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OBJECTIVES:

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I 9+3
Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one’s leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II 9+3
Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Reading exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III 9+3
Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV 9+3
Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.
UNIT V

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
Learners should be able to

- speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents.

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

WEBSITES:

TEACHING METHODS:
- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

EVALUATION PATTERN:
Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
All the four skills are to be tested with equal weightage given to each.

- Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

End Semester Examination: 80%

MA6151 MATHEMATICS – I L T P C
3 1 0 4

OBJECTIVES:
- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES 9+3

UNIT II SEQUENCES AND SERIES 9+3

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3
UNIT V  MULTIPLE INTEGRALS  9+3

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

TEXTBOOKS:

REFERENCES:

PH6151  ENGINEERING PHYSICS – I  L T P C
3 0 0 3

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

UNIT I  CRYSTAL PHYSICS  9
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II  PROPERTIES OF MATTER AND THERMAL PHYSICS  9

UNIT III  QUANTUM PHYSICS  9
UNIT IV ACOUSTICS AND ULTRASONICS
Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

UNIT V PHOTONICS AND FIBRE OPTICS
Spontaneous and stimulated emission - Population inversion - Einstein’s A and B coefficients - derivation. Types of lasers – Nd:YAG, CO\textsubscript{2}, Semiconductor lasers (homojunction & heterojunction) - Industrial and Medical Applications.
Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors - Endoscope.

TOTAL: 45 PERIODS

OUTCOMES:
- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXTBOOKS:
1. Arumugam M. Engineering Physics. Anuradha publishers, 2010

REFERENCES:
1. Searls and Zemansky. University Physics, 2009
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
UNIT II       CHEMICAL THERMODYNAMICS  
Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isochores(problems).

UNIT III      PHOTOCHEMISTRY AND SPECTROSCOPY  

UNIT IV       PHASE RULE AND ALLOYS  

UNIT V        NANOCHEMISTRY  
Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and applications

TOTAL :45 PERIODS

OUTCOMES:  
• The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXTBOOKS:  

REFERENCES:  

GE6151    COMPUTER PROGRAMMING  
L T P C  
3 0 0 3

OBJECTIVES:  
The students should be made to:  
• Learn the organization of a digital computer.  
• Be exposed to the number systems.  
• Learn to think logically and write pseudo code or draw flow charts for problems.
• Be exposed to the syntax of C.
• Be familiar with programming in C.
• Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION

UNIT II C PROGRAMMING BASICS

UNIT III ARRAYS AND STRINGS

UNIT IV FUNCTIONS AND POINTERS

UNIT V STRUCTURES AND UNIONS
Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Design C Programs for problems.
• Write and execute C programs for simple applications

TEXTBOOKS:

REFERENCES:
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 FREE HAND SKETCHING


Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views - Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

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

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 and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

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. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

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 and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only)

Introduction to drafting packages and demonstration of their use.

TOTAL : 75 PERIODS

OUTCOMES:

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

TEXTBOOK:


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.

**GE6161 COMPUTER PRACTICES LABORATORY**

**OBJECTIVES:**
The student should be made to:
- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

**LIST OF EXPERIMENTS:**
1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**OUTCOMES:**
At the end of the course, the student should be able to:
- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

**TOTAL : 45 PERIODS**
LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:
Standalone desktops with C compiler 30 Nos.
(or)
Server with C compiler supporting 30 terminals or more.

GE6162 ENGINEERING PRACTICES LABORATORY                         L T P C
0 0 3 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

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 arc welding of butt joints, lap joints and tee joints.
(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, funnels, etc.
(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 vee – fitting models.
GROUP B (ELECTRICAL & ELECTRONICS)

III  ELECTRICAL ENGINEERING PRACTICE  10
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  13
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, EOR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

OUTCOMES:
- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

REFERENCES:

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 2Nos
   (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.
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

**GE6163 PHYSICS AND CHEMISTRY LABORATORY – I**

**PHYSICS LABORATORY – I**

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

**LIST OF EXPERIMENTS**
(Any FIVE Experiments)
1. (a) Determination of Wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of Young’s modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster’s Bridge

**OUTCOMES:**
- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**
1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee’s Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster’s bridge set up
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)
CHEMISTRY LABORATORY- I

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 vacometry.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of DO content of water sample by Winkler’s method.
2. Determination of chloride content of water sample by argentometric method.
3. Determination of strength of given hydrochloric acid using pH meter.
4. Determination of strength of acids in a mixture using conductivity meter.
5. Estimation of iron content of the water sample using spectrophotometer. (1,10- phenanthroline / thiocyanate method).
7. 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.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Iodine flask - 30 Nos
2. pH meter - 5 Nos
3. Conductivity meter - 5 Nos
4. Spectrophotometer - 5 Nos
5. Ostwald Viscometer - 10 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (each 30 Nos.)

HS6251 TECHNICAL ENGLISH II L T P C 3 1 0 4

OBJECTIVES:
- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.
UNIT I
Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills; Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II
Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his/her success, thanking one’s friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III
Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

UNIT IV
Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V
Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample
GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
Learners should be able to
- speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

WEBSITES
2. http://owl.english.purdue.edu

TEACHING METHODS:
- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
- Project
- Assignment
- Report
- Creative writing, etc.
All the four skills are to be tested with equal weightage given to each.

- Speaking assessment: Individual presentations, Group discussions
- Reading assessment: Reading passages with comprehension questions graded following Bloom’s taxonomy
- Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom’s taxonomy.

End Semester Examination: 80%

MA6251 MATHEMATICS – II

OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS 9+3
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stokes’ theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepips.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+3
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORM 9+3

UNIT IV ANALYTIC FUNCTIONS 9+3
Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+k, kz, 1/z, z², e^z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 9+3
Complex integration – Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula – Taylor’s and Laurent’s series expansions – Singular points – Residues – Cauchy’s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TOTAL (L:45+T:15): 60 PERIODS
OUTCOMES:

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXTBOOKS:


REFERENCES:


PH6251 ENGINEERING PHYSICS – II

OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS


UNIT II SEMICONDUCTING MATERIALS


UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS

Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS

UNIT V    ADVANCED ENGINEERING MATERIALS

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials— Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

TOTAL: 45 PERIODS

OUTCOMES:
- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXTBOOKS:

REFERENCES:

CY6251 ENGINEERING CHEMISTRY - II

OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I WATER TECHNOLOGY
Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement-boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION

UNIT III ENERGY SOURCES
Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator-classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H₂ -O₂ fuel cell- applications.
UNIT IV  ENGINEERING MATERIALS

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refactoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

UNIT V  FUELS AND COMBUSTION


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.

TEXTBOOKS:

REFERENCES:

GE6252  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 & MEASURMENTS

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.
UNIT II  ELECTRICAL MECHANICS  12

UNIT III  SEMICONDUCTOR DEVICES AND APPLICATIONS  12

UNIT IV  DIGITAL ELECTRONICS  12
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING  12
Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

OUTCOMES:
- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

TEXT BOOKS:

REFERENCES:

GE6253  ENGINEERING MECHANICS  L T P C
3 1 0 4

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  BASICS AND STATICS OF PARTICLES  12
UNIT II  EQUILIBRIUM OF RIGID BODIES  12
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  12
Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular
areas by integration – T section, I section, - Angle section, Hollow section by using standard
formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular,
triangular areas by integration – T section, I section, Angle section, Hollow section by using
standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of
inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia
for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of
inertia.

UNIT IV  DYNAMICS OF PARTICLES  12
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion
bodies.

UNIT V  FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  12
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction
–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.

OUTCOMES:
- ability to explain the differential principles applies to solve engineering problems dealing
  with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve dynamics related problems

TEXTBOOKS:

REFERENCES:
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and
   company, New Delhi, 2008.
OBJECTIVES:

- To develop skill to use software to create 2D and 3D models.

List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TOTAL: 45 PERIODS

OUTCOMES:

- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

LIST OF EQUIPMENT 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>Pentium IV computer or better hardware, with suitable graphics facility</td>
<td>30 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Licensed software for Drafting and Modeling.</td>
<td>30 Licenses</td>
</tr>
<tr>
<td>3.</td>
<td>Laser Printer or Plotter to print / plot drawings</td>
<td>2 No.</td>
</tr>
</tbody>
</table>

GE6262               PHYSICS AND CHEMISTRY LABORATORY – II  

OBJECTIVES:

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

LIST OF EXPERIMENTS  
(Any FIVE Experiments)

1. Determination of Young’s modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid – Poiseuille’s method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum
OUTCOMES:
- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. Spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.

(Vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY -II

OBJECTIVES:
- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS (Any FIVE Experiments)

1. Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Estimation of copper content of the given solution by EDTA method
4. Estimation of iron content of the given solution using potentiometer
5. Estimation of sodium present in water using flame photometer
6. Corrosion experiment – weight loss method
7. Conductometric precipitation titration using BaCl$_2$ and Na$_2$SO$_4$

TOTAL: 30 PERIODS

OUTCOMES:
- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis

REFERENCES:

- Laboratory classes on alternate weeks for Physics and Chemistry.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Potentiometer - 5 Nos
2. Flame photo meter - 5 Nos
3. Weighing Balance - 5 Nos
4. Conductivity meter - 5 Nos

Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (30 Nos each)
OBJECTIVES:

- This course aims at providing the required skill to apply the statistical tools in engineering problems.

