ENVIRONMENTAL SCIENCE, ENGINEERING AND MANAGEMENT

SCHEME AND SYLLABI : (With effect from 2022-23 admitted batch)

B.Tech.

I Year - I Semester

Course code	Category	Course Title	Hours per week L	T	Internal Marks	External Marks	Total Marks	Credits
EN 1101	BS	Mathematics – I	4	0	30	70	100	3
EN 1102	BS	Physics	4	0	30	70	100	3
EN 1103	ES	Engineering Graphics	2	3	30	70	100	3
EN 1104	ES	Civil and Environmental Engineering Materials	4	0	30	70	100	3
EN 1105	ES	Engineering Mechanics	4	0	30	70	100	3
EN 1106	ES	Workshop	0	3	50	50	100	1.5
EN 1107	BS	Physics Lab	0	3	50	50	100	1.5
EN 1108	ES	Engineering Geo lab	0	3	50	50	100	1.5
		Total Credits						19.5

EN 2105	HSS	Managerial Economics	4	0	30	70	100	3
EN 2106	PC	Strength of Materials Laboratory	0	3	50	50	100	1.5
EN 2107	PC	Fluid Mechanics Laboratory	0	3	50	50	100	1.5
EN 2108	PC	Surveying Field Work	0	3	50	50	100	1.5
EN 2109	SC	Safety, Health and Environment	1	2	50	50	100	2
EN 2110	MC	Professional Ethics & Universal Human values 1000			0	0	-	100
EN 2111	MC	NCC/NSS	0	2	-	-	-	0
		Total Credits						21.5

A.Tech. I year - II Semester

B.Tech. II year - II Semester

EN 2201	ES	Environmental Microbiology	4	0	30	70	100	3
EN 2202	PC	Structural Analysis	4	0	30	70	100	3
EN 2203	PC	Python Programming	4	0	30	70	100	3
EN 2204	PC	Ecology and Eco-system Engineering	4	0	30	70	100	3
EN 2205	PC	Water Supply Engineering	4	0	30	70	100	3
EN 2206	PC	Environmental Engineering lab	0	3	50	50	100	1.5
EN 2207	PC	Python Programming lab	0	3	50	50	100	1.5
EN 2208	SC	Environmental Instrumentation Analysis	1	2	50	50	100	2
EN 2209	MC	Environmental Science	0	0	-	100	100	0
		Total Credits						20

Internship - I

EN1101: 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

* 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.

* To 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 Book

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.

EN1102 : 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 Ultra-sonics 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 Nano-phase Materials. Relate them to some applications.

Course Outcomes:

* 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.

Ultra-sonics: Introduction, Production of ultra-sonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultra-sonics.

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).

Polarization: Polarization 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 fiber, Numerical aperture, Modes of propagations, classification of fibers, Fiber 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 vapor 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.

EN1103: 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

* Develop simple engineering drawings by considering BIS standards.

* Able to 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: Poly-hedra 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 Book

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

Reference

1. Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata McGraw Hill

EN 1104: CIVIL AND ENVIRONMENTAL 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.

* Impart the knowledge on green building materials

Course Outcomes

After completion of the course, the student will have the

* Capability of testing of building construction materials like cement, bricks, aggregate, etc. to find various properties of them

* Capability of preservation of building construction materials like cement, bricks, aggregate, etc. from the external agencies, weather, etc.

* Understand the design concepts of different types of windows, Doors and staircases etc.

* Ability to introduce environmental friendly materials in the built environment

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 – FALG 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, Fibred Glass, Aluminum, G.I. Sheet Roofing's. Wooden and steel, King Post and Queen Post Trusses.

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.

Green Materials: Bamboo, reclaimed wood, ferrock, recycled steel, low energy windows, Fiber Reinforced Polymer, cob (mix of subsoil, water, fibrous organic material), cork, recycled plastic, Ash Crete, Hempcrete, Mycelium is the vegetative part of a fungus fiber 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.

EN1105 : ENGINEERING MECHANICS

Course Objectives

* To provide students with practice 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 analyze 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.

* Analyze 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 Centre of Gravity: Centre of gravity of parallel forces in a plane – Centre of gravity of parallel forces in space – centroids and Centre of gravity of composite bodies – Theorems of Pappus – Distributed Loads on Beams.

Moments of inertia: Definition – Parallel axis theorem 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 Fredin and 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.

EN1106 : 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

* Can be able to work with Wood Materials in real time applications.
* Can be able to build various parts with Sheet Metal in day-to-day life.
* Can be able to apply Metal Fitting skills in various applications.
* Can be able 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.

References

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.

EN1107 : 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 caliper's, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes

* Ability to design and conduct experiments as well as to analyze and interpret

* Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics

* The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

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 ìo and Extraordinary ìe ray.
6. Determination of Thickness 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.

EN1108 : ENGINEERING GEO 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.

II SEMESTER

EN1201: 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 between 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 Seidel 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 Book

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.

1. Advanced Engineering Mathematics by Erwin Kreyszig.

2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.

3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

EN1202 : GREEN 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 Batteries, Fuels Mechanism of Corrosion of Metals and Corrosion Control Methods, Green Chemistry andTechnology and Processes involving Green Chemistry and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Learning Outcomes

* The students are able to apply the basic concepts and principles studied in Chemistry to the field of Engineering.

* The students are able to apply chemistry to different branches of engineering

* The students are able to acquire the knowledge in the areas of Water Chemistry, Mechanism of Corrosion of Metals and Corrosion Control Methods, Batteries, Fuel Cells, Green Chemistry and Technology and Processes involving Green Chemistry and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Technology : 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.

Batteries : Primary batteries: The chemistry - Types: Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells – liquid cathode, solid cathode and lithium-ferrous sulphide cells. Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells. Advanced Batteries for electric vehicles, requirements of the battery – sodium-beta and redox batteries.

Fuel Cells : Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspectsof the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells-Membranes and Fuels

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 Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Green Chemistry and Technology : Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

Processes involving Green Chemistry : Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

Text Books

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.

2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

3. Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, (2001).

4. M. Aulice Scibioh and B. Viswanathan 'Fuel Cells – principles and applications', University Press, India (2006).

5. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

6. Anastas, P. T., Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press Inc., New York, 1998.

EN1203 : 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 analyze 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 Book

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

References 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.

EN1204 : CPNM

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 this 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

* Identify basic elements of C programming structures as if 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

1. 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.

2. 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.

3. 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.

4. 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

5. 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.

6. 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

7. 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 Book

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.

EN1205: SURVEYING AND GEOMATICS

Course Objectives

* To impart knowledge about the different methods of surveying to determine the position and elevation of inaccessible points.

* To familiarize 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 benchmark.

* Understand the procedure to establish benchmarks 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.

EN1206 : 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 roleplays, 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.

EN1207 : GREEN CHEMISTRY LAB

Course Objectives

* To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis

* To prepare ion exchange/ zeolite column for removal of hardness

* To develop the skill of green synthesis through the preparation of a polymer/drug

Learning Outcomes

* The students are able to determine the amount of various chemical species in solutions by titrations quantitatively with accuracy

* The students are able to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water

* The students develop skills to synthesize a polymer or a drug

SYLLABUS

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 Chromium (VI) by Mohr's Salt Solution
4. Determination of Hardness of Water sample by EDTA method
5. Ion exchange/ Zeolite column for removal of hardness of water
6. Green Synthesis of Polymer/ drug

Text Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.

2. Experiments in Applied Chemistry (For Engineering Students) – Sirita Rattan – S. K. Kataria & Sons, New Delhi

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	H	M	M	M	L	M	M
CO 2	M	L	H	M	M	M	L
CO 3	H	M	M	H	M	H	M

EN1208 : CPNM 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.

SYLLABUS

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 substring 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.

EN2101 : NUMERICAL METHODS

Course Objectives

1. To understand the use of numerical methods in modern scientific computing and familiar about the concepts like error estimation in scientific computing which is helpful in various fields of engineering.

2. To demonstrate the use appropriate methods for interpolation and approximation of functions

3. To elaborate the concepts of numerical differentiation and integration and their applications engineering

4. To understand the processes of numerical simulation, modeling, identification, and finding solution of complex engineering systems

5. To understand the appropriate numerical methods to solve initial and boundary value problems

Course Outcomes:

Student will be able to

1. An ability to identify, formulate and the use the numerical techniques, skills, and modern engineering tools to solve engineering problems

2. Familiar with the knowledge of modern scientific computing and interpretation of errors in numerical methods

3. Familiar with numerical interpolation and construct approximation of functions

4. Familiar with the concepts of numerical integration and differentiation with engineering applications

5. familiar with numerical solution of ordinary differential equations and Partial Differential Equations

SYLLABUS

Numerical Approximation: errors and their computations: Absolute, relative and percentage errors-Errors propagation -A general Error Formula-Error in a series approximation.

Numerical solution of linear equations: Gauss Jacobi; Gauss Seidel iterative methods- method of least square for curve fitting. Eigen value problems

Interpolation Methods: Errors in polynomial Interpolation-Finite differences: Forward, Backward, Central Differences-Interpolation Formulae: Newton Forward formula, Newton Backward formula, Gauss, Stirling's, Bessel's, Everett's Formulae-Interpolation with unequal spaced points: Lagrange's interpolation, Newton's divided Difference-Inverse interpolation.

Numerical Calculus: Numerical Differentiation (first & second order)-Errors in Numerical Differentiation-Maximum and Minimum values of a Function-Numerical Integration: Trapezoidal rule, Simpson's rule, Weddle's Rule-Numerical Double integration using trapezoidal and Simpson's rule.

Numerical Solutions of Ordinary Differential Equations: Introduction to Initial and Boundary Value Problems-Numerical solutions of Ordinary Differential Equations: Taylor's series, Pi-cards method of successive approximations, Euler's method, Modified Euler's method, Runge-Kutta methods (second and fourth orders). Boundary Value Problems: Finite Difference Method (FDM).

Numerical Solutions of Partial Differential Equations: Classification of Second Order Equations-Finite difference approximation to Derivatives-Elliptic equations -Solution of Laplace's equation: Liebman's iteration Process-Solution to Poisson's Equation-Parabolic Equations-Solution of one-dimensional heat equation: Bender-Schmidt method. Crank Nicholson difference Method-Solution of two-dimensional heat equation: ADE method- Hyperbolic Equations-Solution of one dimensional (I-D) wave equation.

Text Books

1. Introductory Methods of Numerical Analysis by S.S. Sastry, 4th Edition, PHI Learning Private Limited

2. Numerical Methods in Engineering and Science by B.S. Grewal, 5th Edition, Khanna Publishers.

Reference Books

1. Numerical Methods for Engineers by Steven C. Chapra and Raymond P. Canale, 6th Edition, McGraw Hill Publications

2. Numerical Methods by M.K. Jain, S.R.K. lyengar, R.K. Jain, Revised 2nd Edition, New Age International (P) Ltd.

EN2102 : 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 stress 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.

* Analyze the stresses on oblique plane and torsional shear stress distribution of solid and hollow circular sections.

* Analyze the stresses on columns and struts using various theories.

* Analyze 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 of Strength of a Material – Analysis for Strength Requirement for Design Purposes – Review of IS Code Provisions.

Effects of Force: Tension, Compression and Shear. Stress as Internally Elastic Resistance of a Material – Strain – Property of Elasticity – Hooke's Law – Stress-Strain Diagrams. Characteristic Strengths, Factors of Safety and Working Stresses for Materials and Various Types of Application of Load. 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, Bending Moment 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 of Stresses; Theory of Pure 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.

EN2103 : ENVIRONMENTAL CHEMISTRY

Course Objectives

* Demonstrate a foundation of the subject relates to environmental chemistry;

* Impart the knowledge of the analysis and laboratory procedures for analytical chemistry related to environmental research and applications;

* Explain basic concepts of water chemistry and water pollution

* Provide an understanding of organic chemistry and interactions with the environmental media

* Study the basics of chemical reactions involved in biochemistry and nuclear chemistry

Course Outcomes

At the conclusion of the course, students will be able to:

* Identify and evaluate the relative importance of various reactions, physical processes and transport mechanisms affecting different chemicals in the environment and Know the principles of green chemistry

* Apply the analytical skills in the estimation of various chemical parameters and their analysis.

* Assess the importance of organic functional groups and significance of organic molecules in the contamination and pollution

* Make out the nature of nuclear structure, nature of radiation, nuclear fission and fusion to apply these in understanding the radioactive pollution

* Specify the factors influencing the function of proteins, carbohydrates and fats in the waste management as part of the biochemistry.

SYLLABUS

Quantitative, Qualitative and physical chemistry: Basic concepts of physical chemistry, Gas laws, Laws of Mass action, Common Ion Effect, Solutions, Vapor pressures of liquids, Binary Mixtures, Solutions of solids in Liquids, Oxidation – Reduction potentials, Ionization, Solubility products, Basics of colloidal chemistry- adsorption and absorption.

Analytical and Equilibrium chemistry: Important techniques in analytical chemistry; data collection – units and quantities, data quality, and data interpretation- Equilibrium constants and Calculations, Le-Chatelier Principle, Transport and transformation of chemicals – Photo catalysis - Soil chemistry - acid-base and ion-exchange reactions in soil - salt affected soil and its remediation

Chemistry of water: Physical and chemical properties of water; water and the environment; behavior of water in the environment; water as a solvent for gases and solids; water as a reaction medium; water as a transport medium.

Organic and Bio Chemistry: Properties of Organic Compounds, Sources of Organic Compounds, Isomerism, Types of Organic Compounds, Aliphatic, Aromatic and Heterocyclic. – Principles of green chemistry - Significance of organic molecules and their interaction with environmental media; importance of functional groups in contamination and pollution - Enzymes, factors affecting the action of Enzymes, (co-enzymes or cofactors, Temperature, pH, Micro and Macro mutants), Proteins, carbohydrates and fats. Functional groups, bonding and reactions of molecules of importance in living organisms.

Nuclear Chemistry: Atomic Structure, Electron orbits, Neutron, Proton, Nuclear structure, Nomenclature of Isotopes, stable and radioactive nucleoids, Nature of Radiation, Energy of Radiation, Units of Radioactivity, half-life, á, ã and neutron induced reaction, nuclear fission and fusion.

Text Books

1. Chemistry for Environmental Engineering and Science, C.N. Sawyer, P.L. McCarty and G.F. Parkin, Tata McGraw-Hill publication.

2. Environmental Chemistry by AK De, Wiley Publications

Reference Books

1. Chemistry for Environmental Engineering and Science, C.N. Sawyer, P.L. McCarty and G.F. Parkin, Tata McGraw-Hill publication.

2. Environmental Chemistry by AK De, Wiley Publications

EN2104 : FLUID MECHANICS

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's law; 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 – Venturi meter, 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.

EN2105 : MANAGERIAL ECONOMICS

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.

EN2106 : STRENGTH OF MATERIALS LABORATORY

Course Objectives:

* To impart knowledge about behavior 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.

SYLLABUS

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

EN2107 : FLUID MECHANICS LABORATORY

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.

SYLLABUS

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. Study of floating body and determination of Metacentric Height.
4. Study of surface profiles in Free and Forced Vortex motions.
5. Study of Venturi meter.
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.

EN 2108 : 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 familiarize 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.

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.

EN 2109 : SAFETY, HEALTH AND ENVIRONEMT

Course Objectives

* Teach the need for developing Environment, Health and Safety systems in work places

* Impart the fundamental knowledge on the occupational health and industrial hygiene and the Environmental Safety Management Principles & practices

* Get acquainted with the principles of ergonomics.

* Make the students understand the Workplace Safety and Safety Systems

* Familiarize the quality management systems in health and safety management and need for education and training

Course Outcomes

After completion of the course, the student will be able to

* Understand the concept of EHS and their importance in the work place environment

* Gain a fundamental understanding of the workplace safety and safety systems and knowledge of the safety technologies

* Identify the hierarchy of control measures for occupational health risks and the role of personal protective equipment and the selection criteria

* Understand the Workplace Safety and Safety Systems along with the features of the satisfactory design of work premises HVAC systems

* Comprehend the information from the quality manuals, safety policies & written risk assessments and health and safety records and other documentation in an organization.

SYLLABUS

Introduction to Occupational Health and Hygiene: Definition of Occupational Health and hygiene - Environmental Safety Management - Principles practices- Need for developing Environment, Health and Safety systems in work places. Regulations and Codes of Practice. Role of trade union safety

representatives - International initiatives. Ergonomics and work place. Medical surveillance for control of occupational diseases and health records.

Industrial Hygiene: Definition of Industrial Hygiene - Categories of health hazards - Exposure pathways and human responses to hazardous and toxic substances; Advantages and limitations of environmental monitoring and occupational exposure limits. Control Measures - Hierarchy of control measures for occupational health risks- Evaluation and control of basic hazards; Role of personal protective equipment and the selection criteria. Concept of threshold, limit values. Effects on humans, control methods and reduction strategies for noise, radiation and excessive stress.

Workplace Safety and Safety Systems: Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision. Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations. Control methods to eliminate or reduce the risks arising from the use of work equipment. Requirements for the safe use of display screen equipment. Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.

Techniques of Environmental Safety: Methods of effective implementation and review of health & safety policies. Functions and techniques of risk assessment, inspections and audits. Investigation of accidents- Principles of quality management systems in health and safety management. Industry specific EHS issues.

Education and Training: Relationship between quality manuals, safety policies and written risk assessments. Records and other documentation required by an organization for health and safety. Requirements for and benefits of the provision of information, instruction, training and supervision. Factors to be considered in the development of effective training programmes. Principles and methods of effective training. Feedback and evaluation mechanism.

Text Books

1. R. K. Jain and Sunil S. Rao, Industrial Safety, Health and Environment Management Systems, Khanna publishers, New Delhi (2006)

2. Environmental and Health and Safety Management by Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995

3. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.

4. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services 2005

Reference Books

1. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services 2005

2. Slote. L, Handbook of Occupational Safety and Health, JohnWilleyand Sons, NewYork.

3. Heinrich H.W, Industrial Accident Prevention, McGrawHill Company, NewYork,1980

EN2110 : PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

Common for all B.Tech and B.Tech+M.Tech Integrated Courses
(w.e.f. 2022-2023)

Course Objectives

* To recognize the moral values that should guide the Engineering profession.

* To resolve moral issues concerning one's profession.

* To develop and exhibit a set of moral beliefs and attitudes that engineers should inculcate.

* To inculcate social values and morality in one's life.

* To develop awareness about Professional/Engineering Ethics and Human Values.

Learning Outcomes

Students will be able to:

* Apply the conceptual understanding of ethics and values into everyday practice.

* Understand the importance of moral awareness and reasoning in life.

* Acquire professional and moral etiquette that an engineer requires.

* Develop the acumen for self-awareness and self-development.

* Develop cultural tolerance and integrity.

* Tackle real-life challenges with empathy.

SYLLABUS

Unit - I: HUMAN VALUES : Values - Respect - Caring - Sharing - Honesty- Courage - Self confidence - Communal Harmony Morals - Virtues

Unit –II PROFESSIONAL VALUES : Integrity - Discipline - Valuing time - Cooperation - Commitment - Code of conduct - Challenges in the workplace

Unit – III PROFESSIONAL ETHICS : Overview - Engineering ethics - Moral issues - Profession - Models of professional roles - Responsibility

Unit – IV RESPONSIBILITIES AND RIGHTS : Safety and risk - Collegiality and loyalty - Confidentiality - Occupational crime - Human rights - Employee rights - Intellectual property rights

Unit – V GLOBAL ISSUES : Globalization - Environmental ethics - Computer ethics - Code of ethics - Multinational corporations - Engineers as advisors in Planning and Policy making

Suggested Textbook:

R.S. Nagarazan. A Textbook on Professional Ethics and Human Values. New Age International Publishers. 2006.

Reference Books:

Premvir Kapoor. Professional Ethics and Human Values. Khanna Publishing House. 2019.

B.S. Raghavan. Human Values and Professional Ethics. S.Chand Publications. 2012.

R.R. Gaur & Others. A Foundation Course in Human Values and Proff. Ethics. Excel Books. 2009.

A. N. Tripathi. Human Values. New Age International (P) Limited. 2009

R. Subramanian. Professional Ethics. OUP India. 2013.

II / IV B.Tech. (Environmental Engineering) Scheme of Instruction and Examination

(with effect from 2021-22 Admitted Batch)

II Semester

EN2201: ENVIRONMENTAL MICROBIOLOGY

Course objectives:

* Impart fundamentals of environmental microbiology involved in water, soil and air.

* Introduce the knowledge on different microorganisms and their metabolisms in the environment

* Provide the knowledge of the microbiology of fresh and polluted water and wastewater along with some of the microbiological examinations;

* Present the knowledge on the microbiology of biological treatment processes

* Introduce the students to aquatic microbiology

Course Outcomes

At the conclusion of the course, students will be able to:

* Understand the fundamentals and importance of microbiology in the environment management applications particularly water and wastewater management

* Aware of the basics of metabolism, including heterotrophic metabolism and phototrophic metabolism

* Realize the basics of respiration and electron flow in an organism, including concepts from aerobic respiration and anaerobic respiration

* Able to comprehend the fundamental kinetic expressions of enzyme activity, microbial growth, and substrate utilization

* Apply the principles of microbiology and microbial remediation in the environment and particularly with reference to the capable of applying to wastewater management

Introduction: Microorganisms - classification, prokaryotic and eukaryotic cells, structure, characteristics, nucleic acids, DNA and RNA, replication. Recombinant DNA - Genetic Engineering.

Metabolism of Microorganisms: Environmental factors, nutrition and metabolism, growth phases, enzymes, carbohydrate, protein, lipids metabolism, respiration, fermentation, Glycolysis, Kreb's cycle, Hexose monophosphate pathway, significance of energetic

Microbiology of Drinking Water: Distribution of microorganisms, indicator organisms, coliforms - fecal coliforms - E. coli, Streptococcus faecalis and Clostridium welchii, differentiation of coliforms - significance - MPN index, M.F. technique, standards. Virus-concentration techniques. Algae in water supplies - problems and control.

Microbiology of Wastewater Treatment: Biodegradation of toxic pollutants - alpha oxidation, beta-oxidation, electron transport system and oxidative phosphorylation mechanism, Microbiology of biological treatment process

Aquatic Microbiology: Ecotoxicology - toxicants and toxicity - factors influencing toxicity, effects, acute, chronic, concentration response relationships, test organisms, toxicity testing bioconcentration - bioaccumulation - bio-magnification - bioassay - biomonitoring.

Text Books

1. Microbiology for sanitary engineers by Mckinney
2. Microbiology for Scientists and Engineers by Grady & Grady.

Reference Books

1. Microbiology by Pelzer, Ecschan & N R Kreig. Tata McGraw Hill Publishing Company Limited.

2. Municipal and Rural sanitation by Victor Ehalers and Earnest W Steel

EN2202 : STRUCTURAL ANALYSIS

Course Objectives:

* Familiarize 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 analyzing 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 of several 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.Gupta and R.Gupta, McGraw-Hill Education India.

2. Mechanics of structures Vol- I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House.

3. Strength of Materials by S.Ramamrutham and R.Narayanan, Dhanpat Rai Publishing House.

Reference Books

1. Elementary Strength of Materials by S. Timoshenko and D. H. Young, Affiliated East-West Press.

2. Analysis and Design of Structures Vol-I by V. N. Vazirani and M. M. Ratwani, Khanna Publishers.

3. Intermediate Structural Analysis by C. K. Wang, McGraw-Hill.

4. Strength of Materials by B. C. Punmia, Laxmi Publications.

EN2203 : PYTHON PROGRAMMING

Course Objectives

1. To develop skills on procedural oriented and object oriented programming in Python

2. To understand and apply different data wrangling techniques using Python.

3. To perform data analysis using python libraries like NumPy, Pandas and exploratory data analysis using Matplotlib

Course Outcomes

At the end of the course, a student should be able to:

1. acquire programming knowledge on Basics of Python
2. acquire programming knowledge on Text and File Handling
3. develop Python programs to Mean, Median, Mode, Correlation
4. acquire programming knowledge on NumPy, Pandas Library
5. acquire programming knowledge on Graph Visualizations in Python and Data Analysis using Python

SYLLABUS

Introduction to Python: Rapid Introduction to Procedular Programming, Data Types: Identifiers and Keywords, Integral Types, Floating Point Types

Strings: Strings, Comparing Strings, Slicing and Striding Strings, String Operators and Methods, String formatting with str.format

Collections Data Types: Tuples, Lists, Sets, dictionaries, Iterating and copying collections

Python Control Structures, Functions and OOP:Control Structures and Functions: Conditional Branching, Looping, Exception Handling, Custom Fuctions

Python Library Modules: random, math, time, os, shutil, sys, glob, re, statistics,creating a custom module

Object Oriented Programming: Object Oriented Concepts and Terminology, Custom Classes, Attributes and Methods, Inheritance and Polymorphism, Using Properties to Control Attribute Access

File Handling: Writing and Reading Binary Data, Writing and Parsing Text Files

NumPy Arrays and Vectorized Computation: NumPy arrays, Array creation, Indexing and slicing, Fancy indexing, Numerical operations on arrays, Array functions, Data processing using arrays, Loading and saving data, Saving an array, Loading an array, Linear algebra with NumPy, NumPy random numbers

Data Analysis with Pandas: An overview of the Pandas package, The Pandas data structure-Series, The DataFrame, The Essential Basic Functionality: Reindexing and altering labels , Head and tail, Binary operations, Functional statistics , Function application Sorting, Indexing and selecting data, Computational tools, Working with Missing Data, Advanced Uses of Pandas for Data Analysis - Hierarchical indexing, The Panel data

Data Analysis Application Examples: Data munging,Cleaning data, Filtering, Merging data, Reshaping data, Data aggregation, Grouping data

Data Visualization: The matplotlib API primer-Line properties, Figures and subplots, Exploring plot types-Scatter plots, Bar plots, Histogram plots, Legends and annotations, Plotting functions with Pandas

Text Books

1. Programming in Python 3: A Complete Introduction to Python Language, Mark Summerfield, Second Edition, Addison-Wesley Publications

2. Python: End-to-End Data Analysis Learning Path, Module 1: Getting Started with Python Data Analysis , Phuong VothiHong , Martin Czygan, , Packt Publishing Ltd

Reference Books

1. Learning Python, 5th Edition, Mark Lutz, Orielly Publications

2. Python for Data Analysis, Wes McKinney, Orielly Publications

3. How to Think Like a Computer Scientist: Learning with Python 3 Documentation 3rd Edition, Peter Wentworth, Jeffrey Elkner, Allen B. Downey, Chris Meyers

4. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall

5. Python Cookbook – Recipes for Mastering Python 3,3rdEdition, David Beazley, Brian K. Jones, Oreilly

EN2204: ECOLOGY AND ECOSYSTEM ENGINEERING

Course Objectives

* Describe the fundamentals of ecology and ecosystems along with the ecological engineering

* Impart the knowledge on the functional interaction of the environmental systems, which helps in realizing the importance of the ecosystems integrity

* Provide knowledge on the ecological models and eco technology

* Understand and apply concepts involved in designing and achieving sustainable uses of ecosystems

* Identify and describe the impact that designing ecosystems to solve engineering problems has in the context of societal and global issues

Course Outcomes

The Student should be able to

* Describe the ecosystems and its structure along with the key functions /services of the ecosystems

* Realize the importance of ecological engineering in addressing the issues and challenges in environmental management

* Apply technology to manage ecosystems efficiently by understanding the essential workings of natural ecological systems

* Understand and develop the mathematical concepts and models to use for the environmental systems such as wetlands, lakes, reservoirs etc.

* Develop detritus-based treatment for waste and analyze some of the case studies in the ecosystem engineering

SYLLABUS

Development and evolution of ecosystems – Principles and concepts – Energy flow and material cycling – productivity – Classification of ecotechnology – ecological engineering.

Classification of systems – Structural and functional interactions of environmental systems –Mechanisms of steady-state maintenance in open and closed systems

Classification of ecotechnology - Principles and components of Systems and Modeling-Modeling and ecotechnology – Classification of ecological models – Applications- Ecological economics- Self-organizing design and processes – Multi seeded microcosms.

Self-organizing processes - Multiple seeded microcosms- Interface coupling in ecological systems - Concept of energy - Adapting ecological engineering systems to potentially catastrophic events – Agro ecosystems - Determination of sustainable loading of ecosystems.

Eco-sanitation – soil infiltration systems–Wetlands and ponds–Source separation systems–Aqua cultural systems – Agro ecosystems – Detritus based treatment for solid wastes –marine systems- Case studies.

Text Books

1. Kangas, P.C. and Kangas, P., Ecological Engineering: Principles and Practice, Lewis Publishers,

2. Concepts of Ecology by Kormondy, PHI Publications

Reference Books

1. Etnier, C. and Guterstam, B., Ecological Engineering for Wastewater Treatment, Lewis Publishers.

EN2205 : WATER SUPPLY ENGINEERING

Course Objectives

The course will address the following:

* Outline planning and the design of water supply systems for a community/town/city

* Provide knowledge of water quality requirement for domestic usage

* Impart understanding of importance of protection of water source quality and enlightens the efforts involved in converting raw water into clean potable water.

* Selection of valves and fixture in water distribution systems

* Impart knowledge on design of water distribution network

Course Outcomes

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

* Plan and design the water and distribution networks and sewerage systems

* Identify the water source and select proper intake structure

* Characterization of water

* Select the appropriate appurtenances in the water supply

* Selection of suitable treatment flow for raw water treatments

SYLLABUS

Water Demand and Quantity studies: Estimation of water demand for a town or city, Types of water demands, Per capita Demand, Factors affecting the Per Capita Demand, Variations in the Demand, Design Period, Factors affecting the Design period, Population Studies, Population Forecasting Studies.

Hydrological Concepts: Hydrological Cycle, Types of Precipitation, Measurement of Rainfall. Surface sources of water: Lakes, Rivers, Impounding Reservoirs, Capacity of storage reservoirs, Mass curve analysis. Groundwater sources of water: Types of water bearing formations, springs, Wells and Infiltration galleries, Yields from wells and infiltration galleries.

Collection of Water: Factors governing the selection of the intake structure, Types of Intakes. Conveyance of Water: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, Pipe joints, Design aspects of pipelines, laying of pipe lines.

Quality and Analysis of Water: Characteristics of water – Physical, Chemical and Biological. Analysis of Water – Physical, Chemical and Biological. Impurities in water, Water borne diseases. Drinking water quality standards.

Treatment of Water: Flowchart of water treatment plant, Treatment methods (Theory and Design) - Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration, Chlorination and other Disinfection methods, Softening of Water, De-fluoridation, Removal of Odours.

Distribution of Water: Methods of Distribution system, Components of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks, Water connection to the houses.

Text Books

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.

2. Elements of Environmental Engineering – K.N. Duggal, S. Chand & Company Ltd., New Delhi, 2012.

Reference Books:

1. Water Supply Engineering – Dr. P.N.Modi

2. Water Supply Engineering – B.C. Punmia

3. Water Supply and Sanitary Engineering – G.S.Birdie and J.S.Birdie

4. Environmental Engineering by D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.

ENVE 2206 : ENVIRONMENTAL ENGINEERING LABORATORY-1

Course Objectives

The course will address the following:

1. Estimation some important characteristics of water and wastewater in the laboratory

2. It also gives the significance of the characteristics of the water and wastewater

Course Outcomes

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

a. Estimation some important characteristics of water and wastewater in the laboratory

b. Draw some conclusion and decide whether the water is potable or not.

c. Decide whether the water body is polluted or not with reference to the state parameters in the list of experiments

d. Estimation of the strength of the sewage in terms of BOD and COD

SYLLABUS

List of Experiments

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.
2. Determination and estimation of Total Hardness–Calcium & Magnesium.
3. Determination of Alkalinity/Acidity
4. Determination of Chlorides in water and soil
5. Determination and Estimation of total solids, organic solids and inorganic solids and settleable solids by Imhoff Cone.
6. Determination of Iron.
7. Determination of Dissolved Oxygen with D.O. Meter & Winkler's Method and B.O.D.
8. Determination of N, P, K values in solid waste
9. Physical parameters – Temperature, Color, Odour, Turbidity, Taste.
10. Determination of C.O.D.
11. Determination of Optimum coagulant dose.
12. Determination of Chlorine demand.
13. Presumptive Coliform test.

NOTE: At least 10 of the above experiments are to be conducted.

Text Books

1. Standard Methods for Analysis of Water and Waste Water – APHA
2. Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, New Delhi

Reference

1. Relevant IS Codes.
2. Chemistry for Environmental Engineering by Sawyer and Mc. Carty.

EN 2207 : PYTHON PROGRAMMING LAB

Course Objectives

* familiarize students with key data structures in Python including lists and dictionaries and apply them in context of searching, sorting, text and file handling

* introduce students to calculation of statistical measures using Python such as measures of central tendency, correlation

* familiarize students with important Python data related libraries such as Numpy and Pandas and use them to manipulate arrays and dataframes

* introduce students to data visualization in Python through creation of line plots, histograms, scatter plots, box plots and others

* implementation of basic machine learning tasks in Python including pre-processing data, dimensionality reduction of data using PCA, clustering, classification and cross-validation.

Course Outcomes

After completion of the course the student should be able to:

* implement searching, sorting and handle text and files using Python data structures such as lists and dictionaries

* calculate statistical measures using Python such as measures of central tendency, correlation

* use Python data related libraries such as Numpy and Pandas and create data visualizations

* implement basic machine learning tasks pre-processing data, compressing data, clustering, classification and cross-validation.

SYLLABUS

1. Python Programs on lists & Dictionaries
2. Python Programs on Searching and sorting
3. Python Programs on Text Handling
4. Python Programs on File Handling
5. Python Programs for calculating Mean, Mode, Median, Variance, Standard Deviation

6. Python Programs for Karl Pearson Coefficient of Correlation, Rank Correlation

7. Python Programs on NumPy Arrays, Linear algebra with NumPy

8. Python Programs for creation and manipulation of DataFrames using Pandas Library

9. Write a Python program for the following.

* Simple Line Plots,

* Adjusting the Plot: Line Colors and Styles, Axes Limits, Labeling Plots,

* Simple Scatter Plots,

* Histograms,

* Customizing Plot Legends,

* Choosing Elements for the Legend,

* Boxplot

* Multiple Legends,

* Customizing Colorbars,

* Multiple Subplots,

* Text and Annotation,

* Customizing Ticks

10. Python Programs for Data preprocessing: Handling missing values, handling categorical data, bringing features to same scale, selecting meaningful features

11. Python Program for Compressing data via dimensionality reduction: PCA

12. Python Programs for Data Clustering

13. Python Programs for Classification

14. Python Programs for Model Evaluation: K-fold cross validation

Reference Books

1. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall

2. Chris Albon, “Machine Learning with Python Cookbook-practical solutions from preprocessing to Deep learning”, O’REILLY Publisher,2018

3. Mark Summerfield, Programming in Python 3—A Complete Introduction to the Python Language, Second Edition, Additson Wesley

4. Phuong Vo.T.H , Martin Czygan, Getting Started with Python Data Analysis, Packt Publishing Ltd

5. Armando Fandango, Python Data Analysis, Packt Publishing Ltd

6. Magnus Vilhelm Persson and Luiz Felipe Martins, Mastering Python Data Analysis, Packt Publishing Ltd

7. Sebastian Raschka& Vahid Mirjalili, “Python Machine Learning”, Packt Publisher, 2017

EN2208 : ENVIRONMENTAL INSTRUMENTATION ANALYSIS

Course Objectives

* Understand the fundamentals of functional elements of measuring system, classification and Calibration process.

* Acquire the knowledge on the estimation of errors in measurement and minimization, measurement of pressure, temperature and flow etc.

* Introduce the Spectro-analytical Methods, Electro Analytical Methods and continuous measurement methods for the environmental quality monitoring.

* Study the theoretical aspects of Chromatographic Methods for the environmental quality monitoring

* Understand the concepts of pollution monitoring, to enable select, design and configure pollution monitoring instruments

Course Outcomes

After completion of the course, the student will be able to

* Describe the functions, strengths, and limitations of various analytical instruments

* Differentiate the various types of errors in the management of data in quantitative analysis

* Use various instruments such as Colorimetry, Spectrophotometer, Fluorometry, Nephelometry for the estimation of parameters

* Understand the Chromatography Method and its application in the environmental quality monitoring

* Comprehend the Electro Analytical Methods and Continuous Monitoring Methods

* Explain the function and importance of analyzer sample systems

SYLLABUS

Fundamentals: Functional Elements of Generalized Measuring Systems - Management of Data in quantitative analysis: Accuracy, precision, types of errors, Minimization of error, statistical analysis and curve fittings - Classification of Measuring Instruments, Introduction of Microprocessors based instrumentation. Standards of Measurement and classification - Calibration of instruments and its importance - Transducers, measurement of non-electrical quantities like pressure, temperature, flow and level etc.

Instrumental Methods: pH meter – Colorimetry, Spectrophotometer: Flame Emission Spectrometry- Absorption spectrometry - Nephelometry - Atomic Absorption Spectrometry - Total Organic carbon analyzer – Mercury Analyzer polar graph for metal estimation and organic compounds - Ion selective Electrode - Instrument components and its working principle

Chromatography Method: Classification, Principal and application of Chromatography –Gas chromatography, GC-MS, HPLC, Ion Chromatography, Paper chromatography and thin layer Chromatography

Electro Analytical Method: Conductometry Potentiometry, Coulometry and Polarography. Continuous environmental quality Monitoring instruments and their principals: NDIR for CO, Chemiluminescence analysis for NOX and fluorescence analysis for SO2

Air Pollution Control Equipment's: Working principles of electrostatic precipitator – cyclone separators – settling chamber – operation and Maintenance. Machinery for solid waste collection and disposal incineration – compactors – magnetic separators- incinerators

Text Books

1. Instrumentation and Mechanical Measurement by Prof. A. K. Tayal

2. Hand Book of Analytical Instrumentation by R. S. Khandpur

3. Instrumentation Measurement and Analyst by B. C. Nakra and K K Chaudhry

Reference Books

1. Standards Methods for the Examination of Water and Waste Water, 20th Edition, WPCF, APHA and AWWA, USA

2. Trivedy R. K. & Goel P.K., Chemical and Biological methods for water pollution studies, Environmental publication, Karat, 1986.

3. Cox C.R., Operation and Control of Water Treatment Processes, World Health Organisation, Geneva, 1964.

EN 2209 : ENVIRONMENTAL SCIENCE

Course Objectives

The objectives of the Environmental Science course are to

* 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.

* Apprise 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

After completion of the course the students will have

* 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; Noise pollution; 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.

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. Sharma, P. D., & Sharma, P. D. (2005). Ecology and Environment. Rastogi Publications

5. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

2. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)

3. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi.

4. MoEF & CC, Govt. of India, CPCB: E-waste Management Rules, 2016 and its amendments 2018.

5. MoEF & CC, Govt. of India, CPCB: Plastic Waste Management Rules, 2016.

Structure and Syllabus for

ENVIRONMENTAL ENGINEERING (MINORS)

Code No.	Course Title	Scheme of Instruction L	T	P	Total	Scheme of Examination Exam (hrs)	Ext	Ses	Marks	Total Credits
EN_M1	Air and Noise Pollution Control	4	-	-	4	3	70	30	100	3
EN_M2	Ecology and Eco-system Engineering	4	-	-	4	3	70	30	100	3
EN_M3	Industrial Pollution Control and Management	4	-	-	4	3	70	30	100	3
EN_M4	Environmental Impact Assessment	4	-	-	4	3	70	30	100	3
EN_M5	Solid and Hazardous Waste Management	4	-	-	4	3	70	30	100	3
EN_M6	Climate Change and CDM	4	-	-	4	3	70	30	100	3
EN_M7	Environmental Modelling and Simulation	4	-	-	4	3	70	30	100	3

EN_M1: AIR AND NOISE POLLUTION 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

* Compute the ground level concentration of a pollutant with the help of Gaussian model

* Understanding the design concepts of various air pollution control equipment and evaluate its use.

SYLLABUS

GENERAL: Air Pollution – Definition – Air Pollution and Global Climate – Units of measurements of pollutants – Air quality criteria – stack emission standards – National ambient air quality standards – Air pollution indices – Air quality management in India.

SOURCES, CLASSIFICATION AND EFFECTS: Sources and classification of air pollutants – Man made – Natural sources – Type of air pollutants – Pollution due to automobiles – Analysis of air pollutants – Chemical, Instrumental and biological methods. Air pollution and its effects on human beings, plants and animals – Economic effects of air pollution – Effect of air pollution on meteorological conditions – Changes on the Meso scale, Micro scale and Macro scale.

SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING: Sampling and measurement of particulate and gaseous pollutants – Ambient air sampling – Stack sampling. Environmental factors – Meteorology – temperature lapse rate and stability – Adiabatic lapse rate – Wind Rose – Inversion – Wind velocity and turbulence – Plume behaviour – Dispersion of air pollutants- Air Quality Modeling.

AIR POLLUTION CONTROL MEASURES: air pollution control principles– Source correction methods – Control equipments – Particulate control methods – Bag house filter – Settling chamber – cyclone separators – inertial devices – Electrostatic precipitator – scrubbers – Control of gaseous emissions – Absorption – Absorption equipments – adsorption and combustion devices (Theory and working of equipments only).

NOISE POLLUTION AND ITS CONTROL: Sources of noise – Units and Measurements of Noise – Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person – Control of other types of Noise Sound Absorbent

Text Books

1. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2000.

2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 1993

Reference Books

1. Fundamentals of Air Pollution Engineering by Richard C. Flagan John H. Seinfeld California Institute of Technology, Prentice Hall Englewood Cliffs, New Jersey

2. Lawrence K. Wang, Norman C (2009). Air Pollution Control Engineering Air Pollution Control Engineering;

3. Noel de Nevers (1999). Air Pollution Control Engineering. McGraw-Hill Science /Engineering /Math 1999-10-12

EN_M2 : ECOLOGICAL AND ECO-SYSTEMS ENGINEERING

Course Objectives

* Describe the fundamentals of ecology and ecosystems along with the ecological engineering

* Impart the knowledge on the functional interaction of the environmental systems, which helps in realizing the importance of the ecosystems integrity

* Provide knowledge on the ecological models and eco technology

* Understand and apply concepts involved in designing and achieving sustainable uses of ecosystems

* Identify and describe the impact that designing ecosystems to solve engineering problems has in the context of societal and global issues

Course Outcomes

The Student should be able to

* Describe the ecosystems and its structure along with the key functions /services of the ecosystems

* Realize the importance of ecological engineering in addressing the issues and challenges in environmental management

* Apply technology to manage ecosystems efficiently by understanding the essential workings of natural ecological systems

* Understand and develop the mathematical concepts and models to use for the environmental systems such as wetlands, lakes, reservoirs etc.

* Develop detritus-based treatment for waste and analyze some of the case studies in the ecosystem engineering

SYLLABUS

Development and evolution of ecosystems – Principles and concepts – Energy flow and material cycling – productivity – Classification of ecotechnology – ecological engineering.

Classification of systems – Structural and functional interactions of environmental systems –Mechanisms of steady-state maintenance in open and closed systems

Classification of ecotechnology - Principles and components of Systems and Modeling-Modeling and ecotechnology – Classification of ecological models – Applications- Ecological economics- Self-organizing design and processes – Multi seeded microcosms.

Self organizing processes - Multiple seeded microcosms- Interface coupling in ecological systems - Concept of energy - Adapting ecological engineering systems to potentially catastrophic events - Agro ecosystems - Determination of sustainable loading of ecosystems.

Ecosanitation – soil infiltration systems–Wetlands and ponds–Source separation systems–Aqua cultural systems – Agro ecosystems – Detritus based treatment for solid wastes –marine systems- Case studies.

Text Books

1. Kangas, P.C. and Kangas, P., *Ecological Engineering: Principles and Practice*, Lewis Publishers,

2. Concepts of Ecology by Kormondy, PHI Publications

Reference Books

1. Etnier, C. and Guterstam, B., Ecological Engineering for Wastewater Treatment, Lewis Publishers.

EN_M3 : INDUSTRIAL POLLUTION CONTROL AND MANAGEMENT

Course Objectives

* Acquire knowledge on characteristics of wastewater 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 wastewater 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 wastewater of specific industries, characteristics of treatment plant effluents, Effect of wastewater 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, Fertiliser, Oil refinery and Petrochemicals.

Text Books

1. Wastewater Treatment by M.N. Rao and A. K. Datta. Oxford & IBH Publishing Co. New Delhi.

2. Industrial Water Pollution Control by W. Wesley Eckenfelder, Jr.; McGrawhill Publishing co., New Delhi

Reference Books

1. Industrial Wastewater Treatment by Patwardhan, A.D. PHI Learning Pvt. Ltd.

2. A Comprehensive Book on Industrial Waste and Management by Dr. H.S. Bhatia. Misha Books

3. Industrial Waste Treatment Handbook by Frank Woodard. Butterworth–Heinemann

EN_M4: ENVIRONMENTAL IMPACT ASSESSMENT

Course Objectives

* To familiarize 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 familiarize with cultural and socio-economic environment

* Impart knowledge on the carrying capacity of the 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

* Understand the concepts of carrying capacity of environment

* Discuss the socio-economic attribute, resettlement and rehabilitation issues

SYLLABUS

Introduction to EIA**:** Definition, Concepts, Types, Limitations, components of EIA process, settings – public participation, public hearing. Methodologies**:** background information, interaction matrix methodologies, network methodologies etc, environmental setting- various factors, documentation and selection process, environmental indices and indicators for describing affected environment.

EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Categorization of Industries for seeking environmental clearance from concerned authorities, procedure for environmental clearance, procedure for conducting environmental impact assessment report, Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan, post environmental monitoring. Case studies in EIA.

Prediction and assessment of impact for air and noise environment: Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise levels and standards, prediction of noise levels and assessment of impact, mitigations.

Prediction and assessment of impact for water and soil environment: Basic information of water quality (Surface water and groundwater), water quality standards, identification of impact, prediction of impact and assessment, mitigations. Background information of soil environment, soil and groundwater standards, prediction and assessment of impact for groundwater and soil, mitigations.

Prediction and assessment of impact on cultural and socioeconomic environment: Basic information on cultural resources, rules and regulations for cultural resources like archaeological, historical structures, Cultural system, prediction and assessment of impact, mitigations. Basic information of socio-economic environment, description of existing socio-economic environment, prediction and assessment of impact, mitigation, resettlement and rehabilitation.

Text Books

1. Environmental Impact Assessment, Canter R.L., Mc Graw Hill International Edition, 1997.

2. Environmental Impact Analysis Handbook, John G. Rau and David C. Wooten (Ed), McGraw Hill Book

Reference Books

1. Environmental Impact Assessment Methodologies by Y Anjaneyulu, and Valli Manikkam, BSP Books PVT Ltd

EN_M5: SOLID AND HAZARDOUS WASTE MANAGEMENT

Course Objectives

* To familiarize 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 familiarize with incineration methods

* To impart knowledge of waste disposal by sanitary landfill

* Impart knowledge on the hazardous waste characteristics and its handling

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.

* Analyze 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.

* Understand the hazardous waste management which will be useful in using the method for waste management

SYLLABUS

Introduction: Definition of solid waste – waste generation, sources and types of solid waste – sampling and characterization – Determination of composition of Municipal Solid Waste – Onsite storage and handling of solid waste.

C**ollection and Transport of Solid Waste:** Type and methods of waste collection systems, analysis of collection system Optimization of collection routes – alternative techniques for collection system. Transfer and Transport**:** Need for transfer operation, transport means and methods, transfer station types and design requirements. Separation and Processing and Transformation of Solid Waste- Waste as a Resource Economics, Disposable Materials, Recycling Collection, Processing, Potential for Reuse

Processing and disposal: Unit operations used for separation and processing, Materials Recovery facilities, Source reduction and waste minimization, Metal Separation & Recovery Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators. Landfills**:** Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

Hazardous Waste Management: Definition and identification of hazardous wastes-sources and characteristics – hazardous wastes in Municipal Waste – Hazardous waste regulations – minimization of Hazardous Waste-compatibility, handling and storage of hazardous waste-collection and transport, e-waste - sources, collection, treatment and reuse.

Hazardous Waste Treatment Technologies - Design and operation of facilities for physical, chemical and thermal treatment of hazardous waste – Solidification, chemical fixation and encapsulation, incineration. Hazardous waste landfills: Site selection, design and operation – remediation of hazardous waste disposal sites.

Text Books

1. Integrated Solid Waste Management, George Techobanoglous and Frank Kreith, McGraw Hill Publication

2. Hazardous Waste Management, Charles A. Wentz; McGraw Hill Publication

3. Solid Waste Management, by K. Sasi Kumar and S. Gopi Krishna, PHI Learning

Reference Books

1. Solid and Hazardous Waste Management by MN Rao, Razia Sultana, BSP Books

2. Municipal Solid Waste Management by P Jayaramireddy, BSP Books PVT Ltd.

3. CPCB's Hazardous waste management rules (management and Handling) by CPCB. Govt. of India.

EN_M6: CLIMATE CHANGE IMPACT MITIGATION AND ADAPTATION

Course Objectives

* To familiarize the climate parameters, climate change and the causes of the phenomenon

* To create better understanding on the global warming, potential, past present and future scenario of global warming

* To realize the impacts of climate change on various attributes of environment and the activities of the people

* To educate the students on the mitigation of climate change impacts and importance of adaptation to combat the climate change impact

* To introduce the alternative energy sources, CDM to reduce the impact on the environment

Course Outcomes

The student should be able to

* categorize the factors influencing climate change at local and global level

* understanding the global warming and the future scenario of global warming

* identify the sectors that will be getting affected due to the climate change

* Plan for the adaptation to combat the climate change impact

* know the alternative energy sources, CDM to reduce the impact on the environment

SYLLABUS

Introduction: Atmosphere – weather and Climate - Causes of global and regional climate change- climate parameters – Temperature, Rainfall, Humidity, Wind – Global Ocean circulation – El Nino and its effect - Carbon cycle.

Global Warming: Emission sources of greenhouse gases, Green House effect as a natural phenomenon, and due to anthropogenic activities, recent role of greenhouse effect. Global warming potential, past present and future scenario of global warming.

Impacts of Climate Change: Effects of Climate Changes on living systems – health effects, agriculture and food security, forestry, human migration, socioeconomic impacts- coastal areas, tourism, industry and business, vul-

nerability assessment- infrastructure. Sea level rise, Coastal erosion and landslides, strategies to combat global warming.

Mitigating Climate Change: IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environment-reflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programmes – green roofing strategies – energy conservation in buildings – energy efficiencies –Concept of carbon sequestration, Carbon sequestration modalities and procedures, Carbon capture and storage, Carbon trading, Montreal protocol, Kyoto protocol, Role and functions of IPCC, National and International action plan on climate change.

Alternate Fuels and Renewable Energy: Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Clean Development Mechanism - Energy Audit.

Text Books

1. Climate Change: causes, Effects and Solutions, John T. Hardy. Willy Publication, USA.

2. Principles and Practices of Air Pollution Control and Analysis, J.R. Mudakavi, I.K.international Publishing House Pvt. Ltd., New Delhi.

3. Carbon Capture: Sequestration and Storage (Issues in Environmental Science and Technology), RE Hester and RM Harrison.

Reference Books

1. Global Warming and Climate Change. Vol I and II. By Velma. I. Grover,Science Publishers, 2005.

2. Climate Change – An Indian Perspective, by Dash Sushil Kumar, Cambridge University Press India Pvt. Ltd, 2007

3. IPCC Fifth Assessment Report, Cambridge University Press, Cambridge, UK,

4. Impacts of Climate Change and Climate Variability on Hydrological Regimes, by Jan C. van Dam, Cambridge University Press, 2003

EE_M7: ENVIRONMENTAL MODELLING AND SIMULATION

Course Objectives

* Learning the fundamentals of environmental systems, Systems approach, Models and modelling.

* Understanding the modes of contaminant transport and their modelling.

* Study of groundwater flow models and contaminant transport.

* Modelling of surface water flow models. Modelling in computer-based software.

Course Outcome

* Learning the fundamentals of environmental systems, Systems approach, Models and modelling.

* Understanding the modes of contaminant transport and their modelling.

* Study of groundwater flow models and contaminant transport.

* Modelling of surface water flow models. Modelling in computer-based software.

SYLLABUS

Environmental systems: Introduction, An overview of mathematical models applied to various environmental issues, Concept, Need, Scope and objectives of environmental modeling, Role of mathematical models in environmental quality management

Model classification: Brief review of different types of models, Mathematical (Deterministic), Numerical, Stochastic and Physical Models. Different stages involved in model building, Calibration and verification of model, Limitations in modelling.

Contaminant Transport phenomenon: Advection, Diffusion, Dispersion, Adsorption, Conservative and non-conservative pollutants. biological process models-simplified models for transport phenomenon in River and streams, Estuaries and lakes.

Sub-surface flow models: Governing Equations for sub-surface flow and transport of pollutants, Simplified models for sub-surface plume movements. Case studies using appropriate software for sub-surface flow and transport of pollutants.

Surface flow models: Surface water quality modeling– Dissolved oxygen models – DO sag model, BOD model, Streeter Phelps equation for point and distributed sources. Eutrophication models for lakes and flowing water; Use of QUAL2K and Water Quality Analysis Simulation Program (WASP).

Air pollution: basic principles of air pollution dispersion modelling. Various types of models available. The relative merits and demerits of the models. The fundamental mathematical equations used in the AERMOD modelling and its limitations

Text Books

1. Ramaswami A. “Integrated Environmental Modelling”, John Wiley, New York.

2. Chapra S.C., “Surface water quality modelling”, McGraw Hill., New York.

3. Rumynin B.G., “Subsurface Solute Transport Model”, Springer, Netherlands.

4. Schnoor J., “Environmental Modelling”, John Wiley, New York.

Reference Books

1. Jacobson M.Z., “Fundamentals of Atmospheric Modelling”, Cambridge UniversityPress, New York.

2. Schnelle K.B. and Dey P.R., “Atmospheric Dispersion Modelling Compliance (1999) Guide”, McGraw-Hill, New York

3. Gordon Geoffrey, “System Simulation”, Prentice Hall (Higher Education Division, Pearson Education).

Structure and Syllabus for

B.Tech. (Environmental Engineering) Honours Program

Code No.	Course Title	Scheme of Instruction L	T	P	Total	Scheme of Examination Exam (hrs)	Ext	Ses	Total Marks	Credits
EN_H1	Remote Sensing and GIS Applications in Environmental Engineering	4	-	-	4	3	70	30	100	3
EN_H2	Ecology and stream pollution	4	-	-	4	3	70	30	100	3
EN_H3	Rural water supply and environmental sanitation	4	-	-	4	3	70	30	100	3
EN_H4	Clean technology	4	-	-	4	3	70	30	100	3
EN_H5	Energy management	4	-	-	4	3	70	30	100	3
EN_H6	Environmental Risks : Assessment and Management	4	-	-	4	3	70	30	100	3
EN_H7	Resource and energy recovery from waste	4	-	-	4	3	70	30	100	3

EN_H1: Remote Sensing and GIS Applications in Environmental Engineering

Course Objectives

To instruct the students on

* The basic concepts and aspects of remote sensing

* Different remote sensing techniques and data analysis using Geographical Information Systems

* Application of RS for monitoring the environmental settings

* Application of GIS for environmental management

Course Outcome

The students will learn or acquire knowledge on

* Understanding and processing of remote sensing data

* Geographic Information System development and geospatial data analysis

* Identification of environmental problems using remote sensing

* The assessment of Environmental Impacts using RS and GIS

* The application of RS and GIS and development of spatial maps with layers

SYLLABUS

Introduction to Remote Sensing: Introduction to remote sensing – Electromagnetic spectrum – Physics of remote sensing – Effects of atmosphere – Atmospheric windows – Interaction of earth surface features with EMR – Spectral characteristics of vegetation, water, soil, etc. Various types of platforms– Airborne and space based platforms - Characteristics of different types of platforms – Characteristics of Remote Sensors –Multi spectral sensors – Multi Spectral Scanners – Microwave remote sensing- Factors affecting Microwave measurement - Radar wave bands- SLAR and SAR

Introduction to Sensors: Sensors- Satellite system parameters- sensor parameters-spatial, spectral and radiometric resolution – False colour composite (FCC) – Multi spectral photographs – Thermal and microwave imaging systemEarth Resources satellite and Meteorological satellites Different types of data products and their characteristics –Basic principles of digital image processing – filtering, Retrieval Algorithms

Introduction to GIS: Geographic Information system – History and development of GIS – GIS definitions and Terminology -Architecture– System concepts – Coordinate systems – Standard GIS packages. Type of data – Spatial and non- spatial data – Data structure – Points – Lines – Polygon – Vector and raster – Files and data formats – Spatial data modeling –Raster GIS model and Vector GIS models.-GIS data file management and Database models – GPS as data capture-data editing - Digital elevation model.

Surface-Water Hydrologic Data: Spatial techniques for Surface-Water Hydrology Modeling, Surface-Water Hydrology Models, ArcSWAT model and its applications; Groundwater Data, Ground water Models and spatial techniques for Groundwater Modeling and Visualization, The ArcHydro Data Model

Geospatial techniques: for planning and design of Water-Supply and Irrigation Systems, Spatial Database Development for Wastewater and Storm water Systems, GIS-Based Wastewater Collection System Design and Management Applications, GIS-Based Decision-Support Systems for Wastewater and Storm water Systems.

Text Books

1. Lillesand T.M. and Kiefer R.W., Remote sensing and Image Interpretation, Second Edition, John Wiley and Sons, 1987.

2. Chang, K (2005). Introduction to Geographic Information Systems, Tata McGraw Hills Edition, New Delhi.

3. Lynn E. Johnson, Geographic Information Systems in Water Resources Engineering, CRC Press, 2008.

4. Praveen Kumar, Mike Folk, Momcilo Markus and Jay C. Alameda, Hydroinformatics: Data Integrative Approaches in Computation, Analysis, and Modeling, CRC Press, 2005.

5. Allan Brimicombe, GIS, Environmental Modeling and Engineering, Second Edition, CRC Press, 2009.

Reference Books

1. Manual of Remote Sensing, American Society of Photogrammetry and Remote Sensing, 1993.

2. Paul Curran P.J., Principles of Remote Sensing , ELBS, 1983.

3. Sabins F.F. Jr., Remote Sensing Principles and Interpretation, W.II. Freeman and Company, 1978.

4. Geo Information Systems – Applications of GIS and Related Spatial Information Technologies, ASTER Publication Co., Chestern (England), 1992.

5. Burrough P.A., Principles of GIS for Land Resources Assessment, Oxford Publication, 1980.

6. Jeffrey Star and John Estes, Geographical Information System – An Introduction, Prentice – Hall Inc., 1990

EN_H 2: ECOLOGY AND STREAM POLLUTION

Course Objectives

The course is intended to impart the knowledge on

* The ecology, ecosystem services and the extended, maintenance in open and closed systems

* Classification of ecological models and their applications

* The steam water characteristics and river water chemical classification

* The issues influencing the self purification capacity of a stream or river

* various types of models used for the water quality studies

Course Outcomes

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

* Understand fundamental concepts of ecology.

* Identify components of ecosystems and their interrelationships.

* Understand importance of stream water chemistry in assessment of fate of pollutants.

* Assess self-purification capacity of receiving waters.

* Model the pollutant transport processes in water bodies.

SYLLABUS

Introduction to Ecosystems: Development and evolution of ecosystems – Principles and concepts – Energy flow and material cycling – productivity – Classification of eco-technology – ecological engineering- Classification of systems – Structural and functional interactions of environmental systems – Mechanisms of steady - state maintenance in open and closed systems- Modeling and ecotechnology

Classification of Ecological models – Applications - Ecological economics- Selforganizing design and processes. Introduction To Fluvial Ecosystems: Fluvial Ecosystem Diversity- The Water Cycle – Stream flow- Flow Variation- The Stream Channel- Sediments and their Transport- Fluvial Processes along the

River Continuum Stream Water Chemistry: Dissolved Gases -Major Dissolved Constituents of River Water -Variability in ionic concentrations -The dissolved load - Chemical classification of river water - The Bicarbonate Buffer System - Influence of Chemical Factors on the Biota-Variation in ionic concentration- Salinization -Effects of acidity on stream ecosystems

Stream Water Quality modeling: Water quality models – Historical development – Non point source pollution- Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations - Dissolved oxygen in Rivers.

Water quality in the surface and groundwater bodies: Dissolved oxygen in estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants - Ground Water Quality Modeling - Contaminant solute transport equation, Numerical methods- legislations for water quality.

Text Books

1. Tebutt T.H.Y. (1998) Principles of Water Quality Control, 5th Ed., Pergamon Press,

2. Thomann V. R., and Mueller A. J. (1997) Principles of Surface Water Quality Modelling and Control, Prentice Hall,

Reference Books

1. Welch, E.D., (1992) Ecological Effects of Wastewater, Cambridge University Press,

2. Frank R. Spellman and Joanne Drinan, (2001) Stream Ecology and Self Purification: An Introduction, 2nd Ed., CRC Press.

EN_H 3: RURAL WATER SUPPLY AND ENVIORNMENTAL SANITATION

Course Objectives

The objectives of the course are

* To understand the rural water supply and sanitation requirements and possible challenges

* To design water supply and sanitation system for rural community

* To get acquainted with low cost waste management systems for rural areas

* To have knowledge on the hygiene and sanitation, solid waste management in rural areas

Course Outcomes

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

* Identify the problems pertaining to rural water supply and sanitation

* Design water supply and sanitation system for rural community

* Design low cost waste management systems for rural areas

* Plan and design an effluent disposal mechanism and solid waste management for small communities

SYLLABUS

Rural Water Supply: Issues of rural water supply –Various techniques for rural water supply- merits- National rural drinking water program- rural water quality monitoring and surveillance- operation and maintenance of rural water supplies

Low Cost Water Treatment: Introduction – Epidemiological aspects of water quality methods for low cost water treatment - Specific contaminant removal systems

Rural Sanitation: Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system in rural areas- Treatment and Disposal of wastewater - Compact and simple wastewater treatment units and systems in rural areas- stabilization ponds - septic tanks - Imhoff tank- soak pits- low cost excreta disposal systems- Effluent disposal.

Hygiene and Sanitation: Occupational Hazards- Schools - Public Buildings Hospitals - Eating establishments- Swimming pools – Cleanliness, maintenance, and comfort - Industrial plant sanitation.

Solid Waste Management: Disposal of Solid Wastes- Composting- land filling - incineration- Biogas plants - Rural health - Other specific issues and problems encountered in rural sanitation

Text Books

1. Eulers, V.M., and Steel, E.W., Municipal and Rural Sanitation, 6th Ed., McGraw Hill Book Company, 1965

2. Park, J.E., and Park, K., Text Book of Preventive and Social Medicine, Banarsidas Bhanot, 1972

Reference Books

1. Wright, F.B., Rural Water Supply and Sanitation, E. Robert Krieger Publishing Company, Huntington, New York, 1977

2. Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: Global Views on Community Water Supply and Sanitation, IWA Publishing (Intl Water Assoc), 2007

EN_H4: CLEAN TECHNOLOGY

Course Objectives

The students will acquire knowledge on

* The current developments and local and global environmental problems

* The concepts of thermodynamics and its possible linkages with the environmental pollution and sustainable development

* The importance of cleaner technologies and the lifecycle assessment & eco-labeling

* Material recycling, biodegradable materials, factors influencing biodegradability etc which may help in proper waste management nd disposal options

Course Outcomes

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

* Understand current developments and problems in the society for clean technologies.

* Apply concepts of thermodynamics in arriving at clean technologies.

* Plan engineered conditions for improved waste management.

* Understand the process of cleaner technologies and the lifecycle assessment in an organization

* Design hazardous waste management treatment and disposal options

SYLLABUS

Introduction: Industrial Society - an overview; Resource Limitations - forests, water, air, soil, material resources; Environmental Problems - local problems such as population, energy, water, pollution etc, global problems such as global warming, climate change, ozone layer depletion, green house effect etc; Sustainable development: principles, environmental, economic and social dimensions of sustainable development by focusing on changing patterns of consumption, production and distribution resources

Thermodynamics: Definitions; Earth as a thermodynamic system; Thermodynamics of the techno system; Thermodynamics and energy in society; Thermodynamics and environmental pollution; Towards a thermodynamically sustainable development.

Cleaner Production: Project Development and Implementation - Overview of Cleaner Production (CP) Assessment Steps and Skills, Process Flow

Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress – Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Eco Labelling

Industrial And Hazardous: Waste Industrial waste types, characteristics of industrial wastes, pollution from major industries, effects of industrial effluents, cleaner production, treatment technologies; Hazardous wastes definition, sources of hazardous waste, transportation,- treatment and disposal methods and processes

System Analysis, Materials & Products: Flexible processes; Ecodesign; Material recycling; Biodegradable materials - degradation mechanisms, test methods, structural factors influencing biodegradability, microbial polymers, other natural polymers, synthetic and decomposable polymers, mixtures of decomposable and non-decomposable materials.

Text Books

1. Allan Johansson, Clean Technology, 1st edition CRC Press, 1992

2. Aswathanarayana U., Harikrishnan T., and Kadher-Mohien S. T., Green Energy Technology, Economics and Policy, CRC Press, 2012

Reference Books

1. Bernard Ganne and Yveline Lecler, Pollution Prevention Handbook, CRC Press, 1995

2. T.T.Shen, Industrial Pollution Prevention, Springer, 1999.

3. Blackman, William C. Basic hazardous waste management, 3rd edition, CRC Press, 2001

EN_H5: ENERGY MANAGEMENT

Course Objectives

To instruct the students on

* Various sources of energy and basic principles of energy conservation

* Energy auditing and the purpose, methodology with respect to various process industries

* Total energy systems and energy management opportunities

* The importance of Energy economics along with the Life Cycle Costing and applications of energy economics

* The environmental issues and challenges posed due to energy production and utilization

Course Outcome

Students will be able to

* Understand the energy scenario and sources of energy and the role of it in the industry

* Conduct energy audit and study the energy conservation process in various utilities of the industry

* Understand the total energy systems and application of energy management principles in the utilities

* Comprehend the Energy economics and Life Cycle Costing

* Identify the relevant environmental issues and challenges posed due to energy production and utilization from the usage of a given fuel

SYLLABUS

Sources of Energy: Energy Scenario – Principles and Imperatives of Energy Conservation – Various Sources – Alternative – non-conventional energy sources – Alternative energy sources-wind-Solar energy – Energy Consumption Pattern – Resource Availability – Role of Energy Managers in Industries

Energy Auditing: Energy Audit – Purpose, Methodology with respect to Process Industries – Power Plants, Boilers etc, - Characteristic Method Employed in Certain Energy Intensive Industries – Various Energy Conservation Measures in Steam System – Losses in Boiler, Methodology of Upgrading Boiler Performance; Energy Conservation in Pumps, Fans, Aerators Compressors, Air conditioning and refrigeration systems, Function, Necessity

Energy Conservation: Total Energy Systems – Concept of total Energy – Advantages & Limitations – Total Energy System & Application – Potential & Economics of total Energy systems, water heat recovery. Potential Areas for Conservation in Various Industries – Energy Management Opportunities in Electrical Heating, Lighting System, Cable Selection – Energy Efficient Motors – Factors Involved in Determination of Motor Efficiency.

Energy Economics: Importance of Energy Management, Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Life Cycle Costing, Carbon Credit. Applications :Case studies on Sugar Industry, Thermal Power Plant; Petrochemical Industries, Educational Institutions

Environmental Issues and Challenges: The environmental issued due to production of energy using fossil fuels such as coal, petroleum, diesel, CNG etc. and it usage – the environmental issues and challenges due to the mining or extraction of the fossil fuels from the deposits or sources – The management options of the environmental issues related to the various energy production processes and the usage of the conventional fuels.

Text Books

1. Trivedi, P R, Jolka K R, Energy Management, Commonwealth Publication, New Delhi, 1997.

2. Witte, Larry C, Industrial Energy Management & Utilization, Hemisphere Publishers, Washington, 1988

Reference Books

1. Trivedi, P R, Jolka K R, Energy Management, Commonwealth Publication, New Delhi, 1997.

2. Witte, Larry C, Industrial Energy Management & Utilization, Hemisphere Publishers, Washington, 1988.

3. CB Smith, Energy Management Principles, Pergamon Press, New York, 3rd Edition, 2004.

4. Hamies, Energy Auditing and Conservation; Methods, Measurements, Management & Case Study, Hemisphere, Washington, 1980

EN_H6: Environmental Risks: Assessment and Management

Course Objectives

The course objectives are to provide

* Basic knowledge on various environmental risks due to the activities around

* Theory and practice of effective management of different of environmental risk assessment processes

* Information on the qualitative, quantitative and probabilistic risk analysis tools

* Conceptual model development in the field of environmental risk management

* Knowledge to identify and assess the wide range of increasingly complex risks and hazards

Course Outcome

On successful completion of the course, the student should be able to

* Analyze and explain the possible consequences in a given situation where environmental risks will occur and the possible or likely impacts on a population

* Review, and suggest improvements for other risk assessment and management methodologies within the given scenarios.

* Gain the knowledge related to the broad field of environmental risk assessment and management.

* apply the methods for the aquatic, sediment, air, soil effects assessment

* Get insight on environmental risk assessment in developing program, which help in improving the sustenance of the program or project.

SYLLABUS

Introduction: Sources of Environmental hazards- Basic definitions of isk, hazard and vulnerability -Types of Risk - Environmental, Safety and ecological risks- Risk assessment framework- Regulatory perspectives and requirements- Risk Analysis and Management – Social benefit Vs technological risks- Path to risk analysis- Perception of risk- Risk assessment in different disciplines.

Elements of Environmental Risk Assessment: Hazard identification and accounting – Fate and behaviour of toxics and persistent substances in the environment – Properties, processes and parameters that control fate and transport of contaminants – Receptor exposure to Environmental Contaminants – Dose Response Evaluation – Exposure Assessment – Exposure Factors, Slope Factors, Dose Response calculations and Dose Conversion Factors – Risk Characterization and consequence determination – Vulnerability assessment – Uncertainty analysis.

Tools and Methods for Risk Assessment: HAZOP and FEMA methods – Cause failure analysis – Event tree and fault tree modeling and analysis – Multimedia and multipath way exposure modeling of contaminant migration for estimation of contaminant concentrations in air, water, soils, vegetation and animal products -Estimation of carcinogenic and non carcinogenic risks to human health – Methods in Ecological risk assessment – Probabilistic risk assessments – radiation risk assessment – Data sources and evaluation.

Risk Assessment in Environmental Management: Identifying and Mitigating Risk - Use of risk assessment and management techniques in policy and regulatory decisions, industry - Factors influencing the significance of a risk - *Risk management and decision analysis* - Assessing Risk From Biological Introductions For Ecological Systems - Risk Assessment And Management For Waste Disposal. - Risk Assessment And Management In Land Uses And Treatments. - Environmental Risk Assessment in Development Programmes - Liability, Insurance and Environmental Risk - Risk Communication.

Exposure and Effects Assessment: Exposure assessment of water, sediment, air, soil, biota, use of environmental monitoring data - Indirect exposure to humans from environmental sources.

Effects Assessment: Aquatic, sediment, air, soil effects assessment - Assessment of contamination of biota; Ecological Risk Assessment: ecology and ecotoxlcology - A Human effects on ecosystems - Ecological Risk Characterization.

Text Books

1. Cutter, S.L.(1999) Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi.

2. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff, "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.

3. Kofi Asante Duah, "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998.

References Books

1. Kasperson, J.X. and Kasperson, R.E. and Kasperson,R.E., Global Environmental Risks, V.N.University Press, New York, 2003.

2. Mark Burman, Risks and Decisions for Conservation and environmental management,Cambridge University Press, 2005

EN_H7: RESOURCE AND ENERGY RECOVERY FROM WASTE

Course Objectives

The objectives of the course is to

* Understand the principles of resources recovery

* Know the processes and the design of recovering materials from the waste

* Understand the energy recovery possibilities from and processes of wastes

* Enlighten various mechanical, biological and thermal methods and manage the undesirable by-products

Course outcomes

On completion of the course, the candidate should be able to:

* Understand the fundamental principles of existing and emerging technologies for the treatment of waste

* Aware of the possibilities of recovery of materials and energy from waste

* Appreciate the importance of waste as a resource in achieving environmental sustainability.

* Analyze and describe the potential of solid waste as a secondary raw material, and

Study the associated problems and possibilities in waste management in a sustainable way that is useful to the society

SYLLABUS

Mechanical Processing for Material Recycling: Resource recovery for a sustainable development- Material and energy flow management and analysis - Systems and processes for reduction, reuse and recycling -Objectives of Waste Processing-Source Segregation and Hand Sorting-Waste Storage and Conveyance – Shredding – Pulping - Size Separation by Screens- Density Separation by Air Classification –magnetic and electromechanical separation processes- Design Criteria and Equipment selection

Biological Processing for Resource Recovery: Mechanisms of Biological Processing – Aerobic Processing of Organic fraction - Composting methods and processes- factors affecting- Design of Windrow Composting Systems- In Vessel CompostingCompost Quality Control- Vermiculture: definition, scope and importance - common species for culture - Environmental requirements - culture methods- Applications of vermiculture- Potentials and constraints for composting in India-Largescale and decentralized plants.

Bio-Chemical Conversion of Waste to Energy: Principles and Design of Anaerobic Digesters – Process characterization and control- The biochemistry and microbiology of anaerobic treatment - Toxic substances in anaerobic treatment - Methane generation by Anaerobic Digestion- Anaerobic reactor technologies - Commercial anaerobic Technologies- Single stage and multistage digesters- Digester design and performance-Gas collection systems-Methane Generation and Recovery in Landfills – Biofuels from Biomass

Thermo-Chemical Conversion of Waste to Energy: Principles and Design of Energy Recovery Facilities -Types and principles of energy conversion processes - Incinerator design - Mass Burn and RDF Systems- Composition and calorific value of fuels and waste, Determination of the stoichiometric air consumption, Calculation of the flue gas composition - grate firing designs, boiler design, removal of bottom ash, heat recovery- Emission Controls – flue gas cleaning, de-dusting, flue gas scrubbers, DeNOx processes, dioxins and furans - Alternative thermal processes: co-incineration, pyrolysis, gasification, plasma arc - Process characterization and control- waste heat recovery- Bottom ash: Quantity, quality, treatment, utilization, disposal- Facility design- decentralized mobile plants- Planning and construction of incineration plants

Case Studies on Waste Recycling: Recycling technologies for paper, glass, metal, plastic – Used Lead Acid Battery Recycling –End of Life Vehicle Recycling – Electronic Waste Recycling – Waste Oil Recycling – Solvent Recovery - Drivers and barriers for material recycling: social, legal and economic factors - Environmental impacts of waste recycling - Design for the environment: the life cycle approach.

Text Books

1 Aarne Veslind and Alan E Rimer (1981). "Unit operations in Resource Recovery Engineering," Prentice Hall Inc., London

2 Manser A G R, Keeling A A (1996). Practical handbook of processing and recycling on municipal waste. Pub CRC Lewis London, ISBN 1-56670-164

Reference Books

1. Chiumenti, Chiumenti, Diaz, Savage, Eggerth, and Goldstein, (2005). Modern Composting Technologies. JG Press October

2. Charles R Rhyner (1995), Waste Management and Resource Recov- ery, Lewis Publishers

3. Gary C. Young (2010) Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, John Wiley & Sons.