SUM, AVERAGE, IF, VLOOKUP, etc.

d. Importing data into Excel from different sources: CSV, text files.

2. Data Analysis with Excel

a. Data manipulation techniques: Sorting, filtering, and grouping data

b. Advanced functions and formulas: INDEX/MATCH, SUMIFS, COUNTIFS, etc.

c. Data visualization with Excel: Creating charts and graphs

d. Using PivotTables for data summarization and analysis

3.Advanced Excel Features

a. Introduction to Excel tables and structured references

b. Working with named ranges and dynamic ranges

c. Excel data validation techniques

4. Introduction to Power BI

a. Overview of Power BI and its advantages over Excel for large datasets

b. Installing Power BI Desktop

c. Understanding the Power BI interface: Navigation, ribbons, and panes

d. Importing data into Power BI Desktop from various sources

5. Data Preparation in Power BI

a. Introduction to Power Query for data transformation

b. Cleaning, shaping, and filtering data in Power Query Editor

6.Data Preparation in Power BI

a. Combining data from different sources

b. Loading data into Power BI model.

7. Data Modeling in Power BI

a. Understanding relationships between tables

b. Creating calculated columns and measures using DAX

8.Data Modeling in Power BI

a. Introduction to DAX functions: CALCULATE, FILTER, RELATED, etc.

b. Working with date and time functions in DAX

9. Visualization Basics in Power BI

a. Creating basic visualizations: Bar charts, line charts, pie charts, etc.

b. Customizing visualizations: Formatting, titles, legends, etc.

10. Visualization Basics in Power BI

a. Using slicers and filters to interact with visualizations

b. Adding drill-down capabilities to visualizations

11. Advanced Visualizations and Dashboards in Power BI

a. Exploring advanced visualizations: TreeMap, Waterfall chart, KPIs, etc.

b. Creating custom visuals from the marketplace

12.Advanced Visualizations and Dashboards in Power BI

a. Designing effective dashboards: Layout, arrangement, and organization

b. Adding interactivity with bookmarks and drill-through

Additional Practice:

1. **Basic Data Analysis:** Import a dataset into Excel and perform basic data analysis tasks such as sorting, filtering, and creating simple charts to visualize the data.

2. **Expense Tracker:** Create a spreadsheet to track your expenses. You can have columns for date, item description, category, and amount. Use formulas to calculate totals and analyze your spending habits.

3. **Data modeling and extracting statistics from dataset:** Connecting Power BI to local data files and cloud servers (COVID19 dataset will be imported into the Power BI for visualization).

Text Books:

1	Learn Power BI - Second Edition: A comprehensive, step-by-step guide for beginners to learn real-world business intelligence 2nd Edition,ISBN: 9781801811958.
2	Power BI Beginner: Zero to Hero in Power BI Desktop by Philip Seamark, ISBN 1691641227.

Reference Books:

1	Power BI Quick Start Guide: Build dashboards and visualizations to make your data come to life by Devin Knight and Siddharth Mehta.
2	Learn Power BI: A Beginner's Guide to Analyzing Data and Creating Reports with Power BI by Murilo Miranda.

Web Links:

1	https://learn.microsoft.com/en-us/power-bi/
2	https://support.microsoft.com/en-us/excel
3	https://cce.sydney.edu.au/course/MSE1
4	https://cce.sydney.edu.au/course/PBBA

Engineering Workshop

(Common to CE,EEE, ME, ECE, PT&Min.E)

	L	T	P	C
Course Code: 2501ME03	**0**	**0**	**1**	**1**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Prepare various wooden joints.
CO2: Demonstrate various sheet metal models.
CO3: Develop the basic knowledge of house wiring.
CO4: Develop the basic knowledge of plumbing.
CO5: Practice various welded joints.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	1	-	-	-	1	1	2	1	-	1
CO2	1	1	-	-	-	1	1	2	1	-	1
CO3	2	2	-	-	-	1	1	2	1	-	1
CO4	1	2	-	-	-	1	1	2	1	-	1
CO5	2	2	-	-	-	1	1	2	1	-	1

Practice:

1. To make a T-Lap joint from the given wooden workpieces.
2. To make a dovetail lap joint from the given wooden workpieces.
3. To make a taper tray using the given sheet metal.
4. To make a funnel using the given sheet metal.
5. To make a square tin using the given sheet metal.
6. To connect three bulbs by using series and parallel connections.
7. To give connection to a bulb by using staircase wiring.
8. To prepare wiring for a tube light with switch control.
9. To prepare a PVC pipe joint by using the given circuit1.
10. To prepare a PVC pipe joint by using the given circuit2.
11. To make a butt joint using the given M.S pieces by arc welding.
12. To make a lap joint using given M.S pieces by arc welding

Additional Practice:

1. To make a cross lap joint from the given wooden workpieces.
2. To make an open scoop using the given sheet metal.
3. To make a T-joint using given M.S pieces by arc welding.

Text Books:

1. Work shop Manual ,P.Kannaiah & K.L.Narayana/ SciTech Publishers, 2nd edition, ISBN: 978-8183711302.
2. Elements of Workshop Technology ,Vol I by S.K. Hajra Choudhury, S.K. Hajra Choudhury & Nirjhar Roy, Media Promoters and Publishers Pvt. Limited, 14th edition. ISBN: 8185099146.

Reference Books:

1. Workshop Technology, Part 1, W.A.J. Chapman, 5th edition, ISBN 9780415503020.
2. Engineering Practices Lab Manual, T. Jeyapoovan& M. Saravanapandian, Vikas Publishing House Pvt. Limited, 4th edition, ISBN: 8125929037.
3. Engineering Practices Laboratory Manual, Ramesh Babu.V., VRB Publishers Private Limited, Chennai, Revised edition, 2019-20, ISBN: 978-81-935993-8.

Web Links:

1. https://bharatskills.gov.in
2. https://www.gopracticals.com/basic-engineering/workshop/

Engineering Graphics

(Common to CE,EEE, ME, ECE,CSE, IT, AIML, CSE(DS), PT&Min.E)

	L	T	P	C
Course Code: 2501ME01	**1**	**0**	**2**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Apply the principles of engineering drawing to construct Engineering curves
CO2: Construct projections of points and lines.
CO3: Demonstrate visualization skills of projections of planes.
CO4: Demonstrate visualization skills of projections of solids and development of surfaces
CO5: Construct isometric and orthographic views of simple solids.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	1	-	2	-	-	1	1	-	-
CO2	3	2	1	-	2	-	-	1	1	-	-
CO3	3	2	1	-	2	-	-	1	1	-	-
CO4	3	2	1	-	2	-	-	1	1	-	-
CO5	3	2	1	-	2	-	-	1	1	-	-

Practice:

1. **Introduction to Engineering Graphics**
   Introduction to AutoCAD, Dimensioning, elements of dimensioning, system of dimensioning, and Conventions in Drawing.

2. **Construction of Cycloids and Involutes**
   a) Construction of Cycloid, Epicycloid and Hypocycloid
   b) Involute of a pentagon and circle

3. **Introduction to Orthographic Projection**
   a) Principles of Projection
   b) Orthographic Projection – Four Quadrants.
   c) First angle & Third angle Projection with examples, reference plane, importance of reference lines or Plane.
   d) Projections of a point situated in any one of the four quadrants.

4. **Projection of straight lines-I:**
    a) Projections of straight lines parallel to both reference planes.
    b) Projections of straight lines perpendicular to one reference plane and parallel to other reference plane
    c) Projections of straight line parallel to one plane & inclined to another plane

5. **Projection of straight lines-II:**
    a) Projections of straight line inclined to both reference planes
6. **Projection of planes:**
    a) Regular planes perpendicular to both reference planes, Parallel to one reference plane and inclined to the other reference plane

    Ex: Rectangle, Pentagon, Hexagon and Rhombus

7. **Projection of planes**
    a) Projections of Planes inclined to both reference planes Ex: Rectangle, Pentagon, Hexagon and Rhombus.

8. **Projection of solids**
    a) Axis Perpendicular to H.P and Axis Perpendicular to V.P

    Ex: Pentagonal and Hexagonal Prisms, Pyramids, Cylinder and Cone
    b) Axis Parallel to H.P and V.P

    Pentagonal and Hexagonal Prisms, Pyramids, Cylinder and Cone

9. **Projection of solids**
    a) Projection of Solids with axis inclined to one reference plane and parallel to another plane

    Ex: Pentagonal and Hexagonal Prisms, Pyramids, Cylinder and Cone

10. **Development of Surfaces**
    a) Development of Prisms and Cylinder simple cases

11. **Development of Surfaces**
    a) Development of Pyramids and Cone simple cases

12. **Conversion of Isometric views to Orthographic views**
    a) Practice figure - 1
    b) Practice figure - 2

Additional Practice:

1. **Conversion of Isometric views to Orthographic views**
   a) Practice figure - 3
   b) Practice figure – 4
2. **Conversion of Orthographic views to Isometric views**
   a) Practice figure - 1
   b) Practice figure - 2

Text Books:

1. Engineering Drawing, N. D. Bhatt, Charotar Publishing House, 54th edition, 2024, ISBN : 9789385039706.
2. Engineering Drawing and Graphics , Venugopal, New Age Publications, 2nd edition, 2019, ISBN: 9788122515452.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2021,ISBN: 978-9385983177.
2. Computer Aided Engineering Graphics, T. Jeyapoovan,Vikas Publishing house, New Delhi, 1stEdition, 2023, ISBN : 9789356743199.

Web Links:

1. https://nptel.ac.in/courses/112103019/
2. https://academy.autodesk.com/authenticated-home-user
3. https://www.sciencedirect.com/book/9780080108391/engineering-drawing-from-thebeginning

Engineering Mechanics
Common to CE, ME & Min.E

	L	T	P	C
Course Code: 2501ME02	**2**	**1**	**1**	**4**

Course Outcomes:

CO1: Solve the resultant of force system using fundamental principles of force-couple system
CO2: Solve the efficiency of equilibrium force system involving friction using free-body diagrams
CO3: Solve the Centre of gravity and Moment of inertia of rigid bodies using Parallel axis theorem, Perpendicular axis theorem and Pappus theorems
CO4: Apply principle of Virtual work and analyze the trusses by Method of sections & Method of joints
CO5: Apply D'Alembert's principle, Work-energy and Impulse-momentum principles to solve Rectilinear and Curvilinear motion problems
CO6: Analyze the plane motion of a rigid body in translation and rotation

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	-	-	-	-	1	1	1	-	1
CO2	3	2	-	-	-	-	1	1	1	-	1
CO3	3	2	-	-	-	-	1	1	1	-	1
CO4	3	2	-	-	-	-	1	1	1	-	1
CO5	3	2	-	-	-	-	-	-	-	-	1
CO6	3	2	-	-	-	-	-	-	-	-	1

UNIT – I

Force systems:
Classification of Forces- Vectors and Tensors- Coplanar Concurrent Forces–Resultant–Moment of Force and its Application –Couple-Varignon's theorem- Resultant of Force Systems-Free-body diagrams and equilibrium- Components in Space(vector notation)
Practice:

1. Verification of Triangle Law, Parallelogram Law and Polygon's law
2. Verification of Law of moments by Rotation Disc
3. Verification of Law of moments by Bell Crank Lever
4. Finding the support reactions using Simply supported beam

UNIT – II

Friction :
Coefficient of friction-Angle of friction- Cone of friction- Coulomb's laws – Applications of Rolling friction, Belt-pulley, Brakes, Clutches, Screw jack, Wedge- Centroid and Center of Gravity :
Concept of Centroid and Centre of Gravity- Regular and Composite areas-Pappus theorems
Practice:

1. Finding Coefficient of friction on inclined plane
2. Find the efficiency of screw jack
3. Finding the Centre of gravity of plane areas
4. Finding the efficiency of pulley system

UNIT – III

Moment of Inertia:
Concept of Moment of Inertia - Parallel axis theorem- Perpendicular axis theorem- Rectangular and Polar Moment of inertia of composite areas- Radius of Gyration- Product of Inertia- Mass Moment of Inertia -Analysis of trusses by Method of Joints and Method of Sections- Principle of Virtual work
Practice:

1. Finding the Moment of inertia of Compound pendulum

UNIT – IV

Rectilinear and Curvilinear motion:
Introduction to Rectilinear motion- Curvilinear motion-Tangential and Normal components-Radial and Transverse Components- D'Alembert's principle -Principle of Work-Energy

UNIT – V

Impulse-Momentum:
Principle of Impulse and momentum - Lagrange's equation
Plane motion of rigid body:
Introduction to plane motion of a rigid body-Translation and rotation

Text Books:

1. Engineering Mechanics-Statics and dynamics, A.K.Tayal, Umesh publications, 14th Edition, ISBN: 9789380117386
2. A textbook of Engineering mechanics, R.K.Bansal. 4th Edition, Laxmi Publications, 2016, ISBN :978-8131800782.

Reference Books:

1. Engineering Mechanics-Statics and Dynamics , R.C.Hibbeler, 15th Edition, 2022, ISBN :9780137514724
2. Vector Mechanics for Engineers - Volume I ,Beer F.P. and Johnston E.R., Statics, Volume II -Dynamics, McGraw Hill, New York, ISBN 9789353166595

Web Links:

1. https://onlinecourses.nptel.ac.in/noc23_me74/unit?unit=17&lesson=18
2. https://ocw.mit.edu/courses/1-050-engineering-mechanics-i-fall-2007/

Construction Materials & Concrete Technology

	L	T	P	C
Course Code:2501CE01	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain the sources, properties, and applications of bricks and stones.
CO2: Demonstrate the properties of binding materials in construction.
CO3: Demonstrate various materials and admixtures required for concrete.
CO4: Analyse the basic properties of concrete and develop suitable mix-designs.
CO5: Demonstrate the properties of various special concrete.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	-	1	1	-	2	3	2	-	2
CO2	2	2	2	1	1	-	2	3	2	-	2
CO3	2	2	-	1	1	-	2	3	2	-	2
CO4	3	2	3	-	-	-	2			-	-
CO5	2	2	-	-	-	2	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	3
CO2	-	3
CO3	-	3
CO4	-	3
CO5	-	3

UNIT – I

Stones and Bricks :
Properties of building stones – Classification of stones – Stone quarrying – Precautions in blasting, Dressing of stone, Aggregates - Classification of aggregate- Tests conducted on aggregate. Composition of good brick earth, Various methods of manufacturing of bricks. Tests for good bricks as per IS code, including field tests, Special forms of Bricks and their uses.

Practice:

1.To determine the grading and fineness modulus of Coarse aggregate by sieve analysis.

2.To determine the specific gravity of coarse aggregate.

3.To find the grading and fineness modulus of fine aggregate (sand) by sieve analysis.

UNIT – II

Lime, Cement and Masonry:

Lime: Various ingredients of lime – Constituents of lime stone – Classification of lime – Various methods of manufacture of lime.

Cement: Portland cement- Chemical Composition – Hydration, Setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement, Bogue compounds - Manufacturing process of cement - Grades of cement - Uses of cement.

Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls.

Practice:

1.To find the normal Consistency and fineness of cement.

2.To determine the initial setting time and final setting time of cement.

3.To find the specific gravity and soundness of cement.

4.To determine the compressive strength of cement.

UNIT – III

Concrete Ingredients and Admixtures:

Cement - Fine aggregates and coarse aggregates. Overview –Chemical and mineral admixtures – additive – Plasticizers – Definition – Situation need high workability– Effects of plasticizer and Super plasticizers in fresh and hardened concrete- Accelerators – Accelerating Plasticizer-Retarders proofers–use–materials-Water-Fly ash -GGBS Metakaolin.

Practice:

1.Workability tests on concrete: Slump Cone test, Compaction factor test and Consistency test (VB Consistometer)

2.Mechanical properties of concrete: Casting of concrete cube, cylinder specimens, curing and testing.

UNIT – IV

Concrete Properties and Mix Design:
Fresh concrete – Workability –Workability tests-Segregation –Bleeding. Test on Hardened concrete. Density. Compressive strength – Affecting factors – Test procedure-Flexural strength – Central point load – Two-point load tests. Splitting tensile test-Stress-strain curve for concrete, Modulus of elasticity of concrete. Principle of mix design – Information required for mix design-Indian standard method of mix design- step by step mix design procedure-Mix design examples.

UNIT – V

Special Concretes:
SCC Materials-Workability requirement-Mix design-Test methods. Fibre reinforced concrete - Types of FRC- Application of FRC-Polymer impregnated concrete-Partially impregnated surface coated polymer concrete-Properties -Advantages – Applications-Blended cement concrete - Slurry infiltrated fibrous reinforced concrete (SIFCON) - Composition - Process - Application Bacterial concrete-Geopolymer concrete-Roller compacted concrete-Smart concrete-Recycled aggregate concrete-Reactive powder concrete- Engineered Cementitious Composites.

Additional Practice:

1. Water absorption test on bricks
2. Non-destructive test on concrete
3. Self compacting tests – L box, V Box, J ring.

Text Books:

1. Building Materials, S.K. Duggal, New Age International Publishers, 5th Edition. (ISBN: 978-9387788398)

2. Concrete Technology, Theory and Practice, Shetty, M.S, S. Chand & Company, New Delhi. (ISBN: 9789352533800)

Reference Books:

1. Building Materials, S.S.Bhavikatti, Vices publications House private ltd, 2nd edition. (ISBN: 9789325960442)

2. Properties of Concrete, Neville, A.M, Fifth Edition, Pearson. (ISBN: 978-8131791073)

Web Links:

1. http://nptel.ac.in/courses/105102088/
2. https://nptel.ac.in/courses/105102012
3. NPTEL Course: Concrete Technology: https://nptel.ac.in/courses/105102012/

Fluid Mechanics

	L	T	P	C
Course Code:2501CE02	**1**	**1**	**1**	**3**

Course Outcomes:

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

CO1: Apply physical properties of fluid in fluid related problem.
CO2: Apply principles of hydrostatic under fluid at rest.
CO3: Apply principles of fluid kinematics under fluid motion.
CO4: Apply principles of fluid dynamics to determine the measurement of flow.
CO5: Apply principles of fluid flow in a closed conduct to determine its head losses and other parameters and buoyancy phenomenon in fluid related problems.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	2	-	-	-	-	-	-	-	1
CO2	2	2	2	-	-	-	-	-	-	-	1
CO3	2	2	2	-	-	-	-	-	-	-	1
CO4	2	2	2	-	-	1	1	1	-	-	1
CO5	2	2	2	-	-	1	1	1	-	-	1

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

UNIT – I

Physical Properties of Fluids & Pressure Measurement:
Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility & Bulk modulus, Surface Tension and Capillarity, Vapour Pressure and Cavitation. Pascal's law, Variation of static pressure, Atmospheric, gauge and vacuum pressures, Simple manometers, Differential manometers.

UNIT – II

Hydrostatics:
Hydrostatic forces on submerged plane, horizontal, vertical, inclined, and curved surfaces – Center of pressure.

UNIT – III

Fundamentals of Fluid Flow:
Methods of describing fluid motion, Types of fluid flow, Description of the flow pattern, Continuity Equation (Cartesian Coordinates), Acceleration of a fluid Particle, Velocity potential, Stream Function, Streamlines, Equipotential lines and Flow Net, Use of the Flow Net, Limitations of Flow Net.

UNIT – IV

Dynamics of Fluid Flow:
Eulers Equation of Motion, Bernoulli's Equation from Euler's Equation, Practical Applications of Bernoulli's Equation: Venturi meter, Orifice Meter, Pitot tube, Momentum Equation, Moment of Momentum Equation.

Practice:
1. Verification of Bernoulli's Equation,
2. Determination of Coefficient of Discharge for Venturi Meter
3. Determination of Coefficient of Discharge for Orifice Meter,
4. Determination of Coefficient of velocity for Pitot tube

UNIT – V

Flow Through Pipes:
Reynolds Experiment, Laws of Fluid Friction - Darcy Weisbach Equation, Other Energy losses in Pipes, Pipes in Series, Equivalent Pipe, Pipes in Parallel.

Buoyancy:
Buoyancy, Centre of Buoyancy, Meta-Centre, Meta-centric Height, Analytical Method for Meta-Centre Height, Conditions of Equilibrium of a Floating and submerged bodies, Experimental Method of Determination of Meta-centric Height.

Practice:
1. Determination of flow by Reynolds Experiment
2. Determination of friction losses in Pipe flow
3. Determination of Minor losses in Pipe flow
4. Determination of Meta-centric Height

Text Books:

1. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education. (ISBN: 13-978-0195699630)
2. Hydraulics and Fluid Mechanics Including Hydraulics Machines Dr. P.N. Modi & S.M. Seth, Rajsons Publications Pvt. Ltd, 22nd Edition, 2022. (ISBN:13-9788189401269)

Reference Books:

1. Introduction to Fluid Mechanics, Edward J. Shaughnessy, Jr, Ira M. Katz, James P. Sehaffer, SI Edition, Oxford Higher Education. (ISBN: 978-0195677836)
2. Fluid Mechanics and Hydraulic Machines, Er. R K Rajput, S. Chand Publishers. (ISBN:13-978-9385401374)

Web Links:

1. http://nptel.ac.in/courses/105103095/
2. http://www.britannica.com

Strength of Materials-I

	L	T	P	C
Course Code:2501CE03	**2**	**0**	**2**	**4**

Course Outcomes:

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

CO1: Demonstrate the relationships between loads, member forces and deformations and material stresses and strains in structural members.

CO2: Build the shear force and bending moment diagram of beams under varying load and support conditions.

CO3: Determine the flexural and shear stresses in beams subjected to bending moment.

CO4: Analyze the deflections in beams under various loading and support Conditions.

CO5: Analyze the stresses in thick and thin cylinder.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	3	2	1	-	1	-	2	-	-	-
CO2	1	3	2	-	-	1	-	2	-	-	-
CO3	1	2	2	1	-	1	-	2	-	-	1
CO4	2	2	-	-	-	1	-	2	-	-	-
CO5	3	3	2	1	-	1	-	2	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	2
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

UNIT – I

Simple Stresses and Strains:
Elasticity and plasticity, Types of stresses and strains, Hooke's law, stress-straindiagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio and volumetric strain,Elastic constants and the relationship between them, Bars of varying section, composite bars, Temperature stresses, Principle of superposition.

Strain Energy:

Resilience, Gradual, sudden, impact loadings and simple applications.
Practice:

1. To estimate the mechanical properties of Mild Steel specimen under Tensile load by Direct Tension.
2. To estimate of Young's modulus of different beams of simply supported beams.
3. To estimate Young's modulus of cantilever beam.
4. To determine the Rigidity modulus of mild steel specimen by performing torsion test.
5. To determine the Brinell& Rock well hardness number of the given Specimen.
6. To find the impact strength of mild steel specimen by performing IZOD and Charpy Impact test.

UNIT – II

Shear Force and Bending Moment:
Definition of beam, Types of beams, Concept of shear force and bending moment, shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads, Point of contraflexure, Relation between S.F, B.M and rate of loading at a section of a beam.

UNIT – III

Bending and Shear Stress:
Bending Stress -Theory of simple bending, Assumptions, Derivation of bending equation, Neutral axis, Determination of bending stresses, section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections, Design of simple beam sections.

Shear Stress - Derivation of formulae, Shear stress distribution across various beam sections like rectangular,circular,triangular, I, T, anglesections and builtupbeams.
Practice:
1.To determine the ultimate shear strength of mild steel specimen test.
2. To find the strain of given sample by using electrical resistance strain gauge.

UNIT – IV

Deflection of Beams:
Bending into a circular arc, slope, deflection and radius of curvature, Differential equation for the elastic line of a beam, Double integration and Macaulay's methods, Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, uniformly distributed load, uniformly varying load, Mohr's theorems, Moment area method, application to simple cases.

Practice:
1.To determine the spring properties (stiffness and rigidity modulus) under tensile and compressive loads.
2.To determine Young's modulus of different continuous beams.

UNIT – V

Thin Cylinders, Thick Cylinders and Spherical Shells:
Thin Cylinder - Thin seamless cylindrical shells, Derivation of formulae for longitudinal and circumferential stresses, hoop, longitudinal and volumetric strains, changes in diameter, and volume of thin cylinders, Thinspherical shells.

Thick Cylinder -Introduction of Lame's theory for thick cylinders, Derivation of Lame's formulae, distribution of hoop and radial stresses across thickness, design of thick cylinders, compound cylinders, Necessary difference of radii for shrinkage, thick spherical shells.

Additional Practice:

1.To verify maxwell's reciprocal theorem on beams.

2.To perform shear test on given specimen.

3.To compare compressive strength of clay brick and reinforced cement concrete cube.

Text Books:

1. Mechanics of Materials, Ferdinand P. Beer, E. Russell Johnston, John T. DeWolf, David F. Mazurek, Sanjeev Sanghi, McGraw Hill, 8th Edition, 2020. (ISBN: 13-978-9390219421)
2. Strength of Materials, R.K.Rajput, S.Chand Publications, 6th edition.(ISBN: 13-978-9385401367)

Reference Books:

1. Strength of Materials, R.K.Bansal, Lakshmi Publications. (ISBN: 13-978-8131800003)
2. Strength of Materials, S.Ramamrutham, Dhanpatrai publishing company. (ISBN:9788187433545)

Web Links:

1. http://nptel.ac.in/courses/105105108/2
2. https://archive.nptel.ac.in/courses/105/105/105105108/
3. https://accessengineeringlibrary.com/maps/strength-of-materials

Engineering Geology

	L	T	P	C
Course Code:2501CE04	**2**	**0**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Sight the geo-morphological processes and formation of landscapes .
CO2: Perform megascopic identification of physical properties of rocks and minerals.
CO3: Familiarize on impacts of tectonic deformations in lithospheric zone.
CO4: Explain the concepts of groundwater hydrology and natural disasters caused by geological process.
CO5: Apply geological principles in selection of sites for construction of dams, reservoirs and tunnels.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	1	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	1	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	1
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

UNIT – I

Physical Geology and Geomorphological Process:
Introduction: Branches of Geology, Importance of Geology in Civil Engineering with case studies. Earth surface features and its internal structure.Geological Agents and their work in weathering and erosion with different rocks and landscapes on earth surface. River development process.

UNIT – II

Mineralogy:
Definitions of mineral, Different methods of study of minerals. The Megascopic identification of physical properties of minerals.

Practice 1 :
Megascopic Identification of Physical Properties of Minerals:

Common rock forming minerals are Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and other ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite and Bauxite.

Petrology:

Defenition of Rock & Rock cycle, origin and classification, structures, textures and forms of Igneous rocks, Sedimentary rocks and metamorphic rocks

Practice 2 :

Megascopic identification of physical properties of rocks , Granite varieties, (pink, gray, green Etc.,). Pegmatite, Dolerite, Basalt etc., Shale, varieties of Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate

UNIT – III

Structural Geology:
Structural Geology: Strike, Dip and Outcrop. Study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering.

Practice 3 : Simple strike & dip problems and marking formations in map.

UNIT – IV

Ground Water Hydrology:
Ground Water: Water table, Cone of depression, Geological controls of Ground Water Movement and types of aquifers, Ground Water Exploration Techniques Landslides.

Landslides: Classification of Landslides, Causes and Effects, measures to betaken to prevent their occurrence at Landslides.

Earthquakes: Terminology, Classification, causes and effects, Shield areas andSeismic bells, Richter scale intensity, Precautions of building constructions in seismic areas.

Practice 4 : Drawing of cross sections of the formations from geological maps.

UNIT – V

Geophysical Exploration Methods:
Geophysics: Importance, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, radiometric method Etc.,
Geology of Dams, Reservoirs and Tunnels:
Types and purpose of Dams, Geological considerations in the selection of a Dam site and Life of Reservoirs. Purpose of Tunneling, effects, Lining of Tunnels. Influence of Geology for successful Tunneling-case studies.

Practice 5:

1.Demonstration of Electrical Resistivity method and well logging.
2. Field work – To explore, identify and study on Mineral & Rock deposits, Geo-morphology & Structural Geology of an area and preparation of field trip report.

Text Books:

1. Engineering Geology, N. Chennakesavulu, Trinity Press (Laxmi Publications), 2nd Edition. (ISBN: 978-9380856278)
2. Engineering Geology, D. Venkat Reddy, Vikas Publishing House pvt Ltd, 1st Edition. (ISBN: 978-9325992351)

Reference Books:

1. Engineering Geology, Subinoy Gangopadhay, Oxford University Press Edition. (ISBN: 978-0198086352)
2. Engineering Geology, F G Bell, Butterworth-Heinemann Ltd; 2nd edition. (ISBN: 978-0750680776)

Web Links:

1. https://structuralgeology.stanford.edu/fundamentals-structural-geology
2. http://www.minsocam.org/MSA/collectors_corner/id/mineral_id_keyi1.htm
3. https://www.rockptx.com/

Geomatics Engineering

	L	T	P	C
Course Code:2501CE05	**1**	**1**	**2**	**4**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Determine linear and angular distances using chain, compass instruments.
CO2: Apply appropriate techniques to measure the level of existing ground.
CO3: Calculate height and distances using Theodolite and Tachometry.
CO4: Apply advanced surveying techniques and curve design in field projects
CO5: Determine regular, irregular areas and volumes of given field.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2		-	-		-	-	-	-	-	-
CO2	2	2	-	-		-	-	-	-	-	-
CO3	2	2	-	-	2	-	-	-	-	-	-
CO4	2	2	-	-	2	-	-	-	-	-	-
CO5	2	2	1	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

UNIT – I

Introduction To Surveying:
Surveying objectives, plane surveying principles and classification, Errors and Mistakes, Types of tapes and chains, offsets, Errors and Corrections.

Compass Surveying: Measurement of directions and angles, types of compass, meridians and bearings, local attraction, traversing.

Practice:

1. To find the area by chain survey (closed circuit).
2. Survey of an area by using compass survey (closed traverse).

UNIT – II

Plane Table Survey & Leveling:
Purpose-principle, accessories, orientation, methods of plane tabling, errors.
Leveling and Contouring: Concept and Terminology, Leveling Instruments and their temporary and permanent adjustments, method of leveling, Characteristics and Uses of contours.
Practice:

1. To find the area of given boundary by method of radiation (plane table survey).
2. To find the level difference by height of instrument method or rise and fall method. (Differential leveling).
3. To find the level difference along the length of the road (longitudinal section) and draw given road profile (fly leveling).

UNIT – III

Theodolite & Tachometric Surveying:
Theodolite, description, principles, uses and adjustments, temporary and permanent, measurement of horizontal and verticalangles, Trigonometric leveling.
Tachometric Surveying: Stadia and tangential methods of Tachometry, Distance and Elevation formulae for Staff vertical position.

Practice:

1. To determine the horizontal and vertical angles by method of repetition (Theodolite survey).
2. To find the height and distance problem by Trigonometric leveling (When base is accessible).

UNIT – IV

Curves & Advanced Surveying:
Curves: Types of curves, design and setting out simple circular curves by linear and angular methods, introduction to compound curves.

Advanced Surveying: Total station- Advantages and applications, Principle and types of EDM Instruments, Global positioning system, Introduction to Drone survey and LiDAR Survey (Light Detection and Ranging).

Practice:

1. Determination of area and perimeter by using total station.
2. To find the area of a given boundary by using drone survey.

UNIT – V

Computation of Areas and Volumes:

Area from field notes, computation of areas along irregular boundaries and area consistingof regular boundaries. Embankments and cutting for a level section- determination of the capacity of reservoir, volume of barrow pits.

Additional Practice:

1. To find the area of given boundary by method of intersection (plane table survey).
2. To determine the horizontal angles by method of reiteration (Theodolite survey).
   To find the distance between two inaccessible points by compass survey

Text Books:

1. Surveying (Vol.No.1,2&3), B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications (P) ltd. (ISBN : 13-978-8170088530)
2. Advance Surveying, Satish Gopi, R.SathiKumar and N.Madhu,Pearson Publications. (ISBN: 13-978-9352860722)

Reference Books:

1. Elements of Plane Surveying, Arthur R Benton and Philip J Taety, McGrawHill. (ISBN: 13-978-0070048843)
2. SurveyingVol1,(2&3), Arora KR, Standard Book House, Delhi.(ISBN:13-9788189401238)
3. PlaneSurveying, Chandra AM, New Age International Pvt.Ltd.,NewDelhi. (ISBN:13- 978-8122519023)

Web Links:

1. nptel.ac.in/courses/105104101/
2. http://www.nptelvideos.in/2012/11/surveying.html
3. http://nptel.ac.in/courses/105107158/17
4. nptel.ac.in/courses/105107122

Hydraulics & Hydraulic Machinery

	L	T	P	C
Course Code:2501CE06	**1**	**1**	**1**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Analyze uniform flow in open channels to compute most economical sectional properties.
CO2: Analyze surface profiles in non-uniform flow by basic dynamic equation for gradually varied flow.
CO3: Apply hydraulic similitude for model test.
CO4: Apply the principle of impact of jet on different vane.
CO5: Analyze working behavior and efficiencies of different hydraulic turbines and performance of centrifugal pump.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	2	-	-	-	-	-	-	-	-
CO2	2	2	2	-	-	1	1	1	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	1	1	1	-	-	-
CO5	3	2	2	1	-	1	1	1	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	1	-
CO3	2	-
CO4	2	-
CO5	2	-

UNIT – I

Flow In Open Channels :

Types of Flow in Channels, Geometrical Properties of Channels, Velocity Distribution, Most economical section, Specific Energy and Critical Depth, Momentum in Open channel Flow, Critical flow and its Computations.

UNIT – II

Non-Uniform Flow In Channels :
Dynamic Equation of Gradually Varied Flow, Relation between Sw and So, Classification of Channel Bottom Slopes, Classification of Surface Profiles, Characteristics of Surface Profiles, Hydraulic Jump

Practice:
1. Determination of Hydraulic jump

UNIT – III

Hydraulic Similitude and Dimensional Analysis :
Dimensions, Dimensional Homogeneity, Method of Dimensional Analysis, Model Investigation, Similitude, Force Ration, Similarity Laws.

UNIT – IV
Impact of Free Jets:
Force Exerted by Fluid Jet on (Stationary Flat Plate, Moving Flat Plate, Stationary Curved Vane, Moving Curved Vane), Torque Exerted on a Wheel with Radial Curved Vanes.

Practice:
1. Determination of coefficient of Impact on various vanes

UNIT – V

Hydraulic Turbines:
Elements of Hydroelectric Power Plants, Head and Efficiencies of Hydraulic Turbines, Classification of Turbines, Pelton Turbine and Francis Turbine (Work Done, Efficiencies, working proportions, Design), Radial Flow Impulse Turbine, Kaplan Turbine (Working Proportions), Working and components of both centrifugal pump & Reciprocating pump

Practice:
1. Determine the efficiency of Pelton wheel,
2. Determine the efficiency of Kaplan turbine
3. Determine the efficiency of Francis turbine,
4. Determine the efficiency of Centrifugal pump
5. Determine the efficiency of Reciprocating pump

Text Books:

1. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education. (ISBN: 13-978-0195699630).

2. Hydraulics and Fluid Mechanics including machines, Dr.P.N.Modi and Dr.S.M.Seth, Rajsons Publications Pvt. Ltd. (ISBN:13-9788189401269)

Reference Books:

1. Fluid Mechanics including Hydraulic machines, Dr. A.K.Jain, Khanna publishers. (ISBN: 13-978-8174091949).

2. Mechanics of Fluids, Merle C. Potter, David C. Wiggert and Bassem H. Ramadan. (ISBN:13-978-0495667735)

Web Links:

1. http://nptel.ac.in/courses/105106114
2. https://nptel.ac.in/courses/105107059

Geotechnical Engineering - I

	L	T	P	C
Course Code:2501CE07	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Identify different types of soils based on index properties
CO2: Determine the permeability of different types of soils
CO3: Utilize the elastic solutions to evaluate the distribution of stresses within the soil mass
CO4: Evaluate the compaction and consolidation characteristics of soil
CO5: Determine the shear strength parameters of soils under different drainage conditions

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2		2							
CO2	3	3		3							
CO3	3	3		2							
CO4	3	3	1	3							
CO5	3	3	1	3							

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	3	
CO3	3	
CO4	3	
CO5	3	

UNIT – I

Introduction :
Soil formation - soil structure and clay mineralogy - Adsorbed water - Multi phase soil system - Phase relationships - Index and physical properties - Classification for engineering purposes -UCS and IS Classification system.
Practice:
1.Determination of Specific Gravity using a Density Bottle and Pycnometer.
2.Determination of Consistency Limits – (i) Liquid Limit (ii) Plastic Limit and (iii) Shrinkage Limit.
3.Determination of Grain Size Distribution using Dry Sieve Analysis and Hydrometer.

UNIT – II

Soil Water and Permeability :
Soil water - Capillarity - Permeability – Darcy's Law - factors affecting permeability - measurement in the laboratory and field. Seepage, - Introduction to flow nets – piping - uplift pressure. Simple problems.
Practice:

1.Determination of Permeability using (i) Constant Head Method and (ii) Falling Head Method.

UNIT – III

Stress Distribution In Soils :
Effective stress concepts in soils - Stress distribution in soil media - Bousinessq's analysis for Point, Circular and Rectangular loads - Westergaard's analysis for point and circular loads – Isobars - Newmark's Chart – 2:1 stress distribution method.

UNIT – IV

Compaction and Consolidation:
Soil compaction – Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control – laboratory (light and heavy compaction) and field compaction methods –CBR .
Compressibility – Compressibility constants - Consolidation - Components of settlement Immediate and consolidation settlement - Terzaghi's one-dimensional consolidation theory – Laboratory method - Methods to determine co-efficient of consolidation.
Practice:

1.Determination of Field Unit Weight using Core Cutter and Sand Replacement Method
2.Determination of maximum dry density and optimum moisture content using the Standard Proctor Compaction test.

UNIT – V

Shear Strength:
Shear strength of cohesive and cohesionless soils - Mohr-Coulomb failure theory - saturated soil mass - Measurement of shear strength, direct shear - Triaxial compression, unconfined compression test and Vane shear test - Pore pressure parameters – various drainage conditions.

Practice:

1.Determination of shear strength parameters using the Direct Shear test.

2.Determination of shear strength parameters using Unconfined Compression test.

3.Determination of shear strength parameters using the Vane Shear test.

4.Determination of shear strength parameters using Triaxial test.

Additional Practice:

1. Determination of suitability of subgrade using California Bearing Ratio.
2. Determination of Consolidation Co-efficient using Oedometer

Text Books:

1. Soil Mechanics and Foundation Engineering Geotechnical Engineering Series Murthy,V.N.S , CBS. (ISBN: 13-978-8123913971)

2. Basic and applied soil mechanics , Gopal Ranjan, and A. S. R. Rao, New Age International, 3rd edition. (ISBN: 13-978-8122440393)

Reference Books:

1. Fundamentals of geotechnical engineering , Braja M. Das and Nagaratnam Sivakugan, Cengage India Private Limited, 5th edition. (ISBN: 13-978-9386858139)
2. Soil Mechanics and Foundation Engineering , Arora K.R., Standard publisher, 2020. (ISBN: 13-978-8180141126)
3. Soil Mechanics and Foundations , Punmia, B.C., Laxmi Publications Pvt. Ltd. New Delhi. (ISBN: 13-978-8170087915)

Web Links:

1. https://nptel.ac.in/courses/105103097/
2. https://nptel.ac.in/courses/105106142/

Strength of Materials-II

	L	T	P	C
Course Code:2501CE08	**2**	**1**	**0**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Calculate the complex stresses in engineering components.
CO2: Determine the effect of torsion on springs and shafts.
CO3: Determine the load carrying capacity of columns.
CO4: Determine the combined effect of direct and bending stresses on engineering Structures.
CO5: Analyze the stresses in unsymmetrical bending structure.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	2	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

UNIT – I

Complex Stresses and Theories of Failures:
Complex Stress - Introduction, stresses on an inclined plane under axial loading, compound stresses, normal and tangential stresses on an inclined plane for biaxial stresses, two perpendicular normal stresses accompanied by a state of simple shear, principal stresses and strains, mohr's circle of stresses, analytical and graphical solutions.

Theories of Failures:
Introduction, various theories of failures like maximum principal stress theory, maximum principal strain theory, maximum shear stress theory, maximum strain energy theory, maximum shear strain energy theory.

UNIT – II

Torsion of Circular Shafts And Springs:
Torsion of Circular Shaft - Theory of pure torsion, derivation of torsion equations: $T/J = q/r = N\phi/L$, assumptions made in the theory of pure torsion, torsional moment of resistance, polar section modulus, power transmitted by shafts, combined bending and torsion and end thrust, design of shafts according to theories of failures.

Springs - Introduction, types of springs, deflection of close and open coiled helical springs, springs in series and parallel, leaf or laminated springs.

UNIT – III

Columns:
Introduction, types of columns, axially loaded compression members, crushing load, Euler's theorem for long columns, assumptions, derivation of Euler's critical load formulae for various end conditions, Equivalent length of a column, slenderness ratio, Euler's critical stress, limitations of Euler's theory, Rankine - Gordon formula, long columns subjected to eccentric loading, secant formula, empirical formulae, straight line formula, Prof. Perry's formula.

UNIT – IV

Combined Stresses:
Stresses under the combined action of direct loading and bending moment, core of a section, determination of stresses in the case of chimneys, retaining walls and dams, conditions for stability.

UNIT – V

Unsymmetrical Bending and Shear Centre:
Unsymetrical Bending - Introduction, centroidal principal axes of section, graphical method for locating principal axes, Moments of inertia referred to any set of rectangular axes, stresses in beams subjected to unsymmetrical bending, principal axes, Deflection of beams under unsymmetrical bending.

Shear Centre - Introduction, shear centre for symmetrical and unsymmetrical (Channel, I, T and L) sections.

Text Books:

1. Mechanics of Materials, Ferdinand P. Beer, E. Russell Johnston, John T. DeWolf, David F. Mazurek, Sanjeev Sanghi, McGraw Hill, 8th Edition, 2020. (ISBN: 13-978-9390219421)
2. A Text book of Strength of materials, R.K. Bansal, Laxmi Publications (P) Ltd, 2018. (ISBN: 10-9788131808146)

Reference Books:

1. Strength of Materials, U C Jindal, Pearson Publications. (ISBN:9789332501232)
2. Mechanics of Materials, B.C. Punmia, Laxmi Publications (P) Ltd. (ISBN:13-978-8170082156)

Web Links:

1. http://nptel.ac.in/courses/105105108/2
2. https://archive.nptel.ac.in/courses/105/105/105105108/
3. http://www.nptelvideos.com/mechanical/strength_of_materials.php

Structural Analysis

Course Code:2501CE09	L	T	P	C
	2	1	0	3

Course Outcomes:

At the end of the course, student will be able to:

CO1: Analyze propped cantilever beams and apply the slope deflection method to determine SFD and BMD.
CO2: Apply the moment distribution methods and Clapeyron's theorem of three moments to analyse the beams and frames.
CO3: Draw the influence lines for reactions, shears and bending moments in beams due to moving loads.
CO4: Analyse two-hinged and three-hinged arches for different loading conditions.
CO5: Apply the flexibility and stiffness matrix methods to analyse the beams.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	-	-	-	-	-	-	-	-	-
CO2	2	2	1	1	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-
CO5	3	3	1	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	1	-

UNIT – I

Propped Cantilevers and Slope Deflection Method:
Propped Cantilever - Analysis of propped cantilever beams- Shear force and bending moment diagrams, Deflection of propped cantilevers.

Slope Deflection Method - Kinematic indeterminacy - Derivation of slope-deflection equation, application to continuous beams and analysis of single bayportal frames without sway.

UNIT – II

Moment Distribution Method and Clapeyron's Theorem of Three Moments:
Moment Distribution Method - Stiffness and carry-over factors – Distribution factors - Analysis of continuous beams – Analysis of single bayportal frames without sway.

Clapeyron's Theorem of Three Moments -Analysis of continuous beams with and without supports settlement, shear force and bending moment diagrams.

UNIT – III

Influence Lines :
ILD for shear, moment and reactions for cantilever and simply supported beams.

Moving Loads :
Moving loads on simply supported beams –single and several points' loads – maximum bending moment and maximum shear force – equivalent UDL - absolute maximum bending moment.

UNIT – IV

Two-Hinged Arches:
Introduction – Types of Arches – Analysis of two hinged Arches. Linear Arch. Eddy's theorem.

Three-Hinged Arches:
Analysis of Three hinged arches. Geometrical properties of parabolic and Semi circular arch. Absolute maximum bending moment diagram for a three hinged arch.

UNIT – V

Flexibility Matrix Method :
Introduction - application to continuous beams (maximum of two unknowns) including Support settlements.

Stiffness Matrix Method:
Introduction - application to continuous beams (maximum of two unknowns) including support settlements. (MATLAB Demo).

Text Books:

1. Structural Analysis 1, Bhavikatti S. S, Vikas Publishing House, Noida.(ISBN: 978-8125942696)
2. Theory of Structures, Punmia, B.C, Ashok kumar Jain & Arun Kumar Jain, Laxmi Publications, India. (ISBN: 9788170086185)

Reference Books:

1. Theory of structures, Dhanpat Rai publications. (ISBN: 978-9384378103)
2. Structural Analysis, Hibbeler, R.C, Pearson India. (ISBN: 978-9332586147)

Web Links:

1. http://nptel.ac.in/courses/105101085/
2. https://lecturenotes.in/subject/154/structural-analysis-1
3. https://www.vidyarthiplus.com/vp/thread-35607.html#.Wsx43ohuZPY

Geotechnical Engineering - II

	L	T	P	C
Course Code:2501CE10	**2**	**1**	**0**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Prepare the soil investigation report based on the suitable soil exploration method

CO2: Determine the allowable bearing capacity for various types of shallow foundation

CO3: Determine the allowable bearing pressure and settlement for various types of shallow foundation

CO4: Calculate the load-carrying capacity of piles and well foundations

CO5: Analyze various types of stability failures in earth-retaining structures

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	3	1	3							
CO2	3	3	2	1							
CO3	3	3	2	2							
CO4	3	3	3	2							
CO5	3	3	3	2							

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	
CO2	3	
CO3	3	
CO4	3	
CO5	3	

UNIT – I

Soil Exploration:
Need – Methods and depth of soil exploration – Factors affecting the depth and location of foundation - Boring and Sampling methods – Field tests – Penetration tests – Pressure meter – Planning of program and preparation of soil investigation report.

UNIT – II

Shallow Foundations – Bearing Capacity Criteria:
Types of foundations and factors to be considered in their location – Bearing capacity – Types of bearing capacity of shallow foundation - factors influencing bearing capacity – analytical methods to determine bearing capacity – Terzaghi's theory – IS Methods.

UNIT – III

Shallow Foundations – Settlement Criteria:
Safe bearing pressure based on N-value – Allowable bearing pressure – Safe bearing capacity and settlement from plate load test – Types of foundation settlements and their determination – Allowable settlements of structures – Raft foundation in sand and clay.

UNIT – IV

Pile Foundations and Well Foundations :
Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae – Pile capacity based on empirical relations – Pile load tests – Load carrying capacity of pile groups in sands and clays – Settlement of pile groups. Types – Different shapes of well – Components of well – Functions – Forces acting on well foundations – Construction and sinking of wells – Tilt and shift.

UNIT – V

Earth Retaining Structures and Slope Stability:
Types of retaining walls - Rankine's and Coulomb's theory of Earth pressure – Culmann's graphical method for active earth pressure. Infinite and finite earth slopes in purely cohesionless and cohesive soil – Types and causes of slope failures – Factor of safety – Stability analysis by method of slices – Friction circle method – Taylor's method.

Text Books:

1. Basic and Applied Soil Mechanics, Gopal Ranjan and A.S.R.Rao, New Age International Publishers. (ISBN: 13-978-8122440393)

2. A Textbook of Soil Mechanics and Foundation Engineering by K.R.Arora, Standard Publishers & Distributors, 2020. (ISBN: 13- 978-8180141126)

Reference Books:

1. A Textbook of Soil Mechanics and Foundations B.C.Punmia, Laxmi Publications. (ISBN: 13-978-8170087915)
2. Foundation Analysis & Design, Bowles & J.E, McGraw-Hill. (ISBN: 13-978-0071188449)

Web Links:

1. https://nptel.ac.in/courses/105/105/105105176/
2. https://nptel.ac.in/courses/105/101/105101083/
3. https://nptel.ac.in/courses/105/108/105108069/

Environmental Engineering

	L	T	P	C
Course Code:2501CE11	**2**	**0**	**2**	**4**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Apply basic principles of protected water supply system for a town or city.

CO2: Illustrate multiple treatment methods based on characteristics of raw water and distribution of treated water.

CO3: Interpret different treatment technologies of wastewater based on characteristics of sewage.

CO4: Identify an appropriate secondary and tertiary treatment method of Sewage.

CO5: Demonstrate the concepts of sludge management, disposal methods and recycling treated water.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	-	1	-	-	2	2	-	-	1	1
CO2	2	2	2	1	-	2	2	-	-	-	-
CO3	2	2	1	1	-	2	3	-	-	-	-
CO4	2	2	2	1	-	2	2	-	-	-	-
CO5	2	-	3	-	-	2	3	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	2
CO2	-	1
CO3	-	3
CO4	-	1
CO5	3	1

UNIT – I

Introduction To Protected Water Supply System:
Importance and Necessity of Protected Water Supply systems, Water borne diseases, Flow chart of public water supply system, Estimation of water demand for a town or city, Per capita Demand and factors influencing it - Types of water demands and its variations factors affecting water demand, Design Period, population forecast, Sources of water, Intakes, conveyance of raw water.

UNIT – II

Raw Water Treatment and Distribution:
Water Quality Index –Calculation-Flow chart of water treatment plant, Treatment methods, Theory and Design of Sedimentation, Coagulation, Filtration, Theory of disinfection, Chlorination and other Disinfection methods, Methods of Distribution system, Layouts of Distribution networks, Analysis of Distribution networks, Components of Distribution system.

Practice:

1. To determine the physical properties of the given water samples (colour, odour, temperature and turbidity).
2. To determine pH and acidity of the given water samples
3. To determine total alkalinity of the given water samples
4. To estimate the total, calcium and magnesium hardness in the given water samples
5. To determine total dissolved solids (TDS) and electrical conductivity (EC) of The given water sample.
6. To determine optimum coagulant dose needed in water treatment using Jar test.
7. To estimate the amount of dissolved oxygen (DO) content and biochemical oxygen demand (BOD) of the given water and wastewater samples respectively.

UNIT – III

Sewage Characteristics and Treatment Methods:
Systems of sanitation, relative merits & demerits, collection and conveyance of wastewater, Classification of seweragesystems, Estimation of sewage flow and stormwater drainage, fluctuations,Types of sewers, Hydraulics of sewers and storm drains, Design of sewers, appurtenances in sewerage, Types of pumps and their suitability with regard to wastewaters, Sampling of wastewater, Physical, Chemical and Biological Examination of sewage, Primary treatment, Screens, Grit chambers, Floatation, Design of Preliminary and Primary treatmentunits.

Practice:

1. To determine the total settleable solids present in the given water sample using Imhoff cone setup
2. To determine the chemical oxygen demand (COD) of the given waste water sample.
3. To determine the total nitrogen and phosphorous content present in the given waste water sample.

UNIT – IV

Secondary and Tertiary Treatment Methods:

Aerobic and anaerobic treatment process comparison, Activated Sludge Process, principles, designs, and operational problems, Oxidation ponds, Trickling Filters– mechanism of impurities removal, classification, design, operation and maintenance problems, RBCs, Fluidized bed reactors, Removal of Nitrogen and Phosphorus, Septic Tanks and Imhoff tanks.

UNIT – V

Sludge Management and Recycling of Treated Water:

Characteristics of sludge, handling and treatment of sludge-thickening, Anaerobic digestion of sludge, Sludge drying beds, Methods of disposal, Disposal into water bodies, Oxygen Sag Curve, Disposal into sea, Disposal on land, Sewage thickness, Importance of Recycling, Indirect and Direct methods of recycling.

Additional Practice:

1. To determine the total iron content of the given water sample.
2. To determine the chloride content in the given water sample.

Text Books:

1. Water Supply Engineering, B.C.Punmia, Laxmi Publications, (ISBN: 9788170080923)
2. Water Supply and Sanitary Engineering, G.S.Birdie, and J.S.Birdie, DhanpatRai Publishing Company, (ISBN: 139788187433798)

Reference Books:

1. Environmental Engineering Vol1 Water supply Engineering, S.K.Garg, Khanna Publications. (ISBN: 9788174091208)
2. Environmental Engineering Vol2 Water supply Engineering, S.K.Garg ,Khanna Publication. (ISBN: 13978-8174091208)
3. Environmental Engineering, Howard S Peavy, Donald R Rowe, George Tchobanoglous, Mc Grawhill.(ISBN: 9780070491342)

Web Links:

1. https://archive.nptel.ac.in/courses/105/105/105105178/
2. https://www.coursera.org/learn/water

Transportation Engineering

Course Code:2501CE12

L	T	P	C
1	1	1	3

Course Outcomes:

At the end of the course, student will be able to:

CO1: Outline the importance of highway engineering in India
CO2: Design the geometric parameters of highway.
CO3: Determine the characteristics of traffic flow.
CO4: Analyze and Design of Pavements.
CO5: Explain the basic concepts of pavement construction techniques and maintenance.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	1	-	-	-	-
CO3	3	2	3	-	-	-	1	-	-	-	-
CO4	3	2	3	-	-	-	1	-	-	-	-
CO5	2	1	1	1	-	1	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	-
CO2	3	-
CO3	3	-
CO4	3	-
CO5	1	-

UNIT – I

Highway Planning:
Different modes of transportation, Characteristics of Road Transportation, Highway Development plans in India, Classification of Roads, Network patterns. Principles of highway alignment, requirements and controlling factors. Engineering surveys for alignment.

UNIT – II

Highway Geometric Design:
Factors affecting geometric design, Design controls and Criteria, Highway Cross Section Elements, Sight Distance Elements, Stopping Sight Distance, Overtaking Sight Distance and intermediate Sight Distance, Design of Horizontal Alignment, Design of Super elevation and Extra widening, Design of vertical alignment - gradients, summit and vertical curves.

UNIT – III

Traffic Engineering:
Basic parameters of traffic volume, speed and density, Traffic volume studies, Traffic signs and road markings, objectives, classification and uses. Principles of design of at- grade intersections, channelized, rotary and signalized intersections, Introduction to grade separated interchanges.

UNIT – IV

Pavement Materials and Design:
Desirable properties of subgrade soil, road aggregates and bituminous materials – Tests on Aggregate and Bitumen- Pavement components and their functions- Factors influencing the design of pavements - Design of flexible and rigid pavements as per IRC.

Practice:
1.To determine the crushing value of aggregates
2.To determine the impact value of aggregates
3.To determine the Flakiness index and elongation index of aggregates
4.To determine the Penetration value and Softening point of bitumen
5.To determine the Ductility value of bitumen

UNIT – V

Pavement Construction and Maintenance:
Construction of gravel, WBM, bituminous and cement concrete roads. Pavement failures - Types and causes of failures in flexible and rigid pavements. Maintenance of highway pavements. Strengthening of existing pavements - evaluation, overlay design. Recycling of pavements.

Text Books:

1. Traffic Engineering and Transport Planning, Kadiyali, L.R., Khanna Publishers, 2018, Ninth Edition.(ISBN: 13-978-8174092205)
2. Highway Engineering, S. K. Khanna & C.E.G. Justo, Nemchand & Bros,10th edition. (ISBN:9788185204321)

Reference Books:

1. Principles of Transportation Engineering, Chakroborty, P. and Animesh Das., Prentice Hall of India Pvt. Ltd, New Delhi, India,Second Edition. (ISBN: 13-9788120353459)
2. Transportation Engineering: An Introduction, Jotin Khisty C., and B. Kent Lall., Prentice Hall of India Pvt. Ltd, New Delhi, India, Third Edition. (ISBN: 13-978-9332569706)
3. Principles of Pavement Design, Yoder E.J. and M.W. Witczak., Second Edition, John Wiley and Sons, New York, USA. (ISBN: 13-978-0471977803)

Web Links:

1. https://archive.nptel.ac.in/courses/105/101/105101087/
2. https://archive.nptel.ac.in/courses/105/105/105105215/
3. https://nptel.ac.in/courses/105104098

Estimating and Costing

	L	T	P	C
Course Code:2501CE13	**3**	**0**	**0**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Outline the preparation of an approximate and detailed estimation of buildings.
CO2: Prepare rate analysis for different items in civil engineering works.
CO3: Estimate the earthwork quantities for roads, canals, and steel quantity in RCC elements
CO4: Apply principles of estimation for the valuation of buildings.
CO5: Apply appropriate method to estimate different items in buildings.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	1	-	-	-	-		-	-	1	-
CO2	3	3	-	-	-	-	2	-	-	2	-
CO3	3	3	-	-	-	-		-	-	2	-
CO4	2	2	-	-	-	-	-	-	-	2	-
CO5	3	3	-	-	-	-	-	-	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	-
CO2	1	-
CO3	1	-
CO4	-	-
CO5	1	-

UNIT – I

Methods of Estimates:
General items of work in building – standard units –principles of working out quantities for approximate, detailed and abstract estimates –methods of estimates of buildings.
Specifications. Necessity, Types of specifications, Specifications for different civil engineering materials.

UNIT-II

Rate Analysis:
Quantity of materials per unit rate of work, Labour estimate, Scheduled of rates – lead statement - Analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works.

UNIT – III

Road Estimates:
Volume of earthwork, Different methods, Earthwork for roads, earthwork in canals. Quantity Estimation for Structural Steel , Estimate of R.C.C and structural Steel - Scheduling - Slab - beam-column.

UNIT – IV

Valuation :
Purpose, Difference between value and cost, Qualifications and functions of a valuer, Scrap & salvage value, Sinking fund, and Capitalized value.

UNIT – V

Quantity Estimation For Building:
Estimation of building - Short wall and long wall method - Centre line method - Load-bearing structures and framed structures.

Text Books:

1. Estimating and Costing in Civil Engineering: Theory and Practice Including Specifications and Valuation , B.N. Dutta, published by UBS Publishers in 2020. (ISBN: 978-8194194801)

2. A Textbook of Estimating and Costing for Civil Engineering, G.S. Birdie, published by Dhanpat Rai Publishing Company. (ISBN: 978-8187433172)

Reference Books:

1. A Textbook of Estimating and Costing (Civil) , D.D. Kohli and R.C. Kohli, published by S Chand Publishing, (ISBN: 978-8121903245)

2. Estimating, Costing and Valuation, Rangwala, Charotar Publishing House Pvt.Ltd.(ISBN: 978-9385039261)

Web Links:

1. https://www.udemy.com/course/estimating-and-costing/
2. https://nptel.ac.in/courses/105103093/15
3. https://esub.com/4-types-construction-contracts/

Design of Reinforced Concrete Elements

	L	T	P	C
Course Code:2501CE14	**2**	**1**	**0**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain design philosophies of reinforced concrete members and concepts of Limit state method.
CO2: Design RC beams by limit state of flexure
CO3: Design RC beams subjected to shear, torsion, and bond.
CO4: Design various types of reinforced concrete compression members.
CO5: Design various isolated Footings, slabs and stair case.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	3	-	-	1	-	-	-	-	-
CO2	2	1	3	-	-	1	2	-	-	-	-
CO3	2	1	3	-	-	1	2	-	-	-	-
CO4	2	1	3	-	-	1	2	-	-	-	-
CO5	2	1	3	-	-	1	2	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	3	-
CO3	3	-
CO4	3	-
CO5	3	-

UNIT – I

Introduction:
Design philosophies, Design codes and handbooks, loading standards, working stress method design constants- Concepts of limit state design.

Design For Flexure:
Limit state analysis and design of singly and doubly reinforced sections- effective depth- Flanged beam sections.

UNIT – II

Design For Shear, Torsion and Bond:
Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length. Limit state design for serviceability.

UNIT – III

Design of Compression Members:
Design of short and long columns – under axial loads, uni- axial bending and biaxial bending – Braced and un-braced columns, Circular column with helical reinforcement.

UNIT – IV

Footings:
Design of isolated and footings - rectangular footings subjected to axial loads, uni- axial and bi-axial bending moments.

UNIT – V

Slabs & Staircase:
Classification of slabs, design of one-way slabs and two - way slabs, using IS Coefficients (conventional).

Design of Staircase
Design of waist slab staircase.

Text Books:

1. Design of Reinforced Concrete Structures, Krishna Raju N., 4th Edition, CBS Publisher, 2019. (ISBN: 978-8123909899)

2. Reinforced Concrete Structures, S. Unnikrishna Pillai & Devdas Menon, Tata McGraw Hill, New Delhi.(ISBN: 9789354601026)

Reference Books:

1. Design of Concrete Structures, Dolan CW, Darwin D., Nilson AH, McGraw-Hill. (ISBN: 978-0073293493)
2. IS 456 Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards.
3. SP 16: 1980 Design Aids for Reinforced Concrete to IS 456: 1978, Bureau of Indian Standards.

Web Links:

1. https://nptel.ac.in/courses/111/107/111107105/
2. https://nptel.ac.in/courses/111/105/111105041/

Design of Steel Structures

	L	T	P	C
Course Code:2501CE24	**2**	**1**	**0**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain design philosophies of steel structures and types of steel connections.
CO2: Design Bolted & Welded connections for steel members.
CO3: Design Steel members subjected to Flexure, Tension and Compression.
CO4: Design slab base and gusset base for column.
CO5: Design Welded Plate Girder and Gantry Girder.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	-	3	-	-	1	-	-	-	-	-
CO2	2	1	3	-	-	1	2	-	-	-	-
CO3	2	1	3	-	-	1	2	-	-	-	-
CO4	2	1	3	-	-	1	2	-	-	-	-
CO5	2	1	3	-	-	1	2	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	3	-
CO3	3	-
CO4	3	-
CO5	3	-

UNIT – I

Connections :
Introduction – Properties of structural steel – IS Rolled steel sections - Lap and Butt connections - Eccentric connections.

Welded Connections:
Introduction - Strength of welds - Butt and fillet welds - Design of Butt and fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.

UNIT – II

Beams:
Design of simple and compound beams - Curtailment of flange plates - Beam to beam connection -Design of laterally supported and unsupported beams.

UNIT – III

Tension & Compression Members:
Introduction to different modes of failures – Design strength - Design of tension members.
Design of compression members - Design of built-up sections (Laced and Battened Columns)- Column splicing.

UNIT – IV

Column Foundations:
Introduction - Design of slab base - Design of gusset base- Column bases subjected to moment.

UNIT – V

Girders :
Design of plate girder - Welded -curtailment of flange plates and stiffeners. Design of Gantry girders.

Text Books:

1. Design of steel structures, S.K. Duggal, Tata McGraw Hill, and New Delhi, 2019.(ISBN: 978-0070260689)
2. Design of steel structures, S.S.Bavakatti, I.K.International Publishing House Pvt. Ltd. (ISBN: 978-9382332091)

Reference Books:

1. Structural Design in Steel, Sarwar AlamRaz, 3rd Edition, New Age International Publishers, New Delhi, 2020. (ISBN: 9788122432282)
2. Design of Steel Structures, P. Dayaratnam, S. Chand Publishers, 2019. (ISBN: 978-8121923200)
3. IS 800 General Construction in Steel - Code of Practice, Bureau of Indian Standards.

Web Links:

1. https://nptel.ac.in/courses/105106112/
2. https://law.resource.org/pub/in/bis/S03/is.sp.6.6.1972.pdf

Hydrology & Irrigation with ML Techniques

	L	T	P	C
Course Code:2501CE15	**2**	**1**	**0**	**3**

Course Outcomes:

At the end of the course, student will be able to:

CO1: Explain hydrological cycle and Machine learning algorithm in rainfall runoff modelling.
CO2: Analyze different types of hydrographs and flood prediction with AI tools.
CO3: Classify the various irrigation systems and diversion head works.
CO4: Explain the various design considerations of canal structures and cross drainage works.
CO5: Examine the behavior of gravity dams and earthen dams

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	2	2	-	-	2	-	-	-	-	-	-
CO2	2	3	-	-	2	-	-	-	-	-	-
CO3	1	-	-	-	-	3	-	-	-	1	-
CO4	2	-	2	-	-	3	-	-	-	1	-
CO5	2	-	-	-	-	3	-	-	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	-	-
CO2	1	-
CO3	1	-
CO4	2	-
CO5	3	-

UNIT – I

Introduction:

Hydrologic cycle – Precipitation - measurement - rain gauge network - presentation of rainfall data - continuity and consistency of rainfall data. Evaporation and Evapotranspiration - Factors affecting - measurement and control. Infiltration- Factors affecting - measurement - and infiltration indices. Runoff: Catchment characteristics - factors affecting runoff. Introduction to ML algorithms in flood forecasting and rainfall-runoff modeling.

UNIT – II

Hydrograph Analysis:

Components of hydrograph - unit hydrograph -assumptions - derivation of unit hydrograph - principle of superposition and S-hydrograph methods - limitations and applications of unit hydrograph. Introduction to AI techniques for pattern recognition in hydrological data to predict the hydrograph for a given catchment.

UNIT – III

Irrigation:

Types of irrigation systems - soil moisture constants - irrigation water requirements - consumptive use and its estimation - duty and delta - factors affecting - depth and frequency of irrigation .

Diversion Head Works:

Diversion Head Works: Types of diversion head works - weirs and barrages - layout of diversion head works and Components. Bligh's creep theory - Khosla's theory.

UNIT – IV

Canals:

Classification, design of non-erodible canals - design of erodible canals -Kennedy's silt theory and Lacey's regime theory.

Canal Structures:

Falls – Types, Canal Regulation and Cross Drainage works: Head and cross regulators - Types and selection of cross drainage works.

UNIT – V

Reservoir Planning and Earthen Dam:

Investigations - site selection for reservoir and dams. Earth Dams: Types, causes of failure - seepage - measures for control of seepage-filters.

Gravity Dams And Spillways:

Forces acting on a gravity dam - causes of failure of a gravity dam - elementary and practical profile of a gravity dam. Introduction to spillways and its types.

Text Books:

1. Engineering Hydrology, Subramanya.K and Pryank J Sharma, Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 6th Edition, 2024. (ISBN 0074624490)
2. Irrigation and water power Engineering, Dr.B.C.Punmia and Dr.Pande - B.B.Lal,Laxmi Publications Pvt. Ltd., New Delhi, 16th Edition 2021. (ISBN-10: 8131807630)

Reference Books:

1. Water Resources Engineering, Mays L.W, Wiley India Pvt. Ltd. (ISBN 0471705251)
2. Irrigation and Water Resources Engineering, G.L.Asawa,New Age International Publishers. (ISBN-13. 978-8122516732)

Web Links:

1. http://nptel.ac.in/courses/105104103/
2. http://www.academicpub.org/jwrhe/
3. https://nptel.ac.in/downloads/105105110/