ANDHRA UNIVERSITY
DEPARTMENT OF CIVIL ENGINEERING

B.Tech - Civil Engineering

The objectives of the undergraduate program of B.Tech. in Civil Engineering are to groom the students into graduates with

PEO 1: The proficiency in the principles of basic and engineering sciences along with planning, analysis, design and execution of the civil engineering systems.

PEO 2: An ability to apply knowledge in assessing the needs of the society for sustainable development and establishing apposite civil engineering practices.

PEO 3: An attitude towards disseminating the knowledge acquired, continued learning, professional development and team spirit and promoting awareness of environmental concerns.

PEO 4: The professional ethics and social responsibilities through participatory approach

Programme Outcomes (POs)

After completion of the Bachelor degree the graduate will acquire the abilities to

PO1. apply the acquired knowledge and principles of Civil Engineering in the execution of civil engineering projects.

PO2. identify, understand, survey, plan, analyse and design the civil engineering facilities.

PO3. develop skills for the preparation of detailed technical reports of civil engineering projects.

PO4. analyze the available or generated data leading a fruitful interpretation and contributing to the application of the engineering principles and theory and also to adopt the best engineering practices for construction and maintenance of the civil engineering structures.

PO5. expose the students to the latest technological developments in civil engineering and encourage them for continuous learning.

PO6. work in multidisciplinary fields with team spirit by understanding the implications of the engineering applications or solutions on environment and society.

PO7. attain aptitude to practice the professional ethics and adhere to social responsibilities for contributing towards a just and sustainable society.

PO8. To train students to function in multi-disciplinary teams.

PO9. To impart adequate communication skills to make graduating students to compete at global level.

PO10.To apply project and finance management tools to control and execute various projects.

PO11. To provide an environment for interdisciplinary learning and enhance the scope of graduating students in higher studies/profession.

PO12. To sensitize the graduating students of professional and ethical responsibilities for becoming responsible engineers to serve the society.

Program Specific Outcomes:

PSO1. To nurture the graduating students with adequate skills to take up civil engineering profession efficiently in developing quality infrastructure.

PSO2. To enable students to excel in higher studies and research in chosen specializations through advanced learning from theprofessional electives.

PSO3. To develop and design sustainable and smart infrastructure considering the global environmental challenges.

SCHEME AND SYLLABI
(with effect from 2021-22)

B.Tech & B.Tech. +M.Tech
I Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CV1101	BS	Mathematics – I	4	0	30	70	100	3
CV 1102	BS	Physics	4	0	30	70	100	3
CV1103	ES	Engineering Graphics	2	3	30	70	100	3
CV1104	ES	Civil Engineering Materials	4	0	30	70	100	3
CV1105	ES	Engineering Mechanics	4	0	30	70	100	3
CV1106	ES	Workshop Lab	0	3	50	50	100	1.5
CV1107	BS	Physics Lab	0	3	50	50	100	1.5
CV1108	ES	Engineering Geology Lab	0	3	50	50	100	1.5
							Total Credits	19.5

B.Tech & B.Tech. +M.Tech
I Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CV1201	BS	Mathematics – II	4	0	30	70	100	3
CV1202	BS	Chemistry	4	0	30	70	100	3
CV1203	HSS	English	4	0	30	70	100	3
CV1204	ES	Computer Programing and Numerical Methods	4	0	30	70	100	3
CV1205	ES	Surveying and Geomatics	4	0	30	70	100	3
CV1206	HSS	English Language Lab	0	3	50	50	100	1.5
CV1207	BS	Chemistry Lab	0	3	50	50	100	1.5
CV1208	ES	Computer Programing and Numerical Methods Lab	0	3	50	50	100	1.5
							Total Credits	19.5

B.Tech & B.Tech. +M.Tech
II Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CV2101	BS	Mathematics -III	4	0	30	70	100	3
CV2102	PC	Mechanics of Solids	4	0	30	70	100	3
CV2103	PC	Fluid Mechanics-I	4	0	30	70	100	3
CV2104	PC	Structural Analysis-I	4	0	30	70	100	3
CV2105	HSS	Managerial Economics	4	0	30	70	100	3
CV2106	PC	Mechanics of Solids Lab	0	3	50	50	100	1.5
CV2107	PC	Fluid Mechanics - I Lab	0	3	50	50	100	1.5
CV2108	PC	Survey Field Work	0	3	50	50	100	1.5
CV2109	SC	Computer Aided Drafting	1	2	50	50	100	2
CV2110	MC	Professional Ethics & Universal Human Values	0	0	00	100	100	0
CV2111	MC	NCC/NSS	0	2	-	-	-	0
							Total credits	21.5

B.Tech & B.Tech. +M.Tech
II Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CV2201	ES	Water Supply Engineering	4	0	30	70	100	3
CV2202	BS/PC	Fluid Mechanics-II	4	0	30	70	100	3
CV2203	PC	Hydrology and Water Resources Engineering	4	0	30	70	100	3
CV2204	PC	Geotechnical Engineering-I	4	0	30	70	100	3
CV2205	PC	Concrete Technology	4	0	30	70	100	3
CV2206	PC	Geotechnical Engineering-I Lab	0	3	50	50	100	1.5
CV2207	PC	Building Materials Lab	0	3	50	50	100	1.5
CV2208	SC	Building Planning and Computer Aided Drawing	1	2	50	50	100	2
CV2209	MC	Environmental Science	0	0	00	100	100	0
Total credits								20
Internship - I								

B.Tech & B.Tech. +M.Tech
III Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CV3101	PC	Reinforced Concrete Structures	4	0	30	70	100	3
CV3102	PC	Steel Structures	4	0	30	70	100	3
CV3103	PC	Geotechnical Engineering-II	4	0	30	70	100	3
CV3104	PE	Professional Elective-I	4	0	30	70	100	3
CV3105	OE	Open Elective-I	4	0	30	70	100	3
CV3106	PC	Geotechnical Engineering - II Lab	0	3	50	50	100	1.5
CV3107	PC	Environmental Engineering Lab	0	3	50	50	100	1.5
CV3108	SC	Computer Applications in Civil Engineering Lab	1	2	50	50	100	2
CV3109	INT	Internship - I			50	50	100	2
							Total Credits	22

B.Tech & B.Tech. +M.Tech
III Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CV3201	PC	Transportation Engineering	4	0	30	70	100	3
CV3202	PC	Engineering Economics Estimation and Costing	4	0	30	70	100	3
CV3203	PC	Structural Analysis-II	4	0	30	70	100	3
CV3204	PE	Professional Elective-II	4	0	30	70	100	3
CV3205	OE	Open Elective-II	4	0	30	70	100	3
CV3206	PC	Computer Aided Analysis and Design Lab	0	3	50	50	100	1.5
CV3207	PC	Fluid Mechanics - II Lab	0	3	50	50	100	1.5
CV3208	PC	Highway Materials Lab	0	3	50	50	100	1.5
CV3209	SC	Soft Skills	1	2	50	50	100	2
							Total Credits	21.5
Internship - II								

B.Tech & B.Tech. +M.Tech
IV Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
CV4101	PE	Professional Elective-III	4	0	30	70	100	3
CV4102	PE	Professional Elective-IV	4	0	30	70	100	3
CV4103	PE	Professional Elective-V	4	0	30	70	100	3
CV4104	OE	Open Elective-III	4	0	30	70	100	3
CV4105	OE	Open Elective-IV	4	0	30	70	100	3
CV4106	HSSE	Elective	4	0	30	70	100	3
CV4107	SC	Quality Evaluation of Civil Engineering Structures	1	2	50	50	100	2
CV4108	INT	Internship - II			50	50	100	2
							Total Credits	22

B.Tech & B.Tech. +M.Tech
IV Year - II Semester

Course code	Category	Course Title	Internal Marks	External Marks	Total Marks	Credits
CV4201	PROJ	Project work	100	100	200	14
					Total Credits	14

Professional Electives

1. Hydraulic and Irrigation Structures
2. Matrix Methods of Structural Analysis
3. Introduction to Rock Mechanics
4. Advanced Design of Structures
5. Advanced Fluid Mechanics
6. Geo-Environmental Engineering
7. Remote Sensing and GIS Applications
8. Earth Retaining Structures
9. Repair and Retrofitting of structures
10. Railways and Harbour Engineering
11. Environmental Impact Assessment
12. Bridge Engineering
13. Industrial Waste Treatment
14. Traffic Engineering and Management
15. Finite Element Method of Analysis

Open Electives

1. Sanitary Engineering
2. Watershed Management
3. Elements of Earthquake Engineering
4. Prestressed Concrete Structures
5. Elements of Coastal Engineering
6. Sub-soil Exploration and Insitu Soil Testing
7. Air Pollution and Control
8. Design and Detailing of Reinforced Concrete and Steel Structures
9. Analysis and Design of Pavements
10. Project Planning and Management
11. Ground Improvement Techniques
12. Solid Waste Management

HSS Electives

1. Industrial Management & Enterprises
2. Organizational Behaviour
3. Operations Research

B.Tech I Year - I Semester

CV-1101 MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

The students will be able to

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- Expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

Partial Differentiation: Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

Applications of Partial Differentiation: Geometrical interpretation -Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

Multiple Integrals: Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

Multiple Integrals-Applications: Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

Fourier Series: Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions -

Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

Text Books:

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

Reference Books:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A Text Book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

CV-1102 PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanopahse Materials. Relate them to some applications.

Course Outcomes:

The students will be able to

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit

- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

Thermodynamics: Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

Electromagnetism: Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics: Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

Optics Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

Lasers and Fibre Optics: Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers. Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, , classification of fibers, Fibre optics in communications, Application of optical fibers.

Modern Physics: Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi-conductors and insulators.

Nanophase Materials: Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method , sol-gel methods, Applications of nano materials.

Text Books:

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

CV-1103 ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
  Familiarize the basic concept of isometric views clearly.

Course Outcomes:

The students will be able to

- Develop simple engineering drawings by considering BIS standards.
- Draw different engineering curves with standard Procedures.
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.

- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.
Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line inclined to both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Books:

1. Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference Books:

1. Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata Mc-Graw Hill

CV1104 CIVIL ENGINEERING MATERIALS

Course Objectives:

- Student can enlisting the various materials of different types of stones, cement, bricks, timber, lime products, tar, bitumen, metal, sand, paints, admixtures, etc...used in building construction
- Student will have the capability of understanding the different processes of brick and cement manufacturing, and their types and uses.

Course Outcomes:

- Student will have the capability of testing of building construction materials like cement, bricks, aggregate, etc ....to find various properties of them.
- Student will have the capability of preservation of building construction materials like cement, bricks, aggregate, etc ....from the external agencies. weather, etc
- Students will understand the design concepts of different types of windows, Doors and stair cases etc

SYLLABUS

Masonry: Different Types of Stone Masonry – Plan, Elevation, Sections of Stone Masonry Works – Brick Masonry – Different Types of Bonds – Plan, Elevation and Section of Brick Bonds up to Two-Brick Wall Thickness – Partition walls – Different Types of Block Masonry – Hollow Concrete Blocks – FAL-G Blocks, Hollow Clay Blocks.

Paints, Varnishes: Constituents and Characteristics of Paints, Types of Paint, their uses and preparation on Different Surfaces, Painting Defects, Causes and Remedies. Constituents of Varnishes, Uses of Varnishes, Different Kinds of Varnishes, Polishes. Painting of Interior Walls, Exterior Walls, Wooden Doors and Windows – Steel Windows – Various Types of Paints (Chemistry of Paints not included) Including Distempers; Emulsion Paints etc., Varnishes Wood Work Finishing Types.

Asbestos, Asphalt Bitumen and Tar: Availability and uses of Asbestos, Properties of Asbestos, Various Types of Asbestos, Difference Between Asphalt and Bitumen, Types, Uses and Properties of Asphalt and Bitumen, Composition of Coal Tar, Wood Tar, Mineral Tar and Naphtha.

Roofing: Mangalore Tiled Roof, RCC Roof, Madras Terrace, Hollow Tiled Roof, Asbestos Cement, Fibre Glass, Aluminium, G.I. Sheet Roofings.

Trusses: King Post and Queen Post Trusses – Steel Roof Truss for 12 m Span with details.

Wooden Doors and Windows: Parallel – Glazed – Flush Shutters, Plywood, Particle Board Shutters – Aluminum, PVC, Steel Doors, Windows and Ventilators, various types of Windows, Glazing – Different Varieties.

Stair Cases: Stair Cases or Stairway Design (Architectural Design or Planning only) various types such as, Straight Flight, Dog-legged, Quarter Landing, Open Spiral, Spiral Stairs etc.

Text Books

1. Engineering Materials [Material Science] by Rangwala, Charotar Publications.
2. Building Construction by B.C. Punmia,. Laxmi Publications.
3. Civil Engineering Construction Materials, S.K. Sharma, KBP House.

Reference Books

1. Concrete: Microstructure, Properties & Materials, PK Mehta, Tata McGra-Hill Publications.
2. Building Construction, Vol.II & III By W.B. Mckay, E.L.B.S. and Longman, UK.
3. Building Materials by S.K. Duggal, New Age International Publishers.

CV-1105 ENGINEERING MECHANICS

Course Objectives:

- To provide students with practise in applying their knowledge of mathematics, science, and engineering, as well as to broaden this knowledge into the vast field of "rigid body Mechanics."
- To prepare students for advanced courses such as Mechanics of Solids and Structural Analysis.
- To educate about distributed force systems, the centroid/center of gravity, how to locate centroids, moment of inertia, and how to find moment of inertia of composite figures and bodies.
- To know frame types and analyse forces in truss members using the method of joints and the method of sections.
- To understand the kinetics and kinematics of rigid bodies and use the work-energy technique to solve simple problems.
- To discuss the implementation of work-energy and impulse-momentum to dynamic systems.

Course Outcomes:

The student will be able to:

- Understand the Effect of forces and its components, the principle of Moments on wide variety of practical situations that are encountered by Engineers.
- Analyse forces in statically determinate structures using scalar and vector analytical techniques.

- Identify the significance of the centroid/center of gravity and locate the centroids of composite figures and bodies.
- Recognize the moment of inertia and the method for determining the moment of inertia of areas and bodies.
- Understand the dynamics of rigid bodies and how to solve simple problems using the work-energy approach and the virtual work method.

SYLLABUS

Basic concepts : Introduction to Engineering Mechanics – Scalar and Vector quantities – Forces – Characteristics of a force – Definitions and examples of various types of force systems – Definition of resultant – Composition and resolution of forces – Moment of a force – Principles of moments of force – Couples – characteristics of a couple – on Transformations of a couple – Resolution of a force into a force and couple. Resultants of Force Systems, Possible resultants of different types of force systems – Resultant of a concurrent, coplanar force system – Resultant of a non-concurrent coplanar force system – Resultant of a concurrent non-coplanar force system – Resultant of a parallel, non-coplanar force system – Resultant of a system of couples in space – Resultant of non-concurrent, non-coplanar, non-parallel force system – screw of Wrench.

Equilibrium: Free body diagrams – Equations of equilibrium for a concurrent coplanar force system – Equilibrium of Bodies acted on by two or three forces – Equilibrium of bodies acted on by non-concurrent coplanar force system – Equilibrium of bodies acted on by parallel, non-coplanar force system – Equilibrium of non-concurrent, non-coplanar non-parallel force system.
Draw a free body diagram (FBD) and evaluate the equilibrium of different force systems.
Centroids and Centres of Gravity: Centre of gravity of parallel forces in a plane – Centre of gravity of parallel forces in space – centroids and centres of gravity of composite bodies – Theorems of Pappus – Distributed Loads on Beams.

Moments of inertia, Definition – Parallel axis theorm for areas – Second moments of areas by integration – Radius of gyration of areas – Moments of inertia of composite areas – Parallel axis and parallel plane theorems for masses – Moments of inertia of masses by integration – Radius of gyration of mass – Moments of inertia of composite masses.

Friction : Nature of friction – Laws of friction – Coefficient of friction – Angle of friction – Cone of friction – Problems involving frictional forces – Frictional forces on flexible bands and belts – Rolling friction.

Method of Virtual Work: Principle of virtual work – Equilibrium of ideal system – Stability of equilibrium.

Kinematics : Absolute Motion : Introduction – Recapitulation of basic terminology of mechanics – Newton's Laws – Introduction to Kinematics of Absolute Motion – Rectilinear

motion of a particle – Angular motion of a line – Curvilinear motion of a particle using rectangular components – Motion of projectiles – Curvilinear motion using Radial and Transverse Components – (Simple Problems only) – basics of simple harmonic motion (Simple problems) – Motion of rigid bodies.

Kinematics: Relative Motion: Introduction to kinematics of relative motion – Relative displacement – Relative velocity – Instantaneous centre – Relative acceleration.

Kinetics: Introduction to Kinetics – Force, Mass and Acceleration approach – Newton's Laws of motion – Equation of motion for a particle. Motion of the mass centre of a system of particles – D Alembert's principle – Rectilinear translation of a rigid body – Curvilinear translation of a rigid body – Rotation of a rigid body – Plane motion of a rigid body – Reserved effective forces and couples and their use in Dynamic Equilibrium method.
Kinetics : Work and Energy approach – Work done by a force – Work done by a couple – Work done by a force system – Energy: Potential energy – Kinetic energy of a particle – Kinetic energy of a rigid body – Principle of Work and kinetic energy – Conservation of energy – Power and efficiency.

Impulse – Momentum approach – Linear impulse – Linear momentum – Principle of linear impulse and linear momentum – Conservation of linear momentum – Elastic impact – Angular impulse – Angular momentum – Principles of angular impulse and angular momentum.

Text Books

1. Engineering Mechanics by Fredinand Leon Singer, B.S.Publications.
2. Applied Mechanics by I.B. Prasad, Khanna Publishers.

Reference Books

1. Engineering Mechanics by S.Timoshenko and D.H. Young, Tata McGraw-Hill Publishing Co. Ltd. India.
2. Engineering Mechanics Vol. I and Vol. II by J.L.Meriam and L.G.Kraige, Wiley Publications.
3. Mechanics for Engineers Statics and Dynamics by F.B. Beer and E.R. Johnston.
4. Engineering Mechanics by R.S.Kurmi, S.Chand Publishing.

CV-1106 WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:
The student will be able

- To work with Wood Materials in real time applications.
- To build various parts with Sheet Metal in day-to-day life.
- To apply Metal Fitting skills in various applications.
- To apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House Wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

Reference Books:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

CV-1107 PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge,
- spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:
The student will be able to

- Design and conduct experiments as well as to analyze and interpret
- Apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics

- Draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

LIST OF EXPERIMENTS

1. Determination of Radius of Curvature of a given Convex Lens by forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray μ_o and Extraordinary μ_e ray.
6. Determination of Thickness of Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

CV-1108 ENGINEERING GEOLOGY LAB

Course Objectives:

- To enable the students to know different types of soils.
- To enable the students to know different properties of different soils.
- To enable the students to know the application of Remote Sensing and Geo Physical Methods.
- Understand weathering process and mass movement

Course Outcomes:

- Students can identify different types of rocks and their mineral composition.
- Students will study the physical properties of minerals by conducting laboratory tests.
- Students can study the models of folds, faults, joints and tunnels.
- Students can study the satellite data and evaluate the terrain through integrated approach.

SYLLABUS

1. General study of topo sheet
2. Physical properties of minerals
3. Physical properties of 3 types of rocks
4. Study of folds, faults and joints (Models)
5. Study of tunnels (models)
6. General observation of satellite data for abstraction of data
7. Integrated approach of Terrain evaluation.

Text Books

1. Principles of Engineering Geology by K.V.G.K.Gokhale. B.S. Publications-2005
2. Engineering Geology by N.Chennakesavalu, Mc-Millan, Indian Ltd-2005
3. A text book of Geology by P.K.Mukherjee, World Press
4. Engineering and General Geology by Parbin Singh, Katson Publishing House
5. Fundamentals of Remote Sensing by George Jospeh, University Press (India) Private Ltd.

B.Tech I Year - II Semester

CV-1201 MATHEMATICS – II

Course Objectives:

- The way of obtaining rank, Eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, Eigen values and Eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

Linear Algebra: Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties

Eigen Values and Eigen Vectors: Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix –Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

Ordinary Differential Equations of First Order and its Applications: Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal

Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

Differential Equations of Higher Order: Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

Laplace Transforms: Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t – Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

Text Books:

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43r^d edition, Khanna publishers.

Reference Books:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A **Text Books** of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

CV-1202 CHEMISTRY

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry: Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment- Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process.

Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electro less Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants - Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications

Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number;

Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials: Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - **Nanocomposites** - Nano electronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A **Text Books** of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

CV-1203 ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management
On saving Time: Seneca

Chindu Yellama
Life skills: Innovation
Muhammad Yunus

Politics and the English Language: George Orwell
Life skills: Motivation
Dancer with a White Parasol: Ranjana Dave

Grammar:

Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing:

Clauses and Sentences – Punctuation – Principals of Good Writing – Essay Writing – Writing a Summary
Writing: Essay Writing
Life skills: Innovation
Muhammad Yunus

Text Books:

1. Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

Reference Books:

1. Practical English Usage, Michael Swan. OUP. 1995.
2. Remedial English Grammar, F.T. Wood. Macmillan.2007
3. On Writing Well, William Zinsser. Harper Resource Book. 2001
4. Study Writing, Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

CV-1204 COMPUTER PROGRAMING AND NUMERICAL METHODS

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

The student will be able to

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, the if…else statement, Nesting of if…else statement, the else. If ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions

that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointes, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments-Program Applications

Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, **Lagrange's Interpolation in unequal intervals. Numerical Integration**: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Books:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

CV-1205 SURVEYING AND GEOMATICS

Course Objectives:

- To impart knowledge about the different methods of surveying to determine the position and elevation of inaccessible points.
- To familiarise the students with chain and compass surveying and train them to determine the bearing of any required station by different methods.
- To impart knowledge about the concept of levelling and reduced level of any station and teach them the procedure to establish bench marks.
- To familiarize the students with total station and explain the usage of Total Station with respect to all the areas of surveying.
- To explain the concept of Global Positioning System and its applications.

Course Outcomes:

Students will be able to

- Determine the precise location of any required point with respect to horizontal and vertical control.
- Carry out different methods of levelling the profile levelling, reciprocal levelling etc. to determine the elevation of points with respect to bench mark.
- Understand the procedure to establish bench marks with respect to mean sea level.
- Handle the instrument theodolite to measure the horizontal and vertical angles and analyze to determine the inaccessible distances.
- Understand the concept of global positioning system and its applications in surveying.

SYLLABUS

Introduction: Classification and Principles of Surveying, Triangulation and Trilateration – Earth as Spheroid, Datum, Geoid, Azimuth, Latitude, Longitude, Map Projections, Scales, Plans and Maps. Chain Surveying: Instrumentation for Chaining – Errors due to Incorrect Chain–Chaining on uneven and sloping Ground – Errors in Chaining –Tape Corrections – Problems: Base Line Measurement – Chain Triangulation – Check Lines, Tie Lines, Offsets. Basic Problems in Chaining – Obstacles in Chaining – Problems – Conventional Signs.

Compass Survey: (a) Introduction to Compass Survey Definitions of Bearing. True bearing, True meridian, Magnetic Meridian, Magnetic Bearing. Plane Table Surveying: Introduction – Advantages, Accessories. Theodolite – Types of Theodolites – Temporary Adjustments, Measurements of Horizontal Angle – Method of Repetition, Method of Reiteration – Uses of Theodolites. Curves – Sample Curves – Elements of Simple Curves – Methods of Setting Simple Curves – Rankine's Method – Two Theodolite Method.

Levelling: Definitions of Terms – Methods of Levelling – Uses and Adjustments of Dumpy Level – Temporary and Permanent Adjustments of Dumpy Level Levelling Staves – Differential Levelling, Profile Levelling – Cross Sections – 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 – Curvature and Refraction Related Problems –Correction – Reciprocal Levelling – Related Problems – L.S & C.S Leveling – Problems in Levelling – Errors in Levelling. Contouring: Definitions – Contour Intervals, Characteristics of Contours

Total Station Surveying: Electronic Theodolite, Electronic Distance Measurements, Total Station, Errors in Measurements, Advantages, Disadvantages, Applications; Contour Mapping, Determination of Height of Remote Point, Position of Hidden Point, Free Station, Area Measurement, Volume Measurement.

Modern Surveying and Mapping: GPS Survey – Introduction, Errors in GPS, Positioning Methods, Classification of GPS Surveying, Applications, Advantages and Disadvantages, Photogrammetric Surveying; Sensors and Platforms, Aerial Photogrammetry, Satellite Images Resolution, Concept of Stereo Models, Photogrammetric Products, Rectified Images, Orthophotography, Topographic Map, Digital Maps, DEM, GIS, Advantages and Disadvantages of Photogrammetric Surveying.

Text Books

1. Surveying Vol. I, II and III by B.C.Punmia, Standard Book House.
2. Advanced Surveying by Satheesh Gopi, Sathikumar and Madhu, Pearson India.
3. Geomatics Engineering by M.K.Arora and R.C.Badjatia, Nemchand & Bros.

Reference Books

1. Surveying Vol. I and II by S.K. Duggal, Tata McGraw-Hill Publishing Co. Ltd.
2. Surveying: Theory & Practices by James M. Anderson and Edward M. Mikhail, Tata McGraw-Hill Publishing Co. Ltd.

CV-1206 ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self- consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;

- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like role plays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. Effective Technical Communication. Tata McGraw Hill Education Private Limited, New Delhi.
2. Speak Well. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. Body Language. Manjul Publishing House, New Delhi.

CV-1207 CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ion exchange/ zeolite columns for the removal of hardness of water
- To determine quantities of chromium, zinc, chlorine and iron available in water.
- To determine acidity and alkalinity in water.
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:
Students will be able to

- Measure the strength of acid present in water
- Calculate the hardness of water sample
- Determine the minerals present in water.
- Analyse the water for Iron and Calcium contents
- Prepare polymer materials

LIST OF EXPERIMENTS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry.
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method.
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ion exchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K.
3. Kataria & Sons, New Delhi

CV-1208 COMPUTER PROGRAMING AND NUMERICAL METHODS LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.

- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems

LIST OF PROGRAMS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.
8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.
9. Implement bisection method to find the square root of a given number to a given accuracy.
10. Implement Newton Raphson method to det. a root of polynomial equation.
11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation.
12. Write a function which will invert a matrix.
13. Implement Simpson's rule for numerical integration.
14. Write a program to solve a set of linear algebraic equations.

B.Tech II Year - I Semester

CV2101 MATHEMATICS – III

Course Objectives:

- The basic knowledge and applications of Vector Calculus used in engineering problems.
- About the gradient, divergence and curl under the differentiation of scalar and vector point functions, also on Line-, Surface- and Volume integrals under the integration of point functions along with their applications in Engineering issues.
- Transformation theorems such as Green's theorem in the plane, Stoke's theorem, Gauss Divergence theorem and their applications.
- How to formulate the Partial Differential Equations from the relation between the dependent and independent variables, the methods of solving first order first degree linear, non-linear Partial Differential Equations, Homogeneous and Non homogeneous linear partial differential equations with constant coefficients .
- The procedure to find out the solutions of Partial Differential Equations by using the method of separation of variables (product method) about the formulation of one dimensional wave (string equation), one-and two-dimensional Heat flow equations, Laplace's equation in Cartesian and polar coordinates, and how to solve these equations using the method of separation of variables.
- The concept of integral transforms, namely, Fourier transforms, Fourier Sine, Cosine and related inverse transforms, and their applications in solving several Physical and Engineering problems.

Course Outcomes:

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

- Operate the differential operator 'del' to the scalar and vector point functions, calculate the gradient, divergence and curl, vector normal to a surface, maximum rate of change of a scalar field, test whether two surfaces are to cut orthogonally or not .
- Find the rate per unit volume at which the physical quantity is issuing from a point, the rate of inflow minus out flow using the divergence and the angular velocity of rotation at any point of the vector field using the curl.
- Test whether the given motion is irrotational or rotational, whether a vector force acting on a particle is conservative or not.
- Find out the potential function from a given vector field.
- Obtain the well-known laplace and poisson equations from an irrotational field.
- Understand to determine the work done by a force field and circulation using a line integral.
- Find out the line, surface and volume integrals, find flux using surface integral and volumes using the volume integral.

- Apply the vector integral theorems (green's theorem in the plane, stoke's and divergence theorems) for evaluating the double and triple integrals as these are used to find areas and volumes.
- Know the methods of solving linear and nonlinear first order and first degree partial differential equations.
- Solve the linear partial differential equations with constant coefficients (homogeneous and non-homogeneous) and know the procedure for finding the complementary function and particular integrals.
- Apply the method of separation of variables to obtain solutions to the boundary value problems involving linear partial differential equations occurred in engineering studies
- Solve wave equation, heat flow equation and the laplace's equations in cartesian and polar coordinates using the method of separation of variables.
- Apply and extend the knowledge of fourier transform techniques in solving several initial and boundary value problems of engineering, such as in conduction of heat / thermodynamics, hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

Unit-I

Vector Calculus-Differentiation: Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator ∇ applied to scalar point functions- gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and culrl (i.e., ∇f, $\nabla.\overline{F}$, $\nabla\times\overline{F}$), Irrotational and Solenoidal fields, the relations obtained after ∇ applied twice to point functions, ∇ applied to products of two functions.

Unit-II

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)

Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

Unit-III

Partial Differential Equations: Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method. Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non-homogeneous linear equations.

Unit-IV

Applications of Partial Differential Equations: Method of separation of variables, One dimensional wave equation-vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

Unit-V

Integral Transforms (Fourier Transform): Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms.

Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

Text Books:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, 43rd Edition, Khanna Publishers.

Reference Books:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A Text Books of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Mathematical Methods of Science & Engineering aided with MATLAB by KantiB.Dutta, Cengage Learning India Pvt. Ltd.
5. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.
6. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

CV2102 MECHANICS OF SOLIDS

Course Objectives:

- The student can understand the concepts of stress and strain by analysis of solids.
- The student can understand the engineering properties of materials, force-deformation, and stress-strain relationships.
- The student can understand the determinate and indeterminate members, and beams, torque, shear forces, and bending moments.
- The student can understand the combined bending and direct stresses on column and strut members, axial load on open and closed coiled helical spring subjected to axial load.

Course Outcomes:
The student will be able to:

- Understand the basic concepts of stresses and strain along with their relations.
- Determine the shear force and bending moments of the simply supported, cantilever and over hanging beams under various loads.
- Assess the flexural normal and shear stresses of various cross sections.
- Analyse the stresses on oblique plane and torsional shear stress distribution of solid and hollow circular sections.
- Analyse the stresses on columns and struts using various theories.
- Analyse open and closed coiled helical springs subjected to axial load.

SYLLABUS

Duties/Obligations Accountability of Structural Engineer for the Design of a Structure: a) Economy b) Safety: (i) Strength Consideration (ii) Stiffness Consideration. Need for Assessment ofStrength of a Material – Analysis for Strength Requirement for Design Purposes – Review of IS Code Provisions.

Effects ofForce: Tension, Compression and Shear. Stress as Internally Elastic Resistance of a Material – Strain – Property ofElasticity – Hooke's Law – Stress-Strain Diagrams. Characteristic Strengths, Factors ofSafety and Working Stresses for Materials and Various Types ofApplication ofLoad. Elastic Strain – Energy, Stress due to Gradually Applied Load, Sudden Load, Impact Load and Shock Load. Lateral Strain, Poisson's Ratio. Complementary Shear Stress, Shear Strain, Shear Modulus. Relation between Modulus of Elasticity, Modulus of Rigidity and Bulk Modulus.Stresses in Composite Assemblies due to Axial Load and Temperature Change.

Effect of Transverse Force, Shear Force, BendingMoment and Axial Thrust Diagrams for A) Cantilever B) Simply Supported and C) Over Hanging Beams for various patterns of Loading. Relation between (i) Intensity of Loading (ii) Shear Force and (iii) Bending Moment at a Section. Theory of Simple Bending: Flexural Normal Stress Distribution; Flexural Shear Stress Distribution for Various Shapes of Cross Section.

Stresses on Oblique Plane – Resultant Stress – Principal Stress and Maximum Shear Stress and Location of their Planes. Mohr's Circle for Various Cases ofStresses; Theory ofPure Torsion for Solid and Hollow Circular Sections – Torsional Shear Stress Distribution, Effect of Combined Torsion, Bending and Axial Thrust – Equivalent B.M and T.M.

Longitudinal and Hoop stresses in Thin Cylinders subjected to Internal Pressure. Wire Wound Thin Cylinders.Thick Cylinders –Lamme's Theory, Compound Tubes – Theory of Failure (i) Principal Stress Theory, (ii) Principal Strain Theory, (iii) Maximum Shear Stress Theory and (iv) Maximum Strain Energy Theory.

Columns and Struts: Combined Bending and Direct Stresses – Kern of a Section – Euler's Theory – End Conditions. Rankine-Gordon Formula – Eccentrically Loaded Columns. Open and Closed Coiled Helical Springs subjected to Axial Load.

Text Books

1. Strength of materials by S.Ramamrutham and R.Narayanan, Dhanpat Rai Publishing Company, New Delhi.
2. Mechanics of Materials by B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications.
3. Analysis of Structures, Vol. I, 1993 edition, by V.N.Vazirani and M.M.Ratwani, Khanna Publishers Books.

Reference Books

1. Strength of Materials (Elementary Theory and Problems) by S.Timoshenko and D.H.Young, CBS Publishers & Distributors Pvt. Ltd.
2. Introduction to Mechanics of Solids by Popov, Prentice-Hall.
3. Strength of Materials by Hyder, Universities Press.
4. Elementary Mechanics of Solids by P.N. Singer and P.K.Jha, New Age International Publishers.

CV2103 FLUID MECHANICS-I

Course Objectives

- To familiarize students with the fundamentals and basic concepts of fluid mechanics.
- To impart knowledge to the students about fluid statics and kinematics which are prerequisite to comprehend fluid dynamics and other more advanced aspects.
- To enable students to understand one-dimensional applications of energy equation and to impart the concepts of flow measuring devices.
- To develop insight in the application of momentum principle to closed conduits.
- To impart knowledge on fluid flow through pipes and pipe network analysis.

Course Outcomes

Students will be able to

- Understand the significant properties of fluids and pressure measurement, and analyze hydrostatic forces on plane and curved surfaces.
- Comprehend kinematics of fluid flow and further derive and apply continuity equation which is useful in analyzing more complex field problems such as seepage analysis.
- Understand the theory of flow measuring devices in pipes and open channel flows using Bernoulli's equation.

- Compute forces on pipe bends using linear impulse momentum application and understand the basics of angular momentum principle which is essential to understand the concepts of hydraulic turbines.
- Perform analysis of pipes and hydraulic design of pipe networks.

SYLLABUS

Fluid Properties: Introduction & Physical Properties of Fluids –Newton's Law of Viscosity. Fluid Statics: Forces acting on a fluid element – Pascal'slaw; Variation of Pressure in Static Fluid; Absolute, Gauge and Total Pressure; Pressure Measurement, Forces on Immersed Bodies in Static Fluids – Force on a Plane Surface and curved surfaces.

Fluid Kinematics: Types of Flow, Streamline, Path line, Streak line; Stream Tube, Translation, Deformation and Rotation of a Fluid Element in Motion; Local, Convective and Total Accelerations; One, Two and Three Dimensional Analysis of Flows. Ideal Fluid Flow – Stream Function, Velocity Potential; Rotational & Irrotational Flows–Vorticity and Circulation; Laplace Equation in terms of Stream Function and Velocity Potential; Flow Nets. Principle of Conservation of Mass – Concepts of System and Control Volume; Continuity Equation in three dimensional Cartesian coordinates; Continuity Equation for flow through a Stream tube.

Fluid Dynamics: Principle of Conservation of Energy – Equation of Motion for Ideal Fluids, Euler's Equation in Streamline Coordinates, Derivation of Energy Equation through integration of Euler's Equation, Bernoulli's Equation, Energy Correction Factor.
Flow measuring devices – Flow Measurement in Pipes – Measurement of Static, Stagnation and Dynamic Pressures and Velocity – Pitot Tube, Prandtl Pitot Tube; Measurement of Discharge through a Pipe using Flow Meters – Venturimeter, Flow Nozzle meter and Orifice meter.

Flow through Tanks and Reservoirs – Measurement of Discharge from Tanks and Reservoirs – Steady and Unsteady Flow through Orifices and Mouthpieces – Small & Large Orifices – Different types of Mouthpieces; Discharge from tanks through Drowned Orifices, Time of Emptying Tanks, Discharge from a Tank with Inflow. Flow Measurement in Channels – Flow Measurement in Open Channels, Flow Past Weirs and Notches, Sharp Crested and Broad Crested Weirs, Weirs with and without end contractions, Ventilation of Weirs, Triangular Notches, Cipolletti Weir.

Principle of Conservation of Momentum – Momentum of Fluids in Motion, Impulse Momentum Equation, Momentum Correction Factor, Application of Momentum Principle – Forces on Pipe Bends and Reducers, Flow through a Nozzle; Angular Momentum of Fluid Flow – Sprinkler Problems.

Flow through Pipes: Introduction to Pipe Flow and Laws of Friction – Reynolds Experiment; Steady Turbulent Flow through Pipes; Laws of Friction; Darcy-Weisbach

Equation; Total Energy and Hydraulic Gradient – Energy and Hydraulic Gradient Lines; Minor Losses in Pipes; Pipes in Series and Parallel – Equivalent Length of Pipe; Flow Between Two Reservoirs; Siphon; Pipe Network Analysis by Hardy–Cross Method; Hydraulic Power Transmission through Pipes and Nozzles, Water Hammer (Only Concept).

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.
2. Fluid Mechanics by A.K.Jain, Khanna Publishers.

Reference Books

1. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co.Ltd.
2. Engineering Hydraulics, H.Rouse, John Wiley & Sons Inc.
3. Mechanics of Fluids, I.H.Shames,McGraw-Hill Professional.
4. Fluid Mechanics and Its Applications, Vijay Gupta and Santosh K Gupta, New Academic Science Ltd

CV2104 STRUCTURAL ANALYSIS-I

Course Objectives:

- Familiarise students to the various methods of determining deflections of beams
- Improve student's ability in understanding strain – energy due to Axial load, Shear force, Bending Moment and Torque.
- Impart skills of analysing the fixed beams, three span continuous beams subjected to different types of loads.
- Enable students understand the concept of moving loads and draw maximum Shear force and Bending moment diagrams for different types of loads
- Expose students to understand Lamme's theory in analyzing thick cylinders and know the concept of theories of failure.

Course Outcomes:

the student will be able to:

- Understand behavior of beams and determine slope and deflections of a beams , trusses (having 9 members or less) using various methods.
- Differentiate determinate and indeterminate structures and determine deflections of statically determinate structures.
- Apply strain energy principle to determine the deflections of beams using various methods.
- Understand the concept of moving loads and draw the maximum Shear force and Bending moment diagrams for different types of moving loads.
- Gain knowledge on thick cylinders and compound cylinders. Learns basic concepts of theories of failure.

SYLLABUS

Deflections of Beams: (i) Cantilever (ii) Simply Supported and (iii) Over Hanging Beams, using (a) Double Integration and (b) Macaulay's Method.

Deflections of Beams Using (i) Moment Area Method, (ii) Conjugate Beam Method, (iii) Unit Load Method (iv) Castigliano's Theorem – 1.

Strain – Energy due to (i) Axial Load, (ii) Shear Force, (iii) Bending Moment and (iv) Torque;
Deflections of Statically Determinate Structures: (A) Single Storey, Single Bay Rectangular Portal Frames using (i) Unit Load Method, (ii) Castigliano's Theorem –1. (B) Trusses (Having 9 Members or less) using (i) Unit Load Method and (ii) Castigliano's Theorem-1.

Analysis of (A) Fixed Beams, (B) Three Span Continuous Beams using (i) Theorem of Three Moments, (ii) Slope Deflection Method and (iii) Moment Distribution Method

Moving Loads: Maximum Shear Force and Bending Moment Diagrams for Different types of Loads. Maximum Bending Moment at a Section under a Wheel Load and Absolute Maximum Bending Moment in the case ofseveral Wheel Loads. Equivalent Uniformly Distributed Live Load for Shear Force and Bending Moment. Reversal of Nature of Shear Force, Focal Length, Counter Bracing for Truss Panels, Influence Lines for (i) Beams and (ii) Members of Warren and Pratt Trusses.

Text Books

1. Theory of Structures, Vol- I,by G.S.Pundit, S.P.GuptaandR.Gupta,,McGraw-Hill Education India.
2. Mechanics of structures Vol- I byH.J.Shah and S.B.Junnarkar, Charotar Publishing House.
3. Strength of Materials by S.Ramamrutham andR.Narayanan, Dhanpat Rai Publishing House.

Reference Books

1. Elementary Strength ofMaterials byS.Timoshenko and D.H.Young, Affiliated East-West Press.
2. Analysis and Design ofStructures Vol-I by V.N.Vazirani and M.M.Ratwani, Khanna Publishers.
3. Intermediate Structural Analysis by C.K.Wang, McGraw-Hill.
4. Strength ofMaterials byB.C.Punmia, Laxmi Publications.

CV2105 MANAGERIAL ECONOMICS
(Common for all Branches)

Course Objectives:

- To introduce micro as well as macro, financial concepts that can be used in business decision making
- To analyze various business situations with the help of different economic concepts.
- To assist in a better understanding of the application of modern principles and methods of microeconomics to real-world business issues in different contexts.
- To master the basic tools of microeconomics: supply and demand analysis; firms' production and pricing decisions, market equilibrium, and market structure analysis.
- To enable the students to understand how organizations make important investment and financing decisions.

Course Outcomes:

The student will be able to

- Understand the concepts of cost, nature of production, and its relationship to Business operations.
- Apply marginal analysis to the "firm" under different market conditions.
- Use the tools of marginal analysis to explain the optimal allocation of resources within the firm.
- Analyze the causes and consequences of different market conditions.
- Integrate the concept of price and output decisions of firms under the various market structure.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis:
Production - Meaning, Production function and its assumptions, use of production function in decision making;
Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures: Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly, Oligopoly, Importance of kinked demand curve; Monopolistic Competition.
Pricing and Business Cycles:

Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., Managerial Economics,Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics,Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., Modern Economic Theory, S.Chand& Company Ltd., New Delhi, 2005.

CV2106 MECHANICS OF SOLIDS LAB

Course Objectives:

- To impart knowledge about behaviour of materials under the action of loads.
- To explain about various kinds of loads that are going to act on materials.
- To understand about various kinds of stress and strain measuring machinery that is used in laboratory.
- To familiarize he students with various physical, mechanical properties of various engineering materials.
- To explain about various deformations of materials under the action of loads.

Course Outcomes:

The student will be able to:

- Understand strength and quality of materials through laboratory tests.
- Understand about properties of elastic materials.
- Find deformation of materials after the respective experiment.
- Apply the knowledge of mathematics to find the properties of materials.

LIST OF EXPERIMENTS

1. Tension test on Mild/HYSD bars
2. Compression test on wood (parallel and perpendicular to grains)
3. Tests on springs for the determination of rigidity modulus and spring constant.
4. Brinell's and Rockwell hardness tests.
5. Charpy and Izod impact tests.
6. Double shear test on mild steel specimen.
7. Bending test.: Load deflection test for the determination of young's modulus on simply supported and cantilever beam for wood and steel.
8. Buckling of Wooden column

CV2107 FLUID MECHANICS-I LAB

Course Objectives:

- To impart knowledge in measuring pressure, discharge and velocity of fluid flow.
- To understand the flow measurement in tanks.
- To determine the metacentric height of a floating body.
- To determine the flow measurement in pipe flow.
- To measure the discharge in a open channel flow.
- To learn and practice writing technical reports.

Course Outcomes:

The student will be able to:

- Conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
- Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design.
- Provide exposure to modern computational techniques in fluid mechanics.

LIST OF EXPERIMENTS:

1. Study of Small Orifice by Constant Head Method and Time of Emptying a Tank through a Small Orifice.

2. Study of Cylindrical Mouthpiece by Constant Head Method and Time of Emptying a Tank through a Cylindrical Mouthpiece.
3. Determination of Metacentric Height of Floating Body.
4. Study of Surface Profiles in Free and Forced Vortex Motions.
5. Study of Venturimeter.
6. Study of Orifice meter.
7. Study of Flow Nozzle Meter.
8. Study of Sharp-crested Full Width and Contracted Weirs.
9. Study of V-Notch and Trapezoidal Notch.
10. Study of Broad-crested Weir.

CV2108 SURVEYING FIELD WORK

Course Objectives:

- To impart knowledge about the art of determining the relative positions of points on, above or beneath the surface of the earth.
- To impart knowledge of the measurement of angles and distances and keeping of a record in field book.
- To familiarise the students with instruments like chain, compass, dumpy level, plane table and some special instruments.
- To impart knowledge about advanced instruments of surveying like total station and GPS.
- To familiarize about the theodolite and electronic theodolites that can read angles directly.

Course Outcomes:

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

- Determine the inaccessible horizontal and vertical distances from the observed bearings
  and calculated angles between the survey lines.
- Determine the relative positions of points on, above or beneath the surface of the earth by direct or indirect measurements of distance, direction and elevation.
- Find out the elevations of points with respect to a given datum and also to establish points at a given elevation.
- Handle the advanced survey instruments like total station and global positioning system.
- Use the theodolite as a tacheometer to determine the elevations and reduced levels of points.

LIST OF EXPERIMENTS:

1. Chain traversing: Plotting a chain traverse for a building.

2. Compass traversing: Measurement of bearings and determination of inaccessible distance using a compass.
3. Levelling: Determination of reduced levels of different points by Height of Instrument method and Rise & Fall method.
4. Theodolite traversing: Measurement of horizontal angles by Reiteration method and repetition method, Determination of inaccessible distance using a theodolite, Heights and Distances using vertical and horizontal angles.
5. Point positioning using GPS
6. Total station exercises:
    i. Contour mapping using total station.
    ii. Height of remote point using total station.
    iii. Position of hidden point using total station
    iv. Area& volume measurement using total station.

CV2109 COMPUTER-AIDED DRAFTING

Course Objectives:

- Use computer aided drafting tools to produce 2D and 3D working drawings.
- Develop 2D civil engineering drawings of simple building elements and 3D drawings of simple objects.
- Familiarize with creating layers, formatting text styles and dimension styles.
- Create a new drawing and edit an existing drawing.
- Draw different 3D elements and edit them with 3D space.

Course Outcomes:

The student will be able to:

- Know basic commands used in computer drafting.
- Acquire skills to draw 2D and 3D drawings.
- Use geometric tools such as lines, circles, polylines, and rectangles in AutoCAD to create and modify geometry.
- Use dimension and annotation tools such as dimensions, tolerances, hatch, and text in AutoCAD to annotate drawings.
- Draw different 3D elements along with editing.

SYLLABUS

Introduction: Introduction to computer drafting tools, Coordinate system, Setting up a drawing starting from scratch, Setting up a drawing using a Wizard, Using and creating a template file, Opening an existing drawing, saving a drawing file, Screen layout, Pull-down menus, Screen icons, Command line, Status bar, Dialogue boxes.

2D Drawing: Point, Line, Ray, Construction Line, Multiline and Polylines, Rectangles, Arc, Circle and Ellipse, Polygon, Spline, etc.

2D Editing; Trim, Extend, Lengthen, Break, Move, Copy, Scale, Stretch, Mirror, Rotate, Fillet, Chamfer, Array, Hatch and gradient, Object snap, Direct distance entry, Polar tracking, Object snap tracking, Dynamic input, Properties, etc.

Layers and Text creation: Creating Layers, Text (multi-line & single line) and Formatting Text Styles

Dimension Command Formatting Dimension Style and Multi-leader Style, Drawing Settings and Aids, Saving and Plotting

3D Drawing: Introduction, 3D Coordinate system, UCS, 3D Orbit, Box, Wedge, Cone, Sphere, Cylinder, Torus, Helix, Loft, Revolve.

Editing with 3D Space: Union, Subtract, Intersect, Extrude faces, Move faces, Rotate faces, Offset faces, Taper faces, Delete faces, Copy faces

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CV2110 PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES
(Common for all Branches)

Course Objectives:

- Develop a holistic perspective based on self-exploration about themselves (human beings), family, society, and nature/existence.
- Illuminate the concepts of laws and their applicability to engineers Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
- Strengthen self-reflection, development of commitment, and courage to act.
- Imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- Imbibe the Values and Ethical Behavior in the personal and professional lives

Course Outcomes:

The student will be able to

- Understand the meaning of the concept - get an overview of the laws relating to law and engineers and also understand the importance of being a person who respects the law and they will have a better critical capacity.
- Self-explore by using different methods to live in harmony at different levels
- Evaluate themselves and understand their position in relation to morality and ethics successful and satisfying work-life requires character
- Awareness about themselves and their surroundings (family, society, nature) and becoming more responsible in life and in solving sustainable problems
- Give solutions with a focus on human relationships and human nature.

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education, Self-Exploration–what is it? – Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!
Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship
Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts
Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the

company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. R. Subramanian, "Professional Ethics", Oxford University Press.
4. S.B. Srivasthva, "Professional Ethics & Human Values", SciTech Publications (India) Pvt.Ltd. New Delhi.
5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan VidyaPrakashan, Amar kantak, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), MohandasKaramchand Gandhi "The Story of My Experiments
4. with Truth", E. FSchumacher. "Small is Beautiful", Slow is Beautiful –Cecile Andrews, J C
5. Kumarappa "Economy of Permanence", PanditSunderlal "Bharat Mein Angreji Raj" and
6. Dharampal, "Rediscovering India
7. G K Kapoor, "Business Law" and Sen &Mitra, "Business & Commercial Laws" and Calvin

8. Frank Allen, “Business law for Engineers” Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). Introduction to Psychology. 6th
9. Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd. Govindarajan, M; Natarajan, G. M. &Senthilkumar, V.S. (2013). Professional Ethics & Human Values. Prentice Hall: New Delhi
10. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.
11. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, “Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.
12. Caroline Whitbec, “ Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

CV2111 NCC/NSS

B.Tech & B.Tech. +M.Tech II Year - II Semester

CV2201 WATER SUPPLY ENGINEERING

Course Objectives:

- Outline planning and the design of water supply systems for a community/town/city.
- Provide knowledge of water quality requirements for domestic usage.
- Understanding the importance of protection of water source quality and enlightening the efforts involved in converting raw water into clean potable water.
- Selection of valves fixture stored in water distribution systems.
- Impart knowledge on design of water distribution network.
- Visit at least one Water Treatment Plant and supply system.

Course Outcomes:

The student will be able to

- Plan and design the water and distribution networks and sewerage systems.
- Identify the water source and select the proper intake structure.
- Design & estimation of the water supply system of an apartment.
- Select the appropriate appurtenances in the water supply.
- Selection of suitable treatment flow for raw water treatments.

SYLLABUS

Introduction: Importance and Necessity of Protected Water Supply systems, Waterborne diseases, Planning of public water supply system, components of public water supply systems. Per capita demand and factors influencing it, types of water demands and their variations, factors affecting water demand, Design Period, Factors affecting the Design period, estimation of water demand for a town or city, Population Forecasting.

Sources of Water: Various surface and subsurface sources are considered for water supply and their comparison- Capacity of storage reservoirs, Types of subsurface water bearing formations, Yields from wells and infiltration galleries. Conveyance of Water from the source to the point of interest: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, selection of pipe materials, Pipe joints.

Quality and Analysis of Water: Characteristics of water and their measurement or estimation or analysis: Physical, Chemical and Biological characteristics. Water quality criteria for different uses- Rural, Municipal, Industrial and Agricultural uses. Drinking water quality standards: IS and WHO guidelines.

Treatment of Water: Typical treatment flow of a municipal water treatment plant, Unit operations of water treatment: Theory and Design of Sedimentation, Coagulation, flocculation, Filtration, Water conditioning and softening, Disinfection, Removal of color and

odors – Removal of Iron and manganese – Fluoridation and deflouridation –Ion Exchange - Ultra filtration- Reverse Osmosis.

Distribution of Water: Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods – Appurtenances of water distribution system–Laying and testing of pipe lines. Ideal water supply system.

Text Books

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.
2. Water Supply Engineering. Dr. P.N. Modi, Standard Book House, Delhi.
3. Rural, Municipal and Industrial Water management, KVSG Murali Krishna, Reem Publications, New Delhi, 2012

Reference Books

1. Elements of Environmental Engineering – K.N. Duggal, S. Chand & Company Ltd., New Delhi.
2. Water Supply Engineering.– Dr. B.C. Punmia, A.K. Jain and A.K. Jain. LaxmiPublicatgins(P) Ltd., NewDelhi.
3. Water Supply and Sanitary Engineering – G.S.Birdie and J.S.Birdie

CV2202 FLUID MECHANICS-II

Course Objectives:

- To classify the types of flows in open channel and also design most economical open channel sections and learns about critical flows.
- To study about non-uniform flows in open channels and also to learn about the characteristics of hydraulic jump in rectangular channels.
- To impart knowledge on impact of jets, working principle, selection and designing of impulse and reaction turbines.
- To explain governing of turbines and performance characteristics of pumps and turbines working under different conditions.
- To explain various components and working principles of centrifugal pump and reciprocating pumps. Also, to teach the criteria of selection of the pumps.

Course Outcomes:

Students will be able to

- To calculate discharge carrying capacity of open channel sections and design of most economical channel sections.
- To calculate water surface profiles in open channels, hydraulic jump analysis.

- Select appropriate hydraulic turbines for given conditions and study their performance characteristics.
- Understand the operation of pumps and study their characteristics.

SYLLABUS

Open Channel Flows: Basic Concepts – Introduction, Classification of Open Channels – Classification of Flow; Geometric Elements of a Channel Section; Velocity Distribution in a Channel Section; Wide Open Channel; Measurement of Velocity; Velocity Distribution Coefficients; Pressure Distribution in a Channel Section – Effect of Slope on Pressure Distribution; Basic Equations – Chezy's Equation, Manning's Equation.
Uniform Flow Computation; Most Economical Channel Sections – Rectangular, Trapezoidal, Circular and Triangular Channel Sections; Critical Flow – Computation of Critical Flow, Section Factor for Critical Flow.

Application of Energy Principle in Open channels – Definition of Specific Energy, Specific Energy Diagram, Critical depth, Critical Velocity, Conjugate or Alternate Depths, Sub-critical, Critical and Super-critical Flows, Froude Number, Relationship between Critical depth and Specific Energy for Rectangular, Trapezoidal Sections; Application of Momentum Principle in Open channels – Specific Force; Canal Transitions – Change of Depth in Channels with Change in Cross-section and Hump in the Bed; Control Sections; Venturi Flume and Parshall Flume.

Varied Flow in Open Channels: Analysis &Computation of G.V.F: Definition of G.V.F. and Derivation of Governing Equation – Mild, Steep, Critical, Horizontal and Adverse Slopes – Backwater and Drawdown Curves –Computation of G.V.F. Profiles in rectangular channels using Direct and Single Step methods (Simple Slope cases only).
Rapidly Varied Flow – Hydraulic Jump, Types of Jumps, Hydraulic Jump in Horizontal Rectangular Channels.

Impact of Jets: Force Exerted by Fluid Jet on Stationary and Moving Flat and Curved Vanes, Torque and Work Done by Series of Moving Vanes.
Hydraulic Machines-Turbines: Introduction and Classification of Turbines –Working of Impulse Turbines and Design Principles – Components and Working Principles of Pelton Turbine – Work Done; Hydraulic and overall Efficiencies; Design of Pelton Turbine – Working Proportions.

Working of Reaction Turbines and Design Principles – Components and Working Principles of a Francis Turbine – Work Done; Hydraulic and overall Efficiencies; Design of Francis Turbine – Working Proportions; Draft Tube Theory; Kaplan Turbine and Working Proportions of Kaplan Turbine.
Performance and Characteristics of Turbines: Unit Quantities, Specific Speed and its Importance; Model Relationships; Operating Characteristic Curves; Cavitation Problem in Turbines.

Hydraulic Machines – Centrifugal Pumps; Functions of a Pump– Selection Criterion – Rotodynamic and Positive Displacement Pumps – Comparison between Centrifugal & Reciprocating Pumps; Components & Working principles of Centrifugal Pumps; Classification of Centrifugal Pumps; Working Head and Number of Stages, Single & Double Suction. Work done by Centrifugal Pumps – Pressure Change in a Pump, Manometric and Static Head – Velocity triangles– Minimum Starting Speed of pump – Multistage Pumps; Pumps in Parallel and Series; Cavitation – Limitation of Suction Lift, NPSH and its importance in Selection of Pumps. Performance Characteristics of Pumps – Similarity Relations and Specific speed of Pumps – Dimensionless characteristics – Constant Efficiency Curves of Centrifugal Pumps.

Hydraulic Machines – Reciprocating Pump: Reciprocating Pumps – Fundamental concepts, Component Parts and Working principle of Single Acting and Double Acting Reciprocating Pumps – Discharge Coefficient, Volumetric Efficiency and Slip; Work done by Reciprocating pumps.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.
2. Flow in Open Channels by K.Subramanya, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Fluid Mechanics by A.K.Jain, Khanna Publishers.
2. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co.Ltd.
3. Flow through Open Channels by K.G.Ranga Raju, Tata McGraw-Hill Publishing Co. Ltd.
4. Open Channel Hydraulics by V.T.Chow, McGraw-Hill Ltd.

CV2203 HYDROLOGY AND WATER RESOURCES ENGINEERING

Course Objectives:

- To build knowledge in hydrology and hydraulics and understanding of water resources systems.
- To develop skills in the groundwater flow, type of aquifer, and yield from the well.
- To provide the knowledge of the design of reservoir operation, sedimentation, and flood routing techniques.
- To develop skills in modeling flood flows and flood routing.
- To study the effect, causes, and remedial measures of waterlogging and canal systems.

Course Outcomes:
The students will be able to

- Demonstrate the concepts of the hydrograph, S-hydrograph, Unit hydrograph, and IUH
- Analysis of groundwater flow hydraulics along with rainwater harvesting methods.
- Demonstrate the basic types of irrigation, irrigation standards, and crop water assessment.
- Identify various types of reservoirs and their design aspects along with flood routing techniques.
- Design aspects of canal systems and waterlogging remedies.

SYLLABUS

Introduction to Hydrological Aspects: Water Resources in India, Hydrology in Water Resources Planning – Hydrologic Planning –Water Budget Equation;
Climate and Weather – Importance of Monsoon Rains, Clouds, Storms, and Precipitation – Precipitation – Types, Measurement of Rainfall; Influence and Feedbacks of Hydrological Changes Due to Climate Change; Average Depth of Rainfall over an Area, Mean Annual Rainfall, Analysis of Rainfall Data – Consistency of Rainfall Record, Double Mass Curve, Depth –Intensity, Depth-Area-Duration Curves, Frequency of Point Rainfall – Intensity-Duration-Frequency (IDF) Curves, Probable Maximum Precipitation (PMP) Curves; Infiltration – Factors affecting and its Determination, Evaporation and Evapo-Transpiration – Pan Evaporation; Runoff – Factors Affecting Runoff, Methods of Determination of Runoff, Hydrograph Analysis, Base Flow Separation, Unit Hydrographs, Hydrograph of Different Durations, Applications of Unit Hydrograph; S-Hydrograph, Synthetic Unit Hydrograph; Stream Flow Measurement methods.

Groundwater Flow: Mechanics of Interstitial Flow, Definitions, Subsurface Distribution of Water, Ground Water Movement; Darcy's Law; Permeability – Intrinsic Permeability; Well Hydraulics – Steady Flow in Different Types of Aquifers and Wells; Determination of Hydraulic Properties of Aquifer; Well Losses; Specific Capacity of Well; Well Efficiency – Pumping Tests – Recuperation Test Method for Determination of Well Yield.
Rain Water Harvesting and Recharging of Underground Storage – Methods of Recharging – Infiltration Galleries, Infiltration Wells, Springs.
Methods of Construction of Open Well–Yield of an Open Well – Methods of Construction of Tube Wells, Well Shrouding and Well Development, Spacing of Tube Wells, Design of Tube Well; Pumping Requirements.

Reservoir Planning and Flood Routing: Types of Reservoir – Investigations for Reservoir Planning, Selection of Site for a Reservoir, Zones of Storage in a Reservoir; Purpose of Reservoir, Design Studies, Reservoir Regulation, Reservoir Yield, Mass Curve and Demand Curve, Determination of Reservoir Capacity, Yield From a Reservoir of given Capacity;

Reservoir Losses – Measures To Reduce Evaporation Loss in Reservoirs, Control of Reservoir Sedimentation.
Flood Routing – Hydrologic Reservoir Routing by Pulse Method of Routing, Channel Routing by Muskingum Method.

Irrigation: Definition of Irrigation, Types of Irrigation Systems – Direct and Indirect, Lift and Inundation Irrigation Systems, Methods of Irrigation – Surface and Sprinkler Methods, Trickle or Drip Irrigation, Soil Moisture Constants, Depth of Water Held By Soil In Different Zones, Water Extraction – Quality of Irrigation Water, Irrigation Efficiencies – Soil Moisture – Irrigation Relationship – Estimating Depth and Frequency of Irrigation on the Basis of Soil Moisture Regime Concept; Water Requirements of Crops, Duty, Delta and Base Period – Their Relationship, Crops – Seasons, Factors Affecting Duty and Methods of Improving Duty, Consumptive Use of Water –Determination of Evapotranspiration – Blaney-Criddle and Penman Equations and Hargreaves Method(concepts only); Assessment of Irrigation Water Charges.

Canal Systems: Classification of Irrigation Canals – Canal Alignment, Design of Unlined Canals, Regime Theories – Kennedy's and Lacey's Theories, Critical Tractive Force Method, Design Problems – Balancing Depth; Regulation of Channel System – Canal Outlets, Requirements of a Good Outlet – Types of Outlets; Water Logging – Causes and Control – Land Drainage; Canal Lining – Methods, Design of Lined Canals, Canal Navigation – Requirements, Methods to make Navigability Feasible.

Text Books

1. Irrigation and Water Power Engineering by B.C.Punmia and P.B.B. Lal, Laxmi Publications Pvt. Ltd.
2. Irrigation and Water Resources & Water Power by P.N.Modi, Standard Book House.

Reference Books

1. Irrigation and Hydraulic Structures by S.K.Garg, Khanna Publishers.
2. Engineering Hydrology by K.Subramanya, Tata McGraw-Hill Education Private Limited.
3. Hand Book of Applied Hydrology by V.T.Chow, McGraw-Hill Book Co.
4. Impacts of Climate Change and Climate Variability on Hydrological Regimes by Jan C. van Dam, Cambridge University Press.
5. Hydrology: Principles, Analysis and Design by H.M.Raghunath, New Age International.
6. Ground Water by H.M.Raghunath, New Age International.

CV 2204 GEOTECHNICAL ENGINEERING I

Course Objectives:

- To impart knowledge in analysing the composition of the soil matrix and proportioning in developing fundamental relations.
- To understand concepts like plasticity, compressibility, Shear strength, compaction, settlement, etc.
- To identify and classify soils based on their properties.
- To develop skills in the identification of soil characterization when it interacts with water.
- To estimate the magnitude and time rate of settlement due to consolidation.

Course Outcomes:

The student will be able to

- Analyse soil and identify its nomenclature which helps in deriving its behaviour at various in situ conditions.
- Apply basic concepts of soil to compute settlements and the bearing capacity of soils.
- Prediction of seepage characterization under various hydraulic structures.
- Apply the knowledge of compaction during the construction of roads, embankments, canals etc, on weak soils.
- Solve practical problems related to consolidation settlement and the time rate of settlement.

SYLLABUS

Introduction: Soil Formation, Minerals in Clays and Sand, Soil Structure, Physical properties of Soil: Void Ratio, Porosity, Degree of Saturation, Water Content, Unit Weights, Specific Gravity, Weight - Volume Relationships, Relative Density, Consistency Limits and Consistency Indices, Activity.

Mechanical Analysis and Soil Classification: Sieve Analysis, Stoke's Law, Hydrometer and Pipette Analysis, Textural Classification, Classification based on size, Unified Soil Classification and Indian Standard Soil classification systems, Field Identification of Soils.

Soil Hydraulics: Types of Soil Water, Capillary Rise and Surface Tension, Darcy's Law and its Limitations, Constant Head and Variable Head Permeability Tests, Factors effecting coefficient of permeability, Permeability of Stratified Soils. Total, Neutral and Effective Stresses, Effective stress principle, Upward flow conditions, Quick Sand Conditions, Critical Hydraulic Gradient.

Stress Distribution in Soils: Boussinesq's Theory for Determination of vertical stress, Assumptions and validity, Extension to line, strip, Rectangular and Circular loaded areas, Pressure Bulb and Influence Diagrams, Newmark's Influence Chart- Construction and Use,

Westergaards's Theory, 2:1 Load Dispersion Method , Contact Pressure Distribution beneath Footings.

Compaction: Mechanism of Compaction, Factors Effecting Compaction, Laboratory Compaction Tests, Effect of Compaction on Soil Properties, Field Compaction: Compaction Equipment and Evaluation of Field Compaction.

Consolidation: Basic Definitions: Compression Index, Coefficient of Compressibility and Coefficient of volume decrease: Spring Analogy for Primary Consolidation: Initial compression, Primary compression and secondary compression, Generation of Effective Stress- Void Ratio relationship from consolidation test: Height of Solids Method and change in Void Ratio method: Determination of Preconsolidation Pressure, Normally consolidated, Over consolidated and under consolidated clays, Terzaghi's One Dimensional Consolidation Theory - Assumptions, Derivation of differential equation and Solution, Laboratory Determination of coefficient of consolidation by time fitting methods.

Shear Strength of Soils: Stress at Point, Mohr circle of stress, Mohr-Coulomb Failure Theory, Shear Parameters, Laboratory Shear Tests- Shear Box, Triaxial and Unconfined Compression Tests, Laboratory and Field Vane Shear Tests, Sensitivity of Clays, Types of Shear Tests based on Drainage Conditions, Total stress analysis and effective stress analysis, Shear Strength of Sands, Critical Void Ratio and Dilatancy, Liquefaction of Soils, Factors affecting Shear Strength of Clays and Sands.

Text Books:

1. Soil Mechanics and Foundation Engineering by K.R.Arora, Standard Publishers
2. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R Rao, New Age International
   Publishers.
3. Geotechnical Engineering by P.Purushothama Raj, Pearson Publishers.
4. Principals of Geotechnical Engineering by Braja.M.Das, Cengage Learning Publishers.

Reference Books:

1. Gopal Ranjan and Rao, P. Basic and Applied Soil Mechanics, New Age International Pvt. Limited, New Delhi, 2002.
2. Murthy, V.N.S., A **Text Books** of Soil Mechanics and Foundation Engineering, UBS PublishersDistributors Ltd., New Delhi, 1999
3. Punmia, B.C. Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi,1995.
4. Braja M. Das, Fundamentals of Geotechnical Engineering, Thomson Asia Pvt. Ltd., Singapore,2005.

CV2205 CONCRETE TECHNOLOGY

Course Objectives:

- To understand the concepts of application of chemical and mineral admixtures in concrete.
- To understand the concepts of dimensional stability due to creep and Shrinkage of concrete.
- To impart knowledge about the durability of concrete.
- To understand the mix design of concrete using different Standards.
- To understand the properties and application of special concretes.

Course Outcomes:

The student will be able to:

- Understand the effect of chemical and mineral admixtures on the properties of concrete.
- Understand the creep, relaxation and shrinkage of concrete.
- Understand the relation between durability and permeability of concrete
- Design the concrete mix as per IS, BS and ACI standards.
- Understand in detail about the properties and application of special concretes.

SYLLABUS

Chemical and Mineral Admixtures: Water Reducers, Air Entrainers, Set Controllers, Special Admixtures – Structure, Properties and effects on Concrete Properties. Introduction to Supplementary Cementing Materials and Pozzolans – Fly ash, Blast Furnace Slag, Silica Fume, and Metakaolin– their Production, Properties, and Effects on Concrete Properties; Other Mineral Additives –Reactive and Inert.

Dimensional Stability and Durability: Creep and Relaxation –Parameters Affecting; Shrinkage of Concrete –Types and Significance. Parameters affecting Shrinkage; Measurement of Creep and Shrinkage.

Durability of Concrete: Introduction to Durability; Relation between Durability and Permeability – Chemical Attack of Concrete; Corrosion of Steel Rebars; other Durability Issues.

Mix Design: Review of Methods and Philosophies of IS, BS and ACI Methods, Mix Design for Special Purposes. Acceptance Criteria for Compressive Strength of Concrete

Special Concretes: Properties and Applications of High Strength –High Performance Concrete, Reactive Powder Concrete, Lightweight, Heavyweight and Mass concrete; Fib rereinforced Concrete; Self-compacting Concrete; Shotcrete.

Text Books

1. Concrete Technology Theory and Practice by M.S.Shetty, S.Chand& Company Ltd, New Delhi.

Reference Books

1. Properties of Concrete by A.M.Neville, Longman 1995.
2. Concrete micro-structure, Properties and Materials by P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw-Hill, USA.

CV2206 GEOTECHNICAL ENGINEERING – I LAB

Course Objectives

- To develop skills to identify and classify different types of soils
- To impart knowledge about different methods of determination of insitu density of soils
- To study the necessity of sedimentation analysis for classifying fine grained soils
- To assess the drainage capacity of different soils
- To understand laboratory methods used for determining density of soil.

Course Outcomes:

The student will be able to

- Perform suitable tests for assessing grain size distribution and classify the soil accordingly Select appropriate method for determining field density of soil for a given soil
- Determine specific gravity of coarse and fine grained soils3
- Evaluate Permeability of given soil
- Estimate compaction characteristics of soil

LIST OF EXPERIMENTS

1. Atterberg limits
2. Field density by Core Cutter and Sand replacement method
3. Grain size analysis
4. Hydrometer/pipette analysis
5. Specific gravity by pycnometer/density bottle method
6. Permeability of soil – Constant and variable head tests
7. IS light compaction

DEMONSTRATION EXPERIMENTS:

1. Consolidation test.
2. Quicksand model and others if any.

CV2207 BUILDING MATERIALS LAB

Course Objectives:

- To impart knowledge about various tests used at construction sites.
- To understand the concepts of physical properties of tiles, different bricks, and paver blocks.
- To familiarize the basic properties of fresh and hardened concrete.
- To develop skills to design mix proportions of concrete to arrive at the required strength of concrete with a specific ratio of its ingredients.

Course Outcomes:

The student will be able to

- Understand the concept of the physical properties of concrete ingredients.
- Understand the concepts of physical properties of tiles, different bricks, and paver blocks.
- Conduct various tests on cement, fine aggregate, and coarse aggregate.
- Analyse the properties of fresh and hardened concrete.
- Design mix proportions of concrete.

LIST OF EXPERIMENTS

1. Determination of Specific Gravity and Unit Weight of Cement
2. Determination of Specific Gravity and Unit Weight of Coarse and Fine Aggregates
3. Determination of Normal Consistency of Cement
4. Determination of Initial and Final Setting Time
5. Determination of Fineness of Cement.
6. Determination of Compressive Strength of Cement (for different grades of cement).
7. Determination of flexural strength and water absorption for different tiles.
8. Determination of compressive strength and water absorption for burnt clay and fly ash bricks.
9. Determination of crushing strength and water absorption for different paver blocks.
10. Determination of Bulking Characteristics of Sand.
11. Sieve Analysis of Coarse and Fine Aggregates and Classification as per IS 383.
12. Workability Tests on Green Concrete by using: Slump Cone, Compaction Factor Apparatus, Flow Table, Vee-Bee Consistometer.
13. Tests on Hardened Concrete.
    a. Determination of Compressive Strength
    b. Determination of Split tensile strength
    c. Determination of Modulus of rupture.
14. Design of Concrete Mix by using IS Code Method (for classwork only)

CV2208 BUILDING PLANNING AND COMPUTER AIDED DRAWING

Course Objectives:

- To familiarize building components, principles, methods, software, and codes of practices for planning and design of the building
- To impart knowledge about the elements of climate to the design and construction of buildings.
- Prepare constructional detailed representation drawing of a building.
- Analyze the planning laws and recommendations involved in planning, and building drawings concepts of buildings.
- Design plan and elevation of different types of building with their functional and furniture requirements.

Course Outcomes:

The students will be able to

- Analyse the various types of residential buildings.
- Assess different climatic elements to decide the orientation of the building for ventilation
- Draw the complete drawing of plan of a residential building
- Draw the plan, elevation, and sectional view of the building with functional requirements.
- Draw the plan using computer drafting tools.

SYLLABUS

Residential Building: Different types of Residential Buildings

Climatology: Elements of Climate: Sun, Wind, Relative Humidity, Temperature effects, Comfort Conditions for House, Various types of Macro Climatic Zones. Orientation of Buildings, Solar Charts, Ventilation.

Principles of Planning

Preliminary Drawing: (a) Conventional Signs of Materials, Various equipment used in a Residential Building (copying exercise) (b) Plan, Section, and Elevation of a Small House (one room and Verandah) (copying exercise) (c) Plan, Section and Elevation of Two Bed Room House (copying exercise) (d) Plan Section and Elevation of Three Bed Room House in Hot and Humid Zone. (copying exercise).

Design of individual Rooms with Particular Attention to Functional and Furniture requirements. Building Regulations and Bye-laws of Residential Buildings;

Drawing the plan, Elevation of Houses with given Functional Requirements and Climatic Data. (emphasis may be given to Hot and Humid zones.)

AUTOCAD Drawing of Residential Building.

Text Bookss

1. Building Planning and Drawing by N. Kumar Swamy and A. Kameswara Rao, Charotar Publication House.
2. Building planning Drawing and Scheduling by Gurucharansingh and Jagadish Singh, Standard Publishers Distributors

Reference Books

1. Civil Engineering Drawing by Sharma and Gurucharan Singh, Standard Publishers.
2. Civil Engineering Drawing Series 'B' by R. Trimurthy, M/S Premier Publishing House.
3. Building Drawing with an integrated Approach to Built Environment by M.G.Shah, C.M.Kale and S.Y.Patki, McGraw-Hill Publishing Company Ltd.

CV2209 ENVIRONMENTAL SCIENCE
(Common for all Branches)

Course Objectives

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Appraise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of sustainable development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

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

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.

- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.
Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),
Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide- watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.
Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.
Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional

energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha,Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., &Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H &Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

B.Tech & B.Tech. +M.Tech III Year - I Semester

CV3101 REINFORCED CONCRETE STRUCTURES
(IS-456 code book is allowed for examination)

Course Objective

- Establish the basic principles of reinforced concrete structural member and system behaviour.
- Explain the basic design philosophy behind the working stress method and Limit State Method of design.
- Introduce the basic principles of the analytical methods and design procedures.
- Impart knowledge of basic structural elements such as slabs, beams, columns, staircases, and isolated footings in the design process.
- Understand the concepts of designing reinforced concrete structures for limit state of collapse.

Course Outcomes:

After completion of this course, students will be able

- To understand the IS code of practice for the design of reinforced concrete structural elements.
- To understand the various design philosophies and their differences.
- To understand behaviour of RCC members under flexural and shear.
- Define design stages of reinforced concrete structures.
- To analyse and design basic structural elements like slabs, beams, columns, staircases & isolated footings.

SYLLABUS

General: Loading standards as per IS 875, Grades of steel and cement, Stress-Strain characteristics of concrete and steel, Introduction to working stress method and Limit State Method (L.S.D.) of design.

Limit State of Collapse of in Flexure: Central Value measures, Measures of distribution, Normal distribution curve. Introduction and Principles of L.S.D., Characteristic load and strengths, Design values, Partial safety factors, Factored loads.

Limit State of Collapse: Flexure of R.C.C. beams of rectangular section. Under reinforced, Balanced and over reinforced sections. Compression stress block, Estimation of ultimate

moment by strain compatibility. Guidelines for choosing width, depth and percentage of reinforcements in beams.

Analysis and design of singly reinforced rectangular beams and doubly reinforced beams, design by using SP 16 (Sessional Work Only).

Design of flanged beams (T and L), Effective flange width, Basis of analysis and design, Minimum and Maximum steel in flanged beams, SP 24 in design of beams.

Design of one way and two way slab: Simply supported slabs on all four sides, Moment in two way slabs with corners held down. Choosing slab thickness. Design of restrained slabs (with torsion at corners) I.S. code provisions. Detailing of reinforcement. Load from slabs on supporting beams. Different kinds of loads on slabs including partition walls, Shear in slabs.

Shear, Torsion and Bond: Limit state of collapse in shear, types of shear failures. Truss analogy, shear span / depth ratio. Calculation of shear stress, types of shear reinforcement. General procedure for design of beams for shear. Enhanced shear near supports. Shear in slabs, steel detailing. Analysis for torsional moment in a member. Torsional shear stress in rectangular and flanged sections. Reinforcement for torsion in RC beams. Principles of design for combined bending shear and torsion. Detailing of torsion reinforcement – Concept of bond, development length, anchorage, bond, flexural bond.

Columns: Short and Long columns, Minimum eccentricity, short column under axial compression, column with helical and tie reinforcement. Short columns subjected to uniaxial and biaxial moments.
Footings: Analysis and design of isolated square and rectangular footings. Design of staircase.

Text Books:

1. Limit State of Design of Reinforced Concrete by P. C. Vergheese, Prentice Hall India Learning.
2. Reinforced Concrete Limit state Design by A.K. Jain, Nem Chand & Brothers.
3. R.C.C Design by Unnikrishna Pillai and Devadas Menon, McGraw-Hill

Reference Books:

1. Limit State Design of Reinforced Concrete Structures by P. Dayaratnam, P.Sarah, Oxford and IBH Publishers.
2. Reinforced Concrete Structures by R.Park and T.Paulay, Wiley Publishers.

CV3102 STEEL STRUCTURES

Course Objective

- To enable the students regarding types of steel material, properties of steel and various tests on steel like yield strength, ultimate strength and breaking strength tests.
- To impart knowledge on various types of rolled steel sections and their classifications.
- To familiarize the students with the concepts of limit state method.
- To make the students to understand code of practice of steel structure which is IS-800:2007.
- To prepare the students in solving different types of numerical problems of steel structures.

Course Outcomes

- Students will be having sufficient knowledge on different topics of steel structures.
- Understand concepts on different types of connections in steel structures like bolted and welded connections.
- Can do the problems on different topics of steel structures.
- Can understand advantages of steel structures.

SYLLABUS

Note: All the designs should be taught in the limit state design method as per IS 800-2007

Fundamental Concepts of limit state design of structures, Different types of rolled steel sections available to be used in steel structures. Stress – Strain relationship for mild steel.
Bolted connections: Behavior of bolted joints, Design strength of ordinary black bolts, high strength friction grip bolts, Simple connections, Moment resistant connections.
Welded Connections: Advantages of welding, Types and prosperities of welds, Types of joints, weld specifications Design of welded joints subjected to axial load, Eccentric welded connections.

Tension members: Types of tension members, Design of strands, slenderness ratio, displacement of tension members, behavior of tension members, modes of failure, factors affecting strength of tension members, angles under tension, design of tension members, Lug angles, splices.

Compression members: Possible failure modes, classification of cross-section, behavior of compression members, Effective length, radius of gyration and slenderness of compression members, Allowable stresses in compression, Design of axially loaded compression members,

built up compression members, Laced and Battened columns, eccentrically loaded columns, Column splices.

Beams: Beam types, section classifications, lateral stability of beams, Allowable stress in bending, Shear and Bearing stresses, Effective length of compression flange, laterally supported and unsupported beams, Design of built up beams.
Roof trusses: Types of trusses, Economical spacing of roof trusses, loads on roof trusses, Estimation of wind load on roof trusses as per IS : 875. Design of members of roof truss and joints, Design of purlins.

Column bases and Foundations: Allowable stress in bearing, Slab base, Gusset base and Grillage foundations.
Introduction to pre-engineered structures, concepts and advantages, disadvantages.

Text Books

1. Limit State Design of steel structures by S.K.Duggal, McGraw-Hill Education Private Ltd.
2. Design of steel structures by K.S.Sai Ram, Pearson Education India.
3. Limit State Design of steel structures by Ramchandra and Virendra Gehlot, Scientific Publishers (India).

Reference Books

1. Design of Steel structures by N. Subramanian, Oxford University Press.
2. Design of steel structures by Limit State Method as per IS: 800-2007 – S.S. Bhavikatti, IK International Publishing House.

CE3103 GEOTECHNICAL ENGINEERING – II

Course Objectives

- To understand methods of explorations for assessing subsoil characteristics
- To study different methods used for determination of shear strength characteristics of soil.
- To impart knowledge of design of shallow and deep foundation systems and their suitability depending on type of soil and loading conditions.
- To understand various earth pressure theories used for design of earth retaining structures
- To analyse and evaluate stability of soil slopes

Course Outcomes:

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

- Plan soil exploration programme and prepare a detailed soil investigation report
- Estimate allowable bearing pressure and settlement of soils
- Evaluate stability of various earth retaining structures.
- Gain diverse knowledge on various shallow and deep foundations adopted in field
- Select and design appropriate foundations based on soil characteristics

SYLLABUS

Subsoil Exploration: Methods of subsoil exploration Direct, semi direct and indirect methods, Soundings by Standard, Dynamic cone and static cone penetration tests, Types of Boring, Types of samples, Criteria for undisturbed samples, Transport and preservation of samples, Borelogs, planning of exploration programmes, report writing.

Bearing Capacity: Safe bearing capacity and allowable bearing pressure, Terzaghi's bearing capacity equations its modifications for square, rectangular and circular foundation, General and local shear failure conditions. Factors affecting bearing capacity of Soil. Allowable bearing pressure based on N-values. Bearing capacity from plate load tests.

Shallow Foundations: Factors effecting locations of foundation and design considerations of shallow foundations, choice of type of foundations. Foundations on expansive soils.
Settlement analysis: causes of settlement, Computation of settlement, allowable settlement. Measures to reduce settlement.

Pile Foundations: Types, Construction, load carrying capacity of single pile – Dynamic Formula, Static formula, Pile load tests, Load carrying capacity of pile groups, settlement of pile groups, Negative skin friction.

Caissons: Types of caissons, pneumatic caissons, Different shapes of well foundations. Relative advantages and disadvantages. Different Components of well and their function. Grip length, problems in well sinking and remedial measures.

Stability Analysis of Slopes: Finite Slopes Fellinius slip circle method, Friction Slip circle method and Taylor's stability numbers, types of failure of finite slopes – Toe slope and Base failure. Infinite slope, factors of safety.

Earth Pressure: Types of Earth pressure. Rankines Active and passive earth pressure, Smooth Vertical wall with horizontal backfill. Extension to Soil Coloumbs wedge theory, Culmans and Rebhanns graphical method for active earth pressure. Bulkheads – Classifications, Cantilever

sheet Piles in Sandy soils and clay soils. Analysis of Anchored bulkheads – free earth support and fixed earth support methods.

Text Books

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publishers
2. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers.

Reference Books

1. Foundation Engineering by P.C. Varghese, Prentice Hall of India
2. Foundation Analysis and Design by J. E. Bowles, Mc Graw-Hill Publishing Co.

CV3104 PROFESSIONAL ELECTIVE-I

CV 3105 OPEN ELECTIVE -I

CV 3106 GEOTECHNICAL ENGINEERING - II LABORATORY

Course Objectives

- To develop skills to identify and classify different types of soils
- To impart knowledge about different methods of determination of insitu density of soils
- To study the necessity of sedimentation analysis for classifying fine grained soils
- To assess the drainage capacity of different soils
- To understand laboratory methods used for determining density of soil

Course Outcomes

Upon successful completion of the course student will be able to

- Perform suitable tests for assessing grain size distribution and classify the soil accordingly
- Select appropriate method for determining field density of soil for a given soil
- Determine specific gravity of coarse and fine grained soils3
- Evaluate Permeability of given soil
- Estimate compaction characteristics of soil

LIST OF EXPERIMENTS

1. Determination of Specific Gravity of Coarse Grained and Fine-Grained Soils
2. Determination of Atterberg Limits of Clay

3. Determination of Field Density by Core Cutter and Sand Replacement Methods
4. Determination of Grain Size Distribution of Coarse Grained Soil by Sieve Analysis
5. Determination of Grain Size Distribution of Fines Fraction of Soil by Hydrometer/pipette Analysis.
6. Determination of Coefficient Permeability of Coarse Grained Soil by Constant Head Permeability Test
7. Determination of Coefficient Permeability of Fine Grained Soil by Variable (Falling) Head Permeability Test
8. Determination of Compaction Characteristics of Soil by IS Light / Heavy Compaction Test.
9. Demonstration Experiments:
    1. Rapid Moisture Meter Test for Quick Determination of Water Content
    2. Determination of Water Content of Compacted Soil in Field by Proctor's Plasticity Needle

Reference Books

1. Relevant IS Codes of Practice

CV 3107 ENVIRONMENTAL ENGINEERING LAB

Course Objectives:

- To impart knowledge about the physical, chemical, and biological characteristics of water
- To enable the student to optimize the coagulation dose.
- To provide knowledge about the breakpoint chlorination, available chlorination, and residual chlorine.
- To assess the quality of water by physical, chemical biological characteristics relative to standard drinking water standards.
- To evaluate the quality of wastewater without being hazardous as effluent from industries.

Course Outcomes:

Students will be able to

- Perform common environmental experiments relating to water and wastewater to assess the quality.
- Statistically analyse and interpret laboratory results.
- Apply the laboratory results to identify the problem and give real-time technical solutions.
- Understand the procedures for water and wastewater sampling and sample preservations.
- Understand the effect of water and wastewater treatment on people and the environment.

LIST OF EXPERIMENTS

1. Determination of pH and Conductivity of a given water and wastewater sample
2. Measurement of Turbidity using Nephelometric Turbid meter and Determination of optimum coagulant dosage (Jar Test). Estimation of Total Solids: Settleable Solids: Suspended solids, dissolved solids
3. Determination of Hardness in a given water sample
4. Estimation of Acidity of a water sample
5. Estimation of Alkalinity of a waste and wastewater sample
6. Determination of Available Chlorine, estimation of Fluorides and iron in a given water sample.
7. Measurement of D.O. by volumetric analysis
8. Estimate the B. O. D. of a wastewater sample.
9. Estimate the C. O. D. of a wastewater sample.

Text Books

1. Environmental Engineering Laboratory Manual by Kotaiah, B. and Kumara Swamy, N. Charotar Pub. House.
2. Chemical Analysis of Water and Soil: A laboratory Manual by Muralikrishan K.V.S.G.., Envir. Prot. Society.

CV 3108 COMPUTER APPLICATIONS IN CIVIL ENGINEERING LAB

Course Objectives:

- Explore features of 'C/ Fortran 77' language and its use in Civil Engineering computations.
- Develop 'C/ Fortran 77' Programmes for various Civil Engineering problems.
- Design columns, footings, singly and doubly reinforced beams by executing C/ Fortran 77 program.
- Evaluate minor losses in pipes and runoff for a catchment by applying C/ Fortran 77 language.
- Determine the physical characteristics of water and bearing capacity of soils by compiling a program using C/ Fortran 77.

Course Outcomes:

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

- Evaluate shear force, bending moment and deflection for various types of beams subjected to different loads by executing 'C/ Fortran 77' program.
- Analyze and design columns, footings, singly and doubly reinforced beams by using C/Fortran 77 language.

- Determine runoff of a catchment, friction factor and minor losses in pipes by writing C/Fortran 77 programs and executing them.
- Compile C/Fortran 77 programs for conversion of angles from WCB to RB and classification of soils.
- Evaluate bearing capacity of soils and physical characteristics of water by executing C/Fortran 77 programs.

LIST OF COMPUTER PROGRAMS USING C/ FORTRAN 77 LANGUAGE:

1. Determination of shear force, bending moment, deflection for different loading conditions for a simply supported beam and cantilever beam.
2. Determination of fixed end moments for different loading conditions of a fixed beam.
3. Analysis and design of singly and doubly reinforced beams.
4. Analysis and design of columns and footings.
5. Estimation of runoff for a catchment.
6. Estimation of friction factor for laminar and turbulent flows, minor losses in pipe flow.
7. Conversion of angles from WCB to RB.
8. Classification of soils, determination of coefficient of permeability, degree of consolidation and shear strength of soil.
9. Estimation of bearing capacity of soil in various soils
10. Estimation of physical characteristics of water as per codal provisions.

CV3109 INTERNSHIP - 1

B.Tech & B.Tech. +M.Tech III Year - II Semester

CV 3201 TRANSPORTATION ENGINEERING

Course Objectives:

- To impart knowledge about the highways and airports to improve the means of transportation.
- To impart knowledge about the different design aspects of designing a pavement, both flexible and rigid pavements.
- To familiarise the students about the construction activity associated with the highways, railways and airports
- To impart knowledge related to various geometric design elements of a highway like super-elevation, cross-section elements, designing curves, both simple curves and transition curves to add comfort and convenience to the road users.
- To impart knowledge related to geometric design elements of highways.
- To impart knowledge about the components and functions of a railway track.

Course Outcomes:

Students will be able to

- Design the geometric elements of highways.
- Design the thickness of highways with material specifications in the component layers
- Control the traffic moving on the highways effectively by facilitating the traffic control devices.
- Can understand the procedure to finalize the alignment of a highway.
- Understand the components of an aircraft and airport.
- Design the drainage facilities for a highway.

SYLLABUS

Highway Engineering I: Road development in India during twentieth century and twenty first century; Highway planning- Classification of Roads; Highway Alignment; Geometric Design of Highways-Cross-section elements, Sight distances, Horizontal and Vertical alignment, Intersection elements.

Traffic Engineering - Traffic characteristics, Traffic Studies, Traffic flow and Roadway capacity, Traffic regulation and control, Road Intersections and their types.

Highway Engineering II: Design of Highway Pavements-pavement types, Pavement components and their functions, CBR method of Flexible pavement design, CC pavements-types of stresses in Rigid pavements, Design of Rigid pavements, joints in CC pavements.

Highway Materials - Tests on Road aggregates and desirable properties, Bituminous binders and their properties;
Highway Construction - Construction of Flexible pavements, Construction of CC pavement and joints.

Highway Drainage-Surface and Sub-surface drainage systems.

Introduction to Airport Engineering: Aeroplane component parts, Aircraft characteristics, Airport site selection, Runway design, Basic Runway length.

Introduction to Railway Engineering: Railway track components and functions; Rails and Rail failures; Rail joints; Sleepers; Ballast.

Text Books

1. Highway Engineering by S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Nem Chand
2. Railway Engineering by S.C. Saxena and S. Arora, Dhanpat Rai Publications Pvt. Ltd.
3. Airport planning and Design by Khanna & Arora

Reference Books

1. Principle and Practice of Highway Engineering by R.C.Sharma and S.K.Sharma, Asia Publishing House.
2. Transportation Engineering by L.R. Kadiyali, Khanna Publications.
3. Principles of Transportation Engineering by Partha Chakraborty, PHI Learning
4. Railway Engineering by Rangwala.

CV 3202 ENGINEERING ECONOMICS, ESTIMATION AND COSTING

Course Objectives:

- Quantity estimation for different civil engineering works like single storey residential building, BT road, canal etc.
- Quantity estimation and preparing schedule of bars of different items of RC works.
- Rate analysis for different items of work and finding the unit rate of different items of work.
- Cost estimation for different civil engineering works like single storey residential building, BT road, canal etc.

- To prepare a project management report for different civil engineering projects like residential building, BT road, canal etc.

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

- Estimate quantities required for different civil engineering works like single storey residential buildings, bt road, canal etc.
- Cost estimation for different civil engineering works like single storey residential building, bt road, canal etc.
- Finding the unit rate for different items of work.
- Prepare schedule of reinforcement bars and scheduling a project.
- Analysing a project and finding critical activities and hence allocate resources as per the schedule of project.

SYLLABUS

Introduction: standard units, units of measurement of different items of work. Meaning of "estimating", abstract estimate of buildings, errors in estimation, different types of estimates. Contingencies and related terms in the estimate, different types of approvals. Plinth area and related terms used in the estimation of various structures, rules and methods of measurements of different works.

Contracts: types of contracts, contract document, contract procedure, conditions of contract, arbitration and tenders.

Specifications: meaning, purpose, types of specifications, method of preparation of specification, general specification, detailed specifications of different items of buildings and other structures.
Rate analysis – data sheet for materials and various items of work in buildings and other structures, schedule of rates. Rate analysis for building works, rate analysis for sanitary and water supply works, rate analysis for road and railway works.

Detailed estimate of building: different items of work in building; principles of taking out quantities, detailed measurement form; long walls and short walls method of building estimate, centre line method of building estimate. Estimate of RCC building, estimate of slope roof buildings; G.I. And A.C. Sheet, detailed estimate of different types of doors and windows, estimate of electricity and water supply, sanitation works etc.

Estimate of earthwork: different formulae for calculations, estimate of metaled road, tar road, concrete road, railway track, estimate of culverts and bridges etc.

Valuation of buildings: purpose, different method of building valuation; different terms used in valuation and their meaning.

Text Books

1. Estimating and costing in civil engineering by b.n. Dutta, sangam books.
2. Textbook of estimating and costing by g.s. Birdie, dhanpat rai publishing company private limited.

Reference Books

1. Estimation, costing, specifications and valuation in civil engineering by m.chakraborti.
2. Textbook on estimating, costing and accounts by d.d. Kohli and r.c. Kohli, s chand & company pvt. Ltd.

CV 3203 STRUCTURAL ANALYSIS – II

Course Objectives:

- To impart the principles of structural analysis and behaviour of indeterminate structures.
- To impart knowledge about various methods involved in the analysis of indeterminate structures.
- To impart skills of these methods for analyzing the indeterminate structures to evaluate the response of structures.
- To make the student familiar with analysis Arches and Suspension bridges.
- To impart knowledge about matrix methods.

Course Outcomes:

The student after undergoing this course will be able to:

- Analyse indeterminate structures and adopt an appropriate structural analysis technique.
- Determine response of structures by Force, displacement and matrix methods.
- Understand the concept of analysis of Arches and Suspension bridges.

SYLLABUS

Analysis of Statically Indeterminate Trusses (having not more than 7 members and 3 supports) containing (a) External Redundant Supports (b) Internal Redundant Members using (i) Method of Consistent Deformation of Unit Load Method (ii) Castigliano's Theorem – II.

Analysis of Three Span Continuous Beams using Kani's Method, Analysis of Statically Indeterminate Frames (Single Storey, Single Bay Portal Frames only) using (i) Slope-deflection method (ii) Moment Distribution Method (iii) Kani's Method.

Arches: Normal Thrust, Radial Shear and Bending Moment in Three Hinged and Two Hinged Parabolic and Segmental Arches. Effects of Rib-shortening and Temperature Change.

Suspension Bridges: Stresses in Loaded Cables with Supports at the Same and Different Levels. Length of Cable; Two and Three Hinged Stiffening Girders.

Introduction to Matrix Methods of Structural Analysis (Very elementary treatment only), Static Indeterminacy, Kinematic Indeterminacy, Stiffness and Flexibility Method for Two Span Continuous Beams only– Truss with 3 supports and 7 members.

Text Books

1. Theory of Structures by S.Ramamrutham, R.Narayan, Dhanpat Rai, Publishing Company.
2. Theory of Structures by B.C.Punmia, Ashok K Jain,Arun K Jain, Laxmi Publications.
3. Mechanics of Structures Vol II by S.B.Junnarkar, H.J.Shah, Charotar Publishing House.

Reference Books

1. Statically Indeterminate Structures by C.K. Wang, Mcgraw-Hill.

CV3204 PROFESSIONAL ELECTIVE – II

CV 3205 OPEN ELECTIVE –II

CV 3206 COMPUTER AIDED ANALYSIS AND DESIGN LAB

Course Objectives:

- Know the necessity of structural analysis and design software along with its applications.
- Familiarize with the generation of models by using design software.
- Understand the usage of various commands in the software.
- Analyze beams and trusses by generating models using structural analysis and design software.
- Create models for two and three dimensional frames and analyze them by using software.

Course Outcomes:

- Understand the importance of structural engineering and design software.
- Summarize the applications of different commands in structural analysis and design software.
- Create various structural models by using design software.

- Develop beams and truss models by using structural engineering software.
- Analyze two dimensional and three dimensional frames by generating models by using the software.

SYLLABUS

1. Introduction to structural engineering.
2. Introduction to structural analysis and design software.
3. Applications of various commands in the software.
4. Model generation using structural engineering software.
5. Analysis and design of various structural components of civil engineering and building frames.
    i. Modeling and analysis of various types of beams.
    ii. Modeling and analysis of trusses.
    iii. Modeling and analysis of two dimensional frames.
    iv. Modeling and analysis of three dimensional frames.

CV 3207 FLUID MECHANICS – II LAB

Course Objectives:

- To provide practical knowledge in verification of principles of fluid flow
- To conduct a test on hydraulic jump and measurement of rugosity coefficients in open channels.
- To understand major losses in pipe flows.
- To understand drag characteristics of cylinder in a wind tunnel e.
- To conduct experiments on impact of jets on vanes.
- To gain knowledge in performance testing of hydraulic turbine and hydraulic pumps at constant speed and head.
- To learn and practice writing technical reports.

Course Outcomes:

- On completion of this course, the student will be able to
- Demonstrate practical understanding in formation of hydraulic jump and measurement of Rugosity coefficients.
- Demonstrate practical understanding of friction losses in pipe flows
- Demonstrate practical understanding of boundary layer, separation and drag
- Provide the student knowledge in calculating performance analysis in turbine and pumps.
- Demonstrate the ability to write clear lab records.

LIST OF EXPERIMENTS

1. Study of Characteristics of a hydraulic jump – To measure and draw (E1-E2)/E1 vs F1 and Lj / y2 vs F1, and compare with theoretical results wherever possible.
2. Study of Rugosity coefficients in an open channel flow.
3. Study of major losses in pipes – Pipe friction – To compute Darcy- Weisbach friction factor.
4. Study of impact of a jet on flat and curved vanes.
5. Study of performance characteristics of a centrifugal pump – To measure the discharge, head developed, and power input at various discharges for centrifugal pump and draw the performance characteristics.
6. Study of performance characteristics of a reciprocating pump – To measure the discharge, head developed, and power input at various discharges for reciprocating pump and calculate percentage slip and efficiency.
7. Study of performance characteristics of a Pelton turbine – To measure the discharge, head difference across the turbine, the brake load, speed of turbine for various discharges and draw the performance characteristics.
8. Study of performance characteristics of a Francis turbine – To measure the discharge, head difference across the turbine, the brake load, speed of turbine for various discharges and draw the performance characteristics.

CV 3208 HIGHWAY MATERIAL LAB

Course Objectives:

- To impart knowledge about the tests to be conducted on aggregate for its suitability in pavement construction.
- To familiarise the students about the applicability of aggregate in flexible pavement and rigid pavement respectively.
- To impart knowledge about the procedure to determine the strength of the soil subgrade to take up the pavement component layers of it.
- To make the students understand the tests to be conducted on a sample of bitumen for use in flexible pavements
- To familiarise the students about the compatibility of stone chippings and bitumen to make a bitumen mix for use as a wearing layer in bituminous pavements.

Course Outcomes:

Students will be able to

- Perform tests on aggregate sample for use in various component layers of flexible pavements and rigid pavements.

- Understand the test procedure and practically conduct the test and infer the applicability of the aggregate sample according the IRC recommendations.
- Assess the strength of the soil subgrade and design the pavement thickness that can be provided over the soil subgrade in the field.
- Perform various tests on the bitumen sample and infer its applicability in flexible pavement construction as a wearing coat material by comparing the test results with IRC specifications.
- Perform tests to identify the compatibility of the stone chipping and bitumen sample.

SYLLABUS

Testing of Aggregates: Sieve Analysis test ; Impact Value test ; Aggregate Crushing value test ; Shape tests – Flakiness Index test, Elongation Index test, Angularity Number ; Los Angeles Abrasion test ; Specific gravity test ; Soundness test.

Testing of Bituminous Material: Penetration Value test; Viscosity test; Softening Point test; Ductility test; Flash and Fire Point test; Specific Gravity test.

Testing on Soil Subgrade: California Bearing Ratio (C.B.R) test.

Testing on Bituminous Mixes: Aggregate Stripping value test.

Reference Book

Highway material testing by S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Nem Chand & Brothers

CV 3209 SOFT SKILLS

Course Objectives:

- To develop skills to communicate clearly.
- To aid students in building interpersonal skills.
- To enhance team building and time management skills.
- To inculcate active listening and responding skills.

Course Outcomes:

- Make use of techniques for self-awareness and self-development.
- Apply the conceptual understanding of communication into everyday practice.
- Understand the importance of teamwork and group discussions skills.

- Develop time management and stress management.

SYLLABUS

Introduction to Soft Skills: Communication – Verbal and Non Verbal Communication - Personal grooming (Etiquette, Attitude, Body Language), Posture, Gestures, Facial Expressions, Eye Contact, Space Distancing, Presentation Skills, Public Speaking, Just a Minute (JAM) sessions, Adaptability.

Goal Setting and Time Management: Immediate, Short term, Long term, Smart Goals, Strategies to Achieve goals, Types of Time, Identifying Time Wasters, Time Management Skills, Stress Busters.

Leadership and Team Management: Qualities of a Good Leader, Team Dynamics, Leadership Styles, Decision Making, Problem Solving, Negotiation Skills.

Group Discussions: Purpose (Intellectual ability, Creativity, Approach to a problem, Tolerance), Group Behaviour, Analyzing Performance.

Job Interviews: Identifying job openings, Covering Letter and CVs / Resumes, Interview (Opening, Body-Answer Q, and Close-Ask Q), Telephone Interviews, Types of Questions.

Reference Books:

1. Krannich, Caryl, and Krannich, Ronald L. Nail the Resume! Great Tips for Creating Dynamite Resumes. United States, Impact Publications, 2005.
2. Hasson, Gill. Brilliant Communication Skills. Great Britain: Pearson Education, 2012
3. Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Education, 2001.
4. Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.
5. Rizvi, Ashraf M. Effective Technical Communication: India, McGraw-Hill Education. 2010
6. Thorpe, Edgar &Showick Thorpe. Winning at Interviews. 2nd Edition. Delhi: Dorling Kindersley, 2006.

B.Tech & B.Tech. +M.Tech IV Year - I Semester

CV4101 PROFESSIONAL ELECTIVE - III

CV 4102 PROFESSIONAL ELECTIVE – IV

CV 4103 PROFESSIONAL ELECTIVE – V

CV 4104 OPEN ELECTIVE –III

CV 4105 OPEN ELECTIVE –IV

CV 4106 HSS ELECTIVE

CV 4107 QUALITY EVALUATION OF CIVIL ENGINEERING STRUCTURES

Course Objectives:

- To study various Non-destructive testing techniques to evaluate quality of concrete
- To impart knowledge regarding advanced quality evaluation techniques
- To understand various causes of degradation in steel structures
- To study different methods used to assess degree of field compaction
- To understand different methods of determining CBR of insitu soil
- To impart skills to check unevenness of pavements through various techniques

Course Outcomes:

At the end of the course student will be able to

- Evaluate homogeneity and strength of concrete using different NDT techniques
- Understand different techniques used to assess durability of concrete
- Select appropriate method to assess corrosion activity of steel
- Assess quality of compaction achieved in embankments and pavements
- Evaluate continuity and integrity of concrete piles
- Understand various methods used for quality evaluation of pavements

SYLLABUS

Introduction – Necessity of Non-Destructive Evaluation and Structural Health Monitoring; Fundamental differences between NDE and SHM philosophies; Causes of degradation in concrete and steel structures; General methods of NDT of civil engineering structures according to Indian Standards; Exposure to different techniques: Rebound Hammer, Ultrasonic Pulse Velocity, Resistivity meter, Poroscope, Half-cell potential cell, Profometer (Cover meter)

Evaluation of Field Compaction: Degree of Compaction, Relative Density, Rapid Moisture Meter, Proctors Compaction Needle.

Quality Evaluation of Casted Piles: Pile Integrity Test

Evaluation of Quality of Pavements: Field CBR test, Dynamic Cone Penetrometer, Determination of Unevenness of Pavement by Benkelman Beam Method, Rebound Deflection of Flexible Pavements, Bitumen Extraction Test.

CV4108 INTERNSHIP - II

B.Tech & B.Tech. +M.Tech IV Year - II Semester

CV4201 PROJECT WORK

PROFESSIONAL ELECTIVES

1. HYDRAULIC AND IRRIGATION STRUCTURES

Course Objectives:

- To study modes of failure, stability analysis and design of gravity dam and earth dams.
- To study various types of spillways and their suitability, energy dissipation below spillways.
- To study seepage theories and their applications in the design of weirs on permeable foundations.
- To study functions, types and suitable locations for canal falls, canal regulators and cross drainage works.
- To study about component parts and their functions.

Course Outcomes:

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

- Analyze the stability analysis and design of gravity dam and an earth dam.
- Suggest a suitable spillway at a dam site and understand the criteria for design of stilling basin for energy dissipation under spillway.
- Understand the functions and suitable locations of canal outlets, canal falls, canal regulators and cross drainage works and design of weirs.
- Understand the functions of component parts of a hydroelectric power scheme.

SYLLABUS

Storage Works: Classification of Dams, Factors Governing Selection of Types of Dam, Selection of Site, Preliminary Investigation.

Gravity Dams: Forces acting on a Gravity Dam, Stability Criteria, Modes of Failure – Elementary and Practical Profiles, Stability Analysis, Principal and Shear Stress – Construction Joints, Openings in Dams – Galleries, Foundation Treatment of Gravity Dam.

Earth Dams: Types, Foundation for Earth Dams, Design of Earth Dams, Causes for Failure of Earth Dams, Criteria for Safe Design, Phreatic Line, Seepage Analysis – Seepage Control Through Body and Foundation.

Spillways: Essential Requirements, Spillway Capacity, Components, Types of Spillways and Their Working, Design of Ogee Spillway, Energy Dissipation Below Spill Way, Scour Protection, Use of Hydraulic Jump as Energy Dissipater – Design of Stilling Basins – USBR and IS Standard Basins; Spillway Crest Gates – Different Types.

Diversion Head Works: Types, Location and Components, Effects of Construction of Weirs on Permeable Foundation, Bligh's, Lanes and Khosla's Theories, Method of Independent Variables, Design Principles of Weirs and Barrages, Design of Weirs on Permeable Foundations, Design of Vertical Drop Weir, and Silt Control Devices.

Regulation Works: Canal Falls – Definition, Necessity and Location, Classification of Falls, Design Principles of Syphon Well Drop, Notch Fall, Sarada Fall, Straight Glacis Fall; Offtake Alignment; Cross Regulator and Distributary Head Regulator – Design of Cross Regulator and Distributor Head Regulator.

River Training Works: River Training and its Objectives, Classification of River Training Works, Marginal Embankment, Guide Banks, Groynes, Cutoffs, Bank Pitching, Launching Aprons, Miscellaneous Types of River Training Works.

Water Power Engineering: Development of Hydro Power in India, Assessment of Available Power, Utilization Factor, Load Factor, Diversity Factor, Storage and Pondage; Types of Hydro Power Schemes; Components of Hydel Schemes – Fore Bay, Intake Structure, Trash Racks, Surge Tanks; Water Hammer Pressure, Substructure and Superstructure of Power House..

Text Bookss

1. Irrigation and Water PowerEngineering byPunmia, B.C. and P.B.B. Lal, Laxmi Publications Pvt. Ltd.
2. Irrigation Water Resources and Water Power Engineering by Modi, P.N., Standard Book House.
3. Irrigation and Hydraulic Structures by Garg, S.K., Khanna Publishers.

Reference Book

1. Hand book of Applied Hydrology,Chow, V.T., McGraw-Hill Book Co.of a hydel project.

2. MATRIX METHODS OF STRUCTURAL ANALYSIS

Course Objectives:

- Impart knowledge regarding matrix-based approach for linear elastic analysis of structures.
- Analyse beams by using Flexibility and Stiffness methods.
- Develop flexibility and stiffness matrices for 2-D frames.
- Determine deflections and forces in statically determinate and indeterminate structures using flexibility and stiffness methods.
- Analyse 2-D trusses by using flexibility and stiffness matrix methods.

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

- Understand basic concepts of matrix methods for analysing of structures.
- Develop flexibility and stiffness matrices for structural elements.
- Analyse various types of beams by using flexibility and Stiffness methods.
- Analyse 2-D trusses using flexibility and Stiffness methods.
- Analyse 2-D frames using flexibility and Stiffness methods.

SYLLABUS

Introduction to matrix methods: Introduction, coordinate systems, displacement and force transformation matrices, element and structure stiffness matrices, element and structure flexibility matrices, equivalent joint loads, stiffness and flexibility approaches.

Matrix methods for beams: Analysis of beams, fixed and continuous beam by flexibility method. Analysis of beams, fixed and continuous beams by stiffness method.

Matrix methods for plane truss problems: Analysis of 2-D trusses by flexibility method. Analysis of 2-D trusses by stiffness method.

Matrix methods for Plane Frames: Analyse of 2-D frames by Flexibility matrix methods. Analysis of 2-D frames by stiffness matrix methods.

Text Bookss

1. Matrix methods of Structural Analysis by G.S.Pandit and S.P.Gupta, Tata McGraw Hill Co..
2. Matrix Analysis of framed Structures by W Weaver and Gere, Van Nostrand Reinhold.

Reference Books

1. Advanced Structural Analysis by Devdas Menon, Narosa Publishing House, 2009.
2. Matrix Analysis of Structures by Asslam Kassimali, Brooks/Cole Publishing Co., USA, 1999.
3. Analysis of Indeterminate Structures by C.K Wang, McGraw-Hill.

3. INTRODUCTION TO ROCK MECHANICS

Course Objectives

- To study the classification and properties of rock mass
- To illustrate the rock exploration techniques required during subsoil investigation

- To acknowledge the importance of identification of defects in rock mass
- To study laboratory and insitu methods for determining strength and deformation characteristics of rocks
- To understand different methods of improving properties of rock mass

Course Outcomes

- Identify and classify the rocks based on their physical and mechanical properties
- Evaluate core recovery and RQD of rock mass
- Understand various methods for evaluating properties of intact rock and rock masses
- Select appropriate reinforcement technique for improving properties of rocks
- Understand the procedure of blasting in rocks

SYLLABUS

Introduction: Geological Formation of Rocks, Structural Geology, Classification of Rocks, Defects in Rock, Physical, Mechanical Properties of Rocks, Exploration Techniques – RQD and RMR, Laboratory Tests for Shear Strength, Tensile Strength, Flexural Strength, Elastic Constants, Field Tests – Test for Deformability, Shear Tests and Strength Tests

Improvement Techniques for Rock: Grouting, Rock Bolting, Rock Reinforcement - Mechanism, Types of Reinforcement, Steps Involved in Installation

Foundations on Rock, Rock Blasting– Explosives, Selection Criteria for Explosives, Steps Involved in Blasting

Text Books

1. Rock Mechanics for Engineers by B.P.Verma, Khanna Publishers

Reference Books

1. Rock Characterization, Testing and Monitoring by E.T.Brown, Pergamon Press, London, U.K
2. Rock Mechanics on the Design of Structures in Rock by Oberti and Duvalk, W. L. John Wiley & Sons.
3. Rock Mass Classification Systems – A Practical Approach in Civil Engineering by B.Singh and R.K.Goel, Elsevier Publisher.

4. ADVANCED DESIGN OF STRUCTURES

Course Objectives:

- To familiarise the students of with earth pressure theories and pressure theories and design of different types of retaining walls.
- To impart knowledge about the analysis and design of liquid retaining structure according to is code.
- To impart knowledge about the limit state design of plate girders used for long spans.
- To impart skills of analyzing and designing different types steel bridges subjected to different types of loads.
- To familiarize students with gantry girder and their design.

Course Outcomes:

Students will be able to

- Understand earth pressure theories, as well as the design and detailing of various retaining walls;
- Analyse and design circular, rectangular, and staging water tanks.
- Proportionate section of plate girder and design of bolted and welded plate girders as per is 800-2007 and understand curtailment of flange plates and, connection of flange angles to web and flange angles to flange plates.
- Compute design loads on the bridges and design deck type or through type girder bridges and bearings.
- Analyse and design steel elevated circular, rectangular and pressed steel water tanks.
- Performs analysis and design of gantry girders.

Retaining walls: types of retaining walls, forces on retaining walls, rankine and coloumb earth pressure theories (c and ϕ soils). Passive earth pressure, drainage of retaining walls. Stability requirements. Preliminary proportioning of cantilever retaining walls. Design of cantilever and counterfort retaining walls.

Water tanks: stress in concrete and steel in water tanks, modular ratio, impermeability requirements, tanks resting on ground and below ground of circular and rectangular shapes; elevated circular and rectangular tanks resting on maximum of 8 columns; design of staging of rectangular tanks. (Use of is – 3370 CODE)

Design of Reinforced concrete combined footings with and without Strap Beam.

Plate girders (bolted and welded): components of a plate girder, economical depth, proportioning of web and flanges, shear buckling resistance of web (simple post critical and

tension field methods), curtailment of flange plates, connection of flange angles to web and flange angles to flange plates.

Web stiffeners: design of bearing stiffeners. End panel design, design of intermediate stiffeners, connections.

Bridges: classification, loadings, deck type and through type bridges, plate girder bridges, design of stringers, cross girders, wind bracings.

Gantry girders: introduction - loading consideration – maximum load effect – selection of gantry girder – analysis and design of gantry girders.

Reference Books:

1. Limit state of design of reinforced concrete – p.c. Vergheese
2. Reinforced concrete limit state design – a.k. Jain.
3. Design of reinforced concrete structures – p. Dayaratnam
4. Design of steel structures by n. Subramanian, oxford university press.
5. Limit state design of steel structures – ramchandra and virendra gehlot, scientific publishers (india)
6. Limit state design of steel structures by s.k.duggal, mcgraw hilleducation private ltd.
7. Design of steel structures by k.s.sai ram, pearson education india.
8. Design of steel structures by limit state method as per is: 800-2007 – s.s. Bhavikatti, ik international publishing house, bangalore – 560 001.

5. ADVANCED FLUID MECHANICS

Course Objectives

- To impart knowledge regarding fundamental of laminar flow with an emphasis on steady laminar flow through pipes.
- To develop an understanding of fluid flow patterns and learns to use boundary layer theory.
- To understand the concepts of turbulent flow in pipes.
- To study in detail about drag and lift characteristics.
- To explain methods of dimensional analysis and the importance of their application to the field of fluid mechanics

Course Outcomes

Students will be able to

- Understand the derivation of governing equation for steady laminar flow through pipes along with understanding the basic concepts of laminar flow.
- To deal design aspects of turbulent flow analysis in pipes.
- Learn the concepts of boundary layer theory, flow separation theory along with drag and list concepts.
- Understand the dimensional analysis criteria to hydraulic problems and carryout model studies on hydraulic systems such as rivers, hydraulic structures and harbors.

SYLLABUS

Laminar flow: Equation of Motion for Real Fluids – Modifications in Equation of Motion, Stress Strain Relationships, Tangential Stress Terms. Plane Two- dimensional Flows – Steady Flow between Parallel Plates, Couette and Poiseuille Flows; Axisymmetric Flows – Flow through a Circular Annulus, Flow without and with Pressure Gradient – Hagen-Poiseuille Equation; Relationship between Friction factor and Reynolds Number for Laminar Flow through Pipes; Stokes law.

Navier-Stokes Equations (No Derivation) – N.S. equations for standard cases of Plane two Dimensional and Axisymmetric Flows.

Boundary Layer Theory: Theory of Boundary Layer – Characteristics of Laminar Boundary Layer – Boundary Layer growth over a Flat Plate (without pressure gradient) – Boundary Layer Thickness and its Characteristics – Displacement, Momentum and Energy Thicknesses; Stability Parameter; Laminar and Turbulent boundary layers.

Boundary Layer Separation – Mechanism of Separation, Control of B.L. Separation; Boundary Layer on Rough Surfaces – Laminar Sublayer, Shear Friction Velocity; Friction Drag.

Turbulent Flow: Critical Reynolds Number – Characteristics of Turbulent Flow – Mean and Fluctuating Components of Velocity. Analysis of Turbulent Flows – Shear Stress due to Turbulence –Velocity distribution for Hydrodynamically Smooth and Rough Pipes; Variation of Friction Factor in Turbulent Flow; Friction Factor for Commercial Pipes – Moody diagram.

Drag, Lift & Propulsion: Concepts of Drag and Pressure Distribution over Immersed Bodies – Drag and Lift – Deformation Drag, Friction Drag, Form Drag – Drag coefficient. Distribution of Fluid Pressure on immersed bodies –Distribution of pressure for two dimensional flow past a cylinder – von Kármán vortex trail, Eddy shedding; Drag of immersed bodies – Variation of Drag Coefficient with Reynolds Number – Drag on Cylinder – Resistance diagram for bodies of revolution; Drag Coefficient of Practical Bodies. Lift & Propulsion – Effect of Circulation in Irrotational Flow, Generation of Lift around a Cylinder, Magnus Effect, Computation of Lift

Force; Lift on Airfoil – Lift Coefficient and its Variation with Angle of Attack, Joukowsky Profile, Polar Diagram, Stall; Induced Drag.

Dimensional Analysis and Similitude: Fundamental Concepts of Dimensional Analysis – Importance of Dimensional Analysis & Model Study; Units and Dimensional Formulae for Various Engineering Quantities; Fourier Concept of Dimensional Homogeneity; Methods of Arriving at Dimensionless Groups – Non-dimensional Parameters; Rayleigh's Method; Buckingham π method – Buckingham modified method; Omitted and Superfluous variables; Examples in Dimensional Analysis – Capillary Rise, Drag on Cylinder, Resistance of a Ship, Discharge over a Sharp Crested Weir, Fall Velocity of a Sphere, Head Characteristics of a Pump, Thrust on a Propeller.

Similarity and Similarity Laws – Concepts of Similarity – Geometric, Kinematic and Dynamic Similarities; Modeling Criteria; Similarity Laws – Important Dimensionless Numbers – Reynolds Number, Froude Number, Mach Number, Euler Number, Weber Number;Application of Similarity Laws to Practical Problems – Bodies Completely Submerged in Fluids, Bodies Subjected to Gravity and Viscous Forces, River Models – Manning's Law; Distorted Models – Depth Distortion and Slope Distortion; Problems Related to Modeling of Spillways, Ships, Pumps and Turbines.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.
2. Fluid Mechanics by Jain, A.K., Khanna Publishers.

Reference Books

1. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co.Ltd.
2. Hydraulic Machines by Jagadish Lal, Metropoliton Book Company.
3. Mechanics of Fluids, I.H.Shames,McGraw-Hill Professional.

6. GEO-ENVIRONMENTAL ENGINEERING

Course Objectives:

- To impart knowledge about solid wastes and MSW.
- To understand about soil pollution and remedies.
- To inculcate the ideas about waste containment and waste disposal facilities.
- To analyse the reasons for soil erosion and its effect on human activities.
- To describe the preventive measures including structure to control soil erosion and consequences.

Course Outcomes:

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

- Understanding characterization of wastes provides various disposal and remediation measures.
- Creation of knowledge about landfill and its components for waste containment.
- Analysis of pollutants and their characterization helps in study of soil pollution and to propose various environment protective measures.
- Deriving knowledge about types of erosions and their controlling measures extends to various erosional features related to geological and geomorphological concern

SYLLABUS

Wastes: Source, Production and Classification of Wastes, Soil Pollution Processes, Waste Characterization, Physical Characterization, Problems due to Improper Disposal of Wastes, Waste Management Strategies.

Soil Pollution, Sources of Soil Pollution, Control of Soil Pollution.

Waste Disposal Facilities such as Landfills, Configuration or Types of Landfill, Components of Landfill, Layout of a Landfill Site, Stages of Decomposition of Waste in a Landfill, Landfill Planning and Design. Barrier Systems – Active Systems, Passive Systems, Vertical Barriers and their Types, Bottom Barriers, Reuse of Waste Materials, Contaminated Site Remediation.

Text Books

1. Geoenvironmental Engineering – Principles and Applications by Reddi, L. N., and Inyang, H. F., Marcel Dekker.

Reference Books

1. Geotechnical Practice for Waste Disposal by Daniel, D. E., Chapman and Hall, London.
2. Clay Barrier Systems for Waste Disposal Facilities by Rowe, R. K., Quigley, R. M. and Booker, J.R., E & FN Spon, London.

7. REMOTE SENSING AND GIS APPLICATIONS

Course Objectives:

- To introduce the basic concept and principles of Remote Sensing
- To illustrate solar energy interactions with atmosphere and with earth surface features
- To Know about different types of satellite and sensors.
- To Learn image analysis and apply for interpretation of satellite images

- To understand data types, data inputs and data analysis in GIS and Learning about map projection and coordinate system.
- To develop knowledge on RS and GIS applications in civil engineering.

Course Outcomes:

After completing this course, the student will have acquired the ability on the following.

- Understand the principle of remote sensing, develop ability to comprehend the energy interactions with atmosphere and earth surface features, spectral properties of various natural and cultural features.
- Understand types of satellite images and their characteristics and develop ability to choose appropriate sensor products for various remote sensing applications.
- Ability to perform image analysis and image interpretation.
- Understand spatial and non-spatial data features in GIS and know vector and raster data representation in GIS.
- Understand the map projections and coordinates systems and able to create thematic layers.
- Understand the integration of Remote Sensing and GIS and apply the knowledge to work in various application fields through spatial analysis.

SYLLABUS

Remote Sensing: Introduction, Basic components of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, Sensors- types and characteristics, passive sensor, active sensor, platforms-airborne remote sensing, space borne remote sensing, data pre-processing, Important Remote Sensing Programme.

Geographic Information System: Introduction, key components, spatial data, raster data models, vector data models, raster versus vector, data input methods and editing, non-spatial data, map projections.

Image analysis: Introduction, elements of visual interpretations, digital image processing- digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, image preprocessing, image rectification, image enhancement, image classification, supervised classification, unsupervised classification.

GIS analysis: Introduction, digital elevation models, RS and GIS data integration, overlay function-vector overlay operations, raster overlay operations, arithmetic operators, comparison and logical operators, conditional expressions, overlay using a decision table, some neighbourhood operations.

RS and GIS applications in Civil Engineering: Land cover and land use, urban applications, Hydrological studies, runoff modeling, flood zone delineation and mapping, groundwater prospects and recharge, reservoir storage estimation, water management, irrigation planning, drought monitoring, environmental impact assessment and other watershed studies.

Text Books

1. Remote Sensing And Image Interpretation By Thomas M. Lillesand And Ralph W. Kiefer, John Wiley And Sons Inc.
2. Gis By Kang Tsung Chang, Tmh Publications & Co.

Reference Books

1. Remote Sensing And Its Applications By Dr George Joseph.
2. Concepts & Techniques Of Gis By C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
3. Principles Of Geographical Information Systems – Peter A Burragh And Rachael A. Mc Donnell, Oxford Publishers 2004.

8. EARTH RETAINING STRUCTURES

Course Objectives:

- To recognize the need for soil retention systems in granular and cohesive soils
- To deepen the understanding of the concepts related to earth pressures and their distribution through classical theories.
- To differentiate between the lateral pressure distribution in braced cuts and retaining walls
- To impart skills to analyse and design retaining walls
- To analyse and design sheet pile walls in granular and cohesive soils

Course Outcomes:

At the end of the course student will be able to

- Compute the earth pressures acting behind the retaining structures, from different methods.
- Carry out analysis and design of the retaining walls for a given height of backfill
- Suggest the most appropriate type of retaining system to be adopted for a given site conditions.
- Develop earth pressure envelops for design of braced cuts and check their stability
- Perform design of anchored bulk heads

SYLLABUS

Earth Pressure: Basic Concepts, Rankine and Coulomb Earth Pressure Theories, Determination of Active and Passive Pressures: Culmann's Graphical Method, Logarithmic Spiral Methods, Friction Circle Method. Consideration of Surcharge, Seepage, Earthquake, Wave Effect, Stratification, Type of Backfill, Wall Friction and Adhesion.

Retaining Structures: Uses, Types, Stability and Design Principles of Retaining Walls, Backfill Drainage, Settlement and Tilting. Sheet Pile Walls: Types, Design of Cantilever Sheet Pile Walls in Granular and Cohesive Soils; Design of Anchored Sheet Pile Walls by Free and Fixed Earth Support Methods, Rowe's Theory of Moment Reduction, Design of Anchors.

Braced Excavations: Types of Sheeting and Bracing Systems, Lateral Earth Pressure on Sheeting in Sand and Clay, Design Components of Braced Cuts. Cellular Cofferdams: Types – Diaphragm and Circular Type, Design by TVA Method. Stability of Cellular Cofferdams, Cellular Cofferdams in Rocks and Soils.

Text Books

1. Foundation design by W. C. Teng, Prentice Hall

Reference Books

1. Basic and Applied Soil Mechanics by Gopal Rajan and A.S.R. Rao, New Age International Publishers.
2. Soil Mechanics in Engineering Practice by K.Terzaghi and R.B.Peck, John Wiley & Sons.
3. Foundation Analysis and Design by J. E. Bowles, Mc Graw-Hill Publishing Co.

9. REPAIR AND RETROFITTING OF STRUCTURES

Course Objectives:

- To learn various distress and damages to concrete and masonry structures
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To assess the damage to structures using various tests
- To learn the importance and methods of substrate preparation
- To learn various repair techniques of damaged structures, corroded structures

Course Outcomes:

At the end of the course student will be able to

- Understand the properties of fresh and hardened concrete.
- Know the strategies of maintenance and repair.
- Get an idea of repair techniques.
- Understand the properties of repair materials
- Understand the retrofitting strategies and techniques

Materials: Construction chemicals, Mineral admixtures, Composites, Fibre reinforced concrete, High performance concrete, polymer-impregnated concrete.

Techniques to test the existing strengths: Destructive and non destructive tests on concrete.

Repairs of Multistory structures: Cracks in concrete, possible damages to the structural element-beams, slab, Column, Footings, etc., Repairing techniques like Jacketing, Grouting, External prestressing, Use of chemical admixtures, Repairs to the fire damaged structures.

Foundation problems: Settlement of shallow foundations – repairs, sinking of piles, wells – repairs.

Corrosion of Reinforcement: Preventive measures – coatings –use of SBR modified cementitious mortar, Epoxy resin mortar, Acrylic modified cementitious mortar, flowing concrete.

Reference Books

1. "Deterioration, Maintenance and Repair of Structures" by Johnson, McGraw Hill.
2. "Concrete Structures: Repairs, water proofing and protection" by Philip H. Perkins, Applied sciences publications Ltd., London, pp.302.
3. "Durability of concrete structure: Investigation, Repair, Protection" Edited by Geoffmang., E. & FN SPON, An imprint of Chapman & Hall, pp.270.
4. "Deterioration, maintenance and Repair of structures" by Johnson, McGraw Hill, pp.375

10.RAILWAYS AND HARBOUR ENGINEERING

Course Objectives:

- To impart knowledge about the different modes of transportation like railways and harbours.
- To impart knowledge about the components of a railway track, its geometric design elements, rail fixtures and fastening etc.

- To familiarise the students about harbours and ports.
- To impart knowledge about the harbour phenomena like waves, tides, sediment transport, littoral drift etc.
- To familiarise the students about the components of harbours and ports like breakwaters etc.

Course Outcomes:
Students will be able to

- Understand and design the railway section incorporating geometric design elements like superelevation, analyzing safe speeds on the sections of railway track, transitional curves etc.
- Provide appropriate signals at station yards thereby reducing accidents.
- Design the features of a turnout like points and crossing.
- Design the facilities to be provided inside a harbour or port for safe navigation.
- Design the different navigational aids to be provided while navigation and also fixed navigational structures like lighthouses.

Railway Engineering I: Comparison of Railway and Highway transportation; Advantages of Railways; Classification of Indian Railways; Railway track components and their functions; Capacity of track; Gauges in Railway Track; Railway track cross-sections.

Railway Engineering II: Functions of Rails; Rail failures; Rail joints and Welding of rails; Creep of rails; Rail fixtures and fastenings; Sleepers; Ballast.
Geometric Design of track - Gradient, Super elevation, Curves, Widening of gauge on Curves.

Railway Engineering III: Points and Crossings - Turnout, Switches, Crossing and its types; Track junctions; Stations and yards; Signaling and Control system; Interlocking; track drainage and maintenance.

Harbour Engineering I: Types of water Transportation; Advantages and disadvantages of water transportation; Harbour Classification; Harbour site investigation and site analysis; Harbour size and depth.

Harbour Engineering II: Natural phenomenon- Tides, Wind, Waves, Currents, Littoral drift.
Harbour works- Break waters and their types; Harbour Components- Jetty, Piers, Wharves, Off-shore moorings.
Navigational Aids - Fixed navigational structures, Floating navigational aids.

Text Bookss

1. Railway Engineering by S.C. Saxena and S. Arora, Dhanpat Rai Publications Pvt. Ltd.

2. Dock & Harbour by .S.P.Bindra

Reference Books.

1. Railway Engineering by Rangwala.
2. Dock & Harbour by Birdie.

11.ENVIRONMENTAL IMPACT ASSESMENT

Course Objectives:

- To familiarise with EIA methodologies
- To impart knowledge on EIA case studies
- To input skills on prediction and assessment of air and noise environment
- To input skills for prediction and assessment of water and soil environment
- To familiarise with cultural and socio economic environment

Course Outcomes:

the student will be able to

- Understand the concept and methodologies of EIA
- Understand the procedure for environmental clearance
- Discuss the basic information on environmental attributes like air, water and noise
- Discuss the standards, impact assessment and mitigation
- Discuss the socio economic attribute, resettlement and rehabilitation issues

SYLLABUS

Concept of Environment – Definition of EIA and EIS – Elements of EIA – Guidelines for the Preparation of EIS – Governmental Policies for Environmental Protection.

Environmental Setting – Environmental Attributes – Air, Water, Soil, Noise, Ecological, Social, Economical, Cultural, Human and Aesthetic Aspects – Environmental Indices.

Methodology for the Identification of Impacts – Criteria for the Selection of Methods – Methodologies – Adhoc, Checklist, Overlaying, Matrix and Network Methods.
Prediction and Assessment of Impacts on – Air, Water, Soil, Noise, Ecological, Social, Economical, Cultural, Human Environments and Aesthetic Aspects.

Review of Environmental Impact Statement – Cost Benefit Analysis – Measures for Environmental Impact Mitigation and Control – Case Studies.

Text Books

1. Environmental Impact Assessment by Larry W. Canter. McGraw-Hill Co.
2. Environmental Impact Assessment Methodologies by Y Anjaneyulu, and Valli Manikkam,, BSP Books PVT Ltd.

Reference Books

1. Environmental Impact Assessment by R.K.Jain, L.V.Urban, G.S.Stacey and H.E. Balbach, McGraw-Hill Co.

12.BRIDGE ENGINEERING

Course Objectives:

- To equip the students with a thorough understanding of the behavior and design of bridges.
- To impart knowledge about components, classifications and choice of bridge type along with the investigation for bridges in detail.
- To give a clear idea of various IRC standard specifications for R.C.C road bridges.
- To develop skills to analyse and design short and medium span bridges using existing codes of practice, taking into account the structural strength, service life, and durability.
- To familiarise the design and Stability analysis of foundation for bridges.

SYLLABUS

Concrete Bridges: Introduction-Types of Bridges-Economic span length, Importance of site investigation in Bridge design -Types of loading-Dead load-Live load(IRC Standards)-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads-Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

Box culvert: General aspects, Design loads, Design of Box culvert subjected to IRC loading.

Solid slab Bridges: Introduction-Method of Analysis and Design of solid slab bridge subjected to IRC loading.

Beam & Slab Bridge (T-Beam Girder Bridge): General features – Design of interior panel of slab – Pigeaud's method – Analysis and design of T-beam longitudinal girder subjected to IRC loading – Analysis and design of Cross Girder.

Piers & Abutments: General features – Bed Block – Materials for Piers & Abutments, Types of piers – Forces acting on piers – Design and Stability analysis of piers – General features of Abutments – forces acting on abutments – Design and Stability analysis of abutments .

Course Outcomes:

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

- Discuss the IRC standard live loads and design the deck slab type bridges.
- Understands the structural responses to different kinds of loads.
- Perform the Analysis of box culverts for the given loading and detail the box culverts.
- Analyse and design solid slab bridge.
- Design and detail of T-Beam bridges.
- Design and check the stability of piers and abutments.

Text Bookss

1. "Essentials of Bridge Engineering", D. Johnson Victor, Oxford University Press.
2. "Design of Bridges", N.Krishna Raju, Oxford & IBH Publishing Co.Pvt.Ltd, New Delhi.

13.**INDUSTRIAL WASTE TREATMENT**

Course Objectives:

- Acquire knowledge on characteristics of waste water from various sources and its primary treatment.
- Impart knowledge about principles of biological waste treatment.
- Design the processes of different biological treatment units.
- Familiarize with the various principles in industrial waste treatment.
- Understand the manufacturing processes, treatment of wastes and disposal methods of various industries.

Course Outcomes:

At the end of the course student will be able to

- Understand characteristics of waste water and primary treatment process of waste water.
- Discuss the different principles of biological waste treatment.
- Understand the design processes of different biological treatment units.
- Understand the various principles involved in treatment of industrial wastes.
- Summarize the manufacturing processes, treatment of wastes and disposal methods of various industries.

SYLLABUS

Characteristics of waste water of specific industries, characteristics of treatment plant effluents, Effect of waste water on self-purification capacity of streams, Primary treatment of waste water.

Principles of biological waste treatment; Microbiological growth rate kinetic equations, sludge production, oxygen requirements, continuous flow treatment models. Aerobic treatment studies in continuous and semi-continuous reactors. Anaerobic treatment, studies, Nitrogen and Phosphoros removal.

Biological treatment facilities : Process designs of the following units w.r.t. Industrial Wastes; Activated sludge process; trickling filter; sludge degestion units; Aerated lagoons; Stabilization ponds (oxidation ponds); oxidation ditches (Paveer ditches); Rotating Biological contactor; Anaerobic filter.

Principles of Industrial waste Treatment: Waste reduction pretreatment of wastes, collection and segregation of wastes, reduction in volume and strength neutralization; equalization; proportioning.

Manufacturing processes, flowsheets; Characteristics and treatment of wastes and disposal methods of the following industries – Sugar, Dairy, Distillery, Paper, Tannery, Textile, Sheet, Fertilizer, Oil refinery and Petrochemicals.

Reference Books

1) Waste Water Treatment by M.N. Rao and A. K. Datta

14.**TRAFFIC ENGINEERING AND MANAGEMENT**

Course Objective:

- To impart knowledge about the traffic characteristics, traffic studies and analysis.
- To design the roadway facilities to achieve an efficient, free and rapid flow of traffic.
- To impart knowledge about traffic studies such as traffic volume studies, speed studies, accident studies etc.
- To explain the functions of traffic control devices and the design of intersections.
- To explain the different management measures to be implemented on roads to improve the capacity.

Course Outcomes:

Students will be able to

- Design the road way facilities with signs, signals, markings and islands so as to achieve efficient flow of traffic.
- Acquire knowledge about different traffic studies such as speed studies, parking studies, accident studies etc.
- Gain knowledge to design the road way facilities efficiently for future traffic in a planned manner.
- Design the traffic signals efficiently to have a continuous and orderly flow of traffic with last delays.
- Implement traffic management strategies such as one-way street, staggering of work hours etc. to minimize congestion on roads with higher traffic intensity.

SYLLABUS

Traffic Engineering: Introduction, Importance of Traffic Engineering under Indian conditions, Traffic characteristics, The Road user and the vehicle. Traffic Surveys: Speed, Journey Time & Delay Surveys, methods of measuring Spot speeds, methods of measurement of Running Speed and Journey Speed, moving observer method, Traffic volume studies – Types of Counts, Automatic devices, Presentation of traffic volume study data.

Origin & Destination Survey – Need for O – D surveys, Survey methods, Presentation of Results, Parking Surveys – Types of Parking surveys, Parking Space Inventory, Cordon Count, Questionnaire type parking usage Survey – Design of parking facility. Analysis and Interpretations of Traffic Studies.

Statistical methods for Traffic engineering - Mean, Standard Deviation and Variance. Traffic flow characteristics, Traffic Capacity studies – factors affecting practical capacity, Design Capacity and Level of Service, Passenger Car Unit. Accident Studies – Accident studies and records, Accident investigations, Measures for reduction in accident rates, Traffic Safety.

Relationship between Speed, Travel time, Volume, Density and Capacity. Traffic Operations – Traffic regulation, Traffic Control Devices, Intersections – Intersection At Grade – Channelized and Unchannelized intersections, Rotary intersections, Grade – separated Intersections, Grade – separated structures.

Traffic Management – Transportation system Management, Travel Demand Management Techniques, Traffic management measures.

Reference Books:

1. Highway Engineering By S.K. Khanna & C.E.G.Justo
2. Traffic Engineering and Transport Planning By L.R. Kadiyali.

15.**FINITE ELEMENT METHOD OF ANALYSIS**

Course Objectives:

- To familiarise with matrix methods.
- To introduce importance and applications of Finite Element Method (FEM).
- To impart knowledge of different mathematical Techniques used in FEM analysis.
- To implement the basics of FEM to relate stresses and strains.
- To learn the theory and characteristics of finite elements that represent engineering structures.

Course Outcomes:

At the end of the course student will be able to

- Analyse the response of structures by matrix methods.
- Understands the concepts behind formulation methods in FEM.
- Understands different mathematical Techniques used in FEM analysis.
- Develop element characteristic equation and generation of global equation of elements.
- Able to apply suitable boundary conditions to a global equation to find displacements, stress and strains induced

SYLLABUS

Matrix Methods of Analysis – Introduction, Analysis of Beams and Portal Frames (One Bay, One Storey Two Bay, Two Storey) by Stiffness Method and Flexibility Method.

Introduction: A Brief History of F.E.M, Need of the Method, Applications of FEM, Review of Basic Principles of Solid Mechanics, Basic Equation in Elasticity Equations of Equilibrium, Constitutive Relationship, Concept of Plane Stress, Plain Strain, Concept of Axi-Symmetric Elements. Concept of Energy Principles and Methods.

Basic Theory Relating to the Formulation of the Finite Element Method, Element Shapes, Nodes, Nodal Degree of Freedom, Node Numbering, Coordinate System (Local and Global), Convergence Requirements, Compatibility Requirement, Geometric Invariance.

Finite Element Analysis of Single Bar Element (One-Dimensional Problem) – Shape Functions, Derivation of Stiffness Matrix, Stress-Strain Relations – All with Reference to Bar Element and Trusses under Axial Forces.

Text Books

1. Structural Analysis – A Matrix Approach by G.S.Pandit and S.P.Gupta, Tata McGraw-Hill Publishing Co. Ltd.
2. Introduction to the Finite Element Method by C.S.Desai and J.F.Abel, Van Nostrand.
3. Finite Element Analysis by C.S.Krishnamoorthy, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Introduction to Finite Elements in Engineering by Tirupathi R. Chandrupatla, Ashok D.Belegundu, Prentice-Hall of India Private Limited.
2. Finite Element Analysis by S.S.Bhavikatti, New Age International Publishers.
3. Basic Structural Analysis by C.S. Reddy, Tata McGraw-Hill, New Delhi.
4. Finite Element Methods for Engineers by Reger, T. Fenuer, The Macmillan Ltd., London

OPEN ELECTIVES

1. SANITARY ENGINEERING

Course Objectives:

- To familiarize the concept of sanitation and Estimation of Sewage Flow.
- To impart knowledge on design of sewers and hydraulics of sewers.
- To expose the necessity of sewage characteristics by physical, chemical and biological examinations.
- To create knowledge on BOD, COD and treatment of sewage water.
- To input knowledge on filters and design of filters.
- To make acquainted with the principles and design of sludge treatment.

Course Outcomes:

The students will be able to

- Understand the necessity of sanitation and estimate the sewage flow in drainages.
- Design the sewers and also appurtenances in sewerage.
- Analyze the physical, chemical and biological characteristics of sewage water.
- Evaluate the content of bod, cod and process involving in the treatment of sewage water.
- Design sludge treatment.

SYLLABUS

Introduction to sanitation – systems of sanitation – relative merits & demerits – collection and conveyance of waste water – sewerage – classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations – types of sewers – Hydraulics of sewers and storm drains– design of sewers – materials for sewers- appurtenances in sewerage – cleaning and ventilation of sewers—safety of sewer workers.

Storm sewers- design: Pumping of wastewater – Pumping stations – location – components parts– types of pumps and their suitability with regard to wastewaters. House Plumbing: plumbing systems of drainage-sanitary fittings and other accessories– single stack system- one pipe and two pipe systems – Design of building drainage.

Bacteriology of sewage: Sewage characteristics – Physical, Chemical and Biological Examination– decomposition- cycles of decomposition-– Sampling and analysis of wastewater – BOD-COD-Treatment of sewage - Primary treatment: Screens-grit chambers – grease traps – floatation – sedimentation – design of primary and pretreatment units.

Secondary treatment: Aerobic and anaerobic treatment process-comparison.

Suspended growth process: Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, miscellaneous methods, Oxidation ponds, Oxidation ditches, Aerated Lagoons.

Attached Growth Process: Trickling Filters – mechanism of impurities removal- classification– filter problems – design and operation-recirculation. RBCs, Fluidized bed reactors, sewage disposal methods.

Anaerobic Processes: Septic Tanks and Imhoff tanks-Principles and Design-sludge treatment and disposal-Fundamentals of UASB. Biosolids (Sludge): Characteristics- thickening – digestion,drying and sludge disposal.

Text Books

1. Wastewater Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw-Hill edition.
2. Environmental Engineering by Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. McGraw-Hill international edition
3. Environmental Engineering. II: Sewage Disposal and Air Pollution Engineering, Khanna Publishers.

Reference Books

1. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, by S.K.Garg, Khanna Publishers
2. Water Supply and Sanitary Engineering by G.S.Birdie and J.S.Birdie, Dhanpat Rai Publishing Company.

3. Water Supply Engineering by P.N.Modi, Standard Book House.
4. Water Supply Engineering by B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd.

2. WATERSHED MANAGEMENT

Course Objectives:

- To give an overview of watershed management and principles of WSM.
- To impart knowledge on water resources and conjunction use of ground water and surface water to meet water demand.
- To impart knowledge on river basin watershed management and ground water management.
- To expose students about social aspects of WSM such as public aspects participation and integrated development.
- To emphasis on conservation of water through recycle and reuse of waste water, water harvesting.
- To explain the interference of integrated watershed management for sustainable development.
- To expose students to applications of RS and GIS for watershed management.

Course Outcomes:

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

- Plan for sustainable development by proper use of all available water resources of a watershed for optimum production with minimum hazards to natural resources.
- Determine the various solutions to meet the water demand.
- Implement damage mitigation measures to control soil erosion.
- Adopt appropriate techniques or methods for water harvesting.
- Knowledge on determining effective watershed modeling.

SYLLABUS

Principles of Watershed Management: Basics concepts, Hydrology and water availability, Surface water, Groundwater, Conjunctive use, Human influences in the water resources system, Water demand, Integrated water resources system

River basins Watershed Management Practices in Arid and Semi-arid Regions, Watershed management through wells, Management of water supply - Case studies, short term and long term strategic planning

Conservation of Water: Perspective on recycle and reuse, Waste water reclamation

Social Aspects of Watershed Management: Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies

Sustainable Watershed Approach: Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation

Water Harvesting: Rainwater management - conservation, storage and effective utilization of rainwater, Structures for rainwater harvesting, roof catchment system, check dams, aquifer storage

Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management.

Text Books:

1. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994.

Reference Books:

1. Murty, J.V.S., Watershed Management, New Age Intl., New Delhi 1998.
2. Allam, G.I.Y., Decision Support System for Integrated Watershed Management, Colorado State University, 1994.
3. Vir Singh, R., Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.
4. American Society of Civil Engineers, Watershed Management, American Soc. of Civil Engineers, New York, 1975.

3. ELEMENTS OF EARTHQUAKE ENGINEERING

Course Objective:

- To give the foundations of many basic engineering principles connected to earthquake engineering.
- To introduce philosophy of seismic design with emphasis on strength, stiffness and ductility effects.
- To provide hands-on experience with the application of engineering concepts in the field of earthquake engineering.
- To apply scientific and technological principles of building planning, analysis, and design in accordance with earthquake design philosophy.
- To train the students to analyze earthquake characteristics and associated effects on structures.

Course Outcomes

Upon completion of this course Students will

- Acquires knowledge about relevant concepts of structural dynamics for single-degree-of-freedom and multiple-degree-of-freedom systems.
- Identifies key elements, causes of earthquakes, different seismic zones and differentiate between intensity and magnitude of earthquake.
- Understands the characteristics of response spectrum and evaluates structural response.
- Define the basic concepts for the design and evaluation of seismic performance of buildings

SYLLABUS

One Degree Systems: Undamped systems, various forcing functions damped systems, Response to pulsating force, Support motion. Lumped Mass Multidegree System: Direct determination of natural frequencies, Characteristic shapes, and multistory rigid frames subjected to lateral loads, damping in multi degree systems.

Earthquakes, Epicenter, Hypocenter and earthquake waves, Measurement of ground motion, Seismic regions, Intensity and Isoseismals of an earthquake, Magnitude and energy of an earthquake, Consequences of earthquakes, Seismic zoning.

Earthquake Response of Linear Systems: Earthquake excitation, Equation of motion, Response quantities, Response history, Response spectrum concept, Deformation, Pseudo-velocity, and Pseudo-acceleration, Response spectra, Peak structural response from the response spectrum, Response spectrum characteristics

Earthquake analysis of Multistory buildings: By seismic coefficient method and Response spectrum method, Base shear, Fundamental period of buildings, Distribution of forces along the height

Text Books

1. Dynamics of Structures, Theory and Applications to Earthquake Engineering by Anil K. Chopra, Prentice Hall of India.
2. Elements of Earthquake Engineering" by Jaikrishna and Chandrasekharan, Saritha Prakasham, Meerut.

Reference Books

1. Earthquake resistant design of structures" by S.K.Duggal, Oxford University Press.
2. Earthquake resistant design of structures" by Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.

4. PRESTRESSED CONCRETE STRUCTURES

Course Objectives:

- To familiarise with different methods of Prestressing and Pretensioning and their practical applications.
- To evaluate the short-term and long-term losses in prestressing and design prestressed structures considering these losses.
- To learn how to analyze and design flexural members under service and ultimate loads.
- To learn how to design structural elements for shear, torsion, anchorage and end block.
- To discuss and appraise the recent advances in the prestressed concrete technology including the use of advanced materials and application of new technologies.

Course Outcomes:

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

- Understand the basic theories and the fundamental behaviour of prestressed concrete.
- Ability to apply the fundamental knowledge to the solution of practical problems.
- Asses the combined stresses induced by prestress and applied loads using basic concepts of analysis, equivalent load method and load balancing approach.
- Analyse uncracked and cracked prestressed concrete sections.

SYLLABUS

Introduction, Basic Concepts of Prestressing, Need for High Strength Steel and Concrete, Advantages of Prestressed Concrete; Materials for Prestressed Concrete, High Strength Concrete and High Strength Steel. Prestressing Systems (1) Freyssinet System (2) Gifford Udall (3) Magnel-Blatan System, Tensioning Devices, Anchoring Devices. (D) Pretensioning and Post Tensioning

Prestressing Losses, Elastic Shortening, Loss due to Shrinkage, Loss due to Creep, Loss due to Friction, Loss due to Curvature etc.; I.S. Code Provisions

Analysis of Prestressed Members, Assumptions, Pressure or Thrust Line; Concept of Load Balancing, Cable Profile, Kern Distance, Stress in Tendons as Per IS 1343, Cracking Moment. Deflection of Prestressed Concrete Beams

Limit State Design of Flexural Members, Stresses, I.S. Code Provisions, Design of Symmetrical Beams, Design of Prestressed Concrete Poles, Design for Shear, I.S. Code Provisions.

Transfer of Prestress (Pretensioned Members), Transmission Length, Bond Stress, Transverse Tensile Stress, End Zone Reinforcement, Flexural Bond Stress, I.S. Code Provisions.

Anchorage Zone in Post Tensioned Members, Stress Distribution in End Block, Guyon's Method of Approach of Analysis of End Block (not more than 2 Cables).

Text Books

1. Prestressed Concrete by N.Krishna Raju., Tata McGraw-Hill Education

Reference Books

1. Prestressed Concrete by N.Rajagopalan, Alpha Science International.
2. Prestressed Concrete by P. Dayaratnam, Oxford and IBH Publishers.
3. Design of Prestressed Concrete Structures by T.Y. Lin and Ned. H. Burns, Wiley India.

5. ELEMENTS OF COASTAL ENGINEERING

Course Objectives

- To familiarize the students about the coastal engineering and coastal processes.
- Making student to understand about the generation and propagation of surface gravity waves, tides, storm surges and Tsunamis.
- To import the skills of analysing the wave transformations and breaking processes.
- To develop the skills to estimate wave forces.
- To develop the skill in analysing the different types of coastal protection structures.

Course Outcomes

Students will be able to

- Understand the different types of coastal processes, beaches, and landforms.
- Learns different types of wave theories and prediction models
- Understands wave transformations and wave breaking
- To familiarize the basic governing equations for the design of coastal protections structures.
- Analyse the wave forces on marine structures.

SYLLABUS

Introduction, General Design Considerations for Coastal Engineering. Long Period Waves: Tides, Seiches, Tsunamis, Storm Surge and Wind Set Up.

Solutions of Linear Wave Equation for Progressive and Standing Waves – Pressure Velocity Fields – Surface Profile and Dispersion Relationship – Principle of Super Position – Wave Energy, Energy Flux and Energy Principle – Group Velocity.
Wave Mechanics. Celerity and Group Velocity. Wind Generated Waves. Wave Statistics.

Wave Transformation: Shoaling, Refraction, Diffraction and Reflection. Wave Breaking Criteria. Wave Forecasting for Deepwater Waves.

Beach Profiles and Surf Zone Wave Breaking. Sediment Transport. Impacts of Coastal Structures on Shoreline Changes. Seawalls, Breakwaters, Groins, Jetties, Wharves.

Wave Forces on Walls. Design of Breakwaters: Rubble Mound-Type, Wall-Type, Structural Cross-Section.
Wave Forces on Piles – Basic Assumptions – Values of the Inertia and Drag Coefficients and Their Dependence on the Wave Theory used.

Text Books

1. Water Wave Mechanics for Engineers and Scientists by R.G.Dean and R.A.Darlymple, World Scientific Publishers.
2. Coastal Hydrodynamics by J.S.Mani. PHI Publishers 2nd Edition.

Reference Books

1. Basic Coastal Engineering by R.M.Sorense, 3rd Edition, Springer.
2. Coastal Engineering Manual (CEM). US Army Coastal Engineering Research Center, 2002-2006. (Download from CECIL or USACE website).

6. SUBSOIL EXPLORATION AND INSITU SOIL TESTING

Course Objectives:

- To understand the objectives and stages of subsoil exploration
- To study different methods of soil exploration
- To understand the importance of different types of soil samples used for assessing its properties
- To analyze and interpret the field test data to characterize subsoil
- To prepare a subsoil investigation report

Course Outcomes:

The Students will be able to

- Select the appropriate method of exploration and depth of exploration for a given project at a given construction site
- Understand different methods of boring and their suitability
- Distinguish between thick and thin-walled samplers
- Plan and interpret in-situ soil tests data to evaluate the bearing capacity of soil
- Plan subsoil investigation program and prepare corresponding bore logs and investigation report

SYLLABUS

SUBSOIL EXPLORATION: Introduction, Objectives of soil exploration, Stages in Subsoil exploration: Reconnaissance, Preliminary and Detailed investigations; Geophysical Methods: Seismic, Electrical Resistivity Methods; Depth and extent of soil exploration, Methods of exploration: Exploration pits, Boreholes, Methods of Boring: Auger Boring, Wash Boring, Rotary Drilling, Percussion Drilling, Core drilling; Types of soil samples: Disturbed and Undisturbed samples, Thick and Thin-walled samplers.

IN-SITU SOIL TESTING: Standard Penetration Test, Static Cone Penetration Test, Dynamic Cone Penetration Test, In situ Vane Shear Test, Observation of Groundwater table, Preparation of Borelogs and Subsoil investigation report.

Text Books

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publications, New Delhi.
2. Soil Mechanics and Foundation Engineering by Dr.K.R.Arora, Standard Publishers Distributors, New Delhi.

Reference Books

4. Head, K. H., Manual of Soil Laboratory Testing, volume 1 to 3, 1981
5. Compendium of Indian Standards on Soil Engineering Parts I and II, 1987 – 1988.

7. AIR POLLUTION AND CONTROL

Course Objectives:

- To provide a general understanding of air quality and its impact on humans, materials, properties, and the local and global effects of air pollution on plants.
- To study the function and transport of air pollutants and their measurement methods.

- Study of sampling types and methods for ambient air and stack.
- Study of macro and micrometeorology for understanding the dispersion of pollutants
- To discuss different types of air pollution control devices and their design principles and limitation.

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

- Classify and identify the sources of air pollutants
- Assess the effects of air pollutant on human health and environment.
- Apply and illustrate the importance of various air pollution dispersion models.
- Evaluate the air quality and relate it with air pollution regulation
- Design various air pollution control equipment and evaluate its use.

SYLLABUS

Air Pollution and its definition – Factors influencing air pollution – Classification of pollutants particulates – Gases-Sources of pollution – Air qualities standards – effects – Location of Industries.

Meteorology – Wind roses – lapses rates – mixing depth atmospheric dispersion – plume behavior, accumulation, estimation of pollutants – Effective stack height.

Air Pollution effects on human beings, animals, plants and materials – Air Pollution Episodes in India and abroad.
Ambient air quality monitoring and stack monitoring.

Control of air pollution – Removal of pollutants – particulate and gaseous – Air pollution control equipments (units) such as settling chamber, cyclones, wet scrubbers/collectors, scrubbers, centrifugal scrubbers spray towers, packed beds, electrostatic precipitators, after burners-absorption – adsorption – Diffusion.

Reference Books

1) Air Pollution Control Technology by T. Painter.
2) Elements of Air Pollution Control by Prof. T. Shivaji Rao.
3) Air Pollution Control by K.V.S.G. Murali Krishna.
4) Fundamentals of Air Pollution by Dr. B.S.N. Raju, Oxford & I.B.H.

8. DESIGN AND DETAILING OF REINFORCED CONCRETE AND STEEL STRUCTURES

Course Objectives:

- Know the design of various types of retaining walls with detailing.
- Familiarize with the design and detailing of circular and rectangular water tanks.
- Design combined footings including detailing.
- Design plate girders and gantry girders with detailing.
- Analyse and design web stiffeners and bridges.

Course Outcomes:

At the end of the course, the students will be able to

- Analyze and design various types of retaining walls along with detailing.
- Analyze and design circular and rectangular water tanks along with detailing.
- Design combined footings including detailing.
- Analyze and design plate girders and gantry girders along with detailing.
- Design web stiffeners and bridges including detailing.

SYLLABUS

REINFORCED CONCRETE STRUCTURES:

Design and detailing of cantilever and counterfort retaining walls.
Design and detailing of rectangular and circular water tanks.
Design and detailing of combined footings.

STEEL STRUCTURES:

Design and detailing of plate girders.
Design and detailing of web stiffeners.
Design and detailing of gantry girders.
Design and detailing of bridges.

9. ANALYSIS AND DESIGN OF PAVEMENTS

Course Objectives:

- To familiarise the students with types of pavements and stress distribution for theoretical and actual subgrade conditions.
- To impart knowledge about design principles and methods for flexible and rigid pavements.

- To impart knowledge of concrete block pavements for different traffic loading conditions.
- To impart knowledge of environmental effects and influences on pavement condition.
- To impart knowledge of pavement management systems including overlays and maintenance.

Course Outcomes:
Students will be able to

- Understand stress distribution in pavements for different traffic loading conditions.
- Understand concrete block pavements with types of pavement distresses.
- Understand pavement instrumentation and condition with origin and remedy.
- Understand roughness and skid resistance in different environmental conditions.
- Understand pavement overlays and maintenance activities to be conducted for both Flexible and Rigid pavements.

SYLLABUS

Pavement types, stress distribution pavements - theoretical and actual Subgrade conditions and traffic loading. Design principles and methods for flexible and rigid pavements.

Design of Concrete block pavements.

Evaluation of pavement condition, pavement instrumentation: Types of pavement distresses, their origins and remedy.

Roughness and skid resistance. Environmental effects and influences. Pavement maintenance, overlays.

Reference Books:

1. Pavement Analysis and Design, second edition, by Yang H. Huang, Prentice Hall publishers.
2. Shell Pavement Design Manual - asphalt pavements and overlays for road traffic, by Nilanjan Sarkar, Ooms Avenhorn Holding India Pvt.Ltd;
3. Highway engineering by Khanna & Justo .

10. PROJECT PLANNING AND MANAGEMENT

Course Objectives:

- Enable students to understand importance of planning and management of construction projects and different elements of a construction management.

- Impart skills of network techniques in solving construction industry projects.
- Explore students to understand updating, resource leveling and smoothening of construction projects.
- Enable students to learn about contracts, tenders and various works and works measurement standards.
- Familiarize with the labour problems and labour legislation in India.

Course Outcomes:

The students will be able to

- Understand importance of planning, scheduling and controlling the construction projects.
- Draw the bar charts, networking diagrams using CPM and PERT to assess the completion time of the project.
- Understand and know the various types of contracts and works related to construction projects.
- Understand the significance and concept of scientific construction management, labour problems in construction projects.
- Discuss various labour problems and labour legislation in India.

SYLLABUS

PERT and CPM : Introduction : Origin of PERT and CPM, Planning, Scheduling and controlling Bar charts, Milestone charts, weaknesses in Barcharts, PERT and CPM networks – Comparison, Event, Activity, Rules for drawing networks, Numbering the events (Fulkerson's law : Dummy activities, Time estimate-Expected time, Earliest allowable occurrence time, Latest allowable occurrence time, slack, project duration, probability of completion, Start and Finish time estimates, Floats, Project scheduling, Critical and sub-critical path.

Cost analysis / updating / resource scheduling: Cost Analysis direct and indirect costs, operation time, Normal and crash points, optimising project cost, crash limit, Free float limit, Optimisation. Updating – Process of updating; when to update, Resource scheduling – Resource smoothening. Resource levelling, circle notation and arrow notation.

Contracts: Contracts – Element of contract, offer acceptance and consideration, valid contract, Department execution of works, Master Roll Form 21. Piece work Agreement form, work order; Contract system with tenders – Definitions – Contract, Contractor, Quotation, Earnest money, Security money, Tender, Tender notice, Tender form, Bidding procedure, Irregularities in Bidding, award, Types of contracts – Lumpsum contract; Lumpsum and schedule contract, Item rate contract, sub-contracts, joint ventures, Arbitration Disputes and claim settlement.

Management – Scope of the Construction Management, Significance of Construction management, Concept of Scientific Management, Qualities of Manager, Organization – Authority, Policy, Recruitment process and Training Development of Personnel Department.

Labour problems, Labour legislation in India, Workmen compensation Act 1923, and subsequent amendments, Minimum Wages Act 1948.

Reference Books

1. PERT and CPM – L. S. Srinath.
2. PERT and CPM – Punmia.
3. Estimating and Costing – B.N. Dutta.
4. Construction Management and Planning – Guna and Sen Gupta, B.

11. GROUND IMPROVEMENT TECHNIQUES

Course Objectives:

- To study the need and importance of ground improvement techniques
- To understand various methods adopted for stabilizing different types of soils
- To study different methods of in-situ densification of soils
- To understand the suitability and applications of grouting technique
- To impart knowledge about the concept of reinforced earth and applications of geosynthetics in reinforced soil structures

Course Outcomes:

At the end of the course student will be able to

- Identify the problem and suggest suitable method to improve soil characteristics
- Understand the effectiveness of radial consolidation in densification of clays
- Illustrate the construction methods for stabilizing soils using lime and cement
- Perform analysis and design reinforced earth retaining walls
- Design suitable ground improvement system in weak soils

SYLLABUS

In-situ Densification Methods in Granular Soils: Introduction of Vibration at the Ground Surface, Impact at the Ground Surface, Vibration at Depth, Impact at Depth.

In-situ Densification Methods in Cohesive Soils: Introduction, Preconsolidation Preloading using Sand Drains, Sand Wicks, and Geodrains/Band drains, Forced Vacuum Preconsolidation, Stone and Lime Columns, Thermal Methods.

Grouting: Objectives, Suspension, Emulsion and Solution Grouts, Categories of Grouting, Grouting Equipment, Stage Grouting in Soils by Tube-a-Manchettee, Ascending and Descending Stage Grouting, Hydro fracture, Grout Control

Reinforced Earth: Principles, Components of Reinforced Earth – Fill, Reinforcing Material and Facing, Evaluation of Interfacial Friction of Fill and Reinforcing Material, Applications of Reinforced Earth, Design Principles of Reinforced Earth Walls
Geotextiles: Introduction, Types of Geotextiles; Functions and their Application, Tests for Geotextiles

Soil Stabilization: Objectives, Methods of Stabilisation, Mechanical Stabilization: Proportioning of Materials by Rothfutch's Method, Factors affecting Mechanical Stabilization, Cement and Lime Stabilization: Mechanisms, Engineering Benefits, Factors affecting Cement and Lime Stabilization, Construction Techniques, Bituminous Stabilization: Types of Soil – Bitumen, Factors affecting Bituminous Stabilization of Soils, Construction Methods.
Deep Mixing of Soils with Lime/Cement: Lime-soil Columns, Soil-Cement Columns, Construction Methods, Applications.

Stone Columns: Introduction, Construction Methods – Vibroflotation Technique and Rammed Stone Column, Functions and limitations.

Text Bookss

1. Ground Improvement Techniques, P.Purushothama Raj, Lakshmi Publications (P) Ltd.

Reference Books

1. Engineering Principles of Ground Modification, Monfred R Hausmann,Mc Graw-Hill Publishing Co.
2. Highway Engineering, Khanna S.K. and Justo C.E., Nem chand Publications.

12. SOLID WASTE MANAGEMENT

Course Objectives:

- To familiarise the student on the sources and types of solid wastes
- To impart knowledge of solid waste management principles
- To input knowledge on waste segregation methods
- To develop skills of composting and familiarise with incineration methods
- To impart knowledge of waste disposal by sanitary landfill

Course Outcomes:

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

- Gains the knowledge about the sources and types of solid wastes.
- Evaluate the characteristics of municipal solid waste.
- Analyse the problems due to improper disposal of solid waste and understand the integrated solid waste management options.
- Explain the merits and demerits of composing and incineration.
- Perform the analysis and design of sanitary landfill.

SYLLABUS

Introduction: Definition of Solid Waste, Garbage, Rubbish–Sources and Types of Solid Wastes. Characteristics of Solid Wastes: Physical, Chemical and Biological Characteristics– Problems due to Improper Disposal of Solid Waste.

Solid Waste Management: Definition– Reduction, Reuse, Recycling and Recovery Principles of Waste Management – Functional Elements of Solid Waste Management – Waste Generation and Handling at Source – Collection of Solid Wastes – Collection Methods and Services– Guidelines for Collection Route Layout.

Transfer and Transport of Wastes: Transfer Station – Processing and Segregation of the Solid Waste – Various Methods of Material Segregation.

Processing and Transformation of Solid Wastes: Composting: Definition–Methods of Composting – Advantages of Composting – Incineration: Definition – Methods of Incineration– Advantages and Disadvantages of Incineration.

Disposal of Solid Waste: Volume Reduction, Open Dumping, Land Filling Techniques. Landfills: Classification–Design and Operation of Landfills, Land Farming, Deep Well Injection.

Text Books

1. Integrated Solid Waste Management: Engineering Principles and Management Issues by George Tchobanoglous, Hilary Theisen, Samuel A Vigil. McGraw-Hill Series in Water Resources and Environmental Engineering.
2. Environmental Engineering by Howard S.Peavy, Donald R.Rowe and George Techobanoglous.

HSS ELECTIVES

1. INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
(Effective from the admitted Batch 2021-2022)

Course Objectives:

- To familiarize the students with the concepts of Management.
- To relate the concepts of Management with industrial organizations.
- To explain the factors affecting productivity and how productivity can be increased in an Industrial undertaking.
- To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

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

- Understand the roles, skills and functions of management.
- Distinguish the different types of business organizations.
- Identify the factors involved in Production Operations Management.
- Diagnose organizational problems and take suitable decisions.
- Establish good Human Resource Management practices.
- Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.

SYLLABUS

Basic Concepts of Management: Management: - Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques;, Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

Text Books:

1. Sharma, S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.
2. Vasant Desai, The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), HImalayan Publishing House, 2018.

Reference Books:

1. Aryasri, A.R., Management Science, McGraw Hill Education (India Private Limited , New Delhi 2014.
2. Sheela, P., and Jagadeswara Rao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

2. ORGANIZATIONAL BEHAVIOUR
(Effective from admitted batch 2021-2022)

Course Objectives:

- To understand the basic concepts of organizational behaviour, its foundations and importance.
- To enable students to have a basic perspective of Motivation and Motivation theories.
- To acquaint the students about group behaviour in organizations, including communication, leadership conflicts and organizational change and how these are linked to and impact organizational performance.

Course Outcomes:

- Identifying fundamental aspects of organizational dynamics.
- Evaluate main theories of motivation and formulating suitable motivational strategies.
- Analyze the behaviour of individuals and groups in organizations.
- Understanding of Leadership theories and Leadership behaviour.
- Apply relevant theories, concepts to address important Organizational Behaviour questions.

SYLLABUS

Organisational Behaviour : Concept of Organisation - Concept of Organisational Behaviour - Nature of Organisational Behaviour - Role of Organisational behaviour - Disciplines contributing to Organisational Behaviour.

Motivation: Définition - Nature of Motivation - Role of Motivation - Theories of Motivation : Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and Mc Gregor's Theory X and Theory Y.

Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

Leadership: Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

Communication: Meaning - Communication Process - Forms of communication: Oral, Written and Non- Verbal communication - Direction of communication : Downward, Upward and Horizontal communication.

Organisational conflicts: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Interorganisational conflict - Conflict management.

Organisational Change: Nature - Factors in Organisational change -Planned change: Process of planned change - Resistance to change: Factors in résistance to change - Overcoming résistance to change.

Text Books :

1. L.M.Prasad: Organisational Beaviour, Sultan Chand & Sons, New Delhi -110002
2. K. Aswathappa: Organisational Behaviour, Himalaya Publishing House, New Delhi

Reference Books.

1. Stephen Robbins: Organisational Behaviour, Pearsons Education, New Delhi.

3. OPERATIONS RESEARCH

Course Objectives:

- Formulate a real world problem as a mathematical programming model.
- Provide knowledge of optimization techniques and approaches.
- Understand and study inventory problems.
- Know the network models.
- Put on knowledge in solving replacement problems and different queueing models

Course Outcomes:

- Learned to translate a real-world problem into a mathematical formulation.
- Formulate and Solve Transportation, Assignment and sequencing problems.
- Resolve inventory problems.
- Able to solve maximum flow and shortest path problems.
- Capable to solve replacement problems and analyze queueing models.

SYLLABUS

Introduction: Definitions of Operations Research; Phases of Operations Research; Types of Operations Research models; applications, merits and demerits of Operations Research.

Allocation: Linear Programming problem formulation; Basic assumptions; Graphical solution; Simplex method; Artificial variable technique; Two phase method; Big M method; Duality principle; Primal and Dual relation.

Transportation: Formulation; Solution methods; Unbalanced transportation problems - North west corner rule; Least cost entry method; Vogel's approximation method; Optimal solution; degeneracy.

Assignment: Formulation; Variations in Assignment problem; Travelling salesman problem.

Sequencing: Sequencing of - *n* jobs through two machines; *n* jobs through three machines; *n* jobs through *m* machines; 2 jobs through *m* machines.

Inventory Control: Introduction; Types of Inventory; Inventory costs; Deterministic models - Economic order quantity (EOQ) and Economic Production Quantity (EPQ) with and without shortages; Quantity discounts; P system; Q system; Inventory control Techniques.

Network Analysis: Network definitions; Time estimates in network analysis; Labeling using

Fulkerson's rule; Forward pass computations; Backward pass computations; Project management using Critical Path Method(CPM) and Programme Evaluation and Review Technique(PERT).

Replacement: Introduction, Replacement of items that deteriorate with time - Value of money unchanging and changing, Replacement of items that fail completely.

Queueing models: Introduction; Single channel poisson arrivals; Exponential service times; Unrestricted queuewith infinite population and finite population models; Multi channel poisson arrivals; Exponential service times with infinite population and restricted queue.

Text Books:

1. Hamdy A Taha, "Operations Research- An Introduction" by TAHA , Prentice Hall, 2009.
2. F.S. Hiller, G.J. Liberman,B. Nag and P.Basu "Introduction To Operations Research, Mc Graw Hill Education(India), 2012.
3. S.D.Sharma, "Operations Research", Kedarnadh Ramnadh & Co.,2017

Reference Books:

1. R. Pannerselvam, "Operations Research", PHI..
2. Richard Bronson, Schaum's Series," Operations Research", Mc Graw Hill
3. N.V.S.Raju, "Operations Research- Theory and Practice" BS publications.
4. V.K. Kapoor, "Operations Research" Sultan Chand & Sons.