UNIT I  RANDOM VARIABLES  9+3
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II  TWO - DIMENSIONAL RANDOM VARIABLES  9+3
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  9+3
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test 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  9+3
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT V  STATISTICAL QUALITY CONTROL  9+3
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- The students will have a fundamental knowledge of the concepts of probability. Have knowledge of standard distributions which can describe real life phenomenon. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXTBOOKS:


REFERENCES:

OBJECTIVES:

- To learn fundamental concepts of stress, strain and deformation of solids with applications to bars, beams and thin cylinders.
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To understand the effect of torsion on shafts and springs.
- To analyse a complex two dimensional state of stress and plane trusses

UNIT I  STRESS AND STRAIN  9

UNIT II  SHEAR AND BENDING IN BEAMS  9
Beams and Bending- Types of loads, supports – Shear Force and Bending Moment Diagrams for statically determinate beam with concentrated load, UDL, uniformly varying load. Theory of Simple Bending – Analysis of Beams for Stresses – Stress Distribution at a cross Section due to bending moment and shear force for Cantilever, simply supported and overhanging beams with different loading conditions - Flitched Beams.

UNIT III  DEFLECTION  9

UNIT IV  TORSION  9

UNIT V  COMPLEX STRESSES AND PLANE TRUSSES  9
2 D State of Stress – 2 D Normal and Shear Stresses on any plane – Principal Stresses and Principal Planes – Mohr's circle - Plane trusses: Analysis of plane trusses - method of joints - method of sections.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
The students will have

- Thorough understanding of the fundamental concepts of stress and strain in mechanics of solids and structures.
- the ability to analyse determinate beams and trusses to determine shearforces, bending moments and axial forces.
- a sufficient knowledge in designing shafts to transmit required power and also springs for its maximum energy storage capacities.

TEXTBOOKS:

REFERENCES:

CE6303 MECHANICS OF FLUIDS

OBJECTIVES:

- 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

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms) - Equation of streamline - stream function - velocity potential function - circulation - flow net. Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli’s equation – applications - Venturi meter, Orifice meter and Pitot tube. Linear momentum equation and its application.

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.

TOTAL: 45 PERIODS

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:

GI6302 SURVEYING

OBJECTIVES:
- To introduce the rudiments of surveying principles.
- To learn the various methods of surveying to solve the real world problems.

UNIT I FUNDAMENTALS AND CHAIN SURVEYING 6
Definition- Classifications - Basic principles – Mistakes, errors and accuracy. Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing – Plotting - applications.

UNIT II COMPASS SURVEYING AND PLANE TABLE SURVEYING 6

UNIT III THEODOLITE SURVEYING 6
Theodolite - Types - Description - Horizontal and vertical angles - Temporary and permanent adjustments – Heights and distances– Tangential and Stadia Tacheometry – Subtense method - Stadia constants - Anallactic lens.

UNIT IV ROUTE SURVEYING 6
Reconnaissance - Route surveys for highways, railways and waterways - Simple curves – Compound and reverse curves - Setting out Methods – Transition curves - Functions and requirements - Setting out by offsets and angles - Vertical curves - Sight distances.

UNIT V HYDROGRAPHIC AND MINE SURVEYING 6

TOTAL (L:30+T:30): 60 PERIODS

OUTCOMES:
At the end of the course the student will be able to understand
- the use of various surveying instruments in mapping
- the error and adjustments procedures associated with surveying and mapping
- the applications of surveying in Route, Mine and Hydrography

TEXTBOOKS:

REFERENCES:
EN6301 ENVIROMENTAL CHEMISTRY L T P C 3 0 0 3

OBJECTIVES:

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

UNIT I ENVIRONMENTAL CHEMISTRY: INTRODUCTION 9
Chemical kinetics - factors influencing the rate – order and molecularity (examples) – derivation of rate constant for first order reaction - time for half - change - nature of BOD reactions – Enzyme reactions, temperature dependence, catalyst.

UNIT II CHEMICAL REACTIONS OF WATER 9

UNIT III ORGANIC COMPOUNDS AND STRUCTURES 9
Functional groups in organic compounds and their structures (Preparation & Properties not required) - carbohydrates - classification – monosaccharides, pentoses (Xylose and arabinose) Hexoses (Glucose, galactose, mannose and fructose) – disaccharides (Sucrose, maltose and lactose) – Polysaccharides (Starch, cellulose and hemicellulose) - Structural formulae - ring structure and hydrolysis reaction only.

UNIT IV ATMOSPHERIC CHEMISTRY 9
Photochemical reactions in the atmosphere- Degradation of VOCs– Chemical process for the formation of inorganic and organic particulate matter –Photochemical smog.

UNIT V SOIL CHEMISTRY 9
Soil classification– Inorganic and organic components of soil –physical and chemical properties of soil- Acid -base and ion exchange reactions--Salt affected soil.

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have
- an insight into 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:

GE6351  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C 3 0 0 3

OBJECTIVES:
To the study of nature and the 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  12
Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – 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  10
Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry; Mitigation procedures- Control of particulate and gaseous emission, Control of SO₂, NOₓ, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards –role of an individual in prevention of pollution – pollution case studies –
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES  10
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 overutilization of

**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 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 mild 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
10. Test on Cement

TOTAL: 45 PERIODS

OUTCOMES:
- The students will gain knowledge in the area of testing of materials and components of structural elements experimentally.

REFERENCES:

LIST OF EQUIPMENT 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 for steel rods</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</td>
<td>1 each</td>
</tr>
<tr>
<td></td>
<td>Rockwell</td>
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<td></td>
<td>Vicker's</td>
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<td></td>
<td>Brinell</td>
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<tr>
<td>5.</td>
<td>Beam deflection test apparatus</td>
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<tr>
<td>6.</td>
<td>Extensometer</td>
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<tr>
<td>7.</td>
<td>Compressometer</td>
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<tr>
<td>8.</td>
<td>Dial gauges</td>
<td>Few</td>
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<tr>
<td>9.</td>
<td>Le Chatelier’s apparatus</td>
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<tr>
<td>10.</td>
<td>Vicat’s apparatus</td>
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</tr>
<tr>
<td>11.</td>
<td>Mortar cube moulds</td>
<td>10</td>
</tr>
</tbody>
</table>

OBJECTIVES:
- To familiarize with the various surveying instruments and methods.
LIST OF EXPERIMENTS:

I  Chain Surveying  8
   • Ranging, chaining and pacing
   • Chain traversing

II Compass Surveying  8
   • Triangulation problem
   • Compass traversing

III Plane Table Surveying  20
   • Radiation and Intersection: Resection - Three point problem
   • Mechanical and Graphical solution
   • Trial and error method
   • Resection - Two Point problem
   • Plane table traversing

IV Theodolite Surveying  16
   • Measurement of horizontal angles and vertical angles
   • Heights and Distances by
   • Triangulation problem
   • Single plane method
   • Stadia and Tangential method

V Setting Out Works  8
   • Simple curve using chain and tape only
   • Simple curve by Rankine’s method

OUTCOMES:
At the end of the course the student will be able to
   • Use various surveying instruments like chain, compass, plane table, theodolite for mapping
   • Set the curves for highway or railway projects

REFERENCES:

LIST OF EQUIPMENT 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>Chain and its accessories</td>
<td>1 set for 4 students</td>
</tr>
<tr>
<td>2.</td>
<td>Compass with tripod</td>
<td>1 set for 4 students</td>
</tr>
<tr>
<td>3.</td>
<td>Plane table and its accessories</td>
<td>1 set for 4 students</td>
</tr>
<tr>
<td>4.</td>
<td>Dumpy level and its accessories</td>
<td>1 set for 4 students</td>
</tr>
<tr>
<td>5.</td>
<td>Theodolite and its accessories</td>
<td>1 set for 4 students</td>
</tr>
</tbody>
</table>

EN6311  ENVIRONMENTAL CHEMISTRY LABORATORY  L T P C  0 0 3 2

OBJECTIVES:
   • To familiarise with the physico chemical characterisation of water and wastewater.
LIST OF EXPERIMENTS:
1. Measurement of pH, Electrical conductivity and Turbidity of water samples
2. Determination of Chlorides in water.
3. Determination of iron and Fluoride in water
4. Determination of acidity and Alkalinity of water.
5. Determination of Sulphate in water.
6. Determination of hardness of water
7. Determination of nitrate & TKN in water (demo)
8. Determination of residual chlorine of water
9. Determination of total dissolved solids
10. Determination of optimum coagulant dosage

TOTAL: 45 PERIODS

OUTCOMES:
• The students completing the course will have the ability to use the techniques, skills and modern instruments to determine the quality of water and wastewater.

REFERENCE:

LIST OF EQUIPMENT 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>pH meter</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Turbidity meter</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>UV visible spectro photo meter</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Electrical conductivity meter</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Jartus apparatus meter</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Glasswares such as pipette, Burette etc</td>
<td>1 for each student</td>
</tr>
</tbody>
</table>

CE6401 CONSTRUCTION MATERIALS

OBJECTIVES:
• 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
UNIT IV TIMBER AND OTHER MATERIALS

UNIT V MODERN MATERIALS

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 these materials
- understand the relationship between material properties and structural form
- understand the importance of experimental verification of material properties.

TEXTBOOKS:

REFERENCES:

CE6453 SOIL MECHANICS AND FOUNDATION ENGINEERING L T P C 3 0 0 3

OBJECTIVES:
- To understand the basic properties and strength nature of various soils and their settlement behaviour in foundations.

UNIT I SOIL PROPERTIES AND COMPACTION OF SOIL 9

UNIT II SOIL MOISTURE – PERMEABILITY, STRESSES IN SOILS 9
UNIT III
SHEAR STRENGTH AND SLOPE STABILITY


UNIT IV
SOIL EXPLORATION


UNIT V
FOUNDATION – BEARING CAPACITY AND SETTLEMENT


OUTCOMES:
The students completing the course will
- have an insight into the structure and engineering properties of soil
- demonstrate an understanding of the processes leading to the formation of soils
- describe the properties of rocks and soils that affect their ability to support any imposed loads
- design simple foundation elements for varying soil conditions and carryout bearing capacity/settlement analysis
- specify appropriate excavation and retaining methods for soils and rocks

TEXTBOOKS:

REFERENCES:

CE6458
APPLIED HYDRAULICS AND FLUID MACHINES

OBJECTIVES:
The objective of the course is to understand the types of flow in open channel, dimensional analysis, momentum principle and application of various turbines and pumps in fluid problems.
UNIT I  UNIFORM FLOW

UNIT II  VARIED FLOWS

UNIT III  MOMENTUM PRINCIPLE
Impulse momentum equation – Application of linear momentum principle – Impact of Jet- Force exerted by a jet on normal, inclined and curved surfaces for stationary and moving cases – Angular momentum principle – construction of velocity vector diagrams.

UNIT IV  HYDRAULIC TURBINES

UNIT V  HYDRAULIC PUMPS

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will
- have an insight into the uniform and varied flow of fluids, momentum principle and its application to hydraulic turbines and pumps
- be able to perform calculations relevant and applicable to flow in open channel, dimensional analysis, momentum principle and its application to turbines and pumps

TEXTBOOKS:

REFERENCES:
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.

TOTAL: 45 PERIODS

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:

EN6402 WATER SUPPLY ENGINEERING

OBJECTIVES:
- The course objective is to identify the sources and quantity of surface and ground water bodies and their demand for the public and also to study the quality of water and their treatment techniques.

UNIT I PUBLIC WATER SUPPLY SCHEMES AND QUANTITY OF WATER 8

UNIT II HYDROLOGICAL CONCEPTS AND SOURCES OF WATER 8

UNIT III QUALITY OF WATER AND TRANSPORTATION OF WATER 8
UNIT IV  
**PURIFICATION OF WATER**

Treatment of water- working principles of all the unit process of water treatment, Purpose and its design – screening – plain sedimentation – coagulation sedimentation – filtration – disinfection – water softening and Desalination – Operation & Maintenance aspects of all the unit process.

UNIT V  
**OTHER TREATMENTS AND DISTRIBUTION OF WATER**


**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
- 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 selection criteria

**TEXTBOOKS :**

**REFERENCES :**

**CE6469  
BASIC STRUCTURAL ANALYSIS  
L T P C  
3 0 0 3**

**OBJECTIVES:**
- To learn the modern method of analysis of beams and frames.

UNIT I  
**ENERGY PRINCIPLES**

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 – Maxwell’s reciprocal theorems

UNIT II  
**DEFLECTION OF DETERMINATE STRUCTURES**

Principles of virtual work for deflections - Deflections of pin-jointed plane frames and rigid plane frames –Williott’s diagram.

UNIT III  
**SLOPE DEFLECTION METHOD**

Slope deflection equations- Analysis of continuous beams and rigid frames - Support settlements.

UNIT IV  
**MOMENT DISTRIBUTION METHOD**

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 CYLINDER

Euler’s theory of long columns – critical loads for prismatic columns with different end conditions; Rankine-Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core 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 using classical methods

TEXTBOOKS:

REFERENCES:

CE6412 HYDRAULIC ENGINEERING LABORATORY

OBJECTIVES:
• 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 Rotometer
2. Flow through Venturi meter Orificemeter
3. Flow through variable duct area - Bernoulli’s Experiment
4. Flow through Orifice, Mouthpiece and Notches

B. Losses in Pipes
5. Determination of friction coefficient in pipes
6. Determination of loss coefficients for pipe fittings

C. Pumps
7. Characteristics of Centrifugal pumps
8. Characteristics of Gear pump
9. Characteristics of Submersible pump
10. Characteristics of Reciprocating pump
D. Turbines
11. Characteristics of Pelton wheel turbine
12. Characteristics of Francis turbine
13. Characteristics of Kaplan turbine

E. Determination of Metacentric height
14. Determination of Metacentric height (Demonstration)

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 EQUIPMENT 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>Bernoulli’s theorem – Verification Apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Calculation of Metacentric height</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>(i) Standard Metacentric height tank</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ii) Ship model with accessories</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Flow measurement open channel flow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) Channel with provision for fixing notches (rectangular, triangular &amp; trapezoidal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>forms)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ii) Flume assembly with provisions for conducting experiments on Hydraulic jumps,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>generation of surges etc.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Flow measurement in pipes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(i) Venturimeter, U tube manometer fixtures like Valves, collecting tank</td>
<td>1 Unit</td>
</tr>
<tr>
<td></td>
<td>(ii) Orifice meter, with all necessary fittings in pipe lines of different diameters</td>
<td>1 Unit</td>
</tr>
<tr>
<td></td>
<td>(iii) Calibration of flow through orifice tank with Provisions for fixing orifices of</td>
<td>1 Unit</td>
</tr>
<tr>
<td></td>
<td>different shapes, collecting tank</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(iv) Calibration of flow through mouth piece Tank with provisions for fixing mouth</td>
<td>1 Unit</td>
</tr>
<tr>
<td></td>
<td>pieces Viz external mouth pieces &amp; internal mouth piece Borda’s mouth piece</td>
<td></td>
</tr>
</tbody>
</table>
6. **Losses in Pipes**  
   **Major loss – Friction loss**  
   Pipe lengths (min. 3m) of different diameters with Valves and pressure rapping & collecting tank  
   1 Unit

7. **Minor Losses**  
   Pipe line assembly with provisions for having Sudden contractions in diameter, expansions Bends, elbow fitting, etc.  
   1 Unit

8. **Pumps**  
   (i) Centrifugal pump assembly with accessories (single stage)  
   1 Unit  
   (ii) Centrifugal pump assembly with accessories (multi stage)  
   1 Unit  
   (iii) Reciprocating pump assembly with accessories  
   1 Unit  
   (iv) Deep well pump assembly set with accessories  
   1 Unit

9. **Turbine**  
   (i) Impulse turbine assembly with fittings & accessories  
   1 Unit  
   (ii) Francis turbine assembly with fittings & accessories  
   1 Unit  
   (iii) Kaplan turbine assembly with fittings & accessories  
   1 Unit

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**EN6411 MICROBIOLOGY LABORATORY**  
**L T P C 0 0 3 2**

**OBJECTIVES:**  
- To understand the experimental procedures involved in the study of micro-organisms and the method of testing their presence.

**LIST OF EXPERIMENTS**  
1. Sampling Techniques  
2. Sterilization Techniques  
3. Preparation of culture media  
4. Isolation of micro-organisms (Air, water, soil, sediment)  
5. Isolation of anaerobic sediments (Sewage sediments)  
6. Isolation of yeast (Sediment)  
7. Purification of micro-organisms  
8. Cultural characteristics of bacteria  
9. Simple staining  
10. Negative staining  
11. Differential staining  
12. Acid-fast staining  
13. Coliform test  
14. MPN test

**TOTAL: 45 PERIODS**
OUTCOMES:
The students completing the course will have
  ● ability to collect water samples for microbial analysis
  ● ability to prepare bacterial culture, do sterilization, isolate and culture microorganisms
  ● ability to determine cultural characteristics of bacteria

REFERENCES:

LIST OF EQUIPMENT 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>Incubator</td>
<td>1 No</td>
</tr>
<tr>
<td>2.</td>
<td>Incubator Shaker</td>
<td>3 Nos</td>
</tr>
<tr>
<td>3.</td>
<td>Microscopes</td>
<td>5 Nos</td>
</tr>
<tr>
<td>4.</td>
<td>Micropipettes</td>
<td>3 in each volume</td>
</tr>
<tr>
<td>5.</td>
<td>Colony counter</td>
<td>1 No</td>
</tr>
<tr>
<td>6.</td>
<td>Anaerobic jar</td>
<td>2 Nos</td>
</tr>
<tr>
<td>7.</td>
<td>Laminar hood</td>
<td>1 No</td>
</tr>
<tr>
<td>8.</td>
<td>Chemicals</td>
<td>1 lot</td>
</tr>
<tr>
<td>9.</td>
<td>Petty dishes</td>
<td>5 Nos</td>
</tr>
<tr>
<td>10.</td>
<td>Innoculum loops</td>
<td>5 Nos</td>
</tr>
<tr>
<td>11.</td>
<td>Glass slides</td>
<td>5 Nos</td>
</tr>
<tr>
<td>12.</td>
<td>China dish</td>
<td>10 Nos</td>
</tr>
<tr>
<td>13.</td>
<td>Staining Kit</td>
<td>5 Nos</td>
</tr>
<tr>
<td>14.</td>
<td>Refrigerator</td>
<td>1 No</td>
</tr>
</tbody>
</table>

EN6501 MUNICIPAL SOLID WASTE MANAGEMENT

OBJECTIVES:
  ● To make the students conversant with different aspects of the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

UNIT I SOURCES AND TYPES
Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management – Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO’s.

UNIT II ON-SITE STORAGE AND PROCESSING

UNIT III COLLECTION AND TRANSFER
Methods of Residential and commercial waste collection – Collection vehicles – Manpower–Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.
UNIT IV  OFF-SITE PROCESSING
Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V  DISPOSAL
Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor– Dumpsite Rehabilitation

OUTCOMES:
The students completing the course will have
- an understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management
- ability to plan waste minimisation and design storage, collection, transport, processing and disposal of municipal solid waste

TEXTBOOKS:

REFERENCES:
2. Bhide A.D. and Sundaresan, B.B. Solid Waste Management Collection, Processing and Disposal, 2001

EN6502  AIR AND NOISE POLLUTION CONTROL  L T P C 3 0 0 3

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

UNIT I  GENERAL
Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality management in India.

UNIT II  SOURCES, CLASSIFICATION AND EFFECTS
Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods.
Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.
UNIT III  SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING  9

UNIT IV  AIR POLLUTION CONTROL MEASURES  9
Control - Source correction methods - Control equipments - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator - scrubbers - Control of gaseous emissions - Absorption - Absorption equipments - adsorption and combustion devices (Theory and working of equipments only).

UNIT V  NOISE POLLUTION AND ITS CONTROL  9
Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent

TOTAL: 45 PERIODS

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:
2. Air Pollution act, India, 1981
4. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
UNIT II WATER (P&CP) ACT, 1974  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 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 OTHER TOPICS  7
Relevant Provisions of Indian Forest Act, Public Liability Insurance Act, CrPC, IPC - Public Interest Litigation - Writ petitions - Supreme Court Judgments in Landmark cases.

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.

EN6504 BASIC STRUCTURAL DESIGN  L T P C  2 0 3 4

OBJECTIVES:
- 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 AND PLANNING  9
UNIT II  LIMIT STATE DESIGN FOR FLEXURE  9
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 III  LIQUID STORAGE STRUCTURES  9
RC Water Tanks- Circular and Rectangular – Design and Drawing – Hemispherical Bottomed Steel Water Tank – Design and Drawing.

UNIT IV  RETAINING WALLS  9
Design and Detailing of RC Cantilever and Counterfort Retaining Walls – Horizontal Backfill with Surcharge – Design of Shear Key.

UNIT V  INDUSTRIAL STRUCTURES  9

TOTAL (L:30+P:45): 75 PERIODS

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

TEXTBOOKS:

CE6567  HYDROLOGY AND WATER RESOURCES ENGINEERING  L T P C
3 0 0 3

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

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  

TEXTBOOKS:  

REFERENCES:  

EN6505  OCCUPATIONAL HAZARDS AND INDUSTRIAL SAFETY  

OBJECTIVES:  
- To introduce the occupational hazards, industrial safety issues, control measures and emergency procedures.  

UNIT I  INDUSTRIAL ATMOSPHERIC CONTAMINANTS AND HEALTH HAZARDS  

UNIT II  INDUSTRIAL TOXICOLOGY AND INDUSTRIAL HYGIENE SURVEY  

UNIT III  INDUSTRIAL VENTILATION  
Industrial Ventilation - general principles of air flow - general dilution ventilation - comfort ventilation. Local exhaust ventilation - principles of hood and duct design - duct system design - fans.  

UNIT IV  CONTROL MEASURES  
Air cleaning Devices - relative efficiencies - Testing of local exhaust ventilation systems. 25 Industrial Noise Control - general engineering principles of control - standards  

UNIT V  INDUSTRIAL ILLUMINATION AND INDUSTRIAL PLANT SANITATION  
Industrial illumination - glare – types & levels of illumination. Industrial plant sanitation - housekeeping - worker facilities.
OUTCOMES:
The students completing the course will have
- an understanding of industrial toxicology, health hazards of industrial environment and control measures
- ability to recognise and report industrial hazards, follow safe work practices and participate in hazard inspection
- Understanding of emergency procedures, safety law and employer and employee responsibilities

TEXTBOOKS:
1. Patty, "Industrial Hygiene and Toxicology", Wiley Inter science, 1979.

REFERENCE:
1. Industrial Ventilation Manual, American Conference of Government Industrial Hygienists, 1993

EN6511 AIR AND NOISE POLLUTION LABORATORY L T P C
0 0 3 2

OBJECTIVES:
- To expose the students to the methods for monitoring of ambient air quality, ambient noise and demonstration of stack monitoring.

LIST OF EXPERIMENTS
1. Particulate Sampling – Dust Fall, Pollution Suspended Particulates and Total Particulate Matters using High Volume Sampler / Respirable Dust Sampler.
2. Experiment on Respirable Dust – Estimating RPM.
3. Estimating Sulphur Dioxide, NOx in Ambient Air Using High Volume Air Sampler.
4. Stack Sampling Techniques and Demonstration of Stack Monitoring.
5. Exercises on Ambient Gas Monitoring including CO & VOC.
6. Demonstration / Exercises on Air Pollution Control Devices – Bag Filter, Scrubber, Cyclone and ESP.
9. Exercises on Luxmeter (Light Intensity measuring Instrument)
10. Demonstration on Wind Monitoring and Analysis of Data for Windrose Diagrams.
11. Demonstration of Rain Gauges.

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have
- ability to conduct ambient air quality survey including the use of high volume air sampler, Respirable Dust Sampler, wind monitoring and noise monitoring
- ability to demonstrate stack sampling, auto exhaust monitoring, use of rain gauges and Light Intensity measurements

REFERENCES:
LIST OF EQUIPMENT 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>High volume sampler with impinger attachments facility</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Fine particulate sampler</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Stac monitoring kit</td>
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</tr>
<tr>
<td>4.</td>
<td>CO and VOC analyser</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Flue gas analyser</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Noise level meter</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Lux meter</td>
<td>2</td>
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</tbody>
</table>

GE6674 COMMUNICATION AND SOFT SKILLS- LABORATORY BASED

<table>
<thead>
<tr>
<th>L</th>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

OBJECTIVES:
To enable learners to,
- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

UNIT I LISTENING AND SPEAKING SKILLS
Conversational skills (formal and informal) - group discussion - making effective presentations using computers, listening/watching interviews, conversations, documentaries. Listening to lectures, discussions from TV/Radio/Podcast.

UNIT II READING AND WRITING SKILLS
Reading different genres of tests ranging from newspapers to creative writing. Writing job applications - cover letter - resume - emails - letters - memos - reports. Writing abstracts - summaries - interpreting visual texts.

UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS
International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service (Language related) - Verbal Ability.

UNIT IV INTERVIEW SKILLS
Different types of Interview format - answering questions - offering information - mock interviews - body language (paralinguistic features) - articulation of sounds - intonation.

UNIT V SOFT SKILLS
Motivation - emotional intelligence - Multiple intelligences - emotional intelligence - managing changes - time management - stress management - leadership - straits - team work - career planning - intercultural communication - creative and critical thinking

TOTAL: 60 PERIODS

Teaching Methods:
1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.

4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.

5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for grazing proficiency and better participation in the class.

Lab Infrastructure:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description of Equipment (minimum configuration)</th>
<th>Qty Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Server</strong></td>
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</tr>
<tr>
<td></td>
<td>• PIV System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 1 GB RAM / 40 GB HDD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• OS: Win 2000 server</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Audio card with headphones</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• JRE 1.3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>Client Systems</strong></td>
<td>60 Nos.</td>
</tr>
<tr>
<td></td>
<td>• PIII or above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 256 or 512 MB RAM / 40 GB HDD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• OS: Win 2000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Audio card with headphones</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• JRE 1.3</td>
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</tr>
<tr>
<td>3</td>
<td><strong>Handicam</strong></td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Television 46”</strong></td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td><strong>Collar mike</strong></td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td><strong>Cordless mike</strong></td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Audio Mixer</strong></td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td><strong>DVD recorder/player</strong></td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td><strong>LCD Projector with MP3/CD/DVD provision for Audio/video facility</strong></td>
<td>1 No.</td>
</tr>
</tbody>
</table>

Evaluation:

**Internal: 20 marks**

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

**External: 80 marks**

- Online Test - 35 marks
- Interview - 15 marks
- Presentation - 15 marks
- Group Discussion - 15 marks
Note on Internal and External Evaluation:

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

OUTCOMES:

At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

REFERENCES:

2. Graded Examinations in Spoken English and Spoken English for Work downloadable materials from Trinity College, London.
4. Interactive Multimedia Programs on Managing Time and Stress.

Web Sources:

http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
http://www.washington.edu/doit/TeamN/present_tips.html
http://www.oxforddictionaries.com/words/writing-job-applications
http://www.kent.ac.uk/careers/cv/coveringletters.htm
http://www.mindtools.com/pages/article/newCDV_34.htm

EN6601 WASTEWATER ENGINEERING L T P C 3 0 0 3

OBJECTIVES:

- To impart knowledge on characteristics of sewage, primary and secondary treatment of sewage as well as disposal of sludge and treated wastewater.

UNIT I QUANTITY, COLLECTIONS AND CONVEYANCE 9
Necessity and objectives of sanitary engineering projects - Definitions - systems of sewerage - quantity of sewage - Fluctuations in flow pattern - Estimation of storm runoff -

UNIT II QUALITY OF SEWAGE AND PRIMARY TREATMENT 8
Characteristics and composition of sewage - physical and chemical analysis - DO, BOD, COD and their significance - cycles of decomposition - Objectives and basic principles of sewage treatment - primary treatment - screens - Grit chamber - settling tank - principles of sedimentations - Design of settling tanks.

UNIT III BIOLOGICAL TREATMENT OF SEWAGE 12
Basic principles of biological treatment - trickling filters - Description and principles of operation of standard / high rate filters - recirculation - activated sludge process - diffuser / Mechanical aeration - Conventional, high rate and extended aeration process - oxidation pond - stabilization ponds - aerated lagoons - SBR, MBR, MBBR.

UNIT IV SLUDGE MANAGEMENT 8
Objectives of sludge treatment - properties and characteristics of sludge - Thickening - sludge digestion - drying beds - conditioning and dewatering - sludge disposal - elutriation.

UNIT V SEWAGE DISPOSAL AND HOUSE DRAINAGE 8
Methods - dilution method - self purification of streams - oxygen sag curve - water quality modeling - land disposal - Eutrophication - recycle & reuse of waste effluents. House drainage - Sanitary fixtures / fittings - one pipe system, two pipe system, etc. - General layout of house drainage - street connections. Septic tanks and effluent disposal system

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have
- ability to estimate sewage generation and design sewer system including sewage pumping stations
- an understanding on the characteristics and composition of sewage, self purification of streams
- ability to perform basic design of the unit operations and processes that are used in sewage treatment
- ability to plan house drainage including onsite wastewater treatment and disposal

TEXTBOOKS:

REFERENCES:
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

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 particluar reference to monitoring of water and air quality

TEXTBOOKS:

REFERENCES

OBJECTIVES:
- To introduce the fundamentals of remote sensing and its applications in the field of environmental engineering.
UNIT I  FUNDAMENTALS OF REMOTE SENSING

UNIT II  AERIAL PHOTOGRAPHY AND SATELLITE REMOTE SENSING

UNIT III  DATA ANALYSIS AND GIS
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
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
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:

MG6851  PRINCIPLES OF MANAGEMENT  L T P C  3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.
UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS


UNIT II PLANNING


UNIT III ORGANISING


UNIT IV DIRECTING


UNIT V CONTROLLING

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

OUTCOMES:

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXTBOOKS:


REFERENCES:


EN6604 CLEANER PRODUCTION

L T P C

3 0 0 3

OBJECTIVES:

- To introduce the importance, and different approaches of cleaner production in industries and to impart knowledge on environmental management tools applying cleaner production principle.
UNIT I  INTRODUCTION
Sustainable development – Indicators of Sustainability – Sustainability Strategies - Barriers to Sustainability – Industrial activities and Environment – Industrialization and sustainable development – Industrial Ecology – Cleaner Production (CP) in Achieving Sustainability – Prevention versus Control of Industrial Pollution – Environmental Policies and Legislations – Regulation to Encourage Pollution Prevention and Cleaner Production – Regulatory versus Market Based Approaches.

UNIT II  CLEANER PRODUCTION

UNIT III  CLEANER PRODUCTION PROJECT DEVELOPMENT & IMPLEMENTATION

UNIT IV  SUPPORT INSTRUMENTS OF PREVENTION METHODS

UNIT V  CASE STUDIES
Industrial Applications of CP, LCA, EMS and Environmental Audits.

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have
- ability to describe and comment the evolution of corporate environmental management strategies and its relation to the concept of sustainable development
- ability to describe Cleaner Production measures applicable to different industries
- ability to conduct energy and material balances for processes as part of a Cleaner Production assessment

TEXTBOOKS:

REFERENCES:

Web Sources
OBJECTIVES:
- 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 : 45 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 EQUIPMENT 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>
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</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>GC</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>Glasswares such as Pipette, Burette etc</td>
<td>1 for each student</td>
</tr>
</tbody>
</table>

ENV6612 ENVIRONMENTAL ENGINEERING DESIGN AND DRAWING L T P C 0 0 3 2

OBJECTIVES:
- 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. Layout of Water treatment plant
2. Sedimentation tank
3. Clariflocculator
4. Slow and rapid sand filters
5. Primary and secondary settling tanks
6. Trickling filter
7. Activated sludge process
8. Sludge digestion tank
9. Septic tank with dispersion trench and soak pit.
10. Infiltration gallery and pumping station.
11. Flow chart of ETP for selected Industries.
12. Flow Chart for CETP.

TOTAL : 45 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
OBJECTIVES:
- To train the students on using GIS softwares for simple applications in environmental engineering and water resources engineering.

GIS SOFTWARES:
- Arc GIS 9.02.
- ERDAS 8.73.
- Mapinfo 6.5
- Open source.

LIST OF EXPERIMENTS:
- Digitization of Map/Toposheet
- Creation of thematic maps.
- Study of features estimation
- Developing Digital Elevation model
- Simple applications of GIS in Environmental Engineering.
- Simple applications of GIS in water Resources Engineering.
- Simple applications of GIS in Ground water Engineering.
- Simple applications of GIS in Air Pollution.
- Simple applications of GIS in water Quality Management.

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have
- ability to carryout digitization of maps, create thematic maps and apply them for applications to Environmental Engineering, water quality management and air pollution control.

REFERENCE:

LIST OF EQUIPMENT 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</td>
<td>1 system for 2 students</td>
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<tr>
<td>2.</td>
<td>GIS software</td>
<td>minimum 5 user license</td>
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<td>3.</td>
<td>A4 / A3 size</td>
<td>Scanner – 1 no</td>
</tr>
<tr>
<td>4.</td>
<td>A4/A3 size</td>
<td>Printer / Plotter – 1 no</td>
</tr>
</tbody>
</table>

OBJECTIVES:
- 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  9

UNIT III  SUSTAINABLE DEVELOPMENT INDICATORS  9
Need for indicators – Statistical procedures – Aggregating indicators – Use of principal component analysis – Three environmental quality indices.

UNIT IV  ENVIRONMENTAL ASSESSMENT  9

UNIT V  ENVIRONMENTAL MANAGEMENT AND SOCIAL DIMENSIONS  9

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:

EN6702  DESIGN OF ENVIRONMENTAL ENGINEERING STRUCTURES  L T P C 3 0 0 3

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  9
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  9
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  9
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  9
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  9
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

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:

EN6703  HAZARDOUS WASTE MANAGEMENT  L T P C  3 0 0 3

OBJECTIVES:
- To impart knowledge on the identification, characterization, source reduction, storage, transport, processing and safe disposal of hazardous wastes.

UNIT I  WASTE IDENTIFICATION AND CHARACTERISATION  9
Hazardous waste definition - Physical and Health hazards wastes – Hazardous Waste Management and Handling Rules – Characterization of hazardous wastes - Analytical– Analytical methods –Hazardous waste inventory- Source reduction of hazardous wastes
UNIT II  STORAGE, TRANSPORT AND PROCESSING OF WASTES

UNIT III  SECURE LANDFILLS
Hazardous waste landfills - Site selections – landfill design and operation - Regulatory aspects – Liner System- Cover system- Leachate Collection and Management – Environmental Monitoring System- Landfill Closure and post closure care

UNIT IV  REMEDIATION OF CONTAMINATED SITES
Contaminated sites – Site Assessment – Remediation Technologies – Onsite and off site remediation techniques - Bioremediation- Phyto remediation- Physico chemical techniques, Soil flushing - Pump and treat systems – restoration of remediated sites

UNIT V  SPECIAL HAZARDOUS WASTES
Biomedical waste – Definition – Sources – Classification – Collection - Segregation Treatment and disposal – National Regulatory framework
Radioactive waste: Definition – Sources - Low level and high level radioactive wastes and their management - Radiation standard by ICRP and AERB.- National Regulatory framework
Lead Acid Batteries: Generation, impacts and management - National Regulatory framework

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

TEXTBOOKS:

REFERENCES:
4. Guidelines and criteria for hazardous waste landfills and hazardous waste treatment disposal facilities, Central Pollution Control Board, New Delhi, 2010
OBJECTIVES:
- 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

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:
EN6711  PLANT LAY OUT DESIGN  L T P C  0 0 3 2

OBJECTIVES:
- To develop skills in design and layouts for various environmental engineering projects.

LIST OF EXPERIMENTS:
1. Layout design for water treatment plants including HFD and PID
2. Layout design for sewage treatment plants including HFD and PID
3. Layout of effluent treatment plant for Textile industry water
4. Layout of effluent treatment plant for Sugar mill waste
5. Layout of effluent treatment plant for distilleries industry waste
6. Layout of effluent treatment plant for Dairy industry waste
7. Layout of effluent treatment plant for Tanning industry waste
8. Layout of effluent treatment plant for Pulp and paper mill waste
9. Layout of effluent treatment plant for pharmaceutical industry waste
10. Layout of effluent treatment plant for Metal finishing industry waste
11. Fertilizer industrial waste
12. Common Effluent Treatment Plants including reclamation for textile industry

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have
- ability to design layouts for various environmental engineering projects for wastewater and effluent treatment

REFERENCES:
2. Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 1993

CE6611  ENVIRONMENTAL ENGINEERING LABORATORY  L T P C  0 0 3 2

OBJECTIVES:
- 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: 45 PERIODS
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
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<tbody>
<tr>
<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>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Sodium Potassium Analyzer – Flame Photometer</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Gas Chromatography</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Atomic absorption spectroscopy (Ni, Zn, Pb)</td>
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</tr>
<tr>
<td>7.</td>
<td>Nephlo - turbidimeter</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>BOD Analyser</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>COD Analyser</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>Jar Test Apparatus</td>
<td>1</td>
</tr>
</tbody>
</table>

OUTCOMES:
- The students completing the course will have ability to conduct characterization of wastewater and able to do treatability studies.

REFERENCE:

EN6712 INDOUSRIAL SAFETY LABORATORY L T P C 0 0 3 2

OBJECTIVES:
- 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 9

UNIT II AMBIENT AIR POLLUTION AND EXHAUST GAS MEASUREMENT AND ANALYSIS 10

UNIT III STUDY ON PERFORMANCE MONITORING OF WATER AND WASTEWATER TREATMENT PLANTS 9

UNIT IV STUDY OF PERSONAL PROTECTIVE EQUIPMENT 8
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 \(( \text{CO}_2)\), 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

LIST OF EQUIPMENT 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>
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</tbody>
</table>

EN6801  ENVIRONMENTAL IMPACT ASSESSMENT

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

UNIT I  INTRODUCTION
Impact of development projects – Sustainable development- Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA-Stages of EIA, Types of EIA

UNIT II  METHODOLOGIES
Methods of EIA – Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives

UNIT III  PREDICTION AND ASSESSMENT
Assessment of Impact on land, water, air, social & cultural activities and on flora & fauna- Mathematical models- Public participation

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. Post project monitoring
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:

EN6811  PROJECT WORK
L T P C
0 0 12 6

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.

OUTCOMES:
• 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.

EN6001  WEALTH FROM WASTE
L T P C
3 0 0 3

OBJECTIVES:
• To impart knowledge on waste recycling and resource recovery from wastes.
UNIT I  INTRODUCTION  9

UNIT II  FLY ASH  9

UNIT III  PLASTIC WASTE, INDUSTRIAL WASTE  9

UNIT IV  BIO FUELS & BIO ETHANOL  9

UNIT V  WASTE WATER  9
Introduction reuse- Quality, the basic treatment processes - Benefits of reuse in agriculture - The costs of reuse projects and economic justification - Factors essential for the success of reuse projects- Case study.

TOTAL : 45 PERIODS

OUTCOMES:
The students completing the course will have the ability to
• discuss issues related to recycling and resource recovery from wastes and wastewater
• develop management plans for fly ash, plastic wastes
• recover biofuel from wastes and biomass

TEXTBOOK:

REFERENCES:

EN6002  GREEN BUILDING DESIGN  L T P C
2 0 2 3

OBJECTIVES:
• To introduce the different concepts of sustainable design and green building techniques and how they may be synthesized to best fit a specific construction project

UNIT I  INTRODUCTION  8

UNIT II  ENERGY EFFICIENT BUILDINGS  7
Passive cooling and day lighting - Active solar and photovoltaic- Building energy analysis methods- Building energy simulation- Building energy efficiency standards- Lighting system design- Lighting economics and aesthetics- Impacts of lighting efficiency - Energy audit and energy targeting- Technological options for energy management.
UNIT III  INDOOR ENVIRONMENTAL QUALITY MANAGEMENT 8

UNIT IV  GREEN BUILDING CONCEPTS 7
green building concept- Green building rating tools- Leeds and IGBC codes. - Material selection- Embodied energy- Operating energy- Façade systems- Ventilation systems- Transportation- Water treatment systems- Water efficiency- Building economics

UNIT V  GREEN BUILDING DESIGN CASE STUDY 30
Students to work through a controlled process of analysis and design to produce drawings and models of their own personal green building project. Topics include building form, orientation and site considerations; conservation measures; energy modeling; heating system and fuel choices; renewable energy systems; material choices; and construction budget. Students will research green construction and design in a particular construction context and report their results to the class.

TOTAL (L:30+P:30): 60 PERIODS

OUTCOMES:
The students completing the course will have ability to
- describe the concepts of sustainable design and green building techniques including energy efficiency and indoor environmental quality management
- create drawings and models of their own personal green building project

TEXTBOOKS:

REFERENCES:
2. Energy Conservation Building Codes: www.bee-india.nic.in

EN6003  PROCESS SAFETY AND LOSS PREVENTION  L T P C 3 0 0 3

OBJECTIVES:
- To introduce the different occupational hazards, safety issues, safety management, regulation and accident prevention technique.

UNIT I  OCCUPATIONAL HEALTH HAZARD 9

UNIT II  OCCUPATIONAL SAFETY 9
UNIT III  ACCIDENT PREVENTION  9

UNIT IV  SAFETY MANAGEMENT SYSTEMS LEGISLATIONS  9

UNIT V  SAFETY MEASURES  9
Plant Layout for Safety- Design and location- Distance between hazardous units- Lighting- colour coding- Pilot plant studies- Housekeeping- Accidents Related with Maintenance of Machines- Work Permit System- Significance of Documentation Directing Safety- Definition- Process- Principles and Techniques Leadership- Role, function and attribution of a leader Case studies- Involving implementation of health and safety measures in Industries.

TOTAL : 45 PERIODS

OUTCOMES:
The students completing the course will have ability to
- describe the different occupational safety issues and safety management system requirements
- develop safety management plans incorporating safety measures and accident prevention techniques

TEXTBOOKS:

REFERENCES:
1. Industrial Safety - National Council of India, 2013
2. Factories Act with Amendments, Govt. of India Publications DGFASLI, Mumbai, 1987

EN6004  WIND POWER ENGINEERING  L T P C
3 0 0 3

OBJECTIVES:
- To impart an understanding of windpower measurements, wind data analysis, wind turbine specifications, engineering and economic analysis of wind turbine power plants.

UNIT I  INTRODUCTION  9

UNIT II  MEASUREMENTS AND ANALYSIS  10
Instrumentation for wind measurements-Wind data analysis-Wind resource estimation-Wind sensing systems-Recording systems-Power extracted from wind -Power curve -Velocity duration curve-wind characteristics and site selection -linear momentum theory-power coefficient- Betz limit.
UNIT III AERODYNAMICS AND COMPONENTS

UNIT IV WIND TURBINES AND GENERATING SYSTEM

UNIT V ECONOMIC ANALYSIS

OUTCOMES:
The students completing the course will have ability to
- describe the concepts of atmospheric stability and wind mechanics
- measure and analyse wind patterns
- specify the aerodynamics and engineering components of wind turbines and power systems
- conduct economic and environmental assessment of wind power plants

TEXTBOOKS:

REFERENCES:

EN6005 WATER POWER ENGINEERING

OBJECTIVES:
- To impart an understanding of hydropower measurements, hydrograph analysis, hydraulic turbine specifications, engineering and economic analysis of hydro power plants.

UNIT I BASIC HYDRO POWER CONCEPTS
Hydrological cycle - Selection of site-Run off - Factors affecting runoff - Hydrograph and flow duration curve - Mass curve - Storage and pondage - Advantages and disadvantages of water power - Potential of hydropower in India- Its development and future prospect.

UNIT II LAYOUT

UNIT III HYDRAULIC TURBINES
Types - Selection factors -Turbine size - Pelton wheel - Francis turbine - Propeller turbine-Kaplan turbine - Bulb turbine - Scale ratio - Comparison of turbines - Governing of hydraulic turbines.

UNIT IV TYPES OF HYDRO POWER PLANTS
Classification of hydro plants - Run-of - River plants -Valley dam plants - High head diversion plants - Diversion Canal Plants - Pumped storage plants -Tidal power plants - Small and Mini
hydro power system: Introduction - Site development - Generation and electrical equipment-System of regulation of hydroelectric power in India.

UNIT V ECONOMIC ANALYSIS 9
Cost of hydro plants - Combined hydro and steam plant - Plant selection-Equipment selection - Economic factors -National water grid - Case studies - Potential of small hydro power in North East India -Hydro power projects in Western Himalayas.

TOTAL : 45 PERIODS

OUTCOMES:
The students completing the course will have ability to
- describe the different concepts relevant to hydropower engineering
- design essential elements of hydropower plant
- conduct economic and environmental assessment of hydro power plants

TEXT BOOKS:

REFERENCES:
1. Dr.Sharma P.C, Kataria S. K. & Sons, "Power Plant Engineering" 2009

EN6006 TIDAL ENGINEERING

OBJECTIVES:
- To understand and solve tidal hydraulic problems related to estuarine dynamics, environmental issues and tidal power generation.

UNIT I INTRODUCTION TO ESTUARIES 9

UNIT II HYDRODYNAMIC ANALYSIS OF ESTUARIES 9
Factors influencing hydrodynamics. Tides, freshwater inflow, salinity, Coriolis’s force. Solution methods – analytical methods, numerical and physical models, hybrid methods.

UNIT III SEDIMENTATION OF ESTUARIES 9

UNIT IV ENVIRONMENTAL CONSIDERATIONS 9
Water quality, biological considerations. Dredging effects. Environmental data collection and analysis. Mitigation decision analysis.

UNIT V TIDAL POWER 9

TOTAL: 45 PERIODS
OUTCOMES:
The students completing the course will have ability to
- describe the different concepts relevant to tidal power engineering
- design essential elements of tidal power plant
- conduct economic and environmental assessment of tidal power plants

TEXTBOOKS:

REFERENCES:

EN6007 CLIMATE CHANGE

OBJECTIVES:
- To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

UNIT I INTRODUCTION

UNIT II ELEMENTS RELATED TO CLIMATE CHANGE
Green house gases - Total carbon dioxide emissions by energy sector – industrial, commercial, transportation, residential – Impacts – air quality, hydrology, green space - Causes of global and regional climate change – Changes in patterns of temperature, precipitation and sea level rise – Greenhouse effect

UNIT III IMPACTS OF CLIMATE CHANGE
Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas

UNIT IV MITIGATING CLIMATE CHANGE

UNIT V ALTERNATE FUELS AND RENEWABLE ENERGY

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

- an insight into carbon cycle, physical basis of the natural greenhouse effect, including the meaning of the term radiative forcing, climate change, global warming and measures to adapt and to mitigate the impacts of climate change
- understanding on the growing scientific consensus established through the IPCC as well as the complexities and uncertainties
- ability to plan climate change mitigation and adaptation projects including the use of alternate fuels and renewable energy

TEXTBOOKS:

REFERENCES:
2. Thomas E, Lovejoy and Lee Hannah “Climate Change and Biodiversity”, TERI Publishers, 2005

EN6008 GROUNDWATER CONTAMINATION

OBJECTIVES:

- To impart knowledge on groundwater movement, development of ground water resources hydro chemical behaviour of contaminants and the principles involved in contaminant transport through groundwater.

UNIT I INTRODUCTION
Ground water and the hydrologic cycles- Ground water as a resource- Ground water contamination- Ground water as a geotechnical problem- Ground water and geologic processes- Physical properties and principles- Darcy’s law- Hydraulic head and fluid potential- Piezometers and nests.

UNIT II OCCURANCE AND MOVEMENT OF GROUND WATER

UNIT III RESOURCE EVALUATION
Development of ground water resources- Exploration of Aquifers- The response of ideal aquifers to pumping- Measurement of parameters- Laboratory tests- Numerical simulation for aquifer yield prediction- Artificial recharge and induced infiltration- Land subsidence- Sea water intrusion.

UNIT IV CHEMICAL PROPERTIES AND PRINCIPLES
Constituents- Chemical equilibrium- Association and dissociation of dissolved species- Effects of concentration gradients- Mineral dissolution and solubility- Oxidation and reduction process-ion exchange and adsorption- Environmental isotopes- Field measurement of index parameters- Chemical evolution- Ground water in carbonate terrain- Ground water in crystalline rocks- Ground water in complex sedimentary systems- Geotechnical interpretation of 14C dates- Process rates and molecular diffusion.
UNIT V SOLUTE TRANSPORT

TOTAL : 45 PERIODS

OUTCOMES:
The students completing the course will have the ability to

- explain the different hydro dynamic principles of groundwater flow, contamination and solute transport
- evaluate groundwater resources
- apply groundwater contaminations models

TEXTBOOKS:

REFERENCES:

EN6009 EPIDEMIOLOGY AND CONTROL OF COMMUNICABLE DISEASES

OBJECTIVES:
- To impart knowledge on diseases transmitted through air, water, food, vectors and pollution sources as well as major components of health services

UNIT I GENERAL

UNIT II RESPIRATORY, WATER, AND FOOD BORNE DISEASES
Respiratory diseases - Definition - Group - control of source.Water and Food borne diseases - General reservoir of infection – agents - food decomposition - vehicle or transmission of diseases - control of water and food-borne diseases.

UNIT III INSECT BORNE DISEASES
Insect borne diseases and Zoo noses – Infections from mosquitoes, house flies, rats, louse, pubic louse and other insects - General, insect borne diseases, zoo noses and their spread - control at source - control of mode of transmission.

UNIT IV MISCELLANEOUS DISEASES AND ILLNESSES
UNIT V ASPECTS OF HEALTH SERVICES
The Organization of Health services – Tasks for the health services - the major components of health services (curative, preventive, special services, statistics and health education) - resources for the health services – community participation in health services. Declaration of ALMA-ATA.

OUTCOMES:
The students completing the course will have the ability to
• explain the different types of diseases transmitted through air, water, food, vectors and other diseases associated with pollution.
• outline the dynamics of disease transmission and different aspects of health services

TEXTBOOK:

REFERENCES:

EN6010 LOW CARBON ECONOMY LT P C
3 0 0 3

OBJECTIVES:
• To impart knowledge on different sources of carbon emission, carbon reduction opportunities, low carbon technologies and Indian Missions on Climate Change

UNIT I CARBON EMISSION
Sources – Primary sectors – Agriculture, Livestock, Forestry – Mining, Secondary sectors – metal processing – non metallic product processing, wood processing – paper and pulp making – food processing, Tertiary sectors – Transportation services, health services

UNIT II CARBON REDUCTION OPPORTUNITIES

UNIT III LOW CARBON TECHNOLOGIES

UNIT IV ENERGY EFFICIENT PROGRAMMES
Good housekeeping practices – Regulation and/standards – Industrial cogeneration – Fiscal policies – Agreement/targets – Energy audits – Research and Development

UNIT V INTEGRATED ENERGY POLICY

TOTAL: 45 PERIODS
OUTCOMES:
The students completing the course will have the ability to
• Identify sources of carbon emissions and outline the carbon reduction opportunities, low carbon technologies
• Develop energy efficient programmes and integrated energy policy in line with national and global approach to climate change mitigation.

TEXTBOOKS:

REFERENCES:

EN6011 URBAN AND RURAL SANITATION LT P C 3 0 0 3

OBJECTIVES:
• 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 9
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:

REFERENCES:

EN6012  URBAN AND RURAL PLANNING  L T P C
3 0 0 3

OBJECTIVES:
The students completing the course will have the ability to
- describe basic issues in urban planning
• formulate plans for urban and rural development
• plan and analyse socio economic aspects of urban and rural planning

TEXTBOOKS:

REFERENCES:
2. Singh.V.B. Revitalized, “Urban administration in India”, Kalpaz publication, Delhi, 2001
5. Vasant desai, Rural development (Vol. I to VI) in the seventh plan, Himalaya Publishing Co. 1988

EN6013 SOLAR ENERGY LT PC
3 0 0 3

OBJECTIVES:
• To expose the students with the different aspects of measurement, harvesting and utilization of solar energy.

UNIT I INTRODUCTION

UNIT II SOLAR CELLS
Various generations- Semiconductor materials- Doping- Fermi level- PN junction and characteristics- Photovoltaic effect- Photovoltaic material- Parameters of solar cells- Effects of cell temperature on cell efficiency- Types of solar cells- Solar modules and arrays- Advantages and limitations of solar energy system- Solar cell power plant- Silicon, thin film and polymer processing- Silicon wafer based solar cells.

UNIT III SOLAR THERMAL ENERGY

UNIT IV SOLAR PHOTOVOLTAICS
UNIT V ECONOMIC ANALYSIS

OUTCOMES:
The students completing the course will have the ability to
- assess solar energy potential
- describe different direct and indirect solar energy tapping systems including Solar Photovoltaic’s, solar cells and solar thermal power plants

TEXTBOOKS:

REFERENCES:

EN6014 SPACE TECHNOLOGY AND WASTE DISPOSAL L T P C 3 0 0 3

OBJECTIVES:
- To impart knowledge on environmental controls, life support systems, shielding strategies and waste management systems during space exploration missions

UNIT I RISK IN HUMAN SPACE EXPLORATION MISSIONS 9
Mission success: maintaining crew safety, health, and performance; carrying out key scientific goals; returning selected specimens or data; and completing public outreach activities Cost risk risk from budgetary issues, including unplanned expenditures or inadequate funding. Programmatic risk: risk created by political, management, or technical challenges - Biomedical risk: crew safety, health – Risk management schemes

UNIT II ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM OF SPACE STATIONS 9
Space Environment - Human-rated vehicle requirements - Crew health and safety- emergency provisions- oxygen regeneration for metabolic consumption- Oxygen Generation Assembly – maintenance of cabin partial pressure, temperature and humidity - air purification for particulates and VOCs– carbon dioxide reduction assembly- Fire detection and suppression subsystem- case studies

UNIT III SHIELDING STRATEGIES FOR HUMAN SPACE EXPLORATION 9
Ionosphere - Space radiation sources, models, and environmental uncertainty- Human risk models and risk uncertainty- Biological response to heavy ion exposure - human factors implications for shielding- Radiation shielding design issues- assessment of current shielding issues - integrated shield design methodologies- case studies

UNIT IV WATER RECOVERY SYSTEM FOR SPACE STATIONS 9
water recovery from crewmember urine, cabin humidity condensate and Extra Vehicular Activity (EVA) wastes - electrolysis systems for water– low pressure vacuum distillation process - Urine Processor Assembly (UPA) and a Water Processor Assembly
UNIT V 
WASTE MANAGEMENT FOR SPACE STATIONS


TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have the ability to

- discuss issues related to waste management and environmental controls in space exploration
- outline life support systems, shielding strategies and waste management systems during space exploration missions

TEXTBOOKS:


REFERENCES:


EN6015 
CLIMATOLOGY AND METEOROLOGY

OBJECTIVES:

- To expose the students the various aspects of Climatology and Meteorology.

UNIT I 
EARTH’S CLIMATE SYSTEM


UNIT II 
OBSERVED CHANGES AND ITS CAUSES

Observation of Climate Change- Changes in patterns of temperature- Precipitation and sea level rise- Observed effects of Climate Changes- Patterns of Large scale Variability- Drivers of Climate change- Climate Sensitivity and Feedbacks- The Montreal Protocol- UNFCCC- IPCC- Evidences of changes in Climate and Environment- On a Global Scale and in Indian.

UNIT III 
IMPACTS OF CLIMATE CHANGE


UNIT IV 
METEOROLOGY

UNIT V PLUME BEHAVIOR AND POLLUTANT DISPERSION

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have ability to
  • describe earth’s climate system, meteorology, observed changes in climate and its impacts
  • predict plume behavior and pollutant dispersion

TEXTBOOKS:
1. Stanley E. Manahan, “Environmental Science and Technology”, Lewis Publisher, 1997

REFERENCES:
4. IPCC, Fourth Assessment Report- the AR4 synthesis report.

EN6016 SITE ASSESSMENT AND REMEDIATION

OBJECTIVES:
  • To introduce the fundamentals of Geo-Environmental Engineering, soil – water – contaminant interaction, waste containment system and remediation of contaminated sites.

UNIT I FUNDAMENTALS OF GEO ENVIRONMENTAL ENGINEERING
Scope of Geoenvironmental engineering- Multiphase behavior of soil- Role of soil in geoenvironmental applications- Importance of soil physics, soil chemistry, hydrogeology-Biological process- Sources and type of ground contamination- Impact of ground contamination on geo-environment- Case histories on geoenvironmental problems.

UNIT II SOIL-WATER-CONTAMINANT INTERACTION

UNIT III WASTE CONTAINMENT SYSTEM
Site selection based on environmental impact assessment- Evolution of waste containment facilities and disposal practices- Different role of soil in waste containment- Different components of waste containment system and its stability issues- Property evaluation for checking soil suitability for waste containment- Design of waste containment facilities.

UNIT IV CONTAMINANT SITE REMEDIATION
Site characterization - Risk assessment of contaminated site - Remediation methods for soil and groundwater - Selection and planning of remediation methods - Some examples of in-situ remediation.
UNIT V  ADVANCED SOIL CHARACTERIZATION  
Contaminant analysis- Water content and permeability measurements- Electrical and thermal property evaluation- Use of GPR for site evaluation- Introduction to geotechnical centrifuge modeling.

TOTAL: 45 PERIODS

OUTCOMES:  
The students completing the course will have ability to  
- describe the fundamentals of Geo-environmental engineering and waste soil interactions  
- carryout advanced soil characterisation  
- apply soil-water-contaminant interactions in the design of waste containment systems and contaminated site remediation

TEXTBOOKS:  

REFERENCES:  

EN6017  NUCLEAR ENERGY  L T P C  
3 0 0 3

OBJECTIVES:  
- To expose the students the various aspects of Nuclear energy.

UNIT I  NUCLEAR REACTIONS  

UNIT II  REACTOR MATERIALS  
Nuclear Fuel Cycles- Characteristics of Nuclear Fuels- Uranium- Production and Purification of Uranium- Conversion to UF4 and UF6- Other Fuels like Zirconium, Thorium and Beryllium.

UNIT III  REPROCESSING  

UNIT IV  SEPARATION OF REACTOR PRODUCTS  
UNIT V  WASTE DISPOSAL AND RADIATION PROTECTION
Types of Nuclear Wastes - Safety Control and Pollution Control and Abatement - International Convention on Safety Aspects - Radiation Hazards Prevention.

OUTCOMES:
The students completing the course will have ability to
- describe the nuclear reactions, design and construction of nuclear reactors and nuclear waste management practices
- choose nuclear reactor materials
- design systems to separate nuclear reactor products and dispose nuclear wastes

TEXTBOOKS:

REFERENCES:

GE 6083  DISASTER MANAGEMENT

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 (PRIs/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.

TOTAL: 45 PERIODS

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, Scenarios in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

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

GE6757 TOTAL QUALITY MANAGEMENT

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

UNIT I INTRODUCTION
### UNIT II  TQM PRINCIPLES
9
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, SS, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

### UNIT III  TQM TOOLS AND TECHNIQUES I
9
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
9

### UNIT V  QUALITY SYSTEMS
9

**TOTAL: 45 PERIODS**

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

### TEXTBOOK:

### REFERENCES:

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**EN6018  COASTAL ZONE MANAGEMENT**

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**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 ZONE
9
Coastal zone – Coastal zone regulations – Beach profile – Surf zone – Off shore – Coastal waters – Estuaries – Wet lands and Lagoons – Living resources – Non living resources.

### UNIT II  WAVE DYNAMICS
10
UNIT III WAVE FORECASTING AND TIDES

UNIT IV COASTAL PROCESSES
Erosion and depositional shore features – Methods of protection – Littoral currents – Coastal aquifers – Sea water intrusion – Impact of sewage disposal in seas.

UNIT V HARBOURS
Structures near coast – Selection of site – Types and selection of break waters – Need and mode of dredging – Selection of dredgers – Effect of Mangalore forest.

TOTAL: 45 PERIODS

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:

EN6019 ENGINEERING ECONOMICS AND COST BENEFIT ANALYSIS

OBJECTIVES:
- To impart knowledge on economic principles, project financing and cost benefit analysis

UNIT I BASIC ECONOMICS

UNIT II DEMAND AND SCHEDULE

UNIT III ORGANISATION
Forms of business - Proprietorship - Partnership- Joint stock company - Cooperative organization - State enterprise - Mixed economy - Money and banking- Banking - kinds - Commercial banks - Central banking functions- Control of credit- Monetary policy- Credit instrument.

UNIT IV FINANCING
Types of financing - Short term borrowing - Long term borrowing- Internal generation of funds- External commercial borrowings- Assistance from government budgeting support and international finance corporations- Analysis of financial statement - Balance sheet - Profit and loss account - Funds flow statement.
UNIT V COST AND BREAK EVEN ANALYSES

Types of costing: Traditional costing approach - Activity based costing - Fixed cost - Variable cost - Marginal cost - Cost output relationship in the short run and in long run - Pricing practice - Full cost pricing - Marginal cost pricing - Going rate pricing - Bid pricing - picking for a rate of return - Appraising project profitability - Internal rate of return - Payback period - Net present value - Cost benefit analysis - Feasibility reports - Appraisal process - Technical feasibility - Economic feasibility - Financial feasibility - Break even analysis - Basic assumptions - Break even chart - Managerial uses of break even analysis.

OUTCOMES:
The students completing the course will have ability to
- describe the basic concepts and terms in economics, supply demand theory, project financing options and reporting
- carry out economic feasibility analysis of projects

TEXTBOOKS:

REFERENCES:

EN6020 RISK ANALYSIS AND MANAGEMENT

OBJECTIVES:
- To impart knowledge on environmental risk assessment and risk management

UNIT I INTRODUCTION
Sources of Environmental hazards - Types of Risk-Environmental, Safety and ecological risks - Risk assessment framework - Regulatory perspectives and requirements - Risk Analysis and Management - Social benefit Vs technological risks - Path to risk analysis - Perception of risk - Risk assessment in different disciplines.

UNIT II ELEMENTS OF ENVIRONMENTAL RISK ASSESSMENT
Hazard identification and accounting - Properties, processes and parameters that control fate and transport of contaminants - - Dose Response Evaluation - Slope Factors- Dose Response calculations and Dose Conversion Factors - Risk Characterization and consequence determination - Estimation of carcinogenic and non carcinogenic risks to human health - - Exposure Assessment - Exposure Factors -Multimedia and multipathway exposure modeling of contaminant concentrations in air, water, soils and vegetation

UNIT III TOOLS AND METHODS FOR RISK ASSESSMENT
UNIT IV  RISK MANAGEMENT

UNIT V  APPLICATIONS
Case studies on risk assessment and management for hazardous chemical storage - Chemical industries - Tanneries - Textile industries- Mineral processing and Petrochemical plants - Hazardous waste disposal facilities - Nuclear power plants- contaminated site remediation - Case histories on Bhopal, Chernobyl, Seveso and Three Mile Island.

TOTAL: 45 PERIODS

OUTCOMES:
The students completing the course will have ability to
- carryout hazard identification and accounting, risk characterization and consequence determination, event tree and fault tree modeling and Probabilistic risk assessments.
- develop management plans including risk communication and emergency preparedness planning
- plan environmental risk assessment of industries and hazardous activities

TEXTBOOKS:

REFERENCES:
UNIT III HOT SPRINGS 
Hot spring system structure-Warm spring-Flow rates-High flow hot springs-Therapeutic uses-Infections-Hot springs around the world-Merits and demerits of geothermal energy-Applications of geothermal energy

UNIT IV POWER GENERATING SYSTEMS 
Single flash steam plant-Double flash steam plant-Dry steam plants-Binary cycle power plants-Advanced geothermal energy conversion systems-Environmental effects

UNIT V ADVANCEMENTS 
Advanced concepts-R&D challenges and activities-Recent progress-Commercialization and deployment activities-Market context-Case study-Larderello dry steam power plant, Italy-Mutnovsky flash steam power plant, Russia

OUTCOMES:
The students completing the course will have ability to
• describe earth-heat flow and temperature distribution and geothermal resources
• plan geothermal power plants

TEXTBOOKS:

REFERENCE:

GE6084 HUMAN RIGHTS L T P C 3 0 0 3

OBJECTIVES:
• To sensitize the Engineering students to various aspects of Human Rights.


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 Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National
Outcomes:
- Engineering students will acquire the basic knowledge of human rights.

References: