PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. To prepare students for successful careers in Environmental Engineering field that meets the needs of National and International organisations.

II. To develop the confidence and ability among students to synthesize data and technical concepts and thereby apply it in real world problems.

III. To develop students to use modern techniques, skill and mathematical engineering tools for solving problems in Environmental Engineering.

IV. To provide students with a sound foundation in mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyse environmental problems and to prepare them for graduate studies.

V. To promote students to work collaboratively on multi-disciplinary projects and make them engage in life-long learning process throughout their professional life.

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. Graduates will demonstrate knowledge of mathematics, science and engineering related to environmental issues.

2. Graduates will demonstrate an ability to identify, formulate and solve environmental engineering problems.

3. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.

4. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.

5. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.

6. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.

7. Graduates will demonstrate knowledge of professional and ethical responsibilities.

8. Graduate will be able to communicate effectively in both verbal and written form.

9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.

10. Graduate will develop confidence for self education and ability for life-long learning.
**PEOs & POs**

The B.E. Environmental Engineering Program outcomes leading to the achievement of the objectives are summarized in the following Table.

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*Course from the curriculum of other UG Programmes.*
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### PROFESSIONAL ELECTIVE

#### SEMESTER V

**ELECTIVE - I**

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OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12
Reading - short comprehension passages, practice in skimming-scanning and predicting-
Language development - Wh- Questions - asking and answering - yes or no questions - parts of speech. Vocabulary development - prefixes - suffixes - articles - count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12
Reading - comprehension-pre-reading-post reading - comprehension questions (multiple choice questions and /or short questions/open-ended questions) - inductive reading - short narratives and descriptions from newspapers including dialogues and conversations (also used as short listening texts) - register.
Writing - paragraph writing - topic sentence - main ideas - free writing, short narrative descriptions using some suggested vocabulary and structures. Listening - telephonic conversations. Speaking - sharing information of a personal kind - greeting - taking leave.
Language development - prepositions, conjunctions - vocabulary development - guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12
Reading - short texts and longer passages (close reading) - Writing - understanding text structure - use of reference words and discourse markers - coherence - jumbled sentences. Listening - listening to longer texts and filling up the table - product description - narratives from different sources. Speaking - asking about routine actions and expressing opinions.
Language development - degrees of comparison - pronouns - direct vs indirect questions - vocabulary development - single word substitutes - adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12
Reading - comprehension-reading longer texts - reading different types of texts - magazines. Writing - letter writing, informal or personal letters - e-mails - protocols of personal email. Listening - listening to dialogues or conversations and completing exercises based on them. Speaking - speaking about oneself - speaking about one’s friend.
Language development - Tenses - simple present - simple past - present continuous and past continuous - vocabulary development - synonyms - antonyms - phrasal verbs.

UNIT V EXTENDED WRITING 12

OUTCOMES: At the end of the course, learners will be able to:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English.
- Write short essays of a general kind and personal letters and emails in English.

15
MA8151 ENGINEERING MATHEMATICS – I

OBJECTIVES:
- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS
12
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES
12

UNIT III INTEGRAL CALCULUS
12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS
12

UNIT V DIFFERENTIAL EQUATIONS
12

TOTAL: 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:
- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
• Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
• Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
• Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
• Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
• Apply various techniques in solving differential equations.

TEXT BOOKS:
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

PH8151 ENGINEERING PHYSICS

OBJECTIVES:
• To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER

UNIT II WAVES AND FIBER OPTICS

UNIT III THERMAL PHYSICS
UNIT IV  QUANTUM PHYSICS  9

UNIT V  CRYSTAL PHYSICS  9
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

OUTCOMES:
Upon completion of this course,
• the students will gain knowledge on the basics of properties of matter and its applications,
• the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
• the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
• the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
• the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

REFERENCES:

CY8151  ENGINEERING CHEMISTRY  L T P C
3 0 0 3

OBJECTIVES:
• To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
• To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
• Preparation, properties and applications of engineering materials.
• Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
• Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
UNIT I  WATER AND ITS TREATMENT  9

UNIT II  SURFACE CHEMISTRY AND CATALYSIS  9

UNIT III  ALLOYS AND PHASE RULE  9

UNIT IV  FUELS AND COMBUSTION  9

UNIT V  ENERGY SOURCES AND STORAGE DEVICES  9
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H₂-O₂ fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:
• The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I  ALGORITHMIC PROBLEM SOLVING

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to
- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TEXT BOOKS:

REFERENCES:

GE8152 ENGINEERING GRAPHICS

OBJECTIVES:
- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.
UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
• familiarize with the fundamentals and standards of Engineering graphics
• perform freehand sketching of basic geometrical constructions and multiple views of objects.
• project orthographic projections of lines and plane surfaces.
• draw projections and solids and development of surfaces.
• visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY  L T P C
0 0 4  2

OBJECTIVES:
• To write, test, and debug simple Python programs.
• To implement Python programs with conditionals and loops.
• Use functions for structuring Python programs.
• Represent compound data using Python lists, tuples, dictionaries.
• Read and write data from/to files in Python.
LIST OF PROGRAMS
1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

TOTAL: 60 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to
• Write, test, and debug simple Python programs.
• Implement Python programs with conditionals and loops.
• Develop Python programs step-wise by defining functions and calling them.
• Use Python lists, tuples, dictionaries for representing compound data.
• Read and write data from/to files in Python.

BS8161 PHYSICS AND CHEMISTRY LABORATORY (Common to all branches of B.E. / B.Tech Programmes)

OBJECTIVES:
• To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)
1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young’s modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
• apply principles of elasticity, optics and thermal properties for engineering applications.
CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:

• To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.

• To acquaint the students with the determination of molecular weight of a polymer by viscometry.

1. Estimation of HCl using Na$_2$CO$_3$ as primary standard and Determination of alkalinity in water sample.

2. Determination of total, temporary & permanent hardness of water by EDTA method.

3. Determination of DO content of water sample by Winkler’s method.

4. Determination of chloride content of water sample by argentometric method.

5. Estimation of copper content of the given solution by Iodometry.

6. Determination of strength of given hydrochloric acid using pH meter.

7. Determination of strength of acids in a mixture of acids using conductivity meter.

8. Estimation of iron content of the given solution using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).


12. Pseudo first order kinetics-ester hydrolysis.


14. Determination of CMC.

15. Phase change in a solid.

16. Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:

• The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TEXTBOOKS:


HS8251 TECHNICAL ENGLISH L T P C
4 0 0 4

OBJECTIVES:
The Course prepares second semester engineering and Technology students to:

• Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.

• Foster their ability to write convincing job applications and effective reports.

• Develop their speaking skills to make technical presentations, participate in group discussions.

• Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

UNIT II READING AND STUDY SKILLS

Listening - Listening to longer technical talks and completing exercises based on them. Speaking - describing a process. Reading - reading longer technical texts identifying the various transitions in a text. Writing - interpreting charts, graphs. Vocabulary Development - vocabulary used in formal letters/emails and reports. Language Development - impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR

Listening - Listening to classroom lectures/talks on engineering/technology. Speaking - introduction to technical presentations. Reading - longer texts both general and technical, practice in speed reading. Writing - describing a process, use of sequence words. Vocabulary Development - sequence words. Language Development - Misspelled words.

UNIT IV REPORT WRITING


UNIT V GROUP DISCUSSION AND JOB APPLICATIONS


OUTCOMES:
At the end of the course learners will be able to:
- Read technical texts and write area-specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

REFERENCES
2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.
OBJECTIVES:
- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I  MATRICES  12

UNIT II  VECTOR CALCULUS  12
Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III  ANALYTIC FUNCTIONS  12
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION  12

UNIT V  LAPLACE TRANSFORMS  12

TOTAL: 60 PERIODS

OUTCOMES:
After successfully completing the course, the student will have a good understanding of the following topics and their applications:
- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS:
REFERENCES:

GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.
UNIT III NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TOTAL: 45 PERIODS

OUTCOMES:
• Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
• Public awareness of environmental is at infant stage.
• Ignorance and incomplete knowledge has lead to misconceptions
• Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

REFERENCES:
OBJECTIVES:
- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVERVIEW

UNIT I  SCOPE OF CIVIL AND MECHANICAL ENGINEERING  10
Overview of Civil Engineering: Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering


B – CIVIL ENGINEERING

UNIT II  SURVEYING AND CIVIL ENGINEERING MATERIALS  10


UNIT III  BUILDING COMPONENTS AND STRUCTURES  15


C – MECHANICAL ENGINEERING

UNIT IV  INTERNAL COMBUSTION ENGINES AND POWER PLANTS  15
Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants — working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

UNIT V  REFRIGERATION AND AIR CONDITIONING SYSTEM  10

OUTCOMES:
On successful completion of this course, the student will be able to
- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.
• measure distances and area by surveying
• identify the components used in power plant cycle.
• demonstrate working principles of petrol and diesel engine.
• elaborate the components of refrigeration and Air conditioning cycle.

TEXTBOOKS:

REFERENCES:

BE8251 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

OBJECTIVES:
• To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
• To explain the fundamentals of semiconductor and applications.
• To explain the principles of digital electronics
• To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS

UNIT II ELECTRICAL MACHINES

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS

UNIT IV DIGITAL ELECTRONICS

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING

TOTAL: 45 PERIODS
OUTCOMES:
- ability to identify the electrical components and explain the characteristics of electrical machines.
- ability to identify electronics components and understand the characteristics

TEXT BOOKS:
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson India, 2011

REFERENCES:

GE8292 ENGINEERING MECHANICS

OBJECTIVES:
- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I STATICS OF PARTICLES

UNIT II EQUILIBRIUM OF RIGID BODIES
Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS

UNIT IV DYNAMICS OF PARTICLES
UNIT V  FRICITION AND RIGID BODY DYNAMICS  9+6
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding fricition –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 45+30=75 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

TEXT BOOKS:

REFERENCES:

GE8261  ENGINEERING PRACTICES LABORATORY  L T P C  0 0 4 2

OBJECTIVES:
- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE  13

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
   Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
   Wood work, joints by sawing, planing and cutting.
II  MECHANICAL ENGINEERING PRACTICE

Welding:
(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:
(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III  ELECTRICAL ENGINEERING PRACTICE
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV  ELECTRONICS ENGINEERING PRACTICE
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL
1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools:
   (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos

MECHANICAL
1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL
1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
   (b) Digital Live-wire detector 2 Nos

ELECTRONICS
1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

MA8391 PROBABILITY AND STATISTICS

OBJECTIVES:
- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.
UNIT I  PROBABILITY AND RANDOM VARIABLES  12

UNIT II  TWO - DIMENSIONAL RANDOM VARIABLES  12
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III  TESTING OF HYPOTHESIS  12
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV  DESIGN OF EXPERIMENTS  12
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT V  STATISTICAL QUALITY CONTROL  12
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

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

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXTBOOKS:

REFERENCES:
EN8301  ENVIRONMENTAL CHEMISTRY  L T P C
3 0 0 3

OBJECTIVE:
- The objectives of the course are to study the basics of environmental chemistry, chemical reactions involved in water and electro kinetic properties.

UNIT I  INTRODUCTION  9
Fate of Chemicals in environment, Stoichiometry and mass balance-Chemical equilibria, acid base, solubility product(Ksp) order of reactions Chemical kinetics, Principles of green chemistry.

UNIT II  AQUATIC CHEMISTRY  9

UNIT III  ATMOSPHERIC CHEMISTRY  9
Atmospheric structure —chemical and photochemical reactions – photochemical smog. Ozone layer depletion – greenhouse gases and global warming. – Acid rain- origin and composition of particulates. Air quality parameters-effects and chemistry in air pollutants analysis.

UNIT IV  SOIL CHEMISTRY  9
Nature and composition of soil-Clays- cation exchange capacity-acid base and ionexchange reactions in soil – Agricultural chemicals in soil-Reclamation of contaminated land; salt by leaching- Heavy metals by electrokinetic remediation.

UNIT V  ENVIRONMENTAL CHEMICALS  9
Heavy metals-Chemical speciation –Speciation of Hg &As- Organic chemicals- Pesticides, Dioxins, PCBs ,PAHs and endocrine disruptors and their Toxicity- Nano materials, CNT, titania, composites ,environmental applications

OUTCOMES:
The students completing the course will have
- an insight in to the chemical reactions in water, air and soil environment.
- the ability to apply chemistry principles in analysing pollution of water, air and soil environment.
- an understanding on the fate of chemicals on the environment and suggest relevant interventions.

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- To prepare the students to solve material and energy balances, kinetics and chemical transformations on environmental process.

UNIT I  INTRODUCTION
System of Units - Chemical process data representation and analysis – Mass-Volume- Flow rate-
Chemical composition - Gas law –Vapour Pressure and Temperature – Material balance in reactor system and processes – Application to single phase and multiphase systems-Energy balance –
Forms and laws of thermodynamics – Energy balance in closed, open system and nonreactive, reactive processes.

UNIT II  PRINCIPLES OF TRANSPORT PROCESSES

UNIT III  CHEMICAL KINETICS AND TRANSFORMATIONS
Chemical reactions and equilibrium - Rate expression in reversible reactions- Effect of temperature on chemical reactions – Activation energy- Reaction of chemical species in the excited states – Application to photochemical and advanced oxidation processes - Homogeneous and heterogeneous catalysis – Catalysis by transition metals and complexes – Enzyme catalysis-
Adsorption and surface reactions – Reactions in electrode surface - - Electro chemical kinetics.

UNIT IV  BIOCHEMICAL ENGINEERING
Cell growth in batch and continuous system - Growth kinetics , Biomass and product yields –
Material balance in a chemostat and fed batch culture - Enzyme reaction kinetics- Mechanism of single enzyme with dual substrate – Substrate and product inhibitions analysis - Non-competitive inhibition rate model – Reaction mechanism with competitive inhibition- Mixing and measurement of gases – aeriation , agitation and mixing phenomena -Types of agitator - Dissolved oxygen –
Oxygen transfer rate – Respiration quotients- Effect of agitation on dissolved oxygen – Air sparing-
Biofilms –Biofilm kinetics .

UNIT V  ENVIRONMENTAL PROCESSES AND REACTORS
Batch and Continuous reactors –CSTR, Plug flow tubular reactor and fluidized bed reactor –
comparison between batch, CSTR, PFTR- Semi-batch reactors- Autocatalytic reactors --
Membrane reactors- Trickling bed reactors - Air lift pressure cycle bioreactor – Loop bioreactor-
Types of separation process and methods – Gas-liquid separation- vapour separation-Liquid-liquid and fluid-solid separation- Membrane separation – Mechanical-Physical separation- Evaporation and Drying process.

TOTAL : 45 PERIODS

OUTCOMES:
- Will have a basic understanding of thermodynamics and basic chemical engineering.
- Basic ability to gain knowledge on heat and mass transfer.
- An understanding on the chemical reactions and Advanced oxidation processes.
- an insight in to the various biochemical processes.
- Will get a basic knowledge of reactor’s model and its applications.

TEXTBOOKS:
REFERENCES:

CE8303 MECHANICS OF FLUIDS L T P C
3 0 0 3

OBJECTIVE:
- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyse and appreciate the complexities involved in solving the fluid flow problems.

UNIT I FLUID PROPERTIES AND FLUID STATICS
Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges - forces on planes – centre of pressure – bouncy and floatation.

UNIT II FLUID KINEMATICS AND DYNAMICS

UNIT III FLOW THROUGH PIPES
Viscous flow - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy -Weisbach's equation - pipe roughness -friction factor- Moody's diagram-Major and minor losses of flow in pipes - Pipes in series and in parallel.

UNIT IV BOUNDARY LAYER

UNIT V DIMENSIONAL ANALYSIS AND MODEL STUDIES
Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies - Distorted Models.

OUTCOMES:
- The students will be able to get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- They will also gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.
**TEXTBOOKS:**

**REFERENCES:**

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**CE8393  STRENGTH OF MATERIALS  L T P C**

**4 0 0 4**

**OBJECTIVE:**
- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

**UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS**

**UNIT II  ANALYSIS OF PLANE TRUSSES**
Determinate and indeterminate plane trusses – determination of member forces by method of joints, method of sections and method of tension coefficient.

**UNIT III  TRANSVERSE LOADING AND STRESSES IN BEAM**

**UNIT IV  TORSION**
Torsion formula - stresses and deformation in circular and hollows shafts – Stepped shafts–Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs - carriage springs.

**UNIT V  DEFLECTION OF BEAMS**
Computation of slopes and deflections in determinate beams - Double Integration method – Macaulay’s method – Area moment method – Conjugate beam method.

**TOTAL : 60 PERIODS**

**OUTCOMES:**
- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behaviour of simple structures.
- Critically analyse problem and solve the problems related to structural elements and analyse the deformation behaviour for different types of loads.
TEXTBOOKS:

REFERENCES:

CE8351 SURVEYING L T P C
3 0 0 3

OBJECTIVES:
- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world Civil Engineering problems.
- To introduce the concepts of Control Surveying
- To introduce the basics of Astronomical Surveying

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING 9

UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING 9
Horizontal and vertical angle measurements - Temporary and permanent adjustments - Heights and distances - Tacheometer - Stadia Constants - Analytic Lens -Tangential and Stadia Tacheometry surveying - Contour – Contouring – Characteristics of contours – Methods of contouring – Tacheometric contouring - Contour gradient – Uses of contour plan and map

UNIT III CONTROL SURVEYING AND ADJUSTMENT 9

UNIT IV ADVANCED TOPICS IN SURVEYING 9
Hydrographic Surveying – Tides – MSL – Sounding methods – Three point problem – Strength of fix – astronomical Surveying – Field observations and determination of Azimuth by altitude and hour angle methods –.Astronomical terms and definitions - Motion of sun and stars - Celestial coordinate systems - different time systems - Nautical Almanac - Apparent altitude and corrections - Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method
UNIT V MODERN SURVEYING

Total Station: Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure - Errors and Good practices in using Total Station GPS Surveying: Different segments - space, control and user segments - satellite configuration - signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - Hand Held and Geodetic receivers - data processing - Traversing and triangulation.

OUTCOMES:
At the end of the course the student will be able to understand
- The use of various surveying instruments and mapping
- Measuring horizontal angle and vertical angle using different instruments
- Methods of leveling and setting Levels with different instruments
- Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth
- Concept and principle of modern surveying.

TEXTBOOKS:

REFERENCES:

CE8481 STRENGTH OF MATERIALS LABORATORY

OBJECTIVE:
- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS
1. Tension test on steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring

TOTAL: 60 PERIODS
OUTCOME:
- The students will have the required knowledge in the area of testing of materials and components of structural elements experimentally.

REFERENCES:

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>UTM of minimum 400 kN capacity</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Torsion testing machine</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Izod impact testing machine</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Hardness testing machine&lt;br&gt;Rockwell&lt;br&gt;Vicker’s&lt;br&gt;Brinell (any 2)</td>
<td>1 each</td>
</tr>
<tr>
<td>5.</td>
<td>Beam deflection test apparatus</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Extensometer</td>
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<td>7.</td>
<td>Compressometer</td>
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<td>8.</td>
<td>Dial gauges</td>
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<td>Le Chatelier’s apparatus</td>
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<td>Vicat’s apparatus</td>
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<tr>
<td>11.</td>
<td>Mortar cube moulds</td>
<td>10</td>
</tr>
</tbody>
</table>

CE8361 SURVEYING LABORATORY L T P C 0 0 4 2

OBJECTIVE:
- At the end of the course the student will possess knowledge about Survey field techniques

LIST OF EXPERIMENTS:

Chain Survey
1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room

Compass Survey
3. Compass Traversing – Measuring Bearings & arriving included angles

Levelling - Study of levels and levelling staff
4. Fly levelling using Dumpy level & Tilting level
5. Check levelling

Theodolite - Study of Theodolite
6. Measurements of horizontal angles by reiteration and repetition and vertical angles
7. Determination of elevation of an object using single plane method when base is accessible/inaccessible.

Tacheometry – Tangential system – Stadia system
8. Determination of Tacheometric Constants
9. Heights and distances by stadia Tacheometry
10. Heights and distances by Tangential Tacheometry
Total Station - Study of Total Station, Measuring Horizontal and vertical angles
11. Traverse using Total station and Area of Traverse
12. Determination of distance and difference in elevation between two inaccessible points using Total station

TOTAL: 60 PERIODS

OUTCOME:
- Students completing this course would have acquired practical knowledge on handling basic survey instruments including Theodolite, Tacheometry, Total Station and GPS and have adequate knowledge to carryout Triangulation and Astronomical surveying including general field marking for various engineering projects and Location of site etc.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>1.</td>
<td>Total Station</td>
<td>3 Nos</td>
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<tr>
<td>2.</td>
<td>Theodolites</td>
<td>Atleast 1 for every 5 Nos</td>
</tr>
<tr>
<td>3.</td>
<td>Dumpy level / Filling level</td>
<td>Atleast 1 for every 5 Nos</td>
</tr>
<tr>
<td>4.</td>
<td>Pocket stereoscope</td>
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<td>5.</td>
<td>Ranging rods</td>
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<td>6.</td>
<td>Levelling staff</td>
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<td>8.</td>
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<td>Tapes</td>
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<td>Arrows</td>
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<td>11.</td>
<td>Prismatic Compass</td>
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<td>12.</td>
<td>Surveyor Compass</td>
<td>2 nos</td>
</tr>
<tr>
<td>13.</td>
<td>Survey grade or Hand held GPS</td>
<td>3 nos</td>
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</tbody>
</table>

HS8381  INTERPERSONAL SKILLS/LISTENING AND SPEAKING  

OBJECTIVES:
The Course will enable learners to:
- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

UNIT I
Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II
Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.
UNIT III
Lexical chunking for accuracy and fluency - factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist - listen for detail

UNIT IV
Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V
Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL : 30 PERIODS

OUTCOMES:
At the end of the course Learners will be able to:
- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

REFERENCES:

EN8401 ENVIRONMENTAL POLICY AND LEGISLATIONS L T P C 3 0 0 3

OBJECTIVE:
- To impart knowledge on the policies, legislations, institutional frame work and enforcement mechanisms for environmental management in India.

UNIT I INTRODUCTION

UNIT II WATER (P&CP) ACT, 1974
Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Water Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.
UNIT III  AIR (P&CP) ACT, 1981  8
Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Air Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

UNIT IV  ENVIRONMENT (PROTECTION) ACT 1986  13
Genesis of the Act – delegation of powers – Role of Central Government - EIA Notification – Sitting of Industries – Coastal Zone Regulation - Responsibilities of local bodies mitigation scheme etc., for Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorisation – Biomedical waste rules – responsibilities of generators and role of Pollution Control Boards

UNIT V  RECENT RULES AND NOTIFICATIONS  7
National Green tribunals- recent environmental rules and notifications-e-waste management-construction and demolition waste management, etc.,

TOTAL : 45 PERIODS

OUTCOMES:
The students completing the course will have
- an understanding of the Indian policies and legislations pertaining to prevention and control of water pollution, air pollution and waste management
- an insight into the Environmental Protection Act and the associated Rules knowledge on the Institutional setup for Environmental management and pollution control.

TEXTBOOKS:

REFERENCE:
1. CPCB, “Pollution Control acts, Rules and Notifications issued there under “Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997.

EN8402  ENVIRONMENTAL MICROBIOLOGY  L T P C  3 0 0 3

OBJECTIVE:
- The objective of the course is to study the basics of environmental microbiology involved in water, soil and air.

UNIT I  MICROBIOLOGY: INTRODUCTION  9
Classification of living organisms with special emphasis on micro-organisms - characteristics - application in environmental engineering - DNA & RNA.

UNIT II  METHODS OF STUDY  9

UNIT III  GROWTH AND METABOLISM OF MICRO-ORGANISMS  9
UNIT IV  RESPIRATIONS  9
Aerobic and anaerobic - role of enzymes - bacterial respiration - fermentation and saprogenic action - basic concepts of molecular biology.

UNIT V  BIODEGRADATION AND BIOLOGICAL TREATMENT  9
Microbiology of wastewater treatment (domestic and industrial), indicator microorganisms, biodegradation of xenobiotics, bioaugmentation, microbial leaching of heavy metals.

OUTCOMES:
The students completing the course will have

- an insight into type, growth metabolism and culturing techniques of microorganisms and their application to environmental engineering
- the ability to perform estimation of bacterial numbers
- the ability to apply microorganisms for the treatment of wastes, bioleaching and bioaugmentation

TEXTBOOKS:

REFERENCES:

EN8403  BASIC STRUCTURAL ANALYSIS

OBJECTIVE:
- To learn the methods of analysis of beams and frames.

UNIT I  ENERGY PRINCIPLES  9
Strain energy and strain energy density – strain energy due to axial load, shear, flexure and torsion – Castigliano's theorems – Principle of virtual work – application of energy theorems for computing deflections in beams and trusses.

UNIT II  INDETERMINATE BEAMS  9
Concept of Analysis - Propped cantilever and fixed beams - fixed end moments and reactions – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT III  SLOPE DEFLECTION METHOD  9
Slope deflection equations- Analysis of continuous beams and rigid frames - Support settlements.

UNIT IV  MOMENT DISTRIBUTION METHOD  9
Stiffness and carry over factors – Distribution and carry over of moments - Analysis of continuous Beams - Plane rigid frames with and without sway – Support settlement.
UNIT V  COLUMNS AND THICK CYLINDERS

Short and long columns - Euler’s theory – critical loads for prismatic columns with different end conditions - Rankine-Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core of section – Thick cylinders – Compound cylinders.

OUTCOMES:
The students completing the course will have
- an insight into the stress - strain energy principles, slope deflection method and moment distribution method
- ability to model loads on structures and analyse structural elements including beams, columns and cylinders
- ability to determine deflections of beams and frames

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:

EN8491  WATER SUPPLY ENGINEERING  L T P C

OBJECTIVE:
- To equip the students with the principles and design of water treatment units and distribution system.

UNIT I  SOURCES OF WATER

UNIT II  CONVEYANCE FROM THE SOURCE

UNIT III  WATER TREATMENT
Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation –Clarifier – Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management – Construction, Operation and Maintenance aspects.
UNIT IV ADVANCED WATER TREATMENT

UNIT V WATER DISTRIBUTION AND SUPPLY
Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have
- an insight into the structure of drinking water supply systems, including water transport, treatment and distribution
- the knowledge in various unit operations and processes in water treatment
- an ability to design the various functional units in water treatment
- an understanding of water quality criteria and standards, and their relation to public health
- the ability to design and evaluate water supply project alternatives on basis of chosen criteria.

TEXTBOOKS:

REFERENCES:

CE8391 CONSTRUCTION MATERIALS

OBJECTIVE:
- To introduce students to various materials commonly used in civil engineering construction and their properties.

UNIT I STONES – BRICKS – CONCRETE BLOCKS

UNIT II LIME – CEMENT – AGGREGATES – MORTAR
UNIT III  CONCRETE  9

UNIT IV  TIMBER AND OTHER MATERIALS  9

UNIT V  MODERN MATERIALS  9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course the students will be able to
- Compare the properties of most common and advanced building materials.
- understand the typical and potential applications of lime, cement and aggregates
- know the production of concrete and also the method of placing and making of concrete elements.
- understand the applications of timbers and other materials
- Understand the importance of modern material for construction.

TEXT BOOKS:

REFERENCES:

CE8405  HYDRAULICS AND HYDRAULIC MACHINERY  L T P C  3 0 0 3

OBJECTIVE:
- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

UNIT I  UNIFORM FLOW  9
Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.
UNIT II  VARIED FLOWS

UNIT III  RAPIDLY VARIED FLOWS

UNIT IV  TURBINES
Turbines - Classification - Reaction turbines - Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbine - Performance of turbine - Specific speed - Runaway speed - Similarity laws.

UNIT V  PUMPS
Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps: Gear pump.

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
- They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
- They will have knowledge in hydraulic machineries (pumps and turbines)

TEXTBOOKS:

REFERENCES:

EN8411 ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY LABORATORY L T P C
0 0 4 2

A: ENVIRONMENTAL CHEMISTRY
1. Estimation of hardness and Chloride in Water sample by volumetric titration
2. Spectrophotometric / Colorimetric determination of sulphate and phosphate
3. Determination of Solids, COD and BOD in wastewater sample

TOTAL: 30 PERIODS

B: ENVIRONMENTAL MICROBIOLOGY
1. Preparation of culture media, Isolation and Culturing of Microorganisms
2. Gram Staining of bacteria
3. Bacteriological analysis of wastewater (Coliforms & Streptococcus) – MPN and MF Techniques

TOTAL: 30 PERIODS

REFERENCES:
CE8461 HYDRAULIC ENGINEERING LABORATORY L T P C
0 0 4 2

OBJECTIVE:
- Students should be able to verify the principles studied in theory by performing the experiments in lab.

LIST OF EXPERIMENTS

A. Flow Measurement
1. Calibration of Rotameter
2. Calibration of Venturimeter / Orificemeter
3. Bernoulli’s Experiment

B. Losses in Pipes
4. Determination of friction factor in pipes
5. Determination of min or losses

C. Pumps
6. Characteristics of Centrifugal pumps
7. Characteristics of Gear pump
8. Characteristics of Submersible pump
9. Characteristics of Reciprocating pump

D. Turbines
10. Characteristics of Pelton wheel turbine
11. Characteristics of Francis turbine/Kaplan turbine

E. Determination of Metacentric height
12. Determination of Metacentric height of floating bodies

TOTAL: 60 PERIODS

OUTCOMES:
- The students will be able to measure flow in pipes and determine frictional losses.
- The students will be able to develop characteristics of pumps and turbines.

REFERENCES:

LIST OF EQUIPMENTS
1. One set up of Rotometer
2. One set up of Venturimeter/Orifice meter
3. One Bernoulli’s Experiment set up
4. One set up of Centrifugal Pump
5. One set up of Gear Pump
6. One set up of Submersible pump
7. One set up of Reciprocating Pump
8. One set up of Pelton Wheel turbine
9. One set up of Francis turbines/one set of kaplon turbine
10. One set up of equipment for determination of Metacentric height of floating bodies
11. One set up for determination of friction factor in pipes
12. One set up for determination of minor losses.

HS8461 ADVANCED READING AND WRITING

OBJECTIVES:
• Strengthen the reading skills of students of engineering.
• Enhance their writing skills with specific reference to technical writing.
• Develop students’ critical thinking skills.
• Provide more opportunities to develop their project and proposal writing skills.

UNIT I
Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II
Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III
Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV
Reading- Genre and Organization of Ideas- Writing- Email writing- visumes – Job application-project writing-writing convincing proposals.

UNIT V
Reading- Critical reading and thinking- understanding how the text positions the reader- identify Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES:
At the end of the course Learners will be able to:
• Write different types of essays.
• Write winning job applications.
• Read and evaluate texts critically.
• Display critical thinking in various professional contexts.

TEXT BOOKS:

REFERENCES

EN8501 BASIC STRUCTURAL DESIGN

OBJECTIVE:
- This course aims at providing students with a solid background on the principles of structural engineering design. Students will be exposed to the theories and concepts of both concrete and steel design and analysis both at the element and system levels.

UNIT I INTRODUCTION TO STEEL DESIGN 6+6

UNIT II DESIGN OF STEEL MEMBERS 6+6
Design of Tension Members - Design of compression Members - Design of Laterally supported Beams.

UNIT III DESIGN FOR REINFORCED CONCRETE FLEXURAL MEMBERS 6+6
Analysis and design of singly and doubly reinforced rectangular and flanged beams - Analysis and design of one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions.

UNIT IV DESIGN OF REINFORCED CONCRETE COLUMNS AND FOOTINGS 6+6
Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending - Design of wall footing – Design of axially loaded pad footing.

UNIT V DESIGN OF LIQUID STORAGE STRUCTURES 6+6
RC Water Tanks- Circular and Rectangular – Design and Drawing – Hemispherical Bottomed Steel Water Tank – Design and Drawing.

TOTAL: 60 PERIODS

OUTCOMES:
The students completing the course will have
- an understanding of the structural design fundamentals and limit state design
- ability to design and detail liquid storage structures, retaining walls and industrial structures

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

UNIT I SOURCES AND CHARACTERISTICS

UNIT II SOURCE REDUCTION, WASTE STORAGE AND RECYCLING

UNIT III COLLECTION AND TRANSFER OF WASTES
Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance; options under Indian conditions – Field problems- solving.

UNIT IV PROCESSING OF WASTES
Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V WASTE DISPOSAL

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will demonstrate
- understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
- Reduction, reuse and recycling of waste.
- ability to plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.
- knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context.
- Design and operation of sanitary landfill.

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

UNIT I  PLANNING AND DESIGN OF SEWERAGE SYSTEM  9

UNIT II  PRIMARY TREATMENT OF SEWAGE  9

UNIT III  SECONDARY TREATMENT OF SEWAGE  9

UNIT IV  DISPOSAL OF SEWAGE  9

UNIT V  SLUDGE TREATMENT AND DISPOSAL  9

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have
- An ability to estimate sewage generation and design sewer system including sewage pumping stations
- The required understanding on the characteristics and composition of sewage, self-purification of streams
- An ability to perform basic design of the unit operations and processes that are used in sewage treatment
- Understand the standard methods for disposal of sewage.
- Gain knowledge on sludge treatment and disposal.

TEXTBOOKS:
REFERENCES:

CE8491 SOIL MECHANICS L T P C
3 0 0 3

OBJECTIVES:
- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION
9

UNIT II EFFECTIVE STRESS AND PERMEABILITY
9
Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability – Darcy’s law – Determination of Permeability – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace’s equation – Introduction to flow nets – Simple problems Sheet pile and wier.

UNIT III STRESS DISTRIBUTION AND SETTLEMENT
9

UNIT IV SHEAR STRENGTH
9
Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Factors influences shear strength of soil.

UNIT V SLOPE STABILITY
9
Infinite slopes and finite slopes — Friction circle method – Use of stability number – Guidelines for location of critical slope surface in cohesive and c - \( \varphi \) soil – Slope protection measures.

TOTAL: 45 PERIODS

OUTCOMES:
- Students will be able to classify the soil and assess the engineering properties, based on index properties.
- Understand the stress concepts in soils
- Understand and identify the settlement in soils.
- Determine the shear strength of soil
- Analyze both finite and infinite slopes.
TEXTBOOKS:

REFERENCES:

EN8511 ENVIRONMENTAL ENGINEERING LABORATORY

OBJECTIVE:
- To understand the sampling and preservation methods and significance of characterization of wastewater.

LIST OF EXPERIMENTS:
2. Coagulation and Precipitation process for treating waste water
3. Determination of suspended, volatile, fixed and settleable solids in wastewater.
4. B.O.D. test
5. C.O.D. test
7. Phosphate in wastewater.
8. Determination of Calcium, Potassium and Sodium.
9. Heavy metals determination - Chromium, Lead and Zinc. (Demonstration only)

TOTAL: 60 PERIODS
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
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<tr>
<th>Sl. No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
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<tbody>
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<td>1.</td>
<td>Oxygen analyzer</td>
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<tr>
<td>2.</td>
<td>Spectrophotometer</td>
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<tr>
<td>3.</td>
<td>Ion – selective electrode</td>
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<tr>
<td>4.</td>
<td>Sodium Potassium Analyzer – Flame Photometer</td>
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<tr>
<td>5.</td>
<td>Gas Chromatography</td>
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<td>6.</td>
<td>Atomic absorption spectroscopy (Ni, Zn, Pb)</td>
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<td>7.</td>
<td>Nephlo - turbidimeter</td>
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<tr>
<td>8.</td>
<td>BOD Analyser</td>
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<tr>
<td>9.</td>
<td>COD Analyser</td>
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OUTCOME:
- The students completing the course will have ability to conduct a performance evaluation of wastewater and able to do treatability studies.

EN8512  ENVIRONMENTAL ENGINEERING DRAWING

OBJECTIVE:
- To train the students on preparing layout of water and wastewater treatment plants as well as general arrangement diagrams for units in water and wastewater treatment.

LIST OF EXPERIMENTS:

Environmental Engineering Systems 1 (Design and Drawing)
1. Layout of water treatment plant from source to distribution system.
2. Various types of intake structures.
3. Ground level reservoirs and elevated service reservoirs.
4. Plain sedimentation tank
5. Clariflocculator.
7. Rapid sand gravity filter.
8. Zeolite water softener.
9. Rain water harvesting system.
10. Pumping station.

Environmental Engineering Systems 2 (Design and Drawing)
1. Layout of domestic wastewater treatment plant.
2. Screen chamber
3. Grit chamber
4. Skimming tank
5. Plain sedimentation tank
6. Trickling filter
7. Activated sludge process
8. Oxidation pond
9. Septic tank
10. Grey water treatment system.

TOTAL : 60 PERIODS
OUTCOMES:
The students completing the course will have
- ability to prepare flow charts and layouts of water and wastewater treatment plants
- ability to design and detail structures and reactors required for water and wastewater treatment

REFERENCES:

EN8601  ENVIRONMENTAL EQUIPMENT AND INSTRUMENTS  L T P C  3 0 0 3

OBJECTIVES:
- To introduce the principles and application of different instruments used for performance monitoring and testing of equipment in wastewater treatment, air pollution control, effluent analysis and emission monitoring.

UNIT I  GENERAL
Study of machinery, electric motors types and characteristics, other prime covers, pumps, capacity, operation and maintenance of pumping machinery, air compressors preventive maintenance, break-down maintenance, schedules – Factors to be considered in the selection of the equipments.

UNIT II  INSTRUMENTATION

UNIT III  WATER SUPPLY MACHINERY AND WASTEWATER MACHINERY
Drilling equipment, pumping equipment for wells. Machinery required for primary and secondary treatment, sewage pumps, sludge pumps, vaccum filtration equipment.

UNIT IV  EQUIPMENTS FOR TREATMENT UNITS
Equipment for treatment unit - electrically and mechanically operated agitators, mixers, aerators, chlorinators, Surface aerators. Meters for measurement of flow, head, electricity.

UNIT V  AIR POLLUTION CONTROL EQUIPMENTS

TOTAL:45 PERIODS
OUTCOMES:
The students completing the course will have
- an understanding of various instruments and equipments used in measurement and monitoring for environmental engineering applications
- ability to describe the operation of a range of sensors and transducers with particular reference to monitoring of water and air quality

TEXTBOOKS:

REFERENCES

EN8602 DESIGN OF ENVIRONMENTAL ENGINEERING STRUCTURES

OBJECTIVES:
- To educate the structural design principles
- To educate the students on aspects of water retaining structures design
- Educating the design of masonry and steel structures used in environmental engineering

UNIT I INTRODUCTION AND DESIGN OF PIPES
Environmental Engineering structures - Introduction -Concept of elastic method, ultimate load method and limit state method – Advantages of Limit State method over other methods – Limit State philosophy as detailed in current IS Code. Structural design of - Concrete, Prestressed Concrete, Steel and Cast-Iron piping mains, - anchorage for pipes - massive outfalls

UNIT II DESIGN OF WATER RETAINING STRUCTURES
IS Codes for the design of water retaining structures - Design of concrete roofing systems – Design of circular, rectangular tanks and Spherical tanks - Design of prestressed concrete cylindrical tank, Clariflocculators, Filters

UNIT III DESIGN OF WASTEWATER RETAINING STRUCTURES
Structural design of wastewater treatment units - Grit chamber, Parshall flume, Aeration tank, Anaerobic baffle reactor, Sludge digester, UASBR, Sludge thickener, Sludge drying beds.

UNIT IV STORAGE STRUCTURES
Design of Square bunker and Storage structures – IS codal provisions – Design of cylindrical silo. Design of various types of foundation like isolated, combined and raft foundation for a Water tanks, Bunkers and Silo”s.

UNIT V SPECIAL STRUCTURES
Design of masonry walls, pillars and footings as per NBC and IS Codes - Structural design of underground reservoirs and swimming pools, Intake towers - effect of earth pressure and uplift considerations – design of - Cyclone separator – Scrubber

TOTAL : 45 PERIODS
OUTCOMES:
- Ability to apply the principle of limit state design.
- Ability to do structural design of concrete and steel pipes
- Ability to do the structural design of a complete water and wastewater treatment plant.
- Ability to do air pollution control devices design
- Ability to design underground water storage structures

TEXTBOOKS:

REFERENCES:

EN8603 INDUSTRIAL WASTEWATER MANAGEMENT
L T P C 3 0 0 3

OBJECTIVE:
- To impart knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control

UNIT I INTRODUCTION 8
Sources and characteristics of various industrial, process and wastes – Population equivalent – Effects of industrial effluents on streams, sewer, land, sewage treatment plants and on human health – Environmental legislations and standards related to prevention and control of industrial pollution and hazardous wastes.

UNIT II CLEANER PRODUCTION 8
Volume reduction - Strength reduction - Material and process modifications - Recycle, reuse and byproduct recovery – Applications – Waste minimization

UNIT III TREATMENT TECHNOLOGIES 11

UNIT IV POLLUTION FROM MAJOR INDUSTRIES 9
Sources - Characteristics - Waste treatment flow charts for selected industries such as Textiles - Tanneries - Pharmaceuticals - Electroplating industries - Dairy - Sugar - Paper - distilleries - Steel plants – Refineries – Fertilizer - thermal power plants - Wastewater reclamation and reuse concepts.

UNIT V HAZARDOUS WASTE MANAGEMENT 9

TOTAL : 45 PERIODS
OUTCOMES:
The students completing the course will have

- an insight into the pollution from major industries including the sources and characteristics of pollutants
- ability to plan minimization of industrial wastes
- ability to design facilities for the processing and reclamation of industrial wastewater

TEXTBOOKS:

REFERENCES:

EN8604 AIR AND NOISE POLLUTION CONTROL

OBJECTIVE:
- To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.

UNIT I INTRODUCTION
Atmosphere and Air Pollution–Sources and classification of air pollutants - Effects on human beings, plants and animals- Effects on property and visibility- Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.

UNIT II SAMPLING, METEOROLOGY AND AIR QUALITY MODEL
Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling- Stack sampling. - Meteorology - Horizontal and vertical motion in the atmosphere- temperature lapse rate and stability–Adiabatic lapse rate- Wind Rose–Fumigation, stagnations, Inversion–Wind velocity and turbulence- Plume behavior - Dispersion of air pollutants, Gaussian Plume Model.

UNIT III AIR POLLUTION CONTROL MEASURES
Control- Source correction methods - Control equipment’s-Particulate control methods–Bag house filter-Settling chamber- cyclone separators-inertial devices- Electrostatic precipitator-scrubbers- Control of gaseous emissions- Absorption- Absorption equipment’s- adsorption and combustion devices– Control of VOC, Sulphur Dioxide, Nitrogen Oxides, Indoor air quality .

UNIT IV NOISE POLLUTION SOURCE MEASUREMENT AND EFFECTS
Sources of noise– Units and Measurements of Noise–Standards-Effects of noise pollution- Control of Noise Pollution
OUTCOMES:
The students completing the course will have
- an understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
- ability to identify, formulate and solve air and noise pollution problems
- ability to design stacks and particulate air pollution control devices to meet applicable laws.

TEXTBOOKS:

REFERENCES:

OBJECTIVE:
- To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also to familiarize the students for the geotechnical design of different type of foundations and retaining walls.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION

UNIT II SHALLOW FOUNDATION
Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi’s formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.
UNIT III  FOOTINGS AND RAFTS
Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum thickness for rigid behaviour – Applications – Compensated foundation – Seismic force consideration – Codal provision

UNIT IV  PILE FOUNDATION
Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – Uplift capacity- Group capacity by different methods (Feld’s rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Cohesive – expansive – non expansive – Cohesionless soils – Codal provisions.

UNIT V  RETAINING WALLS

OUTCOMES:
Students will be able to
- Understand the site investigation, methods and sampling.
- Get knowledge on bearing capacity and testing methods.
- Design shallow footings.
- Determine the load carrying capacity, settlement of pile foundation.
- Determine the earth pressure on retaining walls and analysis for stability.

TEXTBOOKS:

REFERENCES:
CE8091 HYDROLOGY AND WATER RESOURCES ENGINEERING L T P C

3 0 0 3

OBJECTIVE:

• To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

UNIT I PRECIPITATION AND ABSTRACTIONS 10


UNIT II RUNOFF 8

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange’s table and SCS methods – Stage discharge relationships-flow measurements- Hydrograph – Unit Hydrograph – IUH

UNIT III FLOOD AND DROUGHT 9

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts- Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT IV RESERVOIRS 8

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

UNIT V GROUNDWATER AND MANAGEMENT 10

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have

• an understanding of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments,
• ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge
• ability to conduct Spatial analysis of rainfall data and design water storage reservoirs
• Understand the concept and methods of ground water management.

TEXTBOOKS:

REFERENCES:

EN8611 ENVIRONMENTAL INSTRUMENTATION LABORATORY

OBJECTIVE:
• To train the students on the use of different instruments used for performance monitoring and testing of equipment in wastewater treatment, air pollution control, effluent analysis and emission monitoring.

LIST OF EXPERIMENTS:
A. Sample Collection, Handling and Preservation
  • Sampling Protocol: Planning a Sampling Strategy
  • The Representative Sample: Random vs. Judgmental Sampling
  • Sampling Equipment: Devices and Containers for soil, air and water.
  • Sampling Techniques: soil and water
  • Sampling Techniques: gases and vapors
  • Sample Documentation and Preservation, Chain of Custody (COC)
B. Methods of Analysis
  • Sample Preparation: Interferences and Detection Limits
  • Quality Control
  • Field Quality Control: Duplicate Samples
  • Quality Control in the Laboratory: Equipment Calibration, Matrix spike and Blank samples.
C. Electrode (potentiometric) Methods:
  • Use of bench top and field model pH meters
  • Use of Dissolved Oxygen Meters.
  • Use of TDS Meters.
D. Spectrophotometry
  • Estimation of Phosphate.
  • Estimation of Hydrocarbon.
  • Estimation of Nitrogen.
  • Estimation of Heavy Metals.
E. Chromatography
  • Liquid/Gas Chromatography.

TOTAL : 60 PERIODS
OUTCOMES:
The students completing the course will have
- ability to collect, handle, preserve and analyse water, wastewater and solid samples
- ability to conduct potentiometric measurements
- ability to use spectrophotometer, liquid/gas chromatograph for analysis of environmental samples

REFERENCES:

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sampling devices for water, wastewater and soil</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>pH meter</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>DO meter</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>EC meter</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>UV - Visible spectrophotometer</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>HPLC</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>Flame Photometer</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>AAS</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>GC</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>Glasswares such as Pipette, Burette etc</td>
<td>1 for each student</td>
</tr>
</tbody>
</table>

OBJECTIVES: The course aims to:
- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I
Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying –GD strategies- activities to improve GD skills
UNIT IV
Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V
Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

OUTCOMES: At the end of the course Learners will be able to:
• Make effective presentations
• Participate confidently in Group Discussions.
• Attend job interviews and be successful in them.
• Develop adequate Soft Skills required for the workplace

Recommended Software
1. Globearena
2. Win English

REFERENCES:
UNIT IV RADIOACTIVE WASTE MANAGEMENT


UNIT V E-WASTE MANAGEMENT


TOTAL : 45 PERIODS

OUTCOMES:
The students completing the course will have
- an insight into the characterization of hazardous wastes and the role of different stakeholders under the national legal framework
- ability to plan minimization of hazardous wastes
- ability to design facilities for the storage, transport, processing and disposal of hazardous wastes

TEXT BOOKS:

REFERENCES
2. Integrated solidwaste management George Techobanoglus, Hilary Theisen & Sammuel A.Vigil.
5. Management of Solidwaste in developing countries by Frank Flint off, WH Oregional publication.

EN8702 ENVIRONMENTAL HEALTH AND SAFETY

OBJECTIVE:
- To educate the students the health hazards expected and the safety measures to be followed in the industry.

UNIT I INTRODUCTION

UNIT II OCCUPATIONAL HEALTH AND HYGIENE

UNIT III 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.

UNIT IV TECHNIQUES OF ENVIRONMENTAL SAFETY

UNIT V EDUCATION AND TRAINING
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.

TOTAL: 45 PERIODS

OUTCOMES:
- Introduction the concept of EHS and their international standardization.
- A basic knowledge of how the humans are affected and their management methodologies.
- Will gain a basic understanding of the workplace safety and safety systems and an in depth knowledge of the safety technologies
- Will gain an in depth understanding of the safety audits and how they are implemented.
- Will understand the need of training and education of EHS.

TEXT BOOKS:
1. Environmental and Health and Safety Management by By Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995
2. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services 2005

REFERENCES:

EN8703 ENVIRONMENTAL IMPACT ASSESSMENT

OBJECTIVE:
- To impart knowledge on Environmental management and Environmental Impact Assessment.

UNIT I INTRODUCTION
UNIT II METHODOLOGIES
Methods of EIA–Checklists–Matrices–Networks–Cost-benefit analysis–Analysis of alternatives – Uncertainty in EIA

UNIT III PREDICTION AND ASSESSMENT
Assessment of Impact on land, water, air, social & cultural activities and on flora& Fauna-
Mathematical models-Public participation–SIA Judgment authorities-Rapid EIA.

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN
Plan for mitigation of adverse impact on environment–Options for mitigation of impact on water, air, land and on flora& fauna- Addressing the issues related to the Project Affected People.

UNIT V CASE STUDIES

OUTCOMES:
The students completing the course will have ability to

- carry out scoping and screening of developmental projects for environmental and social assessments
- explain different methodologies for environmental impact prediction and assessment
- plan environmental impact assessments and environmental management plans
- evaluate environmental impact assessment reports

TEXTBOOKS:

REFERENCES:

EN8711 ENVIRONMENTAL STRUCTURAL DESIGN AND DRAWING USING CAD

OBJECTIVE:
- To train the students on preparing layout of water and wastewater treatment plants as well as general arrangement diagrams for units in water and wastewater treatment.

LIST OF EXPERIMENTS:
1. Principles of design and drawing of water supply and treatment units from source to distribution system.
2. Principles of design and drawing of wastewater treatment units.
3. Detailed design and drawings of various types of intake structures, conduits and pipes.
4. Detailed design and drawings of ground level reservoirs and elevated service reservoirs.
5. Preparation of drawings for various house plumbing fixtures.
6. Design and drawings of various types of distribution systems and various methods of analysis of distribution networks

**OUTCOMES:**
The students completing the course will have
- ability to prepare flow charts and layouts of water and wastewater treatment plants
- ability to design and detail structures and reactors required for water and wastewater treatment

**TEXTBOOKS:**

**REFERENCES:**

**NOTE TO QUESTION PAPER SETTER:**
30% weightage for planning, while the rest 70% for drafting skill.

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Computer system of Pentium IV or equivalent</td>
<td>1 for each student</td>
</tr>
<tr>
<td>2.</td>
<td>AUTOCAD</td>
<td>1 copy for a set of 3 students</td>
</tr>
</tbody>
</table>

**EN8712 INDUSTRIAL SAFETY LABORATORY**

**OBJECTIVE:**
- To impart knowledge on measurement and analysis of noise, ambient air pollution, exhaust gas, as well as on the use of personal protective equipment and fire extinguishers.

**UNIT I NOISE LEVEL MEASUREMENT AND ANALYSIS**
UNIT II AMBIENT AIR POLLUTION AND EXHAUST GAS MEASUREMENT AND ANALYSIS

Measurement of Exhaust gas measurement of IC engines: Instrument – Gas analyzer
Measurement of breathing zone concentration of dust and fumes: Instrument – Personal air sampler
Measurement of respirable and non-respirable dust in ambient air: Instrument – High volume sampler
Measurement of gaseous pollutants in ambient air: Instrument – Soft computing skills on developing effects of fire & explosion and dispersion: Software – PHAST 1 and ALOHA.

UNIT III STUDY ON PERFORMANCE MONITORING OF WATER AND WASTEWATER TREATMENT PLANTS


UNIT IV STUDY OF PERSONAL PROTECTIVE EQUIPMENTS

Safety helmet – Belt - hand gloves – Goggles - Safety shoe - Gum boots - Ankle shoes - Face shield - Nose mask - Ear plug - ear muff - Apron and leg guard.

UNIT V STUDY OF FIRE EXTINGUISHERS

Selection and demonstration of first-aid fire extinguishers: soda acid, foam, carbon dioxide (CO₂), dry chemical powder, halon.

OUTCOMES:
The students completing the course will have ability to
• conduct noise level measurement and exhaust gas measurement
• assess the performance of wastewater treatment plants
• identify and use appropriate personal protective equipments
• use first aid and fire extinguishers

REFERENCES:
2. Petroleum Act and Rules, Government of India, 1934

TOTAL : 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Noise level meter</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>High volume sampler with impinger attachment facility</td>
<td>1</td>
</tr>
<tr>
<td>-3.</td>
<td>Lab scale fire extinguishers</td>
<td>1 in each type</td>
</tr>
<tr>
<td>4.</td>
<td>Personal protective equipment</td>
<td>1 in each type for demo</td>
</tr>
<tr>
<td>5.</td>
<td>Gas analyser</td>
<td>1</td>
</tr>
</tbody>
</table>

EN8713 INDUSTRIAL TRAINING
(4 WEEKS DURING VI SEMESTER –SUMMER) L T P C
0 0 0 2

OBJECTIVE:
• To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.
SYLLABUS:
The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

EN8801 ESTIMATION AND COSTING

OBJECTIVE:
- To offer knowledge in estimation, tender practices, contract procedures, and valuation.
- The student will be able to prepare estimates, call for tenders and execute works.

UNIT I QUANTITY ESTIMATION

UNIT II RATE ANALYSIS AND COSTING

UNIT III SPECIFICATIONS AND TENDERS

UNIT IV CONTRACTS

UNIT V VALUATION

TOTAL: 45 PERIODS

OUTCOMES:
The student will be able to
- Estimate the quantities for buildings,
- Rate Analysis for all Building works, canals, and Roads and Cost Estimate.
- Understand types of specifications, principles for report preparation, tender notices types.
- Gain knowledge on types of contracts
- Evaluate valuation for building and land.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

- The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 300 PERIODS

OUTCOME:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

EN8001 GIS FOR ENVIRONMENTAL ENGINEERING

OBJECTIVE:

- To introduce the fundamentals of remote sensing and its applications in the field of environmental engineering.

UNIT I FUNDAMENTALS OF REMOTE SENSING 9

UNIT II AERIAL PHOTOGRAPHY AND SATELLITE REMOTE SENSING 9

UNIT III DATA ANALYSIS AND GIS 9
Data Analysis – Visual interpretation and digital image processing – Classification. Introduction to GIS, concepts and data base structure, various GIS software.

UNIT IV REMOTE SENSING AND GIS APPLICATIONS 9
Applications of Remote sensing and GIS – Management and Monitoring of Land, air, water and pollution studies – conservation of resources – coastal zone management – Limitations.

UNIT V LABORATORY PRACTICES 9
Data sources – Visual interpretation - digital image processing – Introduction to ENVI image processing software – GIS / Data Analysis in ARC GIS.

TOTAL: 45 PERIODS
OUTCOMES:
The students completing the course will have
- an understanding of the fundamentals of remote sensing, aerial photography and digital image processing
- ability to carryout data analysis using GIS for management and monitoring of land, air, water and pollution studies including conservation of resources
- ability to use image processing software and analysis in ARC GIS

TEXTBOOKS:

REFERENCES:

EN8002 URBAN AND RURAL SANITATION L T P C 3 0 0 3

OBJECTIVE:
- To expose the students the various aspects of urban and rural sanitation.

UNIT I PRINCIPLES OF HEALTHFUL HOUSING 9
Control of environment – Engineering methods - Modes of transmission of diseases – Mosquitoes and Flies - Life cycle, important characteristics and control measures of carriers. Basic principles of healthful housing - heating - ventilation - lighting - air conditioning – noise control in residential buildings.

UNIT II PLUMBING AND SWIMMING POOL SANITATION 9

UNIT III REFUSE AND FOOD SANITATION 9
UNIT IV URBAN AND RURAL WATER SUPPLY SYSTEM  
Water supply arrangements in urban buildings - design of water supply systems for multistoried buildings - consideration in the development of water supply programmes for rural areas - health and economical aspects in the design and installation of rural water supply systems - methods of construction and development of different types of wells - sanitation of rural wells - pumps for rural wells - treatment methods for rural water supply.

UNIT V RURAL SANITATION 
Layout of drainage systems in urban domestic areas - methods of disposal of night soil in rural areas - different privies - Twinpit pourflush toilets, VIP latrines - water carriage method of sewage disposal - cesspools and seepage pits - septic tank systems - oxidation ponds - aerated lagoons.

OUTCOMES: 
The students completing the course will have the ability to
- describe basic principles of healthful housing, plumbing systems, rural water supply and sanitation
- plan appropriate water supply and sanitation systems for multistoried buildings and rural areas

TEXTBOOKS:

REFERENCE: 

EN8003 SUSTAINABLE DEVELOPMENT L T P C 3 0 0 3

OBJECTIVE: 
- To impart knowledge on the principles for balancing social, economic and environmental dimensions of development and the associated international and national frameworks

UNIT I INTRODUCTION  
Status of environment – Environmental, Social and Economical issues – Need for sustainability – Nine ways to achieve sustainability – population, resources, development and environment.

UNIT II CHALLENGES OF SUSTAINABLE DEVELOPMENT AND GLOBAL ENVIRONMENTAL ISSUES  

UNIT III SUSTAINABLE DEVELOPMENT INDICATORS  
Need for indicators – Statistical procedures – Aggregating indicators – Use of principal component analysis – Three environmental quality indices.
UNIT IV ENVIRONMENTAL ASSESSMENT


UNIT V ENVIRONMENTAL MANAGEMENT AND SOCIAL DIMENSIONS


TOTAL : 45 PERIODS

OUTCOMES:
The students completing the course will have ability to
- describe the national and global environmental, economic and social issues and the principles of different sustainable development frameworks
- apply the sustainable development principles during the planning of developmental activities

TEXTBOOKS:

REFERENCES:

CE8392 ENGINEERING GEOLOGY

OBJECTIVES:
- At the end of this course the students will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and to apply this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor.

UNIT I PHYSICAL GEOLOGY


UNIT II MINEROLOGY

UNIT III  PETROLOGY  9
Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT IV  STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS  9

UNIT V  APPLICATION OF GEOLOGICAL  INVESTIGATIONS  9
Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings - Hydrogeological investigations and mining - Coastal protection structures. Investigation of Landslides, causes and mitigation.

TOTAL: 45 PERIODS

OUTCOMES:
The students completing this course
• Will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies.
• Will get basics knowledge on properties of minerals.
• Gain knowledge about types of rocks, their distribution and uses.
• Will understand the methods of study on geological structure.
• Will understand the application of geological investigation in projects such as dams, tunnels, bridges, roads, airport and harbor

TEXT BOOKS:

REFERENCES:

GE8071  DISASTER MANAGEMENT  LT P C
3 0 0 3

OBJECTIVES:
• To provide students an exposure to disasters, their significance and types.
• To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
• To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
• To enhance awareness of institutional processes in the country and
• To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity
UNIT I INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRls/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:
REFERENCES:
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

GE8074 HUMAN RIGHTS L T P C 3 0 0 3

OBJECTIVE:
- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

TOTAL : 45 PERIODS

OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

EN8004 AIR AND WATER QUALITY MODELLING L T P C 3 0 0 3

OBJECTIVE:
- After completing the course, the students will be knowing the modeling concept of air and water quality and its applicability in the Control of Air and Water pollution

UNIT I MODELING CONCEPTS
Casual and statistical models-Characteristics- Steps in model development - Importance of model building- conservation of mass and mass balance –calibration and verification of models.
UNIT II  AIR QUALITY MODELLING

UNIT III  WATER QUALITY MODELS

UNIT IV  COMPUTER BASED SIMULATION

UNIT V  SOFTWARES
Air quality Model -ARMOD, CALPUFF. - UNAMAP– BLP-RAM-ISCMPTER-CRSTER-Surface water quality models -HSPF, QUAL2K,

TOTAL: 45 PERIODS

OUTCOMES:
- Describe the modeling concepts.
- Will be able to understand the importance of Diagnostic Models.
- The students will learn the mass balance equation and knowing the water quality models.
- The ability to apply the linear programming models and experimental design.
- Will get an unsight on air quality model softwares.

REFERENCES:

EN8005  RENEWABLE ENERGY ENGINEERING

OBJECTIVES:
- To provide knowledge about various renewable energy technologies
- To provide knowledge about various possible hybrid energy systems
- To gain knowledge about application of various renewable energy technologies
UNIT I  INTRODUCTION  9
Primary energy sources, renewable vs. non-renewable energy sources, renewable energy resources in India, Current usage of renewable energy sources in India, future potential of renewable energy in power production and development of renewable energy technologies.

UNIT II  SOLAR ENERGY  9
Solar Radiation and its measurements, Solar Thermal Energy Conversion from Plate Solar Collectors-Applications of Solar Thermal Energy use of low and medium, high temperature and recent advances in industry and buildings

UNIT III  WIND ENERGY  9
Wind energy principles, wind site and its resource assessment, wind assessment, Factors influencing wind, wind turbine components, wind energy conversion systems (WECS), Classification of WECS devices, wind electric generating and control systems, characteristics and applications. Hybrid systems - safety and environmental aspects,

UNIT IV  BIO-ENERGY  9
Energy from biomass, Principle of biomass conversion technologies/process and their classification, Bio gas generation, types of biogas plants, selection of site for biogas plant, classification of biogas plants, Advantage and disadvantages of biogas generation, thermal gasification of biomass, biomass gasifies,

UNIT V  OTHER TYPES OF ENERGY  9
Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini hydel power plants.

OUTCOME:  TOTAL: 45 PERIODS
• This subject gives a brief knowledge about the various renewable energy technologies and their applications.

REFERENCES:
3. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa
5. Non-Conventional Energy Systems / K Mittal /Wheeler

EN8006  OPERATION AND MAINTENANCE OF WATER AND WASTEWATER TREATMENT PLANTS  L T P C
3 0 0 3

OBJECTIVE:
• To educate the student on the various Operation & Maintenance aspects of Common Effluent Treatment Plants.

UNIT I  ELEMENTS OF OPERATION AND MAINTENANCE OF TREATMENT PLANTS  8
Introduction - Plant operation roles - Plant Maintenance program- Knowledge of process and equipment - Proper and adequate tools - Spare units and parts - Laboratory control- Records and Reports- Housekeeping - Safety measures - Corrosion prevention and control

UNIT II  SAMPLING AND ANALYSIS OF EFFLUENTS  10
Introduction - Sampling procedures - Analysis of samples- Determination of pH using pH meter – Colour – Conductivity – Solids - Estimation of dissolved oxygen (D.O) – winkle’s method - Estimation of biochemical oxygen demand (BOD) - Estimation of biochemical oxygen demand (COD) - Estimation of chloride (Mohr’s method) - Estimation of Sulphate (turbidimetric method) -

UNIT III  OPERATION AND MAINTENANCE OF TREATMENT UNITS 10

UNIT IV  OPERATION AND MAINTENANCE OF COLLECTION AND CONVEYANCE SYSTEMS 9

UNIT V  OPERATION AND MAINTENANCE OF MECHANICAL AND ELECTRICAL EQUIPMENT IN TREATMENT PLANTS 8
Operation of General Mechanical and electrical equipment in treatment plants- metering-online line monitoring systems of units, pumps- Motors and Divers-paddles, skimmer

TOTAL: 45 PERIODS

OUTCOMES:
• Will get an basic concepts on operation and maintainanace of waste water treatment plants.
• The ability to gain the knowledge on effluent analysis and sampling techniques.
• Will get the clear concepts and knowledge on the operation of treatment plants.
• The students will learn the collection system and its safety precautions.
• Will get an insight of maintenance of treatment plants.

REFERENCES:
2. Kenneth D. Kerri, Bill B. Dendy, John Brady and Willam Crooks (1996) “Industrial Waste Treatment – A field study training program” Third edition, prepared by California sate University in Cooperation with the California water pollution on control association for the USEPA.

GE8075 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

OBJECTIVE:
• To give an idea about IPR, registration and its enforcement.
UNIT I  INTRODUCTION 9
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II  REGISTRATION OF IPRs 10
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III  AGREEMENTS AND LEGISLATIONS 10

UNIT IV  DIGITAL PRODUCTS AND LAW 9

UNIT V  ENFORCEMENT OF IPRs 7
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:
• Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

REFERENCES

EN8007  ENVIRONMENTAL RISK MANAGEMENT  L T P C
3 0 0 3

OBJECTIVE:
• To provide knowledge related to the broad field of environmental risk assessment, important processes that control contaminant transport and tools that can be used in predicting and managing human health risks.

UNIT I  INTRODUCTION 8
Sources of Environmental hazards – Environmental and ecological risks – Environmental risk assessment framework – Regulatory perspectives and requirements – Risk Analysis and Management and historical perspective: Social benefit Vs technological risks; Path to risk analysis; Perception of risk, risk assessment in different disciplines.
UNIT II ELEMENTS OF ENVIRONMENTAL RISK ASSESSMENT

UNIT III TOOLS AND METHODS FOR RISK ASSESSMENT

UNIT IV RISK MANAGEMENT

UNIT V APPLICATIONS

TOTAL: 45 PERIODS

OUTCOMES:
- The student will gain the knowledge related to the broad field of environmental risk assessment.
- Describe the elements on environmental behavior of toxics.
- The ability to apply the methods for the risk assessment.
- Will have a basic understanding of environmental risk management.
- Will get insight on risk assessment case studies related to the industrial waste.

REFERENCES:
EN8008  ENVIRONMENTAL TOXICOLOGY  L T P C 3 0 0 3

OBJECTIVE:
- To impart knowledge on toxicology, risk assessment and remediation.

UNIT I  BIOCHEMICAL TOXICOLOGY  10
Toxicants, Distribution, Metabolism of toxicants, sites of action, classification of toxicity – acute and sub-acute toxicity bioassay, Factors influencing toxicity, Elimination of toxicants, Methods of toxicity testing – Evaluation - statistical assessment, sediment toxicity, Bio-chemical markers/indicators, Toxicokinetics, Bioconcentration, Bio-accumulation and Bio magnification in the environment.

UNIT II  GENETIC TOXICOLOGY  10
Xenobiotics – Chemical carcinogenesis – Genotoxicity assays – Neurotoxicity, Skin toxicity, Immunotoxicity. Renal toxicity, Endocrine disruptors, hormones, receptors.

UNIT III  INDUSTRIAL TOXICOLOGY  9
Toxicity of monomers, solvents, intermediates, products – toxic substrates – Metals and other inorganic Chemicals, Organic Compounds – Persistent chemicals.

UNIT IV  RISK ASSESSMENT AND REMEDIATION  9
Procedures for assessing the risk – Risk measurement and Mitigation of environmental disorders – Factors in risk assessment.

UNIT V  CASE STUDIES IN RISK ASSESSMENT  7
Pharmaceutical, Petroleum, Carbide industry, Textile and Leather Industry Case study.

TOTAL:45 PERIODS

OUTCOMES:
- To gain knowledge on Toxicology.
- Will able to understand the genetic toxicity and its effects.
- The students will learn the toxicity of chemicals from industrial effluents.
- describe the risk measurement and reclamation.
- Will get an insight on risk assessment case studies related to the industries.

REFERENCES:

EN8009  SOIL AND GROUNDWATER REMEDIATION  L T P C 3 0 0 3

OBJECTIVE:
- The student acquires the knowledge on problem associated with soil contamination, safety disposal of waste and remediate the contaminated soils by different techniques thereby protecting environment.
UNIT I PHYSICS AND CHEMISTRY OF SOIL

UNIT II INORGANIC AND ORGANIC GEOCHEMISTRY

UNIT III CONTAMINANT FATE AND TRANSPORT IN SOIL

UNIT IV GROUND IMPROVEMENT TECHNIQUES IN WASTE MANAGEMENT

UNIT V SOIL REMEDIATION TECHNOLOGIES

TOTAL: 45 PERIODS

OUTCOMES:
- students obtain the knowledge on properties of soil.
- describe the inorganic and organic Geochemistry.
- Will have a fundamental concepts on transport processes in soil.
- Will gain ability to apply idea on ground improvement techniques.
- The students will learn the soil remediation methods.

REFERENCES:
OBJECTIVES:

- To impart knowledge of systems approach to Environmental Management and skills for environmental performance in terms of legal compliance, pollution prevention and continual improvement.
- To enable the students to develop environmental management systems for organisations as per ISO 14001 and also to carry out Environmental Audit.

UNIT I  ENVIRONMENTAL MANAGEMENT PRINCIPLES 9
Unique characteristics of Local, Regional and Global Environmental Problems – PDCA Cycle and Systems approach to Corporate environmental management – Business and Sustainability - Business Charter for Sustainable Production and Consumption –Environmental Stewardship – National policies on environment, abatement of pollution and conservation of resources – Charter on Corporate responsibility for Environmental protection

UNIT II  ENVIRONMENTAL PERFORMANCE EVALUATION 9

UNIT III  PREVENTIVE ENVIRONMENTAL MANAGEMENT 9
Pollution control Vs Pollution Prevention - Four Stages and nine approaches of Pollution Prevention - source reduction, raw material substitution, toxic use reduction and elimination, process modification –Material balance – Technical, economical and environmental feasibility evaluation of Pollution Prevention options in selected industries – Design for the Environment over Product cycle.

UNIT IV  ENVIRONMENTAL MANAGEMENT SYSTEM 10

UNIT V  ENVIRONMENTAL AUDIT 8
Environmental management system audit as per ISO 19011 – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit

OUTCOMES:
On completion of the course, the student is expected to be able to

- understand the elements of Corporate Environmental Management system complying to international environmental management system standards
- critically evaluate strategies within Environmental Management from a systems perspective.
- Lead pollution prevention assessment team and implement waste minimization options
- develop, Implement, maintain and audit Environmental Management systems for Organizations.

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:
2. ISO 19011:, “Guidelines for quality and/or Environmental Management System
3. Auditing, Bureau of Indian Standards, New Delhi, 2015

EN8011 PROJECT FORMULATION AND IMPLEMENTATION

OBJECTIVES:
- To Examine the techniques and procedures relevant for project planning and implementation in developing countries, especially infrastructure projects pertaining to environmental sector
- To enable the students to understand about project identification, feasibility analysis, design, financing, implementation, monitoring and evaluation

UNIT I INTRODUCTION TO PROJECT FORMULATION
Overview of the project cycle – Planning Process and project planning – Search for Project ideas – Strategies in Capital allocation – Key elements in project formulation – Methods and tools for Project formulation – Project identification and selection – Preparation of feasibility reports as per Government policies (AMRUT / JnNURM)

UNIT II PROJECT ANALYSIS

UNIT III PROJECT APPRAISAL
Time and value of money – Investment Criteria – Internal Rate of Return – Net Present Value, Cost Benefit Analysis, and social cost benefit analysis – Project risk analysis – Appraisal of marketing strategy – Pricing and credit worthiness and management capabilities

UNIT IV PROJECT FINACING AND IMPLEMENTATION
Funding options for urban and rural development projects – Tender Procedure – Transparency in Government Tender rules – Organizational aspects in Project management – Network techniques for project management – Resource management - Risk management
UNIT V PROJECT MONITORING AND EVALUATION

Need and techniques for monitoring – Service Level Benchmark Performance and process monitoring – Monitoring Schedules – Penalty and Bonus points

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student is expected to be able to

- Develop knowledge on important aspects of project formulation, criteria for project appraisal, know about the funding agencies and project management
- Get an idea about service level benchmark performances, Penalty & bonus clauses and its importance in project execution

REFERENCES:
3. John M Nicholas “Project Management For Business And Technology” Prentice Hall Of India Pvt Ltd
4. James P Lewis “Project Planning ,Scheduling And Control” Tata Mcgraw-Hill
5. Detailed Project Report : Preparation Toolkit (Sub-mission for Urban Infrastructure and Governance), Government of India
6. www.india.gov.in national portal for India

EN8012 COASTAL ZONE MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:
- At the end of the semester, the student shall be able to understand the coastal processes, coastal dynamics, impacts of structures like docks, harbours and quays leading to simple management perspectives along the coastal zone.

UNIT I COASTAL PROCESSES AND RESOURCES

UNIT II WAVE DYNAMICS

UNIT III WAVE FORECASTING AND TIDES

UNIT IV COASTAL POLLUTION
Coastal Pollution – Causes – Effects - Coastal aquifers – Sea water intrusion – Marine Outfall - Impact of sewage disposal in seas.
UNIT V  
COASTAL ZONE MANAGEMENT  
Pollution Control strategies – National and International Treaties, Coastal Zone Regulation – Total Maximum Daily Load applications – Protocols in Marine Pollution – ICZM and Sustainable Development

OUTCOMES:
The students completing the course will have ability to
- describe the Coastal zone regulations, coastal processes and wave dynamics
- forecast waves and tides and plan coastal structures including harbours

TEXTBOOKS:

REFERENCES:

EN8013  
FATE AND TRANSPORT OF CONTAMINANTS  
L T P C  
3 0 0 3

OBJECTIVE:
- To educate the students on the mechanism of transport and fate of contaminants in the geosphere of the environment.

UNIT I  
EQUILIBRIUM AND TRANSPORT MECHANISMS  

UNIT II  
EXCHANGE RATES BETWEEN AIR AND WATER  
Desorption of gases and liquids from aerated basins and rivers – completely mixed basin – plug flow basin – gas exchange rates between the atmosphere and the surface of rivers – exchange of chemical across the air – water interface of lakes and oceans.

UNIT III  
EXCHANGE RATES BETWEEN WATER AND THE EARTHERN MATERIAL  
Dissolution of chemicals -natural convection dissolution – water interface – mass transfer coefficients at the sediment – water interface. Flux of chemicals between sediment and the overlying seawater – movement of chemicals through the benthic boundary layer.

UNIT IV  
EXCHANGE RATES BETWEEN AIR AND SOIL  
Turbulence above the air – soil interface – the Richardson number – chemical flux rates through the lower layer of the atmosphere –evaporation of liquid chemicals spilled on land – chemical flux rates through the upper layer of earthen material.
UNIT V  CONTAMINANT TRANSPORT ANALYSIS

Potential theory- Potential Functions- Stream Function – Travel time along with Stream Functions- Residential Time Distribution Theory- Analysis of Chemical Spills and Contaminant plumes – Fourier analysis of Initial value – point spill analysis- vertically mix spill analysis- Horizontal Plane Source analysis

TOTAL: 45 PERIODS

OUTCOMES:
- understanding the mechanisms on air, soil and water equilibrium.
- Will have a knowledge of gas exchange rates between air and water
- Will have a knowledge of gas exchange rates between water and soil
- Will have a knowledge of gas exchange rates between air and soil.
- Students will gain on potential analysis and its functions.

TEXT BOOKS:

REFERENCES:

GE8077 TOTAL QUALITY MANAGEMENT

OBJECTIVE:
- To facilitate the understanding of Quality Management principles and process.

UNIT I  INTRODUCTION

UNIT II  TQM PRINCIPLES
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.
UNIT III TQM TOOLS AND TECHNIQUES I
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

OUTCOME:
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

REFERENCES:
4. ISO9001-2015 standards

EN8014 ENVIRONMENTAL BIOTECHNOLOGY

OBJECTIVE:
- To educate the students on the principles and application of biotechnology in remediation of pollutants.

UNIT I BASIC CONCEPTS
Energy flow and material cycling in ecosystems – productivity in ecosystems. Principles and concepts of environmental biotechnology –Important Microorganisms - Applications – Current status.

UNIT II BIODEGRADATION OF TOXIC WASTES
UNIT III  MECHANISM OF DETOXIFICATION  
Environmental fate of organic pollutants – mechanisms of detoxification – oxidation, reduction, and dehydrogenation – Microbial system for Heavy metal accumulation - Biotransformation of metals – Biosorption - Microbial leaching of metals – role of extracellular polymers to detect pollutants.

UNIT IV  BIO REMEDIATION  

UNIT V  RECOMBINANT DNA TECHNOLOGY AND INTELLECTUAL PROPERTY  

TOTAL:45 PERIODS

OUTCOMES:
- understanding the fundamental concepts of ecosystems.
- The students will get the skills on degradation of toxic wastes.
- will obtain knowledge on biological mechanisms.
- Basic ideologies of energy and reclamation will be known.
- Introduction to the concepts of DNA.

REFERENCES:

EN8015  CLIMATE CHANGE, ADAPTATION AND MITIGATION  

OBJECTIVES:
- To understand the Earth’s Climate System and the concept of Global Warming.
- To comprehend the impact of climate change on society and its mitigation measures.

UNIT I  EARTH’S CLIMATE SYSTEM  
UNIT II OBSERVED CHANGES AND ITS CAUSES

UNIT III IMPACTS OF CLIMATE CHANGE

UNIT IV CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

UNIT V CLEAN TECHNOLOGY AND ENERGY

TOTAL : 45 PERIODS

OUTCOMES:
- The students can understand the concept of climate change and its consequences.
- The students can adopt the methodologies in finding the changes in climate

REFERENCES:
2. Al core ‘inconvenient truth” – video form
3. IPCC Fourth Assessment Report – The AR4 Synthesis Report,

EN8016 RESOURCE RECOVERY FROM WASTE L T P C
3 0 0 3

OBJECTIVE:
- To understand the principles and design of recovering materials and energy from wastes through mechanical, biological and thermal methods and manage the undesirable by-products.

UNIT I MECHANICAL PROCESSING FOR MATERIAL RECYCLING
UNIT II 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 Composting- Compost 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.

UNIT III BIO-CHEMICAL CONVERSION OF WASTE TO ENERGY

UNIT IV 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

UNIT V CASE STUDIES ON WASTE RECYCLING

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the Course, the Candidate should:
- Understand the fundamental principles of existing and emerging technologies for the treatment of waste and recovery of materials and energy from waste;
- Appreciate the increasing importance of waste and resource management in achieving environmental sustainability.
- Be able to analyse and describe the potential of solid waste as a secondary raw material, and the associated problems and possibilities in a sustainable society.

REFERENCES:
3 Chiumenti, Chiumenti, Diaz, Savage, Eggerth, and Goldstein , Modern Composting Technologies JG Press October 2005
OBJECTIVE:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I  HUMAN VALUES  10

UNIT II  ENGINEERING ETHICS  9

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION  9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV  SAFETY, RESPONSIBILITIES AND RIGHTS  9

UNIT V  GLOBAL ISSUES  8

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXTBOOKS:


REFERENCES:

OBJECTIVE:
- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I  INTRODUCTION
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II  GENERAL METHODS OF PREPARATION
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III  NANOMATERIALS

UNIT IV  CHARACTERIZATION TECHNIQUES

UNIT V  APPLICATIONS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial
TEXT BOOKS:

REFERENCES: