### Semester III

<table>
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<th>S.No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>Contact Periods</th>
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- **ANNA UNIVERSITY, CHENNAI**
- **AFFILIATED INSTITUTIONS**
- **B.E. ENVIRONMENTAL ENGINEERING**
- **REGULATIONS – 2017**
- **CHOICE BASED CREDIT SYSTEM**
- **III SEMESTER CURRICULUM & SYLLABI**
OBJECTIVES:

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

UNIT I PROBABILITY AND RANDOM VARIABLES

12


UNIT II TWO-DIMENSIONAL RANDOM VARIABLES

12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS

12

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

UNIT IV DESIGN OF EXPERIMENTS

12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2\textsuperscript{2} factorial design.

UNIT V STATISTICAL QUALITY CONTROL

12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES:

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

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

TEXTBOOKS:

REFERENCES:

EN8301 ENVIRONMENTAL CHEMISTRY L T P C
3 0 0 3

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

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

UNIT II AQUATIC CHEMISTRY 9
Water quality parameters- environmental significance and determination; chemicals in water and wastewater, volatilization, hydrolysis, photochemical transformation- Degradation of chemicals-Metals, complex formation, oxidation and reduction, pE – pH diagrams, redox zones – sorption- Colloids, electrical properties, double layer theory, environmental significance of colloids, coagulation.

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

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

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

TOTAL:45 PERIODS

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

REFERENCES:

EN8302 BASICS OF CHEMICAL ENGINEERING L T P C
3 0 0 3

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

UNIT I INTRODUCTION 9

UNIT II PRINCIPLES OF TRANSPORT PROCESSES 9

UNIT III CHEMICAL KINETICS AND TRANSFORMATIONS 9

UNIT IV BIOCHEMICAL ENGINEERING 9

UNIT V ENVIRONMENTAL PROCESSES AND REACTORS 9
Batch and Continuous reactors – CSTR, Plug flow tubular reactor and fluidized bed reactor – comparison between batch, CSTR, PFTR- Semi-batch reactors- Autocatalytic reactors —
Membrane reactors - Trickling bed reactors - Air lift pressure cycle bioreactor – Loop bioreactor - Types of separation process and methods – Gas-liquid separation- vapour separation-Liquid-liquid and fluid-solid separation- Membrane separation – Mechanical-Physical separation- Evaporation and Drying process.

TOTAL : 45 PERIODS

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

TEXTBOOKS:

REFERENCES:

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

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

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

UNIT II FLUID KINEMATICS AND DYNAMICS
UNIT III  FLOW THROUGH PIPES  9
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  9

UNIT V  DIMENSIONAL ANALYSIS AND MODEL STUDIES  9
Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies - Distorted Models.

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

TEXTBOOKS:

REFERENCES:

CE8393  STRENGTH OF MATERIALS  L T P C  4 0 0 4

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

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS  12
UNIT II  ANALYSIS OF PLANE TRUSSES  12
Determinate and indeterminate plane trusses – determination of member forces by method of joints, method of sections and method of tension coefficient.

UNIT III  TRANSVERSE LOADING AND STRESSES IN BEAM  12

UNIT IV  TORSION  12
Torsion formula - stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs - carriage springs.

UNIT V  DEFLECTION OF BEAMS  12
Computation of slopes and deflections in determinate beams - Double Integration method – Macaulay”s method – Area moment method – Conjugate beam method.

TOTAL : 60 PERIODS

OUTCOMES:

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

TEXTBOOKS:

REFERENCES:

CE8351  SURVEYING  L T P C
3 0 0 3

OBJECTIVES :

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

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

UNIT III  CONTROL SURVEYING AND ADJUSTMENT

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

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

TOTAL : 45 PERIODS

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

TEXTBOOKS :

REFERENCES :

8
OBJECTIVE:
- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

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

TOTAL: 60 PERIODS

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

REFERENCES:

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

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<th>Sl. No.</th>
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<td>2</td>
<td>Torsion testing machine</td>
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<td>Izod impact testing machine</td>
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OBJECTIVE:
- At the end of the course the student will possess knowledge about Survey field techniques

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

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

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

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

Tacheometry – Tangential system – Stadia system
8. Determination of Tacheometric Constants
9. Heights and distances by stadia Tacheometry
10. Heights and distances by Tangential Tacheometry

Total Station - Study of Total Station, Measuring Horizontal and vertical angles
11. Traverse using Total station and Area of Traverse
12. Determination of distance and difference in elevation between two inaccessible points using Total station

TOTAL: 60 PERIODS

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

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

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<td>3.</td>
<td>Dumpy level / Filling level</td>
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<td>Survey grade or Hand held GPS</td>
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OBJECTIVES:
The Course will enable learners to:
- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

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

UNIT II
Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III
Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

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

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

TOTAL : 30 PERIODS

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

TEXT BOOKS:
REFERENCES: