



KOLHAPUR INSTITUTE
OF TECHNOLOGY'S
**COLLEGE OF
ENGINEERING
KOLHAPUR**

**An Autonomous Institute
“A” Grade by NAAC with CGPA 3.12**

**Curriculum for
B. Tech Programme
in
Environmental Engineering
Academic Year 2018-19**

**Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur**

Teaching and Evaluation scheme for
Second Year B. Tech. Program in Environmental Engineering Semester-III

| Course Code | Course Name | Curriculum Component | Hours/Week | | | | Evaluation Scheme | | | |
|-------------|--|----------------------|------------|----------|-----------|-----------|---------------------------------------|-------|-----------------|----|
| | | | L | T | P | Credits | Component | Marks | | |
| | | | | | | | | Max | Min for passing | |
| UENV0301 | Applied Mathematics | BS | 3 | 1 | - | 4 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | | |
| UENV0302 | Environmental Chemistry & Microbiology | BS | 4 | - | - | 4 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | | |
| UENV0303 | Fluid Mechanics | PC | 3 | - | - | 3 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | | |
| UENV0304 | Structural Mechanics | PC | 3 | - | - | 3 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | | |
| UENV0305 | Building Construction Technology | PC | 3 | - | - | 3 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | | |
| UENV0361 | Audit Course I: Environmental Studies | BS | 2 | - | - | - | ESE | 50 | 20 | 40 |
| UENV0331 | Water Quality Monitoring Laboratory | BS | - | - | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE(OE) | 25 | 10 | |
| UENV0332 | Fluid Mechanics Laboratory | PC | - | - | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE(OE) | 25 | 10 | |
| UENV0333 | Strength of Materials Laboratory | PC | - | - | 2 | 1 | ISE | 25 | 10 | |
| UENV0334 | Material Testing Laboratory | PC | - | - | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE(OE) | 25 | 10 | |
| UENV0335 | Computer Aided Design Laboratory | ES | - | - | 2 | 1 | ISE | 50 | 20 | |
| | | | 18 | 1 | 10 | 22 | 500 + 300 = 800 + Audit Course | | | |

Total Credits - 22, Total Contact hours - 29

**Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur**

Teaching and Evaluation scheme for
Second Year B. Tech. Program in Environmental Engineering Semester - IV

| Course Code | Course Name | Curriculum Component | Hours/Week | | | | Evaluation Scheme | | | |
|-------------|---|----------------------|------------|----------|-----------|-----------|---------------------------------------|-------|-----------------|----|
| | | | L | T | P | Credits | Component | Marks | | |
| | | | | | | | | Max | Min for passing | |
| UENV0401 | Surveying and Geomatics | PC | 3 | - | - | 3 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | | |
| UENV0402 | Water Resources Engineering | PC | 3 | 1 | - | 4 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | | |
| UENV0403 | Building Planning and Design* | PC | 2 | - | - | 2 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE* | 50 | | |
| UENV0404 | Environmental Hydraulics | PC | 3 | - | - | 3 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | | |
| UENV0421 | Professional Elective I | PE | 3 | 1 | - | 4 | ISE I | 10 | 20 | 40 |
| | | | | | | | MSE | 30 | | |
| | | | | | | | ISE II | 10 | | |
| | | | | | | | ESE | 50 | | |
| UENV0462 | Audit Course II: Environmental Governance | ES | 2 | - | - | - | ESE | 50 | 20 | 40 |
| UENV0431 | Surveying Laboratory | PC | - | - | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE (OE) | 25 | 10 | |
| UENV0432 | Building Planning and Design Laboratory | PC | - | - | 4 | 2 | ISE | 50 | 20 | |
| | | | | | | | ESE (OE) | 25 | 10 | |
| UENV0433 | Open Channel Hydraulics Laboratory | PC | - | - | 2 | 1 | ISE | 50 | 20 | |
| | | | | | | | ESE (OE) | 25 | 10 | |
| UENV0434 | Computational Laboratory | PC | - | - | 2 | 1 | ISE | 50 | 20 | |
| UENV0435 | Environmental Instrumentation Laboratory | PC | - | - | 2 | 1 | ISE | 25 | 10 | |
| | | | 16 | 2 | 12 | 22 | 500 + 300 = 800 + Audit Course | | | |

Total Credits - 22, Total Contact hours – 30

*End Semester Examination of 4 hours

| Professional Elective – I | |
|----------------------------------|--------------------------------------|
| 1 | Ecology and Environmental Sanitation |
| 2 | Remote Sensing and GIS |
| 3 | Engineering Geology |

SYLLABUS
S. Y. B. Tech
Environmental Engineering
SEMESTER - III

| | | | | |
|--|----------|----------|----------|---------------|
| Class: S.Y.B.Tech (Environmental Engineering) | L | T | P | Credit |
| Title of the Course: Applied Mathematics | 3 | 1 | --- | 4 |
| Course Code: UENV0301 | | | | |

Course Pre-Requisite:

Basic terminologies of differential equations, vector algebra, concepts of probability, rules and formulae of integration.

Course Description:

This Course contains linear differential equations, vector calculus, Complex calculus, Statistics and Probability.

Course Objectives:

1. To develop abstract, logical and critical thinking and the ability to reflect critically upon their work.
2. To study various mathematical tools like differential equations, integral transforms, vector calculus, probability and statistics to devise engineering solutions for given situations.
3. The student must be able to formulate a mathematical model of a real life and engineering problem, solve and interpret the solution in real world.

Course Outcomes:

| COs | After the completion of the course the student will be able to | Bloom's Cognitive |
|-----|--|--------------------------------------|
| | | Descriptor |
| CO1 | Illustrate method of least squares to fit the curves for given bivariate data and find coefficient of correlation. | Cognitive (Understanding) Level 2 |
| CO2 | Solve linear differential equations with constants coefficients. | Cognitive (Applying) L3 |
| CO3 | Make use of appropriate probability distribution for finding probabilities of events. | Cognitive (Applying) L3 |
| CO4 | Construct analytic function and harmonic function. Also find the complex integration. | Cognitive (Applying) L3 |
| CO5 | Make use of guidelines of Testing of Hypothesis and apply for data. | Cognitive (Applying) L3 |
| CO6 | Apply knowledge of vector differentiation to find directional derivatives curl and divergence of vector fields. | Cognitive (Analyzing) L4 |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 2 | | | | | | | | | | |
| CO2 | 3 | 2 | | | | | | | | | | |
| CO3 | 3 | 2 | | | | | | | | | | |
| CO4 | 3 | 2 | | | | | | | | | | |
| CO4 | 3 | 2 | | | | | | | | | | |
| CO5 | 3 | 2 | | | | | | | | | | |
| CO6 | 3 | 2 | | | | | | | | | | |

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three units)

ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three units) covered after MSE.

| Course Contents: | |
|---|---------------|
| Unit 1: Linear Differential Equations with Constant Coefficients Definition, general form, complete solution 1.1 Rules for finding complementary function 1.2 Short methods for finding particular integral 1.3 General Rule for finding particular integral 1.4 Cauchy's homogeneous linear differential equation 1.5 Applications of Linear Differential Equations for Environmental engineering. | 8 Hrs. |
| Unit 2: Vector Differential Calculus 2.1 Differentiation of vectors 2.2 Velocity and acceleration 2.3 Gradient of scalar point function and Directional derivative 2.4 Divergence of vector point function 2.5 Curl of a vector point function 2.6 Solenoidal and Irrotational vector fields | 7 Hrs. |
| Unit 3: Statistical Techniques for Environmental Engineering 3.1 Correlation and Coefficient of correlation 3.2 Lines of regression of bivariate data 3.3 Fitting of curves by method of least-squares 3.3.1 Fitting of straight lines 3.3.2 Fitting of exponential curves. 3.4 Applications of Statistical techniques for Environmental engineering. | 7 Hrs. |
| Unit 4: Probability Distributions 4.1 Random variable 4.2 Probability mass function and probability density function 4.3 Binomial distribution 4.4 Poisson distribution 4.5 Normal distribution 4.6 Applications of Probability for Environmental engineering. | 7 Hrs. |
| Unit 5: Test of Significance 5.1 Sampling distribution of mean and standard error 5.2 Large sample tests: Test for an assumed mean and equality of two population means. 5.3 Small sample tests : t-test for an assumed mean and equality of means of two populations, Paired t-test. 5.4 Test by using Chi – square distribution. 5.4.1 Goodness of fit test. 5.4.2 Test for independence of attributes Yates's Correction. | 8 Hrs. |
| Unit 6: Calculus of Complex Functions 6.1 Functions of complex variable 6.2 Analytic function, necessary and sufficient condition for $f(z)$ to be analytic 6.3 Milne – Thomson method to determine analytic function $f(z)$ 6.4 Harmonic function 6.5 Complex integration, Cauchy's theorem and Cauchy's integral formula. | 7 Hrs. |
| Recommended Books: 1. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers, Delhi. 2. A Text Book of Applied Mathematics, Vol. I and vol. II by P. N. Wartikar & J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune. | |
| Reference Books: 1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India Pvt. Ltd. 2. Advanced Engineering Mathematics by H. K. Dass, S. Chand, New Delhi. 3. A text book of Engineering Mathematics by N. P. Bali, Iyengar, Laxmi Publications (P) Ltd., New Delhi. 4. Mathematics for Engineers Vol-I & Vol-II by Rakesh Dube, Narosa Publishing House. | |

| | | | | |
|--|----------|----------|----------|---------------|
| Class: S.Y.B.Tech Environmental Engineering Title of the Course: Environmental Chemistry & Microbiology Course Code: UENV0302 | L | T | P | Credit |
| | 4 | - | - | 4 |

Course Pre-Requisite:

Students shall have knowledge of:

- Engineering Chemistry
- Engineering Fundamentals of Mathematics

Course Description:

The objective of the course is imparting fundamental knowledge of Environmental chemistry and fundamental concepts of microbiology. This subject will also cover experimental procedures of various water quality parameters and wastewater parameters.

Course Objectives:

At the end of the course students will be able to

1. Study concepts of quantitative ,physical, colloidal and bio- chemistry required in Environmental Engineering
2. Understand working principles of different instruments related to Environmental Engineering.
3. Learn effect of toxic and trace contaminants on environment
4. Study characteristic of different microorganisms in water and wastewater engineering

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Cognitive |
|-----|---|------------------------------|
| | | Descriptor |
| CO1 | Explain the concepts of quantitative ,physical, colloidal and bio-chemistry required in Environmental Engineering | Cognitive (Understanding) L2 |
| CO2 | Illustrate working principles of different instruments related to Environmental Engineering | Cognitive (Understanding) L2 |
| CO3 | Interpret effect of toxic and trace contaminants on environment | Cognitive (Understanding) L2 |
| CO4 | Analyze the characteristic of different microorganisms in water and wastewater engineering | Cognitive (Analyzing) L4 |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 2 | | | | | | | | | | | |
| CO2 | 2 | 2 | | | | | | | | | | |
| CO3 | 1 | 2 | | | | 1 | | | | | | |
| CO4 | 1 | 1 | | | | 1 | | | | | | |

| CO | PSO1 | PSO2 |
|-----|------|------|
| CO1 | | |
| CO2 | | |
| CO3 | 1 | |
| CO4 | 1 | |

| Assessments : | |
|----------------------|--------------------------|
| Assessment | Weightage (Marks) |
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE-1 and ISE-2: Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).

MSE: Assessment is based on 50% of course content (Normally first three Units).

ESE: Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

Course Contents:

| | |
|---|-----------------|
| <p>Unit 1: Significance of Chemistry in Environmental Engineering, Basic concepts from general chemistry: Introduction to Stoichiometric reactions, oxidation-reduction equations, basics of mass balance</p> | 6 Hours |
| <p>Unit 2: Basic Concepts from Colloidal Chemistry: Size, methods of formation, general properties, environmental significance, colloidal dispersion in liquids, colloidal dispersion in air Basic concept from Instrumental Analysis: Absorption Spectroscopy- UV-visible, atomic absorption spectroscopy, flame photometry, Mass Spectroscopy and Gas Chromatography-Chromatography and its types, mass spectroscopy and gas chromatography</p> | 8 Hours |
| <p>Unit 3: Toxic effects of organic compound such as phenols, pesticides, surfactants, tannin, lignin and hydrocarbon Heavy metals and trace contaminants- significance and health effects, Characteristics of hazardous material</p> | 8 Hours |
| <p>Unit 4: Basic Concepts from Quantitative Chemistry: Significance of quantitative measurements, gravimetric analysis, volumetric analysis, physical methods of analysis Basic Concepts from physical chemistry: Thermodynamics – Heat & work, energy, enthalpy, entropy, Vapour pressure of liquids, Binary mixtures, Solutions of solids in liquids, Osmosis, Dialysis, Principles of solvent extraction, Electro Chemistry, Chemical Kinetics Catalysis, Adsorption.</p> | 10 Hours |
| <p>Unit 5: General Microbiology: Microscopic flora and fauna concerned to environmental engineering, classification and characteristics of bacteria, morphology of bacteria, reproduction and growth of bacteria-modes of cell division, normal growth cycle of bacteria, kinetics of bacterial growth Culture techniques- selective methods, pure cultures, methods of isolating pure cultures, culture characteristics, gram staining, microscopic examination of microorganisms Indicator organisms of water pollution: Colifom group, their significance in environmental engineering, bacteriological techniques-MPN, Standard plate count, microorganisms other than coliform group</p> | 10 Hours |
| <p>Unit 6: Biochemistry: Classification, Characteristics, Environmental significance of carbohydrates, high energy compounds, proteins, lipids. Enzyme catalysis- characteristics, chemical and physical properties, its Classification, the</p> | 10 Hours |

nature and mechanism of enzyme action (Enzyme catalyzed reaction, energy diagram, Michalius-Menten equation), Factors affecting rate of enzymatic reaction. Enzyme inhibition

Textbooks:

1. Sawyer. C.N. and Mc Carty. P.L., "Chemistry for Environmental Engineers", Tata McGraw-Hill Publishing Company Limited, 4th Edition, 1994.
2. Dr. R. C. Dubey, Dr. D. K. Maheshwari, "A Text Book of Microbiology", S. Chand & Company Ltd., New Delhi, 2015.
3. Dr. S. S. Dara and Dr. S. S. Umare, "A Text Book of Engineering Chemistry", S. Chand & Company Ltd., New Delhi, 2017.

References:

1. Pelczar, Jr, M.J., E.C.S., Krieg, R.Noel., and PelczarMerna Foss. "Microbiology", Tata McGraw Hill Publishing Company Limited, 5th edition., 1996.
2. E.W. Rice, R.B. Baird, A.D. Eaton, L.S. Clesceri, "Standard Methods for the Examination of Water and Wastewater", 22nd Edition
3. Metcalf and Eddy "*Wastewater Engineering Treatment and Reuse*", Tata McGraw Hill Publication, 6th Reprint. 2003.
4. Conn. E.E. and Stumpf, P.K., "Outlines of Biochemistry", Wiley Eastern Limited, 5th Edition,1997.
5. IS (3025) "Methods of sampling and test (physical and chemical) for water and wastewater"

Unit wise Measurable Students Learning Outcomes:

Learning Outcomes:

UO 1: Explain basic concepts of quantitative chemistry in Environmental Engineering.

UO 2: Explain working principles and applications of advanced instruments like AAS, UV spectrophotometer etc

UO 3: Discuss colloids and their significance in environmental engineering.

UO 4: Analyze pollution parameters in laboratory and explain their significance and applications.

UO 5.1: Explain the microorganisms (bacteria, viruses, fungi, mould and protozoa) on basis of their classification and their role in treatment of wastewater.

UO 5.2: Discuss staining and microscopic methods.

UO 6.1: Describe characteristics of different biomolecules.

UO 6.2: Discuss enzymes- Lock and Key model, enzyme formation, factors affecting enzyme reaction

| | | | | |
|--|----------------------|----------|----------|---------------|
| Class: S.Y. B. Tech Environmental Engineering Title of the Course: Fluid Mechanics Course No.: UENV0303 | L | T | P | Credit |
| | 03 hours per week | - | - | 3 |

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Algebra and Engineering Mathematics
- Engineering Physics
- Applied Mechanics

Course Description:

The course provides a comprehensive knowledge and insight into the study of Fluid Mechanics. Students will learn different types of fluids, their properties and functional relationships between them. The course will also impart fundamental background in the statics, kinematics and dynamics of fluid flow system, laws of fluid mechanics and energy relationships. Students will understand the principles of conservation of mass, momentum and energy as applied to fluids in motion, recognize these principles written in the form of mathematical equations. They will apply these equations to analyze problems by making good assumptions and learn systematic engineering methods to solve practical fluid mechanics problems.

Course Learning Objectives:

1. To understand importance of fluid mechanics from engineering point of view.
2. To study the types and behavior of fluids and their corresponding engineering properties.
3. To learn the rational approaches consistent with general laws of basic and engineering sciences, experimental evidences, scientific and fundamentals of fluid statics, kinematics and dynamics.
4. To recognize the physical description and hydraulic illustrations of flow systems.
5. To acquire the principles of fluid mechanics for correlating parameters of various phenomenon of fluid behavior.

Course Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Cognitive |
|------|--|------------------------------------|
| | | Descriptor |
| CO.1 | Explain the fundamental concepts of fluid mechanics by taking into account the basic sciences, processes and characteristics of fluids. | Cognitive (Understanding) L2 |
| CO.2 | Analyze problems to determine pressure forces acting on surfaces, stability conditions, flow systems and losses in pipes using theoretical and analytical expressions. | Cognitive (Analyzing) L4 |
| CO.3 | Appraise the procedure to derive functional relationships between various parameters in a phenomenon using principles of fluid mechanics. | Cognitive (Evaluating) L5 |
| CO.4 | Interpret the use of basic laws and equations in instrumentation through theoretical and standard laboratory procedures. | Cognitive (Evaluating) L5 |
| CO.5 | Adapt appropriate methods to work out practical fluid flow problems using analytical and computational methods. | Cognitive (Creating) L6 |

CO-PO Mapping:

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO.1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| CO.2 | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - |
| CO.3 | - | - | - | 3 | 2 | - | - | - | - | - | - | - |
| CO.4 | - | - | 2 | 2 | 1 | - | - | - | - | - | - | - |
| CO.5 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |

| COs | PSO1 | PSO2 |
|------|------|------|
| CO.1 | - | - |
| CO.2 | - | - |
| CO.3 | - | - |
| CO.4 | - | - |
| CO.5 | - | 1 |

| Assessments : | | | | | | | | | | | |
|---|-------------------|-------------------|-------|----|-----|----|-------|----|-----|----|--|
| <table border="1"> <thead> <tr> <th>Assessment</th> <th>Weightage (Marks)</th> </tr> </thead> <tbody> <tr> <td>ISE-1</td> <td>10</td> </tr> <tr> <td>MSE</td> <td>30</td> </tr> <tr> <td>ISE-2</td> <td>10</td> </tr> <tr> <td>ESE</td> <td>50</td> </tr> </tbody> </table> | Assessment | Weightage (Marks) | ISE-1 | 10 | MSE | 30 | ISE-2 | 10 | ESE | 50 | |
| Assessment | Weightage (Marks) | | | | | | | | | | |
| ISE-1 | 10 | | | | | | | | | | |
| MSE | 30 | | | | | | | | | | |
| ISE-2 | 10 | | | | | | | | | | |
| ESE | 50 | | | | | | | | | | |
| <ul style="list-style-type: none"> • ISE-1 and ISE-2: Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used). • MSE: Assessment is based on 50% of course content (Normally first three Units) • ESE: Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE. | | | | | | | | | | | |
| Course Contents: | | | | | | | | | | | |
| Unit 1: Introduction: Physical Properties of Fluids (Mass Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity: Dynamic and Kinematic Viscosity, Compressibility, Surface Tension, Capillary Effect, Vapour Pressure and Cavitation), Effect of Temperature on Viscosity, Newton's Law of Viscosity, Types of Fluids. Dimensional Analysis: Dimensions and Dimensional Homogeneity, Importance and Use of Dimension Analysis, Buckingham Pi (π) Theorem, Dimensionless Numbers, Similitude, Types of Similarities, Model Laws and Problems on Froude Model Law and Reynolds Model Law. | 07 Hours | | | | | | | | | | |
| Unit 2: Fluid Statics: Types of Pressure, Pascal's Law, Hydrostatic Law, Pressure Measurement Devices, Problems on Pressure Measurement Devices, Concept of Pressure Diagram, Centre of Pressure, Forces on Plane and Curved Surfaces. Buoyancy and Floatation: Archimedes's Principle, Metacentre, Problems, Stability of Submerged and Floating Bodies. | 08 Hours | | | | | | | | | | |
| Unit 3: Fluid Kinematics: Description of Fluid Motion: Lagrangian And Eulerian Method, Velocity and Acceleration of Fluid Particles, Types of Flows, Stream lines, Equipotential lines, Stream Line, Path Line, Stream Tube, Stream Function and Velocity Potential Function, Flow Net, Properties and Uses, Continuity Equation in 3-D Cartesian Form. | 05 Hours | | | | | | | | | | |
| Unit 4: Fluid Dynamics: Forces Acting on Fluid in Motion, Euler's Equation along a Streamline, Bernoulli's Theorem, Assumptions and Limitations, Bernoulli's Applications: Venturimeter (Horizontal and Vertical), Orificemeter, Discharge Derivation, Orifices, Time required for Emptying the Tank, Hydraulic Coefficients of Orifices, Concept of HGL and TEL, Velocity Measurement using Pitot Tube, Pitot Static Tube. | 07 Hours | | | | | | | | | | |
| Unit 5: Laminar Flow and Turbulent Flow: Reynolds Experiment, Critical Reynolds Number, Hazen Poissulle's Equation for Viscous Flow through Circular Pipes, Prandtl Mixing Length Theory, Introduction to Moody's Chart. Boundary Layer Theory: Concept, Boundary Layer along a Thin Plate, Various Thicknesses (Nominal, Displacement, Momentum, Energy) and Problems, Hydraulically Smooth and Rough Boundaries, Separation of Boundary Layer, Control of Separation. | 07 Hours | | | | | | | | | | |
| Unit 6: Losses in Pipes: Major and Minor Losses, Darcy-Weisbach Equation, Short and Long Pipe, Concept of Equivalent Pipe, Dupit's Equation. Flow through Pipes: Pipes in Series, Parallel and Siphon, Two Reservoir Problems, Concept of Water hammer, Surge Tanks (Function, Location and Uses). | 06 Hours | | | | | | | | | | |
| Text Books: <ol style="list-style-type: none"> 1. Fluid Mechanics and Fluid Power Engineering, D. S. Kumar, S. K. Kataria and Sons, Delhi. 2. The Fluid Mechanics and Hydraulics, D. R. Malhotra and N. K. Malhotra, Satya Prakashan, New Delhi. 3. Engineering Fluid Mechanics, R. J. Garde and A. G. Mirajgaoker, Scitech Publications India Pvt. Ltd., Chennai. 4. Fluid Mechanics: Including Hydraulic Machines, A. K. Jain, Khanna Publishers, New Delhi. | | | | | | | | | | | |

5. Hydraulics and *Fluid Mechanics*, P. N. Modi and S. M. Seth, Standard Book House, New Delhi.
6. Engineering Fluid Mechanics, K. L. Kumar, S. Chand and Co, Eurasia Publishing House, New Delhi.
7. A Textbook of Fluid Mechanics and Hydraulic Machines, Dr. R. K. Bansal, Laxmi Publications, New Delhi, 2013.
8. A Textbook of Fluid Mechanics, R. K. Rajput, S. Chand and Company Pvt. Ltd., New Delhi.
9. Fluid Mechanics – I, M. M. Mujumdar and Akshay R. Thorvat, Electrotech Publications.

Reference Books:

1. Fluid Mechanics, Frank .M. White, McGraw Hill Publishing Company Ltd, New Delhi.
2. Fluid Mechanics and Machinery, C. P. Kothandaraman and R. Rudramoorthy, New Age International Publishers.
3. Fluid Mechanics: Fundamentals and Applications, Yunus, A. Cengel and John M. Cimbala Adapted by S. Bhattacharya, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som, Gautam Biswas, Suman Chakraborty, Tata McGraw Hill Education Pvt. Ltd., New Delhi.

Unit wise Measurable Students Learning Outcomes:

Unit Learning Objectives (ULO):

1. To **learn** the fundamentals of fluid mechanics and use of dimensional analysis to find out the functional relationships.
2. To **develop** the understanding of types of pressure, fluid statics, hydrostatic law and principle of buoyancy and floatation.
3. To **interpret** different flows with relevant equations.
4. To **imbibe** basic laws and equations used for analysis of dynamic fluids and their applications.
5. To **study** the characteristics of viscous flow, boundary layer theory and effects of boundary layer resistance.
6. To **determine** the losses in flow system and flow through pipes.

Unit Outcomes (UO):

After completion of the unit, students will be able to,

1. **Differentiate** between various types of fluids and their behavior under action of forces and **Find** the functional relationships in order to describe the unknown phenomenon. **(CO.1, CO.2, CO.3)**
2. **Compute** the pressure forces acting on plane and curved surfaces and **Analyze** the stability conditions of a floating body. **(CO.2, CO.3)**
3. **Distinguish** velocity potential function and stream function and **Solve** for velocity and acceleration of a fluid at a given location in a fluid flow. **(CO.1, CO.2, CO.5)**
4. **Derive** Euler's Equation of motion and **Deduce** Bernoulli's equation to solve problems on dynamics of fluid flow system. **(CO.2, CO.3, CO.4)**
5. **Compare** laminar and turbulent flow characteristics and **Explain** the boundary layer concept. **(CO.1, CO.4)**
6. **Interpret** different pipe fittings and **Evaluate** the fluid velocity considering major and minor losses. **(CO.4, CO.5)**

| | | | | |
|--|----------|----------|----------|---------------|
| Class: S.Y. B. Tech Environmental Engineering Title of the Course: Structural Mechanics Course Code: UENV0304 | L | T | P | Credit |
| | 3 | 1 | - | 4 |

Course Pre-Requisite:
Students must know basic concepts applied mechanics.

Course Description:
Analysis of statically determinate structures. Studies of stress and strain Section properties, principal axis, torsion of circular shafts. Shear stresses in solid & thin-walled sections. Deflection in beams, double integration, moment-area & unit-load methods.

- Course Objectives:**
1. Study the basic behavior of material when subjected to loading.
 2. Understand various patterns of loading on structural members and corresponding resistive mechanisms of structural members.
 3. Study the various straining actions and its effect when present individually on a member.
 4. Understand the basic principles and concepts of structural mechanics to solve problems.

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Cognitive Descriptor |
|-----|---|------------------------------|
| CO1 | Explain Properties and behavior of different materials when subjected to loading. | Cognitive (Explain) L2 |
| CO2 | Identify various forms of load on structural members | Cognitive (Identify) L4 |
| CO3 | Interpret properties and behavior of materials by experimental analysis | Cognitive (Analyze) L4 |
| CO4 | Analyze various stress strain conditions for different structural members. | Cognitive (Compare) L6 |

CO-PO Mapping:

| CO | PO | | | | | | | | | | | | PSO | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-----|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | 1 | 2 |
| CO1 | 2 | | | 1 | | | | | | | | | | |
| CO2 | 2 | 2 | | | | | | | | | | | | |
| CO3 | | | 1 | 3 | | | | | | | | | | |
| CO4 | 3 | 2 | | | | | | | | | | | | |

| CO | PSO 1 | PSO 2 |
|-----|-------|-------|
| CO1 | | |
| CO2 | | |
| CO3 | | |
| CO4 | | |

Assessments :
Teacher Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three Units)

| | |
|--|---------------|
| ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three Units) covered after MSE. | |
| Course Contents: | |
| Unit 1: Engineering properties of different materials, St. Venant's principle, Hooke's law, Behavior of matter subjected to uni-axial loading – Simple Bars, Compound Bars and Composite Bars with respect to Stresses, strains, change in dimensions and change in volume. Behaviour of simple bars subjected to Shear Force, concept of complimentary shear stresses. Behaviour of simple bars subjected to multi-axial loading, elastic constants, strain in three dimensions. | 9 Hrs. |
| Unit 2: Analysis of statically determinate beams S.F. and B.M. diagrams, virtual work approach for computation of shear force and bending moment | 6Hrs. |
| Unit 3: Behaviour of thin walled cylinders subjected to net internal pressure, study of stresses, strains, change in dimensions and change in volume. Strain Energy for various types of loads in structural parts. | 5Hrs. |
| Unit 4: Stresses in beams due to Bending Moments, Bending stress variation diagrams, Stresses in beams due to Shear Forces, Shear Stress variation diagrams, Contribution of resistances by web and flange in case of flanged sections. | 8Hrs. |
| Unit 5: Columns and struts, crippling load theory, Euler's theory of crippling load, Rankine's theory of crippling load, Introduction to Torsion | 4 Hrs. |
| Unit 6: a) Study of stresses in sections subjected to combined effects of Axial Forces and Bending Moments, Eccentrically loaded columns, Core of a section Dams, Chimneys and Retaining Walls b) Slope and deflection of beams : Macaully's method and Conjugate beam method, Moment Area method | 8 Hrs. |
| Textbooks: 1. "Strength of Materials" - S Ramamrutham, Dhanapat Rai Publications. 2. "Strength of Materials" - R.K.Bansal., Laxmi Publications. | |
| References: 1. "Mechanics of Structure" (Vol. I and II) - Junnarkar S.B. and Advani, Charotar Publication. 2. "Mechanics of Materials" - R.C. Hibbler, Pearson Education. 3. "Mechanics of Materials" - Gere and Timoshenko, CBS publishers. 4. "Mechanics of Materials" Vol I and II - Punmia, Jain, Laxmi Publications. 5. "Strength of Materials" - Bhavikatti S.S., New Age Publications. 6. "Strength of Materials" - R.K.Rajput., S.Chand Publications. 7. "Structural Analysis" - Bhavikatti S.S, Vikas Publications house New Dehli. 8. "Introduction to Mechanics of Solids" - J.B. Popov, Prentice – Hall publication. 9. "Strength of Material" - F. L. Singer and Pytel, Harper and Row publication. 10. "Mechanics of Material" - Beer and Johnston, M. 11. "Strength of Materials" – R. S. Khurmi and N. Khurmi, S. Chand Publications | |
| Unit wise Measurable students Learning Outcomes: 1. Student will be able to identify engineering properties of materials and the concept of simple and | |

complementary Shears stress

2. Student will be able to analyze of statically determinate beams S.F. and B.M. of beam.
3. Student will be able to understand the behavior of thin walled cylinders and its internal stresses and strains.
4. Student will be able to analyze Bending moments and shear stresses in various beams sections.
5. Student will be able explain crippling load theory, Euler's theory of crippling load, Rankine's theory of crippling load Stresses in circular shafts due to Torsional Moments, Torsional Stress.
6. Student will be able Study analyze stresses in sections subjected to combined effects of Axial forces and Bending and slope and deflection in beams.

| | | | | |
|--|----------|----------|----------|---------------|
| Class: S.Y. B. Tech Environmental Engineering | L | T | P | Credit |
| Title of the Course: Building Construction Technology | 3 hrs | - | - | 3 |
| Course No.: UENV0305 | | | | |

Course Pre-Requisite:

- Students should have basic knowledge of civil engineering
- Students should know basic building components and building services

Course Description:

- The course comprises of engineering properties of materials
- The course includes details of Temporary supporting structures
- The course also comprises of building finishes like paint, plastering etc.

Course Objectives:

1. Aware the student with a wide range of building materials, their properties and its use in architectural design and construction.
2. Aware the student about various building component, its strength, function and formwork.
3. Aware the student about methods of construction and quality required for various building components.
4. To develop a practical approach in choosing architectural and construction materials based on use, desired results, durability, availability and cost.

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Cognitive |
|------|--|-------------------|
| | | Descriptor |
| CO.1 | List the various building materials and their properties. | Analyzing |
| CO.2 | Explain the basic requirements of building. | Understanding |
| CO.3 | Compare appropriate material for various building elements. | Applying |
| CO.4 | Illustrate the various building requirements as per the comfort & safety zone. | Understanding |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO.1 | 3 | 2 | 1 | | | | | | | | | |
| CO.2 | | 2 | | | | | | | | | | |
| CO.3 | | | | 2 | | | | | | | | |
| CO.4 | | | | | 1 | | | | | | | |

| CO | PSO1 | PSO2 |
|------|------|------|
| CO.1 | | |
| CO.2 | | |
| CO.3 | | |
| CO.4 | | |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

| Course Contents: | |
|---|---------------|
| UNIT 1: Building and its components Functions of various components of building and other structures. Classification and types of foundations. Selection of the suitable type of foundation for required structure and as per situation. Purpose & types of scaffolding and centering. | 8 Hrs. |
| UNIT 2 Brick and stone masonry Stone masonry and its types. Brick masonry and its types Types of bonds in brick masonry Selection of suitable type of masonry | 6 Hrs. |
| UNIT 3 Doors – Classification, T.W. Panelled Door, Flush Door, Aluminium Glazed Doors, Steel Doors, fixtures and fastening, Windows - Classification, T.W. Glazed Windows, Aluminium Glazed Windows, Steel Windows, fixtures and fastening. | 6 Hrs. |
| UNIT 4 Stairs: Technical terms, requirements of a good stair, uses, types, materials for construction. Design of stairs (Dog Legged and Open-well) Lintel: Necessity, Materials: wood, stone, brick, steel, R.C.C. and reinforced brick lintels Roofs and Roof coverings: Terms used. Roof and their selection. Roof coverings and their selection | 7 Hrs. |
| UNIT 5: Ventilation & Air Conditioning: Need, Types & requirements Electrification of building: - Concealed & Open Wiring, Requirements & Location of various points, , Concept of Earthing. House Drainage: Concept of Plumbing, Drainage facilities & plan, Need of Septic Tank. Introduction to rainwater harvesting. Rainwater outlet & Down Tank Systems. Building Finishes Plastering and Pointing; Paints: Different types and application methods. Varnishes & application methods. | 8 Hrs. |
| UNIT 6 :Sustainable building materials Sustainable building materials for construction: mortor, concrete, flooring, wall etc. <ol style="list-style-type: none"> a) Sustainable concrete b) Flyash bricks and concrete c) Solar tiles d) Recycled plastic e) Paper insulation f) Paints and wood treatment etc. | 5 Hrs. |
| Textbooks: <ol style="list-style-type: none"> 1. Building Construction – B.C.Punmia (Laxmi Publications) 2. Basic Civil Engineering – G. K. Hiraskar (Dhanpat Rai Publications) 3. Construction Technology (Volume 1 to 4) – R. Chudley (ELBS) 4. Engineering Materials – R.K.Rajput (S. Chand) 5. A Text Book of Building Construction – Arora&Bindra (Dhanpat Rai Publications) 6. A Text Book of Building Construction – Dr. S. K. Sharma, S. Chand Publications | |

References:

1. A to Z of Practical Building Construction & its Management- Sandeep Mantri (Satya Prakashan, New Delhi)
2. SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi
3. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings
4. A Course in Civil Engineering Drawing – V.B.Sikka (S.K.Kataria and Sons)
5. Civil Engineering Drawing – M. Chakraborty.
6. Handbook of Building Construction- M. M. Goyal (Amrindra Consultancy (P) Ltd.)
7. Building Drawing – Shah, Kale, Patki (Tata McGraw- Hill)
8. Building Design and Drawing – Y. S. Sane (Allied Book Stall, Pune)
9. Building Materials and Construction – Dr. Anil Kumar Misra, S. Chand Publications
10. Concrete Technology – M. S. Shetty, S. Chand Publications

Unit wise Measurable students Learning Outcomes:

At the end of course students will

ULO 1.1: Understand functions of various components of building and other structures.

ULO 1.2: Study the suitability of various types of foundation.

ULO 2.1: Know the various types of bonds in brick masonry.

ULO 2.2: Understand the various components of the buildings..

ULO 3.1: Understand the details of doors and windows.

ULO 3.2: Learn various types of doors and windows.

ULO 4.1: Understand the importance of staircase and its types.

ULO 5: Understand the concepts of ventilation & air Conditioning, house Drainage and electrification of a building.

ULO 6: Understand the sustainable building material.

Unit Learning Outcomes (UOs)

At the end of course students will be able to

UO 1.1: Explain the functions of various components of building and other structures.

UO 1.2: Select the foundation depending on its suitability.

UO 2.1: Decide the various components to be provided for the building.

UO 2.2: Design the sizes and arrangements of these various requirements..

UO 2.3: Select the various components of the building to suit the requirements.

UO 3.1 Decide the various building elements for various purposes of the building..

UO 3.2: Select the building element from various alternatives to satisfy the requirements..

UO 3.3: Design the building element.

UO 4.1: Explain types of various services require for the building.

UO 4.2: Decide the various facilities required in these services to satisfy the purpose..

UO 5.1: Explain the need & techniques of watershed management.

UO 5.2: Describe types of wetland & its role in pollution control.

UO 6.1: Explain the methods of estimation of soil erosion.

UO 6.2: State the causes & remedies for alkaline or saline soils.

| | | | | |
|---|----------|----------|----------|---------------|
| Class: S.Y.B.Tech Environmental Engineering Title of the Course: Audit Course – I: Environmental Studies Course Code: UENV0361 | L | T | P | Credit |
| | 2 | - | - | Audit Course |

Course Pre-Requisite:
Students shall have knowledge of:

- Science
- Technology

Course Description:
The objective of the course is imparting fundamental knowledge and awareness of Environmental science among students *and importance of conservation of environment.*

Course Objectives:
At the end of the course students will be able to

1. Study scope and importance of natural resources, ecosystems, biodiversity for creating awareness and their conservation in multiple disciplines.
2. Learn various types of pollution, their impacts and control measures for minimizing pollution and sustainable development.
3. Understand social issues related environment, environmental ethics and human rights towards environment.
4. Study various laws & regulations related to environment and its applicability in society and industries.
5. Choose one of the sectors of environment for detail study as project.

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Descriptor |
|-----|--|--------------------|
| | | |
| CO1 | Describe natural resources, importance of ecosystem & conservation of biodiversity with respect to multiple disciplines. | Cognitive |
| CO2 | Explain causes, effects, solutions for various pollution problems and its minimization strategies. | Cognitive |
| CO3 | Discuss environmental ethics & their implementation for betterment of environment & human life. | Cognitive |
| CO4 | Differentiate between requirements of laws & regulations for environmental conservation and applicability of legislations in society and industries. | Cognitive |
| CO5 | Prepare detailed project report on selected topic based on environmental issues/problems. | Cognitive |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | | | | | | | 2 | | | | | |
| CO2 | 3 | | | | | | | | | | | |
| CO3 | | | | | | | | 2 | | | | |
| CO4 | | | | | | 2 | | | | | | |
| CO5 | | | | | | | | | | 2 | | |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ESE | 50 |

ESE: Assessment is based on 100% course content

| Course Contents: | |
|---|----------------|
| <p>Module 1:Nature of Environmental Studies Definition, scope and importance, Multidisciplinary nature of environmental studies, Need for public awareness.</p> | 4 Hours |
| <p>Module 2: Natural Resources and Associated Problems a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. f) Land resources: Solar energy , Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individuals in conservation of natural resources.</p> | 4 Hours |
| <p>Module 3: Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem :- a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).</p> | 6 Hours |
| <p>Module 4:Biodiversity and its conservation Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega- diversity nation, Western Ghat as a biodiversity region. Hot-spot 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.</p> | 6 Hours |
| <p>Module 5:Environmental Pollution Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of a individual in prevention of pollution.</p> | 6 Hours |
| <p>Module 6: Social Issues and the Environment Disaster management: floods, earthquake, cyclone, tsunami and landslides. Urban problems related to energy Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issue and possible solutions. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.</p> | 8 Hours |

| | |
|--|-----------------------|
| <p>Module 7:Environmental Protection From Unsustainable to Sustainable development. Environmental Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Population Growth and Human Health, Human Rights.</p> | <p>8 Hours</p> |
| <p>Textbooks: 4. Environmental Studies by Dr. P.D.Raut (Shivaji University, Kolhapur)</p> | |
| <p>References: 1. Miller T.G. Jr., Environmental Science. Wadsworth Publications Co.(TB). 2. Odum, E.P.1971, Fundamentals of Ecology, W.B.Saunders Co. USA,574p 3. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines,Compliances and Standards, vol. I and II, Environmental Media (R)</p> | |
| <p>Unit wise Learning Outcomes: At the end of the course the students will be able to</p> <ul style="list-style-type: none"> UO 1 Describe scope and importance of environmental studies. UO 2 Describe types of natural resources, their use and conservation. UO 3 Explain structure and functions of ecosystem, their types and importance. UO 4 Discuss biodiversity, endangered species and methods of biodiversity conservation. UO 5 Explain causes, effects and solutions to pollution problems. UO 6 Discuss environmental ethics and various social issues related to environment. UO 7 Discuss laws and regulations for conservation of environment. | |

| | | | | |
|---|----------|----------|----------|---------------|
| Class: S.Y.B.Tech Environmental Engineering Title of the Course: Water Quality Monitoring Laboratory Course Code: UENV0331 | L | T | P | Credit |
| | - | - | 2 | 1 |

Course Pre-Requisite:

Students shall have knowledge of:

- Engineering Chemistry

Course Description:

This subject will provide actual experimental analysis of various water quality parameters based on laboratory procedures for water or wastewater samples.

Course Objectives:

At the end of the course students will be able to

1. To provide hands-on practice for analyzing the water quality parameters or wastewater parameters by physical, chemical and biological methods.
2. To impart knowledge of bacterial identification

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Cognitive |
|-----|--|-------------------|
| | | Descriptor |
| CO1 | Carry out water or wastewater quality analysis through physical, chemical, biological methods. | Cognitive |
| CO2 | Identify types of cells, bacteria by using staining methods | Cognitive |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 2 | | | 2 | | 2 | | | | | | |
| CO2 | 1 | | | 2 | | 2 | | | | | | |

| CO | PSO1 | PSO2 |
|-----|------|------|
| CO1 | 1 | |
| CO2 | | |

Assessments :

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE | 50 |
| ESE (OE) | 25 |

ISE is based on experimental work/performance in laboratory/assignment/declared test/etc.

ESE: Assessment is based on oral.

Course Contents:

| | |
|--|-------|
| Experiment No. 1: Alkalinity and Acidity Outcome: To determine alkalinity and acidity of given water sample by pH meter | 2 hrs |
| Experiment No. 2: Turbidity Outcome: To determine turbidity of given water sample | 2 hrs |
| Experiment No. 3: Solids Outcome: To determine total solids, suspended solids and dissolved solids of given water sample | 2 hrs |

| | |
|--|-------|
| Experiment No. 4: Dissolved Oxygen Outcome: To determine dissolved oxygen of given water sample by Winkler method | 2 hrs |
| Experiment No. 5: Biochemical Oxygen Demand Outcome: To determine Biochemical Oxygen Demand of given sample | 2 hrs |
| Experiment No. 6: Iron and Manganese Outcome: To determine Iron and Manganese (Demonstration using Atomic Absorption Spectroscopy) | 2 hrs |
| Experiment No. 7: Gram staining Outcome: To study gram's characteristics of given bacterial suspension | 2 hrs |
| Experiment No. 8: Introduction to Microscope Outcome: To understand parts, function and working of microscope | 2 hrs |
| Experiment No. 9: Standard Plate Count Outcome: To estimate bacterial density by plate count method | 2 hrs |
| Experiment No. 10: Most Probable Number Outcome: To determine bacteriological quality of potable water | 2 hrs |
| Textbooks: 1. Sawyer. C.N. and Mc Carty. P.L., "Chemistry for Environmental Engineers", Tata McGraw-Hill Publishing Company Limited, 4th Edition, 1994. | |
| References: 1. Pelczar, Jr, M.J., E.C.S., Krieg, R.Noel., and PelczarMerna Foss. "Microbiology", Tata McGraw Hill Publishing Company Limited, 5th edition., 1996. 2. Metcalf and Eddy " <i>Wastewater Engineering Treatment and Reuse</i> ", Tata McGraw Hill Publication, 6th Reprint. 2003. 3. Conn. E.E. and Stumpf, P.K., "Outlines of Biochemistry", Wiley Eastern Limited, 5th Edition, 1997. 4. E.W. Rice, R.B. Baird, A.D. Eaton, L.S. Clesceri, "Standard Methods for the Examination of Water and Wastewater", 22nd Edition 5. IS (3025) "Methods of sampling and test (physical and chemical) for water and wastewater" | |

| | | | | |
|--|----------|----------|-------------------|---------------|
| Class: S. Y. B. Tech Environmental Engineering Title of the Course: Fluid Mechanics Laboratory Course No.: UENV0332 | L | T | P | Credit |
| | --- | --- | 02 hours per week | 1 |

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Algebra and Engineering Mathematics
- Engineering Physics
- Applied Mechanics
- Fluid Mechanics

Course Description:

The course explores the fundamental principles of fluid mechanics through laboratory experimentations and demonstrates and analyzes key hydraulic phenomena using hands-on physical devices.

Course Objectives:

1. To introduce the students to a wide variety of fluid measurement systems.
2. To operate fluid flow equipments and instruments for a given purpose.
3. To analyze experimental data by work individually and as a team.

Course Learning Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Cognitive |
|------|--|------------------------------|
| | | Descriptor |
| CO.1 | Demonstrate basic principles and equations of fluid mechanics through experimentation. | Cognitive (Understanding) L2 |
| CO.2 | Calibrate various hydraulic measuring devices through standard laboratory procedures. | Cognitive (Analyzing) L4 |
| CO.3 | Develop skills for analyzing experimental data, designing and conducting experiments, and working individual and in teams. | Psychomotor (Mechanism) L4 |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | | | | 3 | 1 | | | | | 2 | | |
| CO2 | | | | 3 | 1 | | | | | 2 | | |
| CO3 | | | | 2 | 1 | | | | 3 | 2 | | |

| COs | PSO1 | PSO2 |
|-----|------|------|
| CO1 | - | 1 |
| CO2 | - | 1 |
| CO3 | - | 1 |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE | 50 |
| ESE (OE) | 25 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on oral examination.

Course Contents:

| | |
|---|---------|
| Experiment No. 1: Measurement of Discharge. Learning Outcome: To analyze the rate of flow of water using constant time, constant head and volumetric analysis methods. | 2 Hours |
| Experiment No. 2: Stability of Floating Objects. Learning Outcome: To calculate metacentric height of a given ship model to check the | 2 Hours |

| | |
|--|---------|
| stability condition. | |
| Experiment No. 3: Verification of Bernoulli's Theorem. | 2 Hours |
| Learning Outcome: To illustrate Bernoulli's theorem by demonstrating the relationship between pressure head and kinetic energy head for a conduit of varying cross-section. | |
| Experiment No. 4: Calibration of Venturimeter. | 2 Hours |
| Learning Outcome: To determine the coefficients of discharge for given venturimeter using analytical and graphical methods. | |
| Experiment No. 5: Calibration of Orificemeter. | 2 Hours |
| Learning Outcome: To determine the coefficients of discharge for given orificemeter using analytical and graphical methods. | |
| Experiment No. 6: Calibration of Orifice. | 2 Hours |
| Learning Outcome: To evaluate the hydraulic coefficients (C_d , C_v , C_c and C_R) of orifice and their interrelationships. | |
| Experiment No. 7: Pipe Friction Experiment. | 2 Hours |
| Learning Outcome: To determine the Darcy's Coefficient (Friction Factor) for different pipe materials. | |
| Experiment No. 8: Determination of Minor Losses in a given Pipe. | 2 Hours |
| Learning Outcomes: To compute minor losses due to change in cross sectional area and pipe fittings in a given pipe. | |
| Experiment No. 9: Reynolds Experiment. | 2 Hours |
| Learning Outcome: To demonstrate laminar, transitional (intermittently turbulent), and fully turbulent pipe flows, and the conditions under which these types of flow occur. | |
| Experiment No. 10: Study of Moody's Chart. | 2 Hours |
| Learning Outcomes: To relates the Darcy-Weisbach friction factor f , Reynolds number Re , and relative roughness (K/D) for fully developed flow in a circular pipe. | |
| Text Books: | |
| <ol style="list-style-type: none"> 1. Fluid Mechanics and Fluid Power Engineering, D. S. Kumar, S. K. Kataria and Sons, Delhi. 2. The Fluid Mechanics and Hydraulics, D. R. Malhotra and N. K. Malhotra, Satya Prakashan, New Delhi. 3. Engineering Fluid Mechanics, R. J. Garde and A. G. Mirajgaoker, Scitech Publications India Pvt. Ltd., Chennai. 4. Fluid Mechanics: Including Hydraulic Machines, A. K. Jain, Khanna Publishers, New Delhi. 5. Hydraulics and <i>Fluid Mechanics</i>, P. N. Modi and S. M. Seth, Standard Book House, New Delhi. 6. Engineering Fluid Mechanics, K. L. Kumar, S. Chand and Co, Eurasia Publishing House, New Delhi. 7. A Textbook of Fluid Mechanics and Hydraulic Machines, Dr. R. K. Bansal, Laxmi Publications, New Delhi, 2013. 8. A Textbook of Fluid Mechanics, R. K. Rajput, S. Chand and Company Pvt. Ltd., New Delhi. 9. Fluid Mechanics – I, M. M. Mujumdar and Akshay R. Thorvat, Electrotech Publications. | |
| Reference Books: | |
| <ol style="list-style-type: none"> 1. Fluid Mechanics, Frank .M. White, McGraw Hill Publishing Company Ltd, New Delhi. 2. Fluid Mechanics and Machinery, C. P. Kothandaraman and R. Rudramoorthy, New Age International Publishers. 3. Fluid Mechanics: Fundamentals and Applications, Yunus, A. Cengel and John M. Cimbala Adapted by S. Bhattacharya, Tata McGraw-Hill Publishing Company Ltd., New Delhi. 4. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som, Gautam Biswas, Suman Chakraborty, Tata McGraw Hill Education Pvt. Ltd., New Delhi. | |

| | | | | | | | | | | | | |
|---|---|------------|------------|--------------------------|------------|-------------------------------------|------------|------------|------------|-------------|-------------|-------------|
| Class: S. Y. B. Tech Environmental Engineering | | | L | T | P | Credit | | | | | | |
| Title of the Course: Strength of Materials Laboratory | | | - | - | 2 | 1 | | | | | | |
| Course Code: UENV0333 | | | | | | | | | | | | |
| Course Pre-Requisite: Students must know basic concepts applied mechanics and science | | | | | | | | | | | | |
| Course Description: Experimental analysis stress and strain in various structural materials. Study of behavior of materials when subjected to different types of loads. | | | | | | | | | | | | |
| Course Objectives: 1. Study the basic properties of material when subjected to loading. 2. Study the various stresses and strains in different types of structural material under individual action of load. | | | | | | | | | | | | |
| Course Learning Outcomes: | | | | | | | | | | | | |
| CO | After the completion of the course the student should be able to | | | | | Bloom's Cognitive Descriptor | | | | | | |
| CO1 | Demonstrate the properties of materials under action of various loads. | | | | | Explain L2 | | | | | | |
| CO2 | Interpret the behavior of various structural materials in terms of stress and strain. | | | | | Identify L4 | | | | | | |
| CO-PO Mapping: | | | | | | | | | | | | |
| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 2 | | | 2 | | | | | | | | 1 |
| CO2 | | 3 | | 3 | | | | | | | | 1 |
| | | CO | | PSO 1 | | PSO 2 | | | | | | |
| | | CO1 | | | | | | | | | | |
| | | CO2 | | | | 1 | | | | | | |
| Assessments : | | | | | | | | | | | | |
| Teacher Assessment: In Semester Evaluation (ISE). | | | | | | | | | | | | |
| Assessment | | | | Weightage (Marks) | | | | | | | | |
| ISE | | | | 25 | | | | | | | | |
| ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc. | | | | | | | | | | | | |
| Course Contents: | | | | | | | | | | | | |
| Experiment No 1: Study of Universal Testing Machine Outcome: To Identify the components and understand the operation of Universal Testing Machine | | | | | | 2 Hr | | | | | | |
| Experiment No 2: Tensile test on Mild steel and TMT steel. Outcome: To determine tensile strength, percentage of elongation & other mechanical properties of Mild steel | | | | | | 2 Hr | | | | | | |
| Experiment No 3: Compression test on M.S. and C.I, cement bricks or paving blocks. Outcome: Determine crushing strength of different materials. | | | | | | 2 Hr | | | | | | |
| Experiment No 4: Compression test on timber. Outcome: To determine compressive strength of timber. | | | | | | 2 Hr | | | | | | |
| Experiment No 5: Direct shear test on M.S. Outcome: To determine shear strength of mild steel. | | | | | | 2 Hr | | | | | | |
| Experiment No 6: Charpy or Izod Impact test on different metals. Outcome: Find out energy absorption by Charpy and Izod impact test on metal specimen | | | | | | 2 Hr | | | | | | |

| | |
|---|------|
| <p>Experiment No 7: . Bending test on M.S. bar and Timber.</p> <p>Outcome: Determine flexural strength and Young’s Modulus of timber beam, rectangular section and square section having same cross-sectional area</p> | 2 Hr |
| <p>Experiment No 8: Water absorption and compression test on burnt bricks.</p> <p>Outcome: Determine and compare water absorption and compressive strength on clay brick.</p> | 2 Hr |
| <p>Textbooks:</p> <ol style="list-style-type: none"> 1. “Strength of Materials” - S Ramamrutham, DhanapatRai Publications. 2. “Strength of Materials” - R.K.Bansal., Laxmi Publications. | |
| <p>References:</p> <ol style="list-style-type: none"> 1. “Mechanics of Structure” (Vol. I and II) - Junnarkar S.B. and Advi, Charotar Publication. 2. “Mechanics of Materials” - R.C. Hibbler, Pearson Education. 3. “Mechanics of Materials” - Gere and Timoshenko, CBS publishers. 4. “Mechanics of Materials” Vol I and II - Punmia, Jain, Laxmi Publications. 5. “Strength of Materials” - Bhavikatti S.S., New Age Publications. 6. “Strength of Materials” - R.K.Rajput., S.Chand Publications. 7. “Structural Analysis” - Bhavikatti S.S, Vikas Publications house New Dehli. 8. “Introduction to Mechanics of Solids” - J.B. Popov, Prentice – Hall publication. 9. “Strength of Material” - F. L. Singer and Pytel, Harper and Row publication. 10. “Mechanics of Material” - Beer and Johnston, M. | |

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|---|----------|----------|-------------------|---------------|
| Class: S. Y. B. Tech Environmental Engineering Title of the Course: Material Testing Laboratory Course No.: UENV0334 | L | T | P | Credit |
| | --- | --- | 02 hours per week | 1 |

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Students should have basic knowledge of civil engineering
- Students should know basic building components and building services

Course Description:

- The course comprises of engineering properties of materials
- The course includes details of Temporary supporting structures
- The course also comprises of building finishes like paint, plastering etc.

Course Objectives:

1. Aware the student with a wide range of building materials, their properties and its use in construction.
2. Aware the student about the various tests for deciding suitability of building material
3. To develop a practical approach in choosing construction materials

Course Learning Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Cognitive |
|------|--|------------------------------|
| | | Descriptor |
| CO.1 | Demonstrate different bonds in brick masonry | Cognitive (Understanding) L2 |
| CO.2 | Examine the properties of construction materials for deciding its suitability. | Cognitive (Analyzing) L4 |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 |
|-----|-----|-----|-----|-----|------|------|------|------|------|-------|-------|-------|
| CO1 | - | - | 2 | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | - | 3 | - | - | - | - | 2 | - | - | 2 |

| COs | PSO1 | PSO2 |
|-----|------|------|
| CO1 | - | - |
| CO2 | - | 2 |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE | 50 |
| ESE (OE) | 25 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on oral examination.

Course Contents:

| | |
|--|---------|
| Experiment No. 1: Particle size distribution of fine aggregates | 2 Hours |
| Experiment No. 2: Crushing strength of aggregates | |
| Experiment No. 3: Determination Specific gravity of aggregates | 2 Hours |
| Experiment No. 4: Experiment on Silt content of fine aggregates | |

| | |
|---|---------|
| Experiment No. 5: Test on bulking of sand | |
| Experiment No. 6: Initial and final settling time | |
| Experiment No. 7: Consistency test | 2 Hours |
| Experiment No. 8: Soundness Test of concrete | 2 Hours |
| Experiment No. 9: Workability (Slump) test | 2 Hours |
| Experiment No. 10: Compressive Strength Test on concrete mix | |
| Drawing (not to scale) of following elements <ul style="list-style-type: none"> • Stone Masonry: Un-Course Rubble (UCR) and Course Rubble • Brick masonry: English bond, Flemish bond | 2 Hours |
| Design and drawing of Staircase: Dog legged | 2 Hours |
| Textbooks: <ol style="list-style-type: none"> 1. Building Construction – B.C.Punmia (Laxmi Publications) 2. Basic Civil Engineering – G. K. Hiraskar (Dhanpat Rai Publications) 3. Construction Technology (Volume 1 to 4) – R. Chudley (ELBS) 4. Engineering Materials – R.K.Rajput (S. Chand) | |
| References: <ol style="list-style-type: none"> 1. A Text Book of Building Construction – Arora&Bindra (Dhanpat Rai Publications) 2. A to Z of Practical Building Construction & its Management- Sandeep Mantri (Satya Prakashan, New Delhi) 3. SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi 4. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings 5. A Course in Civil Engineering Drawing – V.B.Sikka (S.K.Kataria and Sons) 6. Civil Engineering Drawing – M. Chakraborty. 7. Handbook of Building Construction- M. M. Goyal (Amrindra Consultancy (P) Ltd.) 8. Building Drawing – Shah, Kale, Patki (Tata McGraw- Hill) 9. Building Design and Drawing – Y. S. Sane (Allied Book Stall, Pune) | |

| | | | | |
|--|----------|----------|----------------------|---------------|
| Class: S. Y. B. Tech Environmental Engineering Title of the Course: Computer Aided Design Laboratory Course No.: UENV0335 | L | T | P | Credit |
| | --- | --- | 02 hours per week | 1 |

Course Pre-Requisite:

Students shall have the knowledge of:

- Engineering Mathematics
- Basics Knowledge of Computer
- Microsoft Office Tools

Course Description:

The aim of this course is to provide users the basic commands and tools necessary for professional 2D drawing, design and drafting using AutoCAD. Learning AutoCAD will give students' abilities of using their skills to prepare necessary information in the form of standard engineering drawing using several tools, commands and techniques.

Course Objectives:

1. To navigate throughout AutoCAD using major navigating tools.
2. To understand the basic concepts, tools and techniques to prepare drawings using AutoCAD.
3. To create, plot and print the drawing by scale using several tools.

Course Learning Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Taxonomy |
|------|---|---------------------------------|
| | | Descriptor |
| CO.1 | Demonstrate the adeptness with the organization of the AutoCAD user interface. | Cognitive (Understanding) L2 |
| CO.2 | Appraise the efficient use of basic drawing commands and tools to develop drawing strategies. | Cognitive (Evaluating) L5 |
| CO.3 | Develop ability to produce state-of-the-art computerized drawings and designs. | Cognitive (Creating) L6 |

CO-PO Mapping:

| CO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-----|---|---|---|---|---|---|---|---|---|----|----|----|
| CO1 | | | | | 3 | | | | 2 | | | 2 |
| CO2 | | | | | 2 | | | | 2 | | | 2 |
| CO3 | | | | | 2 | | | | 1 | | | 2 |

| COs | PSO1 | PSO2 |
|-----|------|------|
| CO1 | - | 2 |
| CO2 | - | 2 |
| CO3 | - | 1 |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE | 50 |

ISE: Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

Course Contents:

| | |
|--|---------|
| Experiment No. 1: CONVENTIONAL REPRESENTATIONS, SCALE & SYMBOLS a. Title Block b. Scales for Drawing c. Lettering & Dimensioning | 2 Hours |
|--|---------|

| | |
|--|---------|
| d. Graphical Symbols | |
| Experiment No. 2: MASONARY DRAWING a. Brick Masonry b. Stone Masonry | 2 Hours |
| Experiment No. 3: FOUNDATION DRAWING a. Raft Foundation b. Grillage Foundation c. Pile Foundation d. Inverted Arch Foundation e. Well Foundation | 2 Hours |
| Experiment No. 4: DOOR & WINDOW DRAWING a. Types of Doors b. Types of Windows | 2 Hours |
| Experiment No. 5: STAIRS & STAIRCASE a. Straight Flight Stairs b. Dog Legged Stairs c. Circular Stairs with Open Well d. Spiral Stairs e. Bifurcated Stairs | 2 Hours |
| Experiment No. 6: RESIDENTIAL BUILDING Line Plan with Dimensions a. Single storeyed b. Multi storeyed | 2 Hours |
| Experiment No. 7: RESIDENTIAL BUILDING Elevation with Dimensions a. Single storeyed b. Multi storeyed | 2 Hours |
| Experiment No. 8: RESIDENTIAL BUILDING Section with Dimensions a. Single storeyed b. Multi storeyed | 2 Hours |
| Textbooks: 1. AutoCAD 2012 Instructor, James Leach, Mc-Graw-Hill, New York, 2011 ISBN- 0073375462 | |
| Reference Books: 1. Reference Book on Computer Aided Design Laboratory, Dr. M. N. Shesha Prakash, Dr. G. S. Suresh, Laxmi Publications Pvt. Ltd., New Delhi. 2. Mastering AutoCAD 2017 and autoCAD LT 2017, George Omura and Brian C Benton. 3. Computer Aided Engineering Drawing, S. Trymbaka Murthy. 4. AutoCAD 2015 and AutoCAD LT 2015: No Experience Required, Donnie Gladfelter. 5. AutoCAD 2010 and AutoCAD LT 2010: No Experience Required, Jon McFarland, Wiley India Pvt. Ltd. 6. A course in Civil Engineering Drawing , V.B.Sikka, S.K. Kataria & Sons | |

COURSE OFFERED UNDER PROJECT BASED LEARNING

COURSE NAME: Computer Aided Design Laboratory

COURSE CODE: UENV0335

1. PROBLEM STATEMENT

Draw the Plan & Elevation of Residential Building for a family with four members. (Husband, Wife with two children)

2. ABSTRACT / DESCRIPTION OF PROBLEM STATEMENT

Students know the basic commands for the AutoCAD program. This problem will provide the overall idea of Residential Building Drawing including Masonry, foundation, doors, windows, stairs etc.

3. ACTIVITIES / STEPS WITH DURATION TO SOLVE THE PROBLEM

Plan & Elevation in Autocad Drawings as per given situation which includes

Masonry Drawing – 2 Hours

Foundation Drawing – 2 Hours

Door & Window Drawing – 2 Hours

Stairs & Staircase– 2 Hours

4. ASSESSMENT SCHEME

Term work (50 Marks)

Experiments (Each 10 Marks)

5. EVALUATION SCHEME

| Outcomes / Level | Excellent (5 Marks) | Poor (3Marks) |
|---|--|--|
| 1. Title Box | To the scale | Improper scale |
| 2. Lettering & Symbols | To the scale | Improper scale |
| 3. Scale | As per dimensions given | Not as per given dimensions |
| 4. Measurements & Dimensions | Dimensions provided in drawing for all the major lines | Very less Dimensions provided in drawing for all the major lines |
| 5. Timely Submission | Before Submission Date / on time Submission | One week or more late submission |

SYLLABUS
S. Y. B. Tech
Environmental Engineering
SEMESTER -IV

| | | | | |
|--|----------------------|----------|----------|---------------|
| Class: S.Y. B. Tech Environmental Engineering Title of the Course: Surveying and Geomatics Course No.: UENV0401 | L | T | P | Credit |
| | 03 hours per week | - | - | 3 |

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Civil Engineering and importance of Surveying in it.

Course Description:

The course will help the students to understand the importance of the Surveying, Leveling in Environmental engineering works. They can get all the information of conventional and advanced instruments used in Surveying for construction of Civil engineering works. They can understand the field problems and will give solutions for it.

Course Learning Objectives:

1. To introduce the principles of various surveying methods and applications to Civil and Environmental engineering projects.
2. To expose the students to modern Surveying.
3. To learn the principles of EDM, Total Station and GPS.
4. To learn the basics of Remote sensing and GIS.
5. To use the given surveying equipments, prepare contour maps and carryout surveying works related to land and civil engineering projects.

Course Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Taxonomy |
|------|--|------------------------------------|
| | | Descriptor |
| CO.1 | Apply basic knowledge of principles of surveying and levelling to conduct land survey. | Cognitive (Applying) L3 |
| CO.2 | Make use of skills for collection of field data using conventional and modern surveying instruments, and analyze the same. | Cognitive (Applying) L3 |
| CO.3 | Apply knowledge of contouring to read, prepare topographic maps including contours of any site. | Cognitive (Applying) L3 |
| CO.4 | Explain importance of hydrographic surveying, Remote sensing and GIS by studying the details. | Cognitive (Understanding) L2 |

CO-PO Mapping:

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO.1 | - | - | 3 | 2 | - | - | - | - | - | - | - | - |
| CO.2 | - | - | - | 3 | 2 | - | - | - | - | - | - | - |
| CO.3 | - | - | 2 | 1 | - | - | - | - | - | - | - | - |
| CO.4 | - | - | - | - | - | - | 2 | - | - | - | - | - |

| COs | PSO1 | PSO2 |
|------|------|------|
| CO.1 | - | - |
| CO.2 | - | 2 |
| CO.3 | - | - |
| CO.4 | - | - |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignments/Unit Tests/Quiz/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units).
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

Course Contents:**Unit 1:**

- **Levelling and Contouring :** Introduction, Surveying and Leveling, Study and use of Auto level, field procedure in leveling, source and errors in leveling, precautions and difficulties faced in leveling.
Countour intervals, characteristics of contours, methods of contouring, Interpolation of contours, drawing contours, uses of contour maps, Interpretation of typical contour sheet.

**06
Hours****Unit 2:**

Theodolite Surveying: Various parts and axis of transit, technical terms, temporary and permanent adjustments of a transit, horizontal and vertical angles, methods of repetition and reiteration.

Precautions in using theodolite, errors in theodolite survey, Use of theodolite for various works such as prolongation of a straight line, setting out an angle

Tacheometry: Principle, Uses of tacheometry, Instruments used in tacheometry, Determination of tacheometric constants, Systems of tacheometric surveying - stadia system fixed hair method, Errors.

**06
Hours****Unit 3:****EDM, GPS, Total Station:**

- **EDM:** Principle, Classification of E.D.M., Instruments, Construction and use of Geodimeter, Tellurometer.
- **GPS:** Basic principle, GPS segments, receivers, applications in survey.
- **Total Station:**
Introduction to survey by total station, Advantages and disadvantages of Total Station, types of total stations, Handling of total station.

**08
Hours****Unit 4:**

Curves: Significance of curves and curve setting, Classification of curves, Elements of simple, compound, transition and combined curve, setting out of simple curve by linear and angular methods.

**07
Hours****Unit 5:**

Hydrographic Surveying: Introduction, Purpose of hydrographic survey, Methods of hydrographic survey, mean sea-level, tide gauges, location of soundings, equipments for taking soundings.

**06
Hours****Unit 6:****Remote Sensing and Geographical Information System:**

Remote Sensing: Introduction, Definition, Necessity, Importance and use; Basic concepts in Remote Sensing , Basic Laws of electromagnetic radiation, Atmospheric effects on radiation, Interaction of EM energy with matter, Satellite remote sensing, Problems confronting remote sensing system. Applications of remote sensing.

**07
Hours**

Geographical Information System: Introduction, Definition, Objectives, Components (people, procedure, hardware, software & data) & functions (input, manipulation, management, query & analysis and visualization) of GIS. Coordinate systems and projections, Georeferencing, GIS data – spatial (Raster & vector) & aspatial data. Introduction to vector and raster data Applications of GIS, Limitations of GIS.

Text Books:

1. A Text book of Advanced Surveying by R.Agor
2. Surveying and Leveling by Basak – Second Edition

Reference Books:

1. Surveying Vol.I, II and III by Dr. B.C. Punamia
2. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni
3. Surveying Vol. I, II and III by Dr. K.R. Arora
4. Surveying Vol. I and II by S. K. Duggal
5. Surveying and Levelling by N.N. Basak
6. Surveying and Levelling by R. Agor
7. Advanced Surveying by R. Agor.
8. Advanced Surveying -Total Station, GIS and Remote Sensing by SatheeshGopi, R.Sathikumar and N. Madhu , Pearson publication.
9. Surveying and Leveling by S.S. Bhavikatti
10. Surveying by S.K.Duggal- Vol. I, Vol. II
11. Advanced Surveying by P. Som, B. N. Ghosh
12. GPS Sattelite Surveying—Alfred Leick—Wiley
13. Remote sensing and Geographical Information System, By A. M. Chandra and S. K. Ghosh, Narosa Publishing House.
14. Remote Sensing & GIS,2/E—Bhatta-- Oxford University Press.
15. Surveying &levelling by R. Subramanian, Oxford Publication.
16. Plane Surveying – Dr. Alok De, S. Chand Publications

Unit wise Measurable Students Learning Outcomes:

Unit Learning Objectives (ULO):

Unit1: Demonstrate basic knowledge of principles of surveying, leveling and field procedures to conduct the Land survey.

Unit-2: Develop skills for collection of field data using traditional surveying equipments such as Levels and theodolite.

Unit-3: Explain principles of GPS, EDM, and Total Station, for environmental engineering works.

Unit-4: Explain simple and transition curves for Civil engineering works.

Unit-5: Study hydrographic surveying for measurement of capacity of reservoirs.

Unit-6: Explain use of Remote sensing and GIS in Environmental engineering.

Unit Outcomes (UO):

After completion of the unit, students will be able to,

1. Do surveying, leveling & contouring for environmental engineering works. **(CO1, CO3)**
2. Apply surveying instruments like theodolite and tachometer for surveying and leveling skillfully. **(CO2)**
3. Apply the principles of GPS, EDM, Total Station for environmental engineering works.**(CO2)**
4. Demonstrate simple and transition curves. **(CO2)**
5. Explain the hydrographic surveying for measurement of capacity of reservoirs.**(CO4)**
6. Explain Remote sensing and GIS. **(CO4)**

| | | | | |
|---|----------|----------|----------|---------------|
| Class: S.Y. B. Tech Environmental Engineering | L | T | P | Credit |
| Title of the Course: Water Resources Engineering | 3 | 1 | - | 4 |
| Course No.: UENV0402 | | | | |

Course Pre-Requisite:

Students shall have knowledge of:

- Engineering Mathematics
- Elements of Hydrological Cycle

Course Description:

Water Resources Engineering is a branch of Civil Engineering which deals with the occurrence, movement, distribution of water on earth surface & underground. The course emphasizes on methods of measurement of rainfall; abstraction losses; runoff; groundwater flows; irrigation water requirements; watershed management etc.

Course Objectives:

1. To emphasize the importance of study of Hydrology and necessity of conservation of Water Resources.
2. To develop the ability among students to synthesize data & understanding technical concepts of Water Resource Engineering
3. To build up the skills to analyze, design, interpret data to find out the discharge of flood; Runoff, to understand relationship between Rainfall & Runoff.

Course Learning Outcomes:

| CO | After the completion of the course the student will be able to | Bloom's Cognitive Descriptor |
|------|---|------------------------------|
| | | CO.1 |
| CO.2 | Explain the occurrence, potential of groundwater flows to wells & sources of contamination. | Cognitive - Understanding |
| CO.3 | Illustrate the benefits of Land Drainage, Wetlands and Watershed Management. | Cognitive - Understanding |
| CO.4 | Make use of data for calculating Runoff Volumes, Flows to Wells and Water Requirement for Irrigation. | Cognitive -Applying |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO.1 | 2 | | | | | | | | 2 | | | |
| CO.2 | 2 | | | | | | | | 2 | 1 | | |
| CO.3 | 2 | | | | | | | | 2 | 2 | | |
| CO.4 | 2 | | | | | | | | 2 | | | |

| CO | PSO1 | PSO2 |
|------|------|------|
| CO.1 | | |
| CO.2 | | |
| CO.3 | | |
| CO.4 | | |

Assessment :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 100 |

| Course Contents: | |
|---|---------------|
| <p>Unit 1: Hydrology Definition, Importance and Scope of Hydrology, Hydrologic Cycle, Forms and Types of Precipitation, Methods of Measurement, Factors Affecting Precipitation, Estimating Missing Data, Mass Rainfall Curve, Hyetograph, Double Mass Curve Analysis , Determination of Average precipitation over the catchment, Evaporation and Evapotranspiration, Factors affecting and Measurement Infiltration: Process of Infiltration, Factors affecting Infiltration, Infiltration Indices, Effect of Infiltration on Runoff and Groundwater Recharge.</p> | 8 Hrs. |
| <p>Unit 2: Runoff Classification of Runoff, Factors affecting Runoff, Catchment Yield Calculations, Rainfall-Runoff Relationship, Hydrograph: Storm Hydrograph, Base flow and Separation of Base flow, Direct Runoff Hydrograph, Unit Hydrograph Theory – Assumptions and Limitations, Derivation and Use of Unit Hydrograph, S-Curve Design Flood Hydrograph – Components, Introduction to Synthetic Unit Hydrograph (SUH).</p> | 8 Hrs. |
| <p>Unit 3: Watershed Management & Wetlands Watershed Management: Need of Watershed Management, Techniques of Watershed Management. Wetlands: Concept, Types, Wetland Ecosystem, Benefits of Wetlands</p> | 4 Hrs. |
| <p>Unit 4: Groundwater Hydrology Occurrence and Distribution of Groundwater, Types of Aquifers, Specific Yield of Aquifer, Movement of Groundwater, Darcy's law, Permeability, Hydraulics of Well under Steady Flow Conditions in Confined and Unconfined Aquifers, Estimation of flows to wells, Specific Capacity of Well, Types of Wells Sources of Groundwater Contaminations, Contaminant Plumes, Transport Mechanism, Control of Groundwater Contamination</p> | 8 Hrs. |
| <p>Unit 5: Irrigation Definition and Necessity of Irrigation, Types of Irrigation, Different Systems of Irrigation, Methods of Application of Water to Soil for Irrigation, Minor Irrigation Works, Lift irrigation Classes and Availability of Soil water, Depth and Frequency of Irrigation, Crops Classification and Crop Rotation, Command Area-Calculations Duty, Delta, Factors affecting Duty, Methods of improving Duty, Consumptive Use of Water, Assessment and Efficiencies of Irrigation Water.</p> | 8 Hrs. |
| <p>Unit 6: Water Logging and Control Water logging and Salinity, Causes (Natural & Artificial), Effects, Remedial Measures, Soil Efflorescence, Drainage Arrangement, Management of Saline & Alkaline Soils.</p> | 4 Hrs. |
| <p>Textbooks: 1. Engineering Hydrology – Jay rami Reddy 2. Engineering Hydrology – K. Subramanya 3. Engineering Hydrology – H. M . Raghunath 4. Water Resources Engg. – Dr. P.N.Modi (Standard Book House)</p> | |
| <p>References: 1. Applied Hydrology – V. T. Chaw 2. Watershed Management in India – J.V.S.R. Murthy (New Age International) 3. Hydrology and Soil Conservation – Ghanshyam Das , (PHI) 4. Water resources systems – R. S. Varshney. 5. Hydrology – K. Subramanya.</p> | |
| <p>Term work: Assignments based on above units</p> | |
| <p>Unit Outcomes (UOs) At the end of course students will be able to UO 1.1: Interpret the elements of hydrological cycle. – CO 207.1 UO 1.2: Interpret the methods of measurement of abstraction losses. – CO 207.1 UO 2.1: Make use of data for calculation of runoff volumes. – CO 207.5 UO 2.2: Make use of data for derivation of Flood Hydrograph & Unit Hydrograph. – CO 207.5</p> | |

UO 3.1: Illustrate the benefits of watershed management. - CO 207.4
UO 3.2: Illustrate the benefits of wetlands.- CO 207.4
UO 4.1: Summarize the sources of groundwater contamination. – CO 207.3
UO 4.2: Explain the distribution of groundwater & movement of groundwater – CO 207.3
UO 5.1: Make use of data for calculation of water requirements for crops. – CO 207.5
UO 5.2: Make use of data for calculation of canal water requirements & reservoir capacity. – CO 207.5
UO 6.1: Illustrate the causes for saline or alkaline soils.- CO 207.4
UO 6.2: Illustrate the benefits of techniques to avoid the water logging & salinity. - CO 207.4

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|--|-------------|----------|----------|---------------|
| Course: S. Y. B. Tech Environmental Engineering Title of the Course: Building Planning and Design Course Code: UENV0403 | L | T | P | Credit |
| | 2 hrs /week | --- | --- | 2 |

Course Pre-Requisite: Students must know the details of various building components, sections, details of various environmental structures.

Course Description:
To prepare a detailed design and drawing of residential and public buildings as per various terrain conditions.

- Course Objectives:**
1. To understand the sequence of activities in a building project.
 2. To decide the shapes & sizes of various components of the building
 3. To plan the building satisfying the requirements & obtaining the best performance from the available climate.
 4. To decide & draw the various details of the building.

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Cognitive Descriptor |
|------|--|------------------------------|
| | | CO.1 |
| CO.2 | Select the various building elements for achieving the thermal comfort as per the climatic zones. | Applying |
| CO.3 | Decide the necessary building services for sanitation, rainwater harvesting & solid waste disposal facilities. | Evaluating |
| CO.4 | Plan the building as per building bye-laws. | Creating |
| CO.5 | Design various floor plans with services for execution of work. | Creating |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO.1 | | 3 | | | | | | | | | | |
| CO.2 | | | 2 | | 2 | | | | | | | |
| CO.3 | | | 2 | | 2 | | | | | | | |
| CO.4 | 3 | | | 2 | 3 | | | | | | 1 | 1 |
| CO.5 | | 2 | | | 2 | | | | | | | |

| CO | PSO1 | PSO2 |
|------|------|------|
| CO.1 | | |
| CO.2 | | |
| CO.3 | 2 | 1 |
| CO.4 | | 2 |
| CO.5 | | 2 |

Assessments :

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Weightages (Marks) |
|------------|--------------------|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

| | |
|--|----------------|
| ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE. | |
| Course Contents: | |
| Unit 1:--- Introduction to Building Planning (Residential & Public Building) Sequence of activities in a building project, Functions and role of various agencies: Owner, Architect, Civil Engineer, Structural Engineer, and Contractor. Site Selection, Principles of Planning (Orientation, aspect, prospect, grouping, circulation, functional relations of different units, roominess, flexibility, privacy, space utilization, sanitation, ventilation, strength and stability of structures), Orientation of Buildings. | 6 Hrs. |
| Unit 2:--- Building Bye Laws (Residential & Public Building) Climatic Zones of India, Necessity of building rules and bye laws for Residential & Public Building, plot sizes, road widths, open spaces, floor area ratio of (FAR), marginal distances, building line, control line, heights regulations, Area calculations for Built up area, floor area, carpet area, rules for ventilation, lighting, drainage, sanitation and parking of vehicles, rules for layout plans. | 6 Hrs |
| Unit 3:--- Functional planning and design of Residential building Line plans and working drawings and submission plans to sanctioning authorities, checklist for planning a building project, site plan, utilities and services (Water Supply, Drainage, Plumbing, Electrification, Interior & Exterior), legal documents budget restrictions for Residential Buildings | 10 Hrs. |
| Unit 4: --- Functional planning and design of Public building Line plans and working drawings and submission plans to sanctioning authorities, checklist for planning a building project, site plan, utilities and services (Water Supply, Drainage, Plumbing, Electrification, Interior & Exterior), legal documents budget restrictions for Educational institutes, banks, hospitals, Hotels and Restaurants, Design aspects. | 10 Hrs. |
| Unit 5: --- Perspective Drawing: Principles of perspective drawing, parallel and oblique perspective. | 6 Hrs. |
| Unit 6: --- Modern Concepts in Building Design Green Building Concepts: Evaluation of sustainable/green buildings based on different rating systems. Introduction to the LEED rating system and energy conservation building codes (ECBC) compliance. | 10 Hrs. |
| Textbooks: 1. Building Planning by Shah Kale | |
| References: 1. Building Construction – B.C.Punmia (Laxmi Publications) 2. Text Book of Building Construction – S.P. Arora, S.P. Bindra (Dhanpat Rai Publications) 3. A to Z of Practical Building Construction and Its Management- Sandeep Mantri (Satya Prakashan, New Delhi) 4. SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi 5. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings 6. A Course in Civil Engineering Drawing – V.B.Sikka (S.K.Kataria and Sons) 7. Civil Engineering Drawing – M. Chakraborty. 8. Engineering Materials – R.K.Rajput (S. Chand) 9. Handbook of Building Construction- M. M. Goyal (Amrindra Consultancy (P) Ltd. | |
| Unit wise Measurable students Learning Outcomes: 1. Study the requirements of the owner and the various alternatives for achieving these requirements. 2. Understand the various types of buildings and the guidelines for planning of various elements 3. Study the various factors of climate affecting the comfort performance of the building. 4. Learn the building byelaws and rules from various sanctioning authorities. 5. Learn the various services to be provided for the residential buildings. 6. Understand the concept of perspective of various types | |

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|--|----------------------|----------|----------|---------------|
| Class: S. Y. B. Tech Environmental Engineering Title of the Course: Environmental Hydraulics Course No.: UENV0404 | L | T | P | Credit |
| | 03 hours per week | - | - | 3 |

Course Pre-Requisite:

Students shall have the knowledge of:

- Algebra and Engineering Mathematics
- Engineering Physics
- Applied Mechanics
- Fluid Mechanics

Course Description:

The course is imparting fundamental knowledge of environmental hydraulics as applicable in environmental engineering. The course will cover the hydraulics of pipes under pressure, (water mains and networks), and open channel flow (sewers, drains, and channel sections). Students will learn how to apply basic hydraulics principles, laws and equations in solving practical design problems. The course will cover the fundamentals of open channel flow, depth energy relationships, flow measurement through channels, impact of jets, demonstrations and practical design problems.

Course Learning Objectives:

1. To understand the basic principles of environmental hydraulics for the analysis and design of water and sewerage system.
2. To recognize the physical description and hydraulic illustrations of flow systems.
3. To study types of open channel flow, depth energy relationships and flow profiles.
4. To learn the basic principles and assumptions of dynamic equations applied to fluid flow systems.
5. To identify the rational approaches for determination of flow characteristics and forces acting on plates and vanes.

Course Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Cognitive |
|------|--|------------------------------------|
| | | Descriptor |
| CO.1 | Explain the basic hydraulics principles used in the analysis and design of pipe flow and open channel flow systems. | Cognitive (Understanding) L2 |
| CO.2 | Solve problems on water and sewerage systems, impact of jet, flow profiles and flow measurement through open channels using acquired knowledge, facts, and techniques. | Cognitive (Analyzing) L4 |
| CO.3 | Derive functional expressions considering various parameters in a phenomenon using principles of hydraulics. | Cognitive (Evaluating) L5 |
| CO.4 | Interpret the use of basic laws and equations to determine velocities, flow rates, flow characteristics through theoretical and standard laboratory procedures. | Cognitive (Evaluating) L5 |
| CO.5 | Adapt appropriate methods to work out hydraulics problems using analytical and computational methods. | Cognitive (Creating) L6 |

CO-PO Mapping:

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO.1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| CO.2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| CO.3 | - | - | - | 3 | 2 | - | - | - | - | - | - | - |
| CO.4 | - | - | 2 | 2 | 1 | - | - | - | - | - | - | - |
| CO.5 | 2 | - | - | - | 2 | - | - | - | - | - | - | - |

| COs | PSO1 | PSO2 |
|------|------|------|
| CO.1 | - | - |
| CO.2 | - | - |
| CO.3 | - | - |
| CO.4 | - | - |
| CO.5 | - | 1 |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE-1 | 10 |
| MSE | 30 |
| ISE-2 | 10 |
| ESE | 50 |

- **ISE-1 and ISE-2:** Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).
- **MSE:** Assessment is based on 50% of course content (Normally first three Units)
- **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.

Course Contents:

| | |
|--|----------------|
| <p>Unit 1: Water Distribution System: Classification of Distribution System: Pumping, Gravity and Dual System, Layout of Distribution Pipe Network: Dead End, Ring, Grid, Radial System, Continuous and Intermittent Water Supply, Pressure in the Distribution System, Capacity of Distribution, Mass Curve Method, Design of Distribution System, Design Period and Factors Affecting, Hardy Cross Method for Analyzing Complex Networks.</p> | 06 Hrs. |
| <p>Unit 2: Uniform Flow in Open Channel: Difference between Pipe Flow and Open Channel Flow, Types of Open Channel, Types of Open Channel Flows, Geometric Elements of Open Channel, Velocity Distribution, Measurement of Velocity using Chezy's and Manning's Formula, Hydraulically Efficient Section (Rectangular, Triangular, Trapezoidal and Circular), Depth Energy Relationship, Specific Energy, Specific Energy Curve, Concept of Froude Number, Critical, Sub-Critical, Super-Critical Flows, Specific Force.</p> | 07 Hrs. |
| <p>Unit 3: Fundamentals of Fluid Flow: Gradually Varied Flow (GVF): Classification of Channel Slopes, Dynamic Equation of GVF (Assumption and Derivation), Classification of GVF Profiles, Direct Step Method of Computation of GVF Profiles, Circular Arc Method. Rapidly Varied Flow (RVF): Definition, Hydraulic Jump: Phenomenon, Conjugate Depth Relationship, Characteristics, Uses and Types of Hydraulic Jump. Spatially Varied Flow: Basic Principles and Assumptions, Dynamic Equation for Increasing and Decreasing Discharge.</p> | 08 Hrs. |
| <p>Unit 4: Sewerage System: Types of Sewer Systems, Types of Sewerage System: combined, Separate and Partially Separate System, Patterns of Collection Systems: Perpendicular, Zone, Interceptor, Radial, Fan Pattern, Design Period, Design Discharge, Quantity of Sewage, Infiltration, Storm Runoff, Hydraulic Formulae, Free Board, Minimum and Maximum Velocity, Nomograms and Tables of Hydraulic Computations, Hydraulic Characteristics of Circular Sewer.</p> | 08 Hrs. |
| <p>Unit 5: Notches and Weirs: Types, Derivation of Discharge Equation, Errors in Measurement of Discharge, Time of Emptying Tank with Notch or Weir, Calibration of Notches and Weirs, Velocity of Approach, Francis Formula, Sharp Crested, Broad Crested, Ogee Weir, Proportional Weir, Parshall Flume and Venturi Flume, Slope-Area method, Velocity-Area method.</p> | 06 Hrs. |

| | |
|--|----------------|
| Unit 6: Impact of Jet: Impulse Momentum Principle, Impact of Jet on Vanes- Flat, Curved (Stationary and Moving), Series of Flat, Curved Vanes Mounted on Wheel, Inlet and Outlet Velocity Triangles. | 06 Hrs. |
| Textbooks: <ol style="list-style-type: none"> 1. Fluid Mechanics and Fluid Power Engineering, D. S. Kumar, S. K. Kataria and Sons, Delhi. 2. The Fluid Mechanics and Hydraulics, D. R. Malhotra and N. K. Malhotra, Satya Prakashan, New Delhi. 3. Engineering Fluid Mechanics, R. J. Garde and A. G. Mirajgaoker, Scitech Publications India Pvt. Ltd., Chennai. 4. Fluid Mechanics: Including Hydraulic Machines, A. K. Jain, Khanna Publishers, New Delhi. 5. Hydraulics and <i>Fluid Mechanics</i>, P. N. Modi and S. M. Seth, Standard Book House, New Delhi. 6. Engineering Fluid Mechanics, K. L. Kumar, S. Chand and Co, Eurasia Publishing House, New Delhi. 7. A Textbook of Fluid Mechanics and Hydraulic Machines, Dr. R. K. Bansal, Laxmi Publications, New Delhi, 2013. 8. A Textbook of Fluid Mechanics, R. K. Rajput, S. Chand and Company Pvt. Ltd., New Delhi. 9. Fluid Mechanics – I, M. M. Mujumdar and Akshay R. Thorvat, Electrotech Publications. 10. Water Supply and Sanitary Engineering, G. S. Birdie, J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi. 11. Environmental Engineering – 1, Water Supply Engineering, B. C. Punmia, Arun K. Jain and Ashok K. Jain, Laxmi Publications Pvt. Ltd., New Delhi. 12. Environmental Engineering – 2, Wastewater Engineering, B. C. Punmia, Arun K. Jain and Ashok K. Jain, Laxmi Publications Pvt. Ltd., New Delhi. 13. Analysis of Water Distribution Networks, Pramod Bhave, R. Gupta. Narosa Publishing House. | |
| References: <ol style="list-style-type: none"> 1. Fluid Mechanics, Frank .M. White, McGraw Hill Publishing Company Ltd, New Delhi. 2. Fluid Mechanics and Machinery, C. P. Kothandaraman and R. Rudramoorthy, New Age International Publishers. 3. Fluid Mechanics: Fundamentals and Applications, Yunus, A. Cengel and John M. Cimbala Adapted by S. Bhattacharya, Tata McGraw-Hill Publishing Company Ltd., New Delhi. 4. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som, Gautam Biswas, Suman Chakraborty, Tata McGraw Hill Education Pvt. Ltd., New Delhi. 5. Flow in Open Channels, K. Subramanya, McGraw Hill Education India Pvt. Ltd., New Delhi. 6. Open Channel Flow, M. Hanif Chaudhry, Pentice Hall, Boston. 7. Open Channel Hydraulics, V. T. Chow, Tata McGraw Hill. 8. Flow Through Open Channels, K.G. Ranga Raju, Tata McGraw Hill. 9. Fundamentals of Hydraulic Engineering Systems, R. J. Houghtalen, A. Osman Akan, and Ned H. C. Hwang, Prentice Hall, Boston. | |
| Unit wise Measurable Students Learning Outcomes: Unit Learning Objectives: <ol style="list-style-type: none"> 1. To study the water distribution system, layout and types of networks. 2. To understand the uniform flow through open channel and depth energy relationships. 3. To imbibe in detail GVF profiles, hydraulic jump and concept of SVF. 4. To learn basic principles of hydraulics, laws and equations for the analysis and design of sewerage system. 5. To recognize the methods for measurement of flow through open channels. 6. To determine impact of jet on flat and curved plates / vanes for various conditions. Unit Outcomes: Students will be able to <ol style="list-style-type: none"> 1. Explain methods of water distribution, layout and types of networks and Solve problems on water distribution networks. (CO.1, CO.2, CO.5) 2. Derive the conditions for most economical channel section and Solve problems on flow through open channels and depth energy relationships. (CO.1, CO.2, CO.3, CO.4) 3. Develop dynamic equations for non uniform flows and Solve problems on water surface profiles, | |

hydraulic jump. (CO.1, CO.2, CO.3)

4. **Select** and **Apply** basic hydraulics principles, laws and equations and appropriate methods in the analysis and design of sewerage system. (CO.1, CO.2, CO.5)
5. **Derive** functional expressions and **Solve** problems on flow measurement through open channel using theoretical and standard laboratory procedures. (CO.2, CO.3, CO.4)
6. **Derive** functional expressions and **Solve** problems on force exerted by jet on flat and curved plates (stationary and moving). (CO.2, CO.3, CO.5)

| | | | | |
|--|----------------|----------------|----------|---------------|
| Class: S. Y. B. Tech Environmental Engineering Title of the Course: Professional Elective – I: Ecology and Environmental Sanitation Course Code: UENV0421 | L | T | P | Credit |
| | 3 hrs per week | 1 hrs per week | - | 4 |

Course Pre-Requisite: Basic concept of Environmental Science.

Course Description: Introduction to sanitation and public health as related to the environment, including potential hazards that may occur due to unhygienic conditions or environmental pollution.

Course Objectives:

1. Know concepts of ecosystem and effects of human interference on ecosystem.
2. Study importance of sanitation requirement of public places and rural sanitation.
3. Understand various communicable diseases and significance of vital statistics.
4. Understand the different types of housing standards and drainage system.

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Cognitive Descriptor |
|-----|--|------------------------------|
| | | CO1 |
| CO2 | Summarize various communicable diseases and significance of vital statistics. | Cognitive (Understanding) L2 |
| CO3 | Identify sanitation requirement of public places and necessity of rural sanitation | Cognitive (Applying) L3 |
| CO4 | Explain different types of housing standards and drainage system | Cognitive (Evaluating) L5 |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | | | | | | | | | | | |
| CO2 | | | | | | 2 | | 3 | | | | |
| CO3 | | 2 | | | | 3 | | | | | | |
| CO4 | 2 | | | | | 2 | | | | | | |

| CO | PSO 1 | PSO 2 |
|-----|-------|-------|
| CO1 | 2 | |
| CO2 | 1 | |
| CO3 | | |
| CO4 | | |

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three Units)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three Units) covered after MSE.

Course Contents:

Unit 1:---Ecology

Definition, Ecosystem, Components of an ecosystem, Energy flow in ecosystem, Carrying Capacity of Ecosystem.

Bio-geochemical cycles: Sulfur, Carbon, Nitrogen, Phosphorus, Oxygen

Population Ecology:

Ecological pyramids; limiting factors, laws and combined concept of limiting factors, Population dynamics, Population distribution and growth forms. Interaction such as competition, co-existence, prey predator among different species,

Effect of pollution and human Interference on Environment:

Effect of human activities on environment, Bio-accumulation, Bio-magnification, Deforestation, global warming, acid rain, overpopulation, climate change.

Effect of agricultural activities on environment, fertilizers related problems: micronutrient imbalance, nitrate pollution, Eutrophication; pesticides related problems, water logging, salinity.

National plan for conservation of aquatic ecosystem :

Lakes and Wetlands, Definition, Importance of natural wetlands, classification, types of natural wetlands, RAMSAR convention, Conservation of wetlands, effects of human activities on natural wetlands and ponds

10 Hrs.

Unit 2: Sanitation of Public places and role of agencies:

Public health activities of WHO, Government, Municipalities, Health care system in India, Role of environmental engineer in sanitation.

Building byelaws for sanitation requirements of Market, Slaughter house, Theater, Swimming pool, Institutional buildings and other places. Control of insect vector and rodents.

5 Hrs.

Unit 3: a) Communicable Diseases & Health

Epidemics, Transmission of diseases, Diseases transmitted through air, water, food, contacts & insects, General measures to control disease and preventative measures

b) Vital Statistics:

Uses and sources of vital statistics, birth and death certification, indicators of community health, morbidity & mortality rates, causes and factors affecting morbidity, infants mortality rates.

5 Hrs.

Unit 4: a) Milk and Food Sanitation:

Milk and food as vehicles of infection. Essential of milk sanitation, Pasteurization and its methods. Importance of food sanitation, food preservation methods.

b) Housing

Housing - Concept of healthful housing, Blighted area and causes of slum development, Criteria for good housing, Housing standards.

4 Hrs.

| | |
|---|---------------|
| <p>Unit No 5: Plumbing & House drainage Plumbing, Principles, Plumbing fixtures requirements, materials for plumbing, Definition of common terms, Types of trap, layout and system of plumbing, Typical plumbing layouts, Two pipe and One pipe system, Single stack system, Piping installation and testing. Maintenance & repairs of plumbing fixtures & facilities. Septic tank- working and construction.</p> | 9 Hrs. |
| <p>Unit 6: Rural Sanitation Necessity & Importance, Various aspects of rural sanitation – Water Supply, Sewage disposal, Community cleanliness, Application & Implementation of Waste to Energy concept: Biogas plant: Working Principle, types and applications, Septage management, DEWATS, Government policies & programs for rural sanitation.</p> | 7 Hrs. |
| <p>Textbooks: 1. Plumbing Engineering- Theory & practice: Prof. S.M.Patil, Seema publications 2. Fundamental of Ecology: E P Odum</p> | |
| <p>References: 1. Municipal Sanitation- Ethler& Steel 2. Environmental Sanitation – Salvato 3. Fundamentals of Ecology: M. C. Dash (TMH publication) 4. Preventive & Social Medicine: J. E Parks 5. Concept of Ecology: E. J Kormondy (PHI Publication) 6. Plumbing- Design & practice: S.G.Deolalikar, TMH</p> | |

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|--|----------|----------|----------|---------------|
| Course: S. Y. B. Tech Environmental Engineering Title of the Course: Professional Elective – I: Remote Sensing and GIS Course Code : UENV0421 | L | T | P | Credit |
| | 03 | 01 | -- | 04 |

Course Pre-Requisite:

Student should know the basic knowledge of Surveying and applications in Environmental Engineering field along with basic knowledge of Computers and Geography.

Course Description:

1. The course will make student capable to understand fundamentals Remote sensing and its Applications in Environmental Engineering field.
2. The course will make student capable to interpret and analyze various Environmental issues with the help of GIS software..

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Cognitive |
|-----|---|-------------------|
| | | Descriptor |
| CO1 | Explain the basics of Geographic information systems (GIS) and Remote sensing. | Understanding |
| CO2 | Select and acquire both primary and secondary spatial data for use in GIS | Applying |
| CO3 | Analyze digital data in raster and vector formats. | Analysing |
| CO4 | Explain how Remote sensing and GIS is useful in various Engineering applications. | Evaluating |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 2 | | | 2 | | | | | | | | |
| CO2 | | | | | 1 | | | | | | | |
| CO3 | | | | | 1 | | | | | | | |
| CO4 | | | | | 2 | | | | | | | |

| CO | PSO1 | PSO2 |
|-----|------|------|
| CO1 | | |
| CO2 | | |
| CO3 | | |
| CO4 | | 2 |

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three Units)

ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three Units) covered after MSE.

| Course Contents: | |
|---|--------------|
| Unit 1: Introduction to Remote Sensing : Definition, Physics of Remote Sensing, Electromagnetic Radiation and its Interactions With atmosphere, Remote sensing advantages & Limitations, Remote Sensing process., Aerial Photographs, Data Products | 6 Hrs |
| Unit : 2 Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms- IRS, Landsat, SPOT, etc. sensors, sensor resolutions (spatial, spectral, radiometric and temporal). | 7 Hrs |
| Unit : 3 Photogrammetry & Image Processing and Interpretation: Terms, Types, vertical photographs, scale, ground coordinates, relief displacement, Flight planning Photomaps and Mosaics. Stereoscopy and photo interpretation. Data analysis - Visual Interpretation and Basics of digital image processing. | 7 Hrs |
| Unit : 4 Introduction to Geographical Information Systems Overview of GIS, Definitions, Components, Applications GIS Data, Models Projections and Coordinate Systems, Attribute Data, Spatial Data, Spatial Analysis, Introduction to any GIS Software. | 7 Hrs |
| Unit : 5 Data input and Editing: Data stream, data encoding, map digitization and conversion, data analysis, network and surface analysis in GIS, analytical modeling, forms of GIS output, decision support systems, GIS project design and management. | 7 hrs |
| Unit : 6 GIS applications Forestry, Bio-diversity, Environment, Soil resource management, Hydrological modelling, Public utilities (water distribution, sewerage, solid waste management). | 7 Hrs |
| References: | |
| <ol style="list-style-type: none"> 1. Advanced Surveying by Satish Gopi, R. Sathikumar and N. Madhu 2. Remote Sensing and GIS by Anji Reddy 3. Advanced Surveying by Agor R. 4. Future Trends in Remote Sensing by Prebel Gudmandes 5. Scale in Remote sensing and GIS by Dale A. Quattrochi 6. Sensors and Environmental applications of Remote Sensing by Jam Askne | |

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|--|----------|----------|----------|---------------|
| Class: S. Y. B. Tech Environmental Engineering Title of the Course: Professional Elective – I: Engineering Geology Course Code : UENV0421 | L | T | P | Credit |
| | 03 | 01 | -- | 04 |

Course Pre-Requisite:
Student should know the basic knowledge of Physics, Chemistry and Geography.

Course Description:
1.The course will make student capable to identify the different types of Rocks, Minerals, Structure and their Engineering significance when it produce physically.
2. The course will make student capable to solve and interpret various Geological Maps and apply its knowledge in different Engineering projects.

Course Objectives:
During the course the student will able to understand
1.The basics of Engineering Geology, different types of Rocks and Minerals
2. Responsibilities of Civil Engineers and Geologist regarding dynamics of structural feature of Rocks like fold, fault, joints.
3.Environmental impact of Dam and Reservoirs.

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Cognitive |
|-----|--|-----------------------|
| | | Descriptor |
| CO1 | Recall the fundamental concepts of Geology | Cognitive (Knowledge) |
| CO2 | Define the Causes, Effects of natural calamities like Earthquakes, Landslide and Floods | Cognitive (Knowledge) |
| CO3 | Classify the types of minerals, rocks their structural features, Mechanism and Investigation | Cognitive (Applying) |
| CO4 | Assess the Environmental impact of Dams and Reservoirs on Environment | Cognitive (Analyze) |

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | 2 | - | - | - | 2 | - | - | - | - | - | - |
| CO3 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | | 2 | - | - | - | - | 2 | - | - | - | - | - |

| CO | PSO1 | PSO2 |
|-----|------|------|
| CO1 | - | - |
| CO2 | - | - |
| CO3 | - | - |
| CO4 | - | - |

Assessments :
Teacher Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

| | |
|---|--------------|
| <p>MSE: Assessment is based on 50% of course content (Normally first three Units) ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three Units) covered after MSE.</p> | |
| <p>Course Contents:</p> <p>Unit : 1 Introduction: Geology and Environmental Geology. Scope of Environmental Geology, interior of the earth. Weathering, erosion and denudation. Geological work of River – Processes and features of erosion and deposition.</p> | 4 Hrs |
| <p>Unit : 2 Mineralogy and Petrology: Mineralogy –Definition, Physical properties of minerals. Petrology – Igneous Rocks –Structures, Classification of igneous rocks—on the basis of mode of occurrence, silica percentage and colour index. Igneous intrusions. Secondary rocks– classification, Formation of Sedimentary rocks, structures and classification. Metamorphic rocks--agents, types and structures.</p> | 7 Hrs |
| <p>Unit : 3 Structural Geology: Strike, Dip, Unconformity and its types. Joints, Folds, Faults - their mechanism, types and engineering significance. Geological profile of unconformable series of beds with igneous intrusions. Mineral Resources - Metallic and non-metallic minerals, Impacts of Mining activities on the environment, Environmental Management in mining.</p> | 9 Hrs |
| <p>Unit : 4 Natural Hazards: Nature, environmental security and hazard zoning, Risk assessment analysis, strategies for hazard mitigation. Earthquakes – Causes, Effects, Recording of earthquake. Landslides –Causes and remedial measures. Volcanoes - Types and Environmental effects. Floods – Causes, Flood Management. Laws of groundwater exploitation</p> | 6 Hrs |
| <p>Unit : 5 Preliminary Geological Investigations: Various steps in the geological studies of a project site, Engineering consideration of structural features. Geophysical exploration : Electrical Resistivity method its application. Exploratory drilling: Core drilling operations and Numerical. Remote Sensing and GIS applications.</p> | 8 hrs |
| <p>Unit : 6 Dams and Reservoirs: Geotechnical consideration and environmental impact, effects of geological structures, Seismicity conditions, Reservoir Induced seismicity (RIS), Environmental impact of water impoundment, alternatives to big dams.</p> | 6 Hrs |
| <p>Educational Visits from Engineering Geology point of view. Submission of visit report is mandatory</p> | |
| <p>Textbooks:</p> <ol style="list-style-type: none"> 1. Principles of Petrology G. W. Tyrrell 2. The Engg. and General Geology – Parbin Singh 3. A text book of Engineering Geology – Dr.R.B.Gupte 4. Principles of Engineering Geology – K.M.Bangar 5. Engineering geology – D Venkat Reddy 6. Environmental Geology by Edward A Keller | |

| | | | | |
|--|----------|----------|----------|---------------|
| Class: S.Y.B.Tech Environmental Engineering | L | T | P | Credit |
| Title of the Course: Audit Course – I: Environmental Governance | 2 | - | - | Audit Course |
| Course Code: UENV0462 | | | | |

Course Pre-Requisite:

- Basic concepts from environment.
- Fundamental knowledge of political system.
- Basics of environmental governance in India.

Course Description:

Students will understand the importance of constitution of India, fundamental rights and duties. Also functioning of parliament. Various policies of government of India, Governance of Environmental Legislation in India. Concept of sustainable development.

Course Objectives:

At the end of the course students will be able to

1. Understand the essentials of Constitution of India.
2. Understand various policies of Govt. of India.
3. Know environmental governance in India.
4. Learn concept of Sustainable Development.

Course Learning Outcomes:

| CO | After the completion of the course the student should be able to | Bloom's Cognitive |
|-----|---|-------------------|
| | | Descriptor |
| CO1 | Describe essentials of constitution of India. | Knowledge |
| CO2 | Explain various principles of Govt. of India. | Understand |
| CO3 | Use the Environmental governance in Environmental Engineering problems. | Apply |
| CO4 | Analyze the concepts of Sustainable development. | Analyze |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | | 1 | | | | | | | | | | |
| CO2 | | 1 | | | | | | | | | | |
| CO3 