Anil Neerukonda Institute of Technology & Sciences (Autonomous)

(Permanent Affiliation by Andhra University & Approved by AICTE
Accredited by NBA (ECE, EEE, CSE, IT, Mech. Civil & Chemical) & NAAC)
Sangivalasa-531 162, Bheemunipatnam Mandal, Visakhapatnam District
Phone: 08933-225083/84/87   Fax: 226395
Website: www.anits.edu.in   email: principal@anits.edu.in

DEPARTMENT OF CIVIL ENGINEERING
COURSE STRUCTURE AND SYLLABUS
(R23 REGULATIONS)

II Year Course structure

III Semester

Course Code	Title of the course	Category	Credits	L	T	P	Total	CIE	SEE	Total
23MA1103	Vector Calculus & Statistical Methods	BS	3	3	0	0	3	40	60	100
23CE3101	Engineering Mechanics	ES	3	3	0	0	3	40	60	100
23CE3102	Strength of Materials	ES	3	3	0	0	3	40	60	100
23CE3901	Surveying and Geomatics	ES	4	2	1	2	5	90	110	200
23CE2101	Universal Human Values and Ethics- II	HSS	3	3	0	0	3	40	60	100
23CE4911	Water Supply Engineering	PC	4	3	0	2	5	90	110	200
23CE3203	Strength of Materials Lab	ES	1.5	0	0	3	3	50	50	100
23CR9101	Logical Reasoning and Corporate skills	HSS	1	2	0	0	2	100	0	100
23MC0103	Constitution of India	MC	0	2	0	0	2	100	0	100
	Total		**22.5**				**29**	**590**	**510**	**1100**

IV Semester

Course Code	Title of the course	Category	Credits	L	T	P	Contact Hours	CIE	SEE	Total
23CE4113	Concrete Technology	PC	2	2	0	0	2	40	60	100
23CE4114	Fluid Mechanics-I	PC	3	2	1	0	3	40	60	100
23CE4912	Geotechnical Engineering – I	PC	4	2	1	2	5	90	110	200
23CE4115	Highway Engineering	PC	3	2	1	0	3	40	60	100
23CE4116	Structural Analysis – I	PC	3	2	1	0	3	40	60	100
23CE4913	Wastewater Engineering	PC	4	2	1	2	5	90	110	200
23CE4211	Concrete Technology Lab	PC	1.5	0	0	3	3	50	50	100
23CR9102	Numerical Ability & Professional Communication skills	HSS	1	2	0	0	2	100	0	100
23MC0104	Health and Nutrition	MC	0	2	0	0	2	100	0	100
	Total		**21.5**				**28**	**590**	**510**	**1100**

Note: Students undergo Internship - I during summer vacation after II year and Evaluated during III year I semester

Vector Calculus & Statistical Methods

23MA1103   **Credits: 3**

Instruction: 3 Lectures / week   Sessional Marks: 40

End Exam: 3 Hours   End Exam Marks: 60

Prerequisites: Differentiation, Integration and functions.

Course Objectives:

The aim of this course is to introduce basic fundamentals of vector calculus, formulate and solve first order partial differential equations and its applications.

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

1.	Explain the characteristics of scalar and vector valued functions and provide a physical interpretation of the gradient, divergence, curl and related concepts.
2.	Transform line integral to surface integral, surface to volume integral and vice versa using Green's theorem, Stoke's theorem and Gauss's divergence theorem.
3.	Construct partial differential equation of a given equation and solve first order partial differential equations and their applications.
4.	Analyze the basic principles of statistical measures.
5.	Examine, analyze and compare probability distributions**.**

CO-PO –PSO Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1			
CO2	3	2										1			
CO3	3	2										1			
CO4	3	2										1			
CO5	3	2										1			

Correlation levels   1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

	CO-PO-PSO Justification
1	CO1 deals with finding the gradient, div and curl of a given vector point functions and these fundamental concepts in vector calculus are widely used in many areas of engineering.
2	CO2 deals with vector integration like line, surface and volume integrals and these are widely used in various fields of engineering.
3	CO3 deals with formation, finding solution and applications of PDE and there are widely used in various fields of engineering.
4	CO4 deals with knowledge of statistical central and dispersion measures.
5	CO5 deals with knowledge of probability distributions and is widely used in many areas of engineering.

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SYLLABUS

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UNIT I   **10 Periods**
VECTOR DIFFERENTIATION
Scalar and vector point functions – Del applied to scalar point functions – Directional derivative – Del applied to vector point functions – Physical interpretation of divergence and curl – Del applied twice to point functions – Del applied to products of point functions.

UNIT II   **10 Periods**
VECTOR INTEGRATION
Integration of vectors – Line integral , circulation, work done – Surface integral , flux – Green's theorem in the plane – Stoke's theorem – Volume integral – Gauss divergence theorem (all theorems without proofs) – Irrotational and solenoidal fields.

UNIT III   **10 Periods**
PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS
Introduction – Formation of partial differential equations by eliminating arbitrary constants and functions – Solutions of a partial differential equations by direct Integration – Linear equations of the first order (Lagrange linear equations).

APPLICATIONS : Method of separation of variables – Vibrations of a stretched string: Wave equation – One dimensional heat flow equation ($\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$), and two dimensional heat flow equation. (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$).

UNIT IV   **10 Periods**
STATISITCS
Measures of central tendency : Mean, Median, Mode, Geometric mean, Harmonic mean.
Measures of dispersion : Quartile deviation, Mean deviation, Standard deviation, Variance.

UNIT V   **10 Periods**
PROBABILITY AND DISTRIBUTIONS
Introduction – Basic terminology – Probability and set notations – Addition law of probability – Independent events – Baye's theorem – Random variable – Discrete probability distribution: Binomial distribution – Continuous probability distributions: Poisson distribution and normal distribution (mean , variance , standard deviation and their properties without proofs).

 TEXT BOOKS:

   B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

 REFERENCE BOOKS:

 1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
 2. N. P. Bali, Engineering Mathematics, Lakshmi Publications.
 3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Calculus, 13/e, Pearson
    Publishers, 2013.
 4. H. K. Dass, Advanced Engineering Mathematics, S. Chand and complany Pvt. Ltd.
 5. Michael Greenberg, Advanced Engineering Mathematics, Pearson, Second Edition.

ENGINEERING MECHANICS

23CE3101   **Credits: 3**

Instruction: 2 Lectures & 1 Tutorial / week   Sessional Marks: 40

End Exam: 3 Hours   End Exam Marks: 60

Course Objectives:
The objective of the course is to enable the student.
1. To develop logical thinking approach to engineering problems.
2. Learn about the basic concepts of force, moment, resultant forces.
3. Learn about centroid & centre of gravity, static analysis of simple plane trusses, area moment of inertia,

Course Outcomes:
At the end of course student will be able to:
1. Analyze a given physical problem into a suitable forces and moments.
2. Identify the centroid of a given plane area and find its area/ mass moment of inertia
3. Apply the concept of friction to simple engineering problems
4. Calculate the displacement, velocity and acceleration of a moving particle
5. Apply the work-energy, D ALEMBERTS principle to particles and connected systems

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3											2	2	2
	2	3	3											2	2	2
	3	3	3											2	2	2
	4	3	3											2	2	2
	5	3	3											2	2	2

SYLLABUS

UNIT – I   **12 Periods**

Equilibrium Analysis: Fundamental Concepts, COPLANAR CONCURRENT FORCES: Composition of Forces; Analytical Method; Resolution of Forces; Composition of Forces by Method of Resolution; Equilibriant; Equilibrium of a Body; Types of Forces on a Body; Freebody Diagram; Lami's Theorem; Equilibrium of Connected Body Problems for Exercise. COPLANAR NONCONCURRENT FORCES: Moment of a Force; Varignon's Theorem; Couple; Resolution of a Force into a Force and a Couple; Resultant of Force Systems; x and y Intercepts of Resultant; Equilibrium Conditions; Reactions of Supports of Beams;

UNIT – II   **12 Periods**
Friction: Frictional Force; Law's of Friction; Angle of Friction, Angle of Repose and Cone of Friction; Wedges; Problems Involving Non-concurrent Force System; Rope Friction.

Analysis of pin jointed plane frames: Perfect, Deficient and Redundant Frames; Assumptions;

Nature of Forces in Members; Methods of Analysis; Method of Joint; Method of Sections.

UNIT – III   **12 Periods**

Centroid: Centre of Gravity; Centre of Gravity of a Flat Plate; Centriod; Difference Between Centre of Gravity and Centriod; Use of Axis of Symmetry; Centriod of Simple Figures From First Principle; Centriod of composite Sections;

Moment of Inertia: Moment of Inertia; Polar Moment of Inertia; Radius of Grysation; Theorems of Moment of Inertia; Moment of Inertia from First Principles; Moment of Inertia of Standard Sections; Moment of Inertia of Composite Sections.

UNIT – IV   **12 Periods**

Introduction to Dynamics: Basic Terms; General Principles in Dynamics; Type of Motion. LINEAR MOTION: Motion Curves; Motion with Uniform Velocity; Motion with Uniform Acceleration; Acceleration with Gravity; Motion with varying acceleration. RELATIVE VELOCITY: Motion on Parallel Paths in Like Directions; Motion on Parallel Paths in Opposite Directions; Motion in a plane in Any Direction; Relative Distance; Relative Velocity and Resultant Velocity. D' ALEMBET'S PRINCIPLE: Newton's Second Law of Motion; D'Alembert's Principle.

UNIT – V   **12 Periods**

Work Energy Method: Work; Work Done by a Varying Force; Energy; Power; Work Energy Equation for Translation; Motion of Connected Bodies; Work Done by a Spring.

Impulse Momentum: Linear Impulse and Momentum; Connected Bodies; Force of Jet on a Vane; Conservation of Momentum.

TEXT BOOKS
1. SS Bavikatti and Rajasekharappa (2004) ―Engineering Mechanics" New Age International Pvt. Ltd, New Delhi.
2. F.L. Singer (1954) Engineering Mechanics Harper Collins Publishers, New York.

REFERENCES
1. S. Timoshenko and D.H. Young (2017) Engineering Mechanics Pearson Prentice publication, .
2. Basudeb Bhattacharyya, ―Engineering Mechanics‖ Oxford University Press.
3. E. Nelson, Charles Best, W.G. McLean, Merle Potter ―Schaum's outline of Engineering Mechanics: Statics"
4. F.P. Beer and E.R. JhonstonJr ―Vector Mechanics & Statics" McGraw Hill.
5. J.L. Meriam and L.G. Kraige "Engineering Mechanics: Statics" Wiley India Ltd.
6. I.B. Prasad "Applied Mechanics‖ by Khanna Publishers.
7. Relevant NPTEL Courses.

STRENGTH OF MATERIALS

23CE3102   **Credits: 3**

Instruction: 2 Lectures & 1 Tutorial / week   Sessional Marks: 40

End Exam: 3 Hours   End Exam Marks: 60

Course Objectives:
1. Understand the concept of Stress and Strain so as to compute different types of stresses.
2. Draw the Shear force and bending moment diagrams for determinate beams.
3. Determine the principal stresses on oblique planes.

Course Outcomes:

At the end of course student will be able to:
1. Determine the different types of stresses and strains in prismatic and non prismatic bodies subjected to forces acting in one or more directions.
2. Analyze and illustrate the SFD and BMD for determinate beams acted upon by different types of loads and their combinations.
3. Determine the bending stress and shear stress in beams having different cross sections and illustrate the variation of bending stress and shear stress distribution along the cross section.
4. Determine various stresses on an oblique plane of a prismatic body subjected to forces acting in one or more directions.
5. Determine the stresses in a body subjected to torsion, Calculate different parameters in a helical spring subjected to axial load and axial twist, Determine the various stresses and their corresponding strains in thin cylindrical vessels subjected to fluid pressure

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	3											2	2	
	2	2	3											3		
	3	2	3											3		
	4	2	3											2	2	
	5	2	3											3		

SYLLABUS

UNIT - I   **12 Periods**

Simple Stresses and Strains: Elasticity and plasticity – Types of stresses and strains – Hooke's law - Generalized Hooke's Law– stress – strain diagram for mild steel and HYSD- bars Working stress – Factor of safety

UNIT – II   **12 Periods**

Elastic Constants: Lateral strain, Poisson's ratio and volumetric strain – Elastic constants and the relationship between them – Bars of varying section – composite bars – Temperature stresses.

UNIT - III   **12 Periods**

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

UNIT – IV   **12 Periods**

Bending Stresses: Theory of simple bending – Assumptions – Derivation of bending equations, Neutral axis – Determination of bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I-T- sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I- T- sections.

UNIT - V   **12 Periods**

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsional Rigidity equation – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts; Springs: Introduction – Types of springs – deflection of closed and open coiled helical springs under axial load.

Principal Stresses and Planes: Introduction – Principal planes and Principal Stresses – Method of determining stresses on an inclined section.

TEXT BOOKS
   1. R.K.Bansal (2018), "Strength of Materials", Laxmi Publications, Sixth edition, India.
   2. Beer Johnston (2017) "Mechanics of Materials", McGraw Hill Education, Seventh Edition, India.

REFERENCES
   1. Timoshenko (2003), "Elements of Strength of Materials", East-West publications, Fifth edition, India.
   2. P.N. Singh and P.K. Jha (2021) "Elementary Mechanics of Solids", New Age International Private Limited, Second edition , New Delhi, India.
   3. Egor P. Popov (2015) "Engineeering Mechanics of Solids", Pearson Education India, Second edition, India.
   4. S.Ramamrutham (2020)" Strength of materials", Dhanpat Rai Publishing Company(P)Ltd, 20th edition, New Delhi, India.
   5. Relevant NPTEL Courses.

SURVEYING & GEOMATICS
(Integrated course)

23CE3901   **Credits: 4**

Instruction: 2 Lectures, 1 Tutorial & 2 Practicals / week   Sessional Marks: 90

End Exam: 3 Hours   End Exam Marks: 110

Prerequisites: Basic Mathematics

Course Objectives:
1. To impart an awareness on the principles of surveying, various methods and instruments of surveying.
2. To gain awareness of the errors commonly associated with field measurements.
3. To Explore modern advancements in surveying technology and methodologies

Course Outcomes:
At the end of course student will be able to:
1. Demonstrate proficiency in utilizing chain and prismatic compass techniques to accurately calculate distances, determine areas, and ascertain angles and bearings.
2. Determine reduced levels and distances of different stations through the application of various methods of both differential and trigonometric levelling. Additionally, they will be capable of preparing contour maps to visually represent the terrain surveyed.
3. Calculate areas and distances utilizing traditional surveying tools such as chains, tapes, and compasses, enhancing their practical skills in land measurement and navigation techniques.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2										1	2	2	2
	2	2	2										1	2	2	2
	3	2	2		3					3	3		1	2	2	2

SYLLABUS

Unit I   **12 Periods**

Chain Surveying: Classification of surveying-Principles of Surveying. -Linear measurements. Instrumentation for chaining – Errors due to incorrect chain - Chaining on uneven and sloping ground-Errors in chaining - Tape corrections – Problems.

Unit II   **12 Periods**

Compass Surveying: Definitions of Bearing. True bearing, True meridian, Magnetic Meridian, Magnetic bearing – Arbitrary Meridian, R.B. & B.B of lines – Designation of bearings, Conversion of bearings from one system to the other Related problems – Calculation of angles for bearings, Calculation of bearing for angles, Related problems – Theory of Magnetic compass (i.e. Prismatic compass), Temporary adjustments of compass-Magnetic Declination – Local Attraction-Related Problems

Unit III   **12 Periods**

Levelling: Definitions of terms-Methods of levelling - Uses and adjustments of dumpy level-Temporary adjustments of dumpy level levelling staves - Differential levelling, - Reciprocal levelling. Precise levelling - Definition of BS, IS, FS, HI, TP-Booking and reduction of levels, H.I. methods-Rise and fall method-Checks-Related problems

Contouring: Definitions- Contour Interval and horizontal equivalent - Characteristics of contours-methods of locating contours-Direct and indirect methods-Interpolation of contours-Contour Gradient

Unit IV   **12 Periods**

Theodolite Survey: Theodolite Component Parts, Classification, – Temporary Adjustments, Measurement of horizontal angle – Method of repetition, Method of reiteration – Uses of theodolites – Permanent adjustments of a theodolite. Open and closed traverse – Closing errors, Balancing the error – Bowditch method – Transit method.

Unit V   **12 Periods**
Tacheometry: Instruments - Principle of tacheometry – Methods of Tacheometry - Stadia methods – Fixed hair method – Movable hair method – Tangential method.

LIST OF EXPERIMENTS
1. Surveying past obstacles using chain and prismatic compass
2. Distance between Inaccessible points using prismatic compass
3. Surveying of a given area by prismatic compass (closed Traverse) and plotting after adjustment
4. Fly Levelling (HI method/Raise and Fall Method)
5. Longitudinal and cross-sectional levelling and plotting
6. Determine Horizontal angles using Repetition & Reiteration methods
7. Trigonometric levelling- Height and distance problem
8. Contouring of a small area by method of grid
9. Distance and elevation computations by tacheometric surveying.

Text Books
1. B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain (2005)- Surveying, Laxmi publications (P) Ltd , India.
2. Manoj, K. Arora and Badjatia (2011) Geomatics Engineering, Nem Chand & Bros, India

References
1. James M Andersen, Edward M Mikhail(1998), Surveying Theory and Practice, McGraw Hill education, Boston.
2. Relevant NPTEL Courses.

UNIVERSAL HUMAN VALUES AND ETHICS- II

23CE2101

Instruction: 2 Lectures & 1 Tutorial / week

End Exam: 3 Hours

Credits: 3

Sessional Marks: 40

End Exam Marks: 60

Prerequisites:

Universal Human Values-I through Induction Program (desirable)

Course objectives:

The objective of the course is to enable the student in

1. Development of a holistic perspective based on self-exploration about him/her (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course outcomes:

By the end of the course, students are expected to

1. Articulate Basic human aspirations and requirements for their fulfilment and identify the Role and process of Value education
2. Articulate the needs and activities of the self and body and frame program for self-regulation and health for harmony of the self and body
3. Recognize the value of Relationship and the nine feelings in Relationship for fulfilment of relationship for harmony in the family
4. Identify human goals and articulate systems for their fulfilment leading to harmony in the society; Also identify the characteristics of four orders of nature and mutually fulfilling interaction for harmony in nature.
5. Identify the nature of existence and the role of human being for harmony in existence; Also articulate ethical human conduct, humanistic constitution and holistic Criteria for Technologies, production systems and management models for Universal human order.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1						2	2	3				2	2	2	2
	2								3				2			
	3								3				2			
	4						2	3	3	2			2	2	2	2
	5							2	3				2	2		2

SYLLABUS

UNIT – I **12 Periods**

Introduction – Fulfillment of Basic Human Aspirations: Need for value education – Process of Value Education – Self-Exploration – Its content and process – Natural Acceptance and Experiential Validation – Basic Human Aspirations – Basic requirements for fulfillment of aspirations – Right understanding, Relationship and Physical Facility- Priority – Human

Consciousness – Role of Education-Sanskar – Understanding Happiness and Prosperity – Programme for perpetual happiness and prosperity.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship with family and society, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT – II   12 Periods

Harmony in the Self: Human being as co-existence of Self and Body - Needs of Self and Body – Distinguishing Self and Body – Activities of the Self – Imaginations and its sources – Self-organized /Enslaved behavior - Self as the doer, seer and enjoyer – Harmony of the Self and body – Programme for self-regulation and health – Prosperity – Identification of physical facilities.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT – III   12 Periods

Harmony in the Family: Human relationship – Feelings in Relationship – Trust – Intention and competence – Respect as right evaluation – Over, under and otherwise-evaluation – Minimum content of Respect – Complete content of Respect – Other feelings in Relationship – Love – Response and Reaction.

Include practice sessions to reflect on relationships in family, real life examples, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT – IV   12Periods

Harmony in the Society: Human Goals – Systems for fulfillment of human goals - Education-Sanskar - Health-Self regulation - Production-Work - Justice-Preservation - Exchange-Storage - Undivided Society, Universal Human Order.

Harmony in the Nature: Four Orders of Nature – Characteristics of the four orders – Mutually fulfilling interaction - Understanding the harmony in the Nature

Include practice sessions to reflect on relationships in hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT – V   12 Periods

Harmony in the Existence: Existence as Units in Space – Submergence of Units in Space – Existence as Co-existence - Development in the Existential Sense – Role of Human being in Existence

Universal Human Values and Ethical Human Conduct: Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Humanistic Constitution and Humanistic Universal Order - Holistic Criteria for Technologies, production systems and management models - Holistic Community Model - Journey towards Universal Human Order

Include practice Exercises and Case Studies in Practice (tutorial) Sessions e.g., to discuss the conduct as an engineer or scientist etc.

TEXT BOOKS
1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

REFERENCES
1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Small is Beautiful - E. F Schumacher.
5. Slow is Beautiful - Cecile Andrews
6. Economy of Permanence - J C Kumarappa
7. Bharat Mein Angreji Raj – Pandit Sunderlal
8. Rediscovering India - by Dharampal
9. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
10. India Wins Freedom - Maulana Abul Kalam Azad
11. Vivekananda - Romain Rolland (English)

WATER SUPPLY ENGINEERING
(Integrated Course)

23CE4911   **Credits: 4**

Instruction: 3 Lectures & 2 Practical / week   Sessional Marks: 90

End Exam: 3 Hours   End Exam Marks: 110

Course Objectives:

1. The principal objective of the course is to develop technical knowledge for better understanding the concepts of water supply and its characteristics and enabling them to use these technical skills in solving the problems in industries.
2. To impart knowledge in planning, design, construction, operation, and maintenance aspects of water supply systems.
3. To provide theoretical and practical exposure in the field of water treatment and supply.
4. To increase the management skills regarding collection, treatment and distribution of sustainable water.

Course Outcomes:

By the end of the course the student will be able to

1. Estimate the quantity of water required to a town / city and population forecasting studies using per capita demand and design period.
2. Determine the importance of quality of water, and the methods of analysis of water and types of water borne diseases.
3. Classify the sources of water of water supply and their yield and different methods of collection and conveyance of water.
4. Determine Physico-chemical characteristics of water.
5. Analyse the given water sample to determine the optimum coagulant dosage.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2													3
	2	2	2													3
	3	2	2					1								3
	4	2	1		2		2			3	3					3
	5	2	1		2		2			3	3					3

SYLLABUS

UNIT - I   **12 Periods**

Introduction: Introduction: Importance and Necessity of Protected Water Supply systems, Objectives of Protected water supply system, Flow chart of public water supply system, Role of Environmental Engineer.

Water Demand and Quantity studies: Estimation of water demand for a town or city, Types of

water demands, Per capita Demand, Factors affecting the Per Capita Demand, Variations in the Demand, Design Period, Factors affecting the Design period, Population Forecasting studies.

UNIT - II   **12 Periods**
Quality of water: Characteristics of water – Physical, Chemical and Biological. Analysis of Water – Physical, Chemical and Biological. Impurities in water, Water borne diseases. Drinking water quality standards- Relevant codes (IS 10200:2012, WHO Standards).

UNIT - III   **12 periods**
Sources of Water Supply: Surface sources of water: Lakes, Rivers, Impounding Reservoirs, Capacity of storage reservoirs, Mass curve analysis. Groundwater sources of water: Types of water bearing formations, springs, Infiltration galleries and Wells, Yields from wells.

Collection and Conveyance: Factors governing the selection of the intake structure, Types of Intakes. Conveyance of Water: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, Pipe joints.

UNIT - IV   **12 Periods**
Treatment of Water: Layout and general outline of water treatment units –Treatment methods (Theory and Design) - Sedimentation, Sedimentation with Coagulation, Clariflocculation, Filtration, Chlorination and other Disinfection methods, Softening of Water, De-fluorination.

UNIT - V   **12 Periods**
Distribution System: Distribution of Water: Methods of Distribution system, Components of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks.

Pumping: Necessity of pumping in water supply - classification and brief description of types of pumps - selection of pump - calculation of head, horsepower – economical diameter of pumping main.

LIST OF EXPERIMENTS
1. Determination of pH and Electrical Conductivity of water
2. Determination of turbidity in water and Optimum coagulant dose.
3. Estimation of total solids, organic solids and inorganic solids and settleable solids by Imhoff Cone.
4. Estimation of Total Hardness–Calcium & Magnesium.
5. Estimation of Acidity in water
6. Estimation of Alkalinity in water
7. Determination of Available and Residual Chlorine content in water

TEXTBOOKS
1. Birdie G S and Birdie J S, (2010) "Water Supply and Sanitary Engineering", Dhanpat Rai and Sons, Fifth Edition, Delhi.
2. Garg, S.K., (1977) "Environmental Engineering Vol. I ", Khanna Publishers, Thirty Fourth Edition, New Delhi.

REFERENCES

1. Modi, P.N, (2018) "Environmental Engineering Vol. I", Standard Book House, Fifth Edition New Delhi.
2. Punmia B.C, (2005) "Environmental Engineering Vol. I", Lakshmi Publications (P) Ltd., New Delhi.
3. Handbook on Water Supply and Drainage, (1987) SP35, B.I.S., New Delhi.
4. National Building Code of India, SP 7 (1) (2005), Bureau of Indian Standards, First Reprint, May 1992. – (Part-9 Section 1)
5. Relevant IS Codes
6. Relevant NPTEL Courses.
7. BIS 10500- 1991, Indian Standard Drinking Water – Specification (Second Edition)
8. Guidelines for Drinking-water Quality, (2008), WHO Standards (3rd Edition)

STRENGTH OF MATERIALS LABORATORY

23CE3203   **Credits: 3**

Instruction: 3 Practicals / week   Sessional Marks: 40

End Exam: 3 Hours   End Exam Marks: 60

Course Objectives:
From this course students will learn the following
1. The stress – strain characteristics of mild steel bar.
2. Determining modulus of elasticity, modulus of rigidity of different materials.
3. Determine the properties such as hardness, compressive strength, shear strength, impact strength of different materials.

Course Outcomes:
At the end of course student will be able to:
1. Apply concepts of mathematics, engineering fundamentals, or civil engineering to determine the properties of engineering materials.
2. Apply concepts of engineering fundamentals, or civil engineering to substantiate the test results.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	1	1		1					2	2			3		
	2	1	1		1					2	2			3		

LIST OF EXPERIMENTS

1. Tension test on Mild Steel.
2. Compression test on wood (parallel to grains and perpendicular to grains)
3. Test on close coiled helical spring for the determination of rigidity modulus and spring constant
4. Hardness tests - Brinell's & Rockwell's.
5. Impact tests – Charpy and Izod
6. Torsion test.
7. Bending test.: Load deflection test for the determination of Young's modulus on a simply supported and cantilever beam for wood and steel.

REFERENCES
1.   P.N. Singh and P.K. Jha (2021) "Elementary Mechanics of Solids", New Age International Private Limited, Second edition, New Delhi, India.
2.   Relevant NPTEL Courses.

Logical Reasoning & Corporate Skills

(II Year, I Sem.)

Course Category:	Humanities		Credits:	1
Branch	All Branches			
Course Code:	23CR9101		Lecture-Tutorial-Practical:	2+2
Prerequisites:	Knowledge of LSRW Skills, Basic Maths		Continuous Evaluation:	
			Semester End Evaluation:	
			Total Marks:	100

	Upon successful completion of the course, the student will be able to:	
Course Outcomes	**CO1**	Build career-oriented demeanour and learn corporate culture to work in teams with LSRW skills **(L3),** Detect errors of grammar and usage in a given sentence/text and rectify them by making appropriate changes
	CO2	Acquire leadership qualities through verbal, nonverbal, written and emotional intelligence. **(L3),** Detect errors of grammar and usage in a given sentence/text and rectify them by makingappropriate changes
	CO3	Analyse different types of vocabulary and do model papers to obtain LSRW skills. **(L4),** Detect errors of grammar and usage in a given sentence/text and rectify them by makingappropriate changes
	CO4	Use their logical thinking and analytical abilities to solve reasoning questions from number analogy and series and letter based aptitude questions company specific and other competitive tests.
	CO5	Solve questions related to clock and calendar , etc..from company specific and other competitive tests.

Contribution of Course Outcomes towards achievement of Program Outcomes& Strength of correlations	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									M	M		M		
CO2									M	M		M		
CO3									M	M		M		
CO4	M													
CO5	M													
	L- Low					**M-Medium**					**H-High**			

PART-A: Verbal Ability Skills	

UNIT-1	Corporate Etiquette – Work Place Etiquette and Conflict Resolution - Grammar Revision Verbal Ability : Prepositions, Articles, tenses and conjunction	CO1
UNIT-2	EQ – Negotiation Skills – Telephone Etiquette – MNCs Paper Model Introduction, Situational Dialogue Practice – Team Activities Related to Spoken English Verbal Ability: Fill in the blanks (Based on the given appropriate words)	CO2
UNIT-3	E Mail Writing – Vocabulary from Story Telling Activity –MNCs Model Paper 1 Practice Verbal Ability: Sentence arrangements	CO3
UNIT-4	Virtual Reading – Functional English – IELTS Vocabulary – News Paper Reading Verbal Ability: Inferred meaning (Homophone, Homonyms)	CO3

PART-B: Logical Reasoning	

UNIT-I: Numerical computation: Number Series, Letter Series, Number analogy, letter analogy, word analogy	CO4
UNIT-II: Coding Decoding- Letter to letter, letter to digit, letter to number and symbol, Word to word coding, odd man out	CO4
UNIT-III: Directions-Finding distance, Direction and Shadow based problem, Blood Relations-Mixed Blood Relations, Puzzle-Based Blood Relation, Single-Person Blood Relation, Symbol based Blood Relations.	CO4

UNIT-IV: Clocks –finding Angle, Time, Mirror image, Faulty clock, Calendars – Finding day of the week, Number of odd days, Repetition of same calendar	CO5
UNIT-V : Seating Arrangement-Circular arrangement, linear arrangement ,Order Sequence and Ranking	CO5

CONSTITUTION OF INDIA

23MC0103   **Credits: -**
Instruction: 1 Lecture / week   Sessional Marks: 100

Prerequisites: None
Course Objectives:
1. To Enable the student to understand the importance of constitution
2. To understand the structure of executive, legislature and judiciary
3. To understand philosophy of fundamental rights and duties
4. To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
5. To understand the central and state relation financial and administrative.

Course Outcomes:
At the end of course student will be able to:
1. Understand historical background of the constitution making and its importance for building a democratic India.
2. Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
3. Analyze the decentralization of power between central, state and local self-government.
4. Learn about Union Government, State government and its administration.
5. Get acquainted with Local administration and Pachayati Raj.
6. Gain knowledge on roles and functioning of Election Commission

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1		2		3	3	3		3	3	3		3			
	2		3		3	3	3		3	3	3		3			
	3		3		3	3	3	2	3	3	3		3			
	4		3		3	3	3	2	3	3	3		3			
	5		3		3	3	3	2	3	3	3		3			

SYLLABUS

Unit I   **12 Periods**

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution – Sources and constitutional history, Features – Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Unit II   **12 Periods**

Union Government and its Administration: Structure of the Indian Union: **Federalism**, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

Unit III   **12 Periods**

State Government and its Administration: Governor – Role and Position – CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Unit IV   **12 Periods**

Urban and Rural Administration – Local Administration – District's Administration Head – Role and Importance, Municipalities – Mayor and role of Elected Representative – CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy – (Different departments), Village level – Role of Elected and Appointed officials – Importance of grass root democracy

Unit V   **12 Periods**

The Election Commission of India: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Text Books
1. Subash Kashyap (2024) , Our Constitution, National Book Trust
2. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
3. Indian Administration by Avast and Avasti

References
1. J.A. Siwach, Dynamics of Indian Government & Politics
2. D.C. Gupta, Indian Government and Politics
3. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
4. J.C. Johari, Indian Government andPolitics Hans
5. J. Raj IndianGovernment and Politics
6. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
7. Noorani, A.G. (2012) (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press

SEMESTER II

CONCRETE TECHNOLOGY
(Integrated course)

23CE4113   **Credits: 2**

Instruction: 2 Lectures / week   Sessional Marks: 40

End Exam: 3 Hours   End Exam Marks: 60

Course Objectives:
1. Learn about the properties, uses and tests on various ingredients required for making concrete.
2. Study the behavior of concrete in fresh and hardened state.
3. Understand the applications of special concrete and learn concrete mix design.

Course Outcomes:
At the end of course student will be able to:
1. Evaluate the suitability of cement for construction by analyzing the characteristics.
2. Classify aggregates used in concrete based on their characteristics and relative suitability.
3. Select suitable test to determine workability with justification and analyse the role of admixtures on properties of concrete.
4. Analyze the characteristics of hardened concrete based on different tests.
5. Design the concrete mix as per Indian Standards and outline the role of special concretes.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2											2		
	2	2	2											1	1	
	3	2	2											2		
	4	2	2											2		
	5	2	2	2					1					2		

SYLLABUS

UNIT – I   **12 Periods**

Cement: Composition of ordinary Portland cement- oxide composition and compound composition- their functions in cement. Manufacture of ordinary Portland cement by wet process and dry process. Types of cement - OPC & blended (only fly ash & slag) and their uses. Tests on cement (IS 4031) – field tests – laboratory tests.

Tests on cement with industrial admixtures (IS 1727) (For Internal Evaluation only)

UNIT – II   **12 Periods**

Aggregate: Classification of aggregate (as per IS 383) based on origin, shape, size, unit weight: Manufactured sand (M – Sand)– characteristics of aggregates – strength, particle shape and texture, specific gravity, bulk density, voids, porosity and absorption of aggregates – Moisture content of aggregate – bulking of fine aggregate. Tests on aggregates.

UNIT - III   **12 Periods**
Fresh Concrete: Manufacture of concrete – Batching, Mixing, Transportation, Placing, Vibrating, Finishing, Curing – Workability – Factors affecting workability – segregation and   bleeding – Tests available for measurement of workability
Admixtures: Admixtures – functions of admixtures – General purpose admixtures such as Retarding admixture, accelerating admixtures, Air Entraining admixtures, Water reducing admixture

UNIT - IV   **12 Periods**
Hardened Concrete: Strength of concrete – water-cement ratio – gel-space ratio – gain of strength with age – effect of maximum size of aggregate on strength – compressive strength – flexural strength – tensile strength of concrete – bond strength – factors affecting the strength of concrete. Introduction to creep and shrinkage of concrete– Tests on hardened concrete (as per IS 516)

UNIT - V   **12 Periods**
Special Concretes: Introduction to special concretes – lightweight concrete – no fines concrete – fibre reinforced concrete – self compacting concrete
Concrete Mix Design: Concrete mix design – BIS 10262 Method of mix design Tests on Special Concretes – Introduction to High Performance Concrete (ACI 211) (For Internal Evaluation only)

TEXT BOOKS
    1. Shetty, M. S. and Jain, A K (2019), "Concrete Technology Theory and Practice", S Chand Publishers, 8th Edition, New Delhi
    2. Neville, A M (2012), "Properties of Concrete", Prentice Hall Publishers, 5th Edition, United States

REFERENCES
    1. Gambhir, M. L. (2017), "Concrete Technology Theory and Practice", Mc Graw Hill Education, 5th Edition, Boston.
    2. Gupta B L, & Amit Gupta (2014), "Concrete Technology", Standard Publishers Distributors. New Delhi.
    3. Santha Kumar, A R (2006), "Concrete Technology", Oxford University Press, 2nd Edition.
    4. Relevant IS Codes
    5. Relevant NPTEL Courses.

FLUID MECHANICS – I

23CE4114   **Credits: 3**
Instruction: 2 Lectures / week   Sessional Marks: 40
End Exam: 3 Hours   End Exam Marks: 60

Prerequisites: Engineering Mechanics

Course Objectives:
The objective of the course is to enable the student
1. To classify the properties of fluids and fluid statics
2. To derive the equation of conservation of mass and its application
3. To solve kinematic problems such as finding particle paths and stream lines and to use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems
4. To analyze laminar and turbulent flows
5. To compare the various flow measuring devices

Course Outcomes:

By the end of the semester, the student will be able to:
1. Determine the physical properties of fluids further Pressure measurement and different types of forces acting on a fluid element extended to forces on various gates.
2. Calculate the forces that act on submerged planes and curves
3. Apply conservation principles of mass momentum and energy on fluids through system
4. Calculate the force exerted by the fluid on bends, nozzles, plates and vanes by impulse momentum principle and to analyze Laminar flow.
5. Analyze the steady laminar and turbulent flows through pipes and solve pipe networks for series and parallel pipes.

Mapping of course outcomes with program outcomes:

		PO									10	11	12	PSO 1	2	3
		1	2	3	4	5	6	7	8	9						
CO	1	3	3													2
	2	3	3													2
	3	3	3													2
	4	3	3													2
	5	3	3													2

SYLLABUS

UNIT – I   **10 Periods**
Introduction: Dimensions and units – Physical properties of fluids - specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law -atmospheric, gauge and vacuum pressures-measurement of pressure. Pressure gauges, Manometers: Differential and Micro

Manometers.

UNIT – II   12 Periods
Hydrostatics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined, Curved surfaces– Centre of pressure
Buoyancy and Floatation: Archimedes Principle- Buoyancy & Floatation - Stability of Floating Bodies- Centre of Buoyancy - Metacentric Height and its Determination

UNIT – III   14 Periods
Fluid Kinematics: Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two, three dimensional flows – stream and velocity potential functions, flow net analysis.
Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line - Momentum equation and its application – forces on pipe bend

UNIT – IV   14 Periods
Laminar Flow: Reynolds experiment – Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen-Poiseuille Formula, Flow between parallel plates, Flow through long tubes, hydrodynamically smooth and rough flows.
Turbulent Flow: Closed Conduit Flow: Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line.

UNIT - V   10 Periods
Measurement of Flow: Pitot tube, Venturi meter and Orifice meter – classification of orifices, small orifice and large orifice, Mouthpieces. Flow over rectangular, triangular, trapezoidal and stepped notches - –Broad crested weirs

TEXT BOOKS
1. Modi P.N. & Seth S.M. (2022), "Hydraulics & Fluid Mechanics including Hydraulics Machines", Standard Book House, New Delhi,.
2. Jain A.K. (1998), "Fluid Mechanics including Hydraulic Machines", Khanna Publishers, New Delhi,.

REFERENCES
1. Kumar K.L. (2006), "Engineering Fluid Mechanics", S. Chand & Company Publishers, New Delhi.
2. Bansal R.K. (2018), "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi.
3. Frank. M. White (2011), "Fluid Mechanics (In SI Units)", Tata McGraw Hill Education, New Delhi
4. Schaum's Outline Series (2011), "Fluid Mechanics and Hydraulics", McGraw Hill Education, New Delhi
5. Relevant NPTEL Courses.

GEOTECHNICAL ENGINEERING – I
(Integrated Course)

23CE4912   **Credits: 4**

Instruction: 2 Lectures, 1 Tutorial & 2 Practicals/ week   Sessional Marks: 90
End Exam: 3 Hours   End Exam Marks: 110

Prerequisites:
Engineering Mechanics, Engineering Geology.

Course Objectives:
The objective of the course is to impart the basic knowledge and skills related to the
1. Physical and plasticity characteristics of soil and various soil classification systems.
2. Stresses in soils due to self-weight, water and foundations
3. Compaction of soils
4. Consolidation of saturated soils

Course outcomes:
By the end of the course, the student will be able to:
1. Apply principles of soil mechanics to estimate the physical properties of soil.
2. Analyse the physical and plasticity characteristics of the given soil sample to classify the soil as per Indian Standard Classification system.
3. Apply the principles of soil mechanics to estimate the geostatic stresses in a soil mass and its permeability.
4. Determine the specific gravity and consistency limits of the given sample of soil and classify the soil as per I.S.1498-1970
5. Determine the permeability and compaction characteristics of the given sample of soil using relevant laboratory test.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3													2	
	2	3	2												3	
	3	3													2	
	4	3			3					3	3				3	
	5	3			3					3	3				3	

SYLLABUS

UNIT - I   **12 Periods**
Physical Properties of Soil: Three phase system - phase diagram - physical properties- Functional Relationships between physical properties-determination of water content, specific gravity, In-situ density, Relative density**.**

UNIT - II   **12 Periods**
Plasticity Characteristics of soil: Atterberg's limits and their determination-liquid limit, plastic limit, shrinkage limit - Index properties-Activity-Free swell index.

Soil Classification: Soil classification-need and criteria for soil classification-IS Particle size classification-Classification tests-grain size analysis -hydrometer analysis- grain size distribution curve - Unified Soil Classification- Indian Standard Soil classification- Coarse grained soils- Fine grained soils-Plasticity chart.

UNIT - III   **12 Periods**
Effective stress: Stresses due to self-weight-total, neutral and effective stresses – Pressure diagrams under different soil conditions.

Permeability: Permeability-Darcy's law-Limitations of Darcy's law-laboratory tests for determination of permeability- Constant head method, Variable head method- Factors effecting permeability.

UNIT - IV   **12 Periods**
Seepage Analysis: Types of soil water -Average permeability of stratified soils. Seepage pressure-critical hydraulic gradient -quick sand condition.

Stresses in soil due to Foundation loads: Boussinesq theory- Concentrated load-Strip footing- circular footing- Rectangular footing-Newmark's influence chart - Pressure bulb-Significant depth-Westergaard'stheory - 2:1 distribution method

UNIT - V   **12 Periods**
Compaction: Principle of compaction, OMC and MDD, Lab tests-IS light weight and heavy weight compaction tests, Factors effecting compaction - zero air void line-Effect of compaction on engineering properties of soils - Field compaction control – Proctor's Needle.

Consolidation: Definition and significance-mechanism-Terzaghi's soil-spring analogy -lab consolidation test – e-log p curve-Coefficient of compressibility-coefficient of volume change-compression index-determination of consolidation settlement – Terzaghi's theory of 1D consolidation- Time-settlement calculations. Determination of coefficient of consolidation-time fitting methods – Pre-consolidation pressure-normally consolidated and over consolidated clays- secondary consolidation.

LIST OF EXPERIMENTS
1. Determination of specific gravity of soils by density bottle method
2. Determination of Grain size distribution - Sieve analysis
3. Determination of Liquid limit by Casagrande's method
4. Determination of Liquid limit by Uppal's Method
5. Determination of Plastic limit
6. Determination of in-situ density by core cutter method.
7. Determination of Permeability by Constant head method
8. Determination of Permeability by Variable head method
9. Determination of OMC and MDD by I.S. Light Compaction

TEXTBOOKS
1. Narasinga Rao, B.N.D.(2015), Soil Mechanics and Foundation Engineering, Wiley Publishers, New Delhi
2. Arora, K.R. (2008), "Soil Mechanics and Foundation Engineering", Standard Publishers, Delhi.

REFERENCES
1. Lambe, T. W., & Whitman, R. V. (1991). *Soil mechanics* (Vol. 10). John Wiley & Sons, New York
2. Murthy, V.N.S. (2009), "A text book of Soil Mechanics and Foundation Engineering", UBS Publishers Distributors Ltd., New Delhi.
3. Braja M. Das, (2005), "Fundamentals of Geotechnical Engineering", Thomson Asia Pvt. Ltd., Singapore.
4. Craig, R.F. (2014), "Soil Mechanics", McGraw hill, New Delhi
5. Gopal Ranjan and Rao, A.S.R. (2007), "Basic and Applied Soil Mechanics", New age International (P) Ltd, New Delhi.
6. Shashi K Gulhati and Manoj Dutta (2005), Geotechnical Engineering, Tata McGraw Hill, New Delhi
7. Relevant NPTEL Courses.

HIGHWAY ENGINEERING

23CE4115   **Credits: 3**
Instruction: 2 Lectures / week   Sessional Marks: 40
End Exam: 3 Hours   End Exam Marks: 60

Prerequisites:
Surveying – I & II.

Course Objectives:
The objective of the course is to prepare the student to
1. To know about the history of highway development, surveys and classification of roads.
2. To study about the pavement materials and design the geometric elements of highways.
3. To know about the construction procedure of various types of pavements and study the pavement maintenance.
4. To study about the traffic characteristics and design of intersections

Course Outcomes:

1. Estimate the recommended length of road network and carry out Engineering surveys
2. Design cross section elements, sight distance, horizontal and vertical alignment of a highway
3. Design flexible and rigid pavements as per IRC
4. Identify various highway constructions techniques and highway maintenance
5. Design signal time and rotary intersection by analysing traffic studies

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	2												3	
	2	1	2	3			1		2						3	
	3	1	2	3											3	
	4	1	2				1								3	
	5	1	2	2			1								3	

SYLLABUS

UNIT – I   **12 Periods**
Highway development and planning – History of Roads - Classification of roads, necessity of highway planning, planning surveys , Road network Patterns , preparation of master plan highway planning in India. Classification of roads, Highway alignment - Factors controlling alignment, engineering surveys, Drawing & report

UNIT – II   **12 Periods**

Highway Geometric Design – Design of cross-sectional elements, Sight distance – Stopping Sight Distance & Overtaking Sight Distance, horizontal alignment – Super elevation & Transition Curves, vertical alignment – Summit Curves and Valley Curves.

UNIT – III   **12 Periods**

Highway construction and maintenance: Highway materials and their properties and tests - Construction of water bound macadam roads, Bituminous pavements and cement concrete pavements; Construction of joints in cement concrete pavements; Maintenance of highways; Importance of highway drainage; Requirements; Surface drainage & Sub–surface drainage.

UNIT – IV   **12 Periods**

Pavement Design: Design of Highway Pavements Design factors; Design of flexible pavements – IRC method, Design of Rigid pavements - Westergaard's stress equation for wheel loads and temperatures stress.

UNIT – V   **12 Periods**

Traffic engineering: Introduction - Traffic characteristics- Road user, vehicular & travel pattern; Traffic studies (Surveys); Traffic Control devices; Traffic operation- signal design; Types of intersections; Design of rotary intersection; Street lighting

TEXT BOOKS

1. Khanna, S.K. and Justo C.E.G. (2018), "Highway Engineering", Nem Chand & Bros, India.
2. Kadiyali, L.R., (2011), "Traffic engineering and Transport planning", Khanna Publishers, New Delhi.

REFERENCES

1. Chakroborty, P. and Das, A. (2003), "Principles of Transportation Engineering" Prentice Hall of India, New Delhi.

2. Sharma, R.C. and Sharma, R.K. (2012), "Principles, Practice and Design of Highway Engineering" S Chand & Company, New Delhi.

3. Relevant NPTEL Courses

<p style="text-align:center">STRUCTURAL ANALYSIS – I</p>

23CE4116   **Credits: 3**

Instruction: 2 Lectures / week   Sessional Marks: 40

End Exam: 3 Hours   End Exam Marks: 60

Course Objectives:
1. Determine combined direct and bending stresses in columns
2. Apply suitable methods for calculating deflections in statically determinate beams and trusses.
3. Apply suitable methods for analysing statically indeterminate beams.

Course Outcomes:

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

1. Determine combined bending and direct stresses in columns due to eccentric loading and apply the theories of buckling to long columns
2. Calculate deflections for statically determinate beams.
3. Apply the concept of Energy theories on beams and trusses.
4. Analyse fixed and continuous beams.
5. Analyse statically indeterminate beams by using slope deflection method and moment distribution method and understand the concept of Moving loads and Influence lines.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3											3		
	2	3	3											3		
	3	3	3											3		
	4	3	3											3		
	5	3	3											3		

<p style="text-align:center">SYLLABUS</p>

Unit I   **12 Periods**

Combined bending and direct stresses: Resultant stress when a column of rectangular section is subjected to eccentric load along one axis and along both the axes - kern of a section.

Columns and Struts: Euler' theory – end conditions. Rankine – Gordon formula – other empirical formulae – Eccentrically loaded columns – Perry''s formula, Secant formula.

Unit II   **12 Periods**

Deflections of statically determinate beams:
a. Double integration method
b. Macaulay's method
c. Moment area method
d. Conjugate beam method.

Unit III   **12 Periods**

Strain energy: Expression for strain energy stored in body due to (i) Axial load, (ii) Shear force, (iii) Bending Moment and (iv) Torque
Deflections of Statically Determinate Beams & Trusses: (a) Unit load method (b) Castigliano's theorem– 1.

Unit IV   **12 Periods**

Fixed beams: Analysis of Fixed beams subjected to single and multiple point loads, UDL, UVL, couple, and combination of loads. Effect of sinking and rotation of supports.
Continuous beams - Analysis for shear force and bending moment - Clapeyron's theorem of three moments- effect of sinking of supports.

Unit V   **12 Periods**

Slope deflection method: Introduction, Assumption, Sign Conventions, Derivation of slope deflection equation, applications of slope deflection equation to statically indeterminate beams
Moment Distribution Method: Introduction, Sign conventions, Carryover Factor, Distribution Factor, Application of moment distribution method to statically indeterminate beams

Text Books
1. S. Ramamrutham (2008), "Strength of materials", Dhanpat Rai & Sons, New Delhi.
2. Vazrani and Ratwani (1999), "Analysis and Design of structures Vol-I, Khanna publishers, New Delhi.
3. S.S.Bhavakatti (1999), "Structural analysis Vol-I", Vikas Publishing House Pvt Ltd, New Delhi.
4. S.S.Bhavakatti (1999), "Structural analysis Vol-II"9, Vikas Publishing House Pvt Ltd. New Delhi.

References
1. R. Subramanian (2016), "Strength of Materials Third edition", Oxford University Press, New Delhi.
2. C.K.Wang (2017), "Intermediate Structural Analysis", McGraw Hill International Editions , New Delhi.
3. Devdas Menon (2008), "Structural Analysis", Alpha Science International Ltd., Noida.
4. C.S. Reddy (2017), "Basic Structural Analysis", Tata McGraw Hill Education, New Delhi.
5. Thandavamoorthy (2011), "Structural analysis", Oxford University Press, New Delhi.
6. Relevant NPTEL Courses.

WASTEWATER ENGINEERING
(Integrated Course)

23CE4913   **Credits: 4**

Instruction: 2 Lecture, 1 Tutorial & 2 Practical / week   Sessional Marks: 90

End Exam: 3 Hours   End Exam Marks: 110

Prerequisites: Environmental Engineering-I

Course Objectives:

The objective of the course is to enable the student to

1. Identify the wastewater generation sites and make them understand the Principles of Estimation and characterization of wastewater generated in a community.
2. Understand various Unit operations and Unit Processes and their functions in wastewater treatment.
3. Design the components of wastewater treatment system.
4. Learn the necessity of treatment and safe disposal of sewage and sludge generated out of community.

Course Outcomes:

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

1. Identify Sources of wastewater generation and Estimate the Quantity of wastewater generated
2. Design the sewer and Storm water drain to cater the wastewater generated.
3. Analyse the characteristics of sewage & design the components of Primary treatment.
4. Test and decide whether the water sample is safe for drinking purpose according to IS 10500:2012
5. Estimate the strength of the sewage in terms of DO, BOD and COD

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2														3
	2	2	1	2												3
	3	2	1	2				1								3
	4	2	1		2		2			3	3					3
	5	2	1		2		2			3	3					3

SYLLABUS

UNIT – I   **12 Periods**

Introduction to sanitation: Definition of terms, Sources of wastewater - Systems of sanitation, relative merits & demerits, collection and conveyance of wastewater, sewerage, classification of sewerage systems- fluctuations.

UNIT – II   **12 Periods**

Sewage appurtenances: Appurtenances: Manhole, drop manhole, Inverted siphon, Storm water inlets and catch basins, materials for sewers, Layout of sewers.

Hydraulics of sewers and storm drains: Estimation of sewage flow and storm water drainage, Hydraulic Design of Sewers, and storm Drains

UNIT – III   **12 Periods**

Sewage Characteristics: Sample collection - Sewage characteristics: Physical, Chemical and Biological Characteristics and their testing, BOD-first stage BOD exertion, COD-Relative Stability and Population Equivalent, Decomposition of Sewage-Cycles of Decay

Primary Treatment - Preliminary treatment – Screens - grit chambers – Skimming tanks - Sedimentation – design of primary and pretreatment units.

UNIT – IV   **12 Periods**

Secondary treatment: Aerobic and anaerobic treatment process-comparison.
Suspended growth process: Activated Sludge Process, principles, designs, and operational Problems, modifications of Activated Sludge Processes, Oxidation ponds, Oxidation ditches, Aerated Lagoons.
Attached Growth Process: Trickling Filters-mechanism of impurities removal. Classification–filter problems-design and operation- recirculation.

UNIT – V   **12 Periods**

Anaerobic Processes: Septic Tanks and Imhoff tanks -Principles and Design

Bio-solids (Sludge) management: Characteristics- thickening – digestion, drying.

Disposal of sludge: methods of disposal – disposal into water bodies- Oxygen Sag curve disposal on land.

LIST OF EXPERIMENTS
1. Determination of Dissolved Oxygen and Biological Oxygen Demand by Winkler's Method.
2. Determination of Biological Oxygen Demand by Winkler's Method.
3. Estimation of chloride content in water
4. Estimation of fluoride content in water.
5. Determination of C.O.D. (Demo)

TEXTBOOKS
1. Garg, S.K. (2020), "Environmental Engineering (Vol.II): Sewage disposal and Air Pollution Engineering", Khanna Publishers, Delhi.
2. Modi, P.N. (2020), "Sewage Treatment Disposal and Waste Water Engineering" Standard Book House, Delhi.

REFERENCES
1. Metcalf & Eddy (2017), "Wastewater Engineering: Treatment and Reuse" Tata McGraw-Hill, New Delhi.
2. Raju, B.S.N. (2000), "Water supply and Wastewater Engineering" McGrawHill education,

New Delhi.

3. Peavy H.S., Rowe D.R., and Tchobanoglous G, (2017), "Environmental Engineering" McGraw-Hill international edition, New York.
4. BIS 3025 (Part 44): Method of Sampling and Test (Physical and Chemical) for Water and Wastewater, Part 44: Biochemical Oxygen Demand (BOD)
5. Relevant NPTEL Courses.

CONCRETE TECHNOLOGY LAB

23CE4211   **Credits: 3**
Instruction: 3 Practicals / week   Sessional Marks: 40
End Exam: 3 Hours   End Exam Marks: 60

Course Objectives:
From this course students will learn the following
1. To apply the basic knowledge of civil engineering in selecting appropriate cement, fine and coarse aggregates in making concrete.
2. To be able to make concrete of required strength.

Course Outcomes:
At the end of course student will be able to:
1. Analyse the properties of cement, concrete and its ingredients.
2. Judge the suitability of various ingredients of concrete in construction.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	**1**	1	1		1					2	2			3		
	2	1	1		1					2	2			3		

LIST OF EXPERIMENTS

1. Specific gravity of cement and unit weight of cement
2. Fineness (By Sieving) & Consistency of cement
3. Initial and final setting time of cement.
4. Compressive strength of cement.
5. Specific gravity and unit weight of coarse aggregate.
6. Specific gravity and unit weight of fine aggregate.
7. Sieve analysis of coarse and fine aggregates
8. Bulking of sand.
9. Workability of fresh concrete by: Slump Cone, Compaction factor, Flow Table, Vee-Bee Consistometer Methods
10. Compressive Strength of concrete (Demonstration)
11. Split tensile strength of concrete (Demonstration)
12. Modulus of rupture of concrete (Demonstration)
13. Soundness of cement using Lee-Chatlier apparatus (Demonstration)

REFERENCES
1. Shetty, M. S. & Jain, A K (2019), "Concrete Technology Theory and Practice", S Chand Publishers, 8thEdition.
2. Neville, A M (2012), "Properties of Concrete", Prentice Hall Publishers, 5th Edition.
3. Relevant IS Codes.
4. Relevant NPTEL Courses.

Numerical Ability & Professional Communication skills
(II Year II Sem.)

Course Category:	Humanities		Credits:	2
Branch	All Branches			
Course Code:	23CR9102		Lecture-Tutorial-Practical:	2+2
Prerequisites:	Knowledge of LSRW Skills, Basic Maths		Continuous Evaluation:	
			Semester End Evaluation:	
			Total Marks:	100

		Upon successful completion of the course, the student will be able to:
Course Outcomes	CO1	Comprehend the essentiality of LSRW skills in paper presentations, seminars, workshops, conferences etc. with teams. **(L2)**, To solve different types of questions based on vocabulary, structure, grammar and verbalreasoning
	CO2	Attain the knowledge of soft skills in various conditions**(L3)**, Solve questions based on sentence completion and fill in the blanks
	CO3	Explore diverse fields through English **(L4),** To solve different types of questions based on vocabulary, structure, grammar and verbalreasoning
	CO4	Use their logical thinking and analytical abilities to solve Quantitative aptitude questions from company specific and other competitive tests.
	CO5	Solve questions related to Time and distance and time and work etc. from company specific and other competitive tests.

Contribution of Course Outcomes towards achievement of Program Outcomes& Strength of correlations		PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1									M	M		M		
	CO2									M	M		M		
	CO3									M	M		M		
	CO4	M													
	CO5	M													
		L- Low				M-Medium					H-High				

	PART-A: Professional Communication skills	
UNIT-1	Abstract Preparation – Noticing Key Words –Literature Survey – Using Academic Verbs Verbal Ability : Sentence correction	CO1
UNIT-2	Organizational Skills – Time Management – IELTS Test Papers Exercises Verbal Ability : sentence completion	CO2
UNIT-3	Meeting Skills – Arranging a Meeting – Prior to Meeting, During Meeting and After Meeting Process – Note Making – Note Taking Verbal Ability : Error Identification	CO3
UNIT-4	Analogy – Origin of the Words – Eponyms – MNCs Question Papers Verbal Ability : vocabulary	CO4

PART-B : Numerical Ability	
UNIT-I: Numerical computation- Applications based on Numbers –Classification of Number System, Prime and Composite, Even and Odd Numbers, Divisibility Rule, Remainder Theorem, Finding Highest power, LCM &HCF	CO4
UNIT-II: Numerical estimation – I Averages, Ratio Proportion, Application of Ratios (Ages),Partnerships, Shares and dividends,	CO4
UNIT-III: Numerical estimation – II Percentages and its Applications, Profit Loss and Discount, Simple interest and Compound Interest	CO4

UNIT-IV: Time and work, Application of Time-work (Pipes & Cisterns), Time and Distance, circular Tracking, concept of Boats & steams.	CO5
UNIT-V : Mixtures and allegations, application of percentage and Ratios and Averages in Mixtures,	CO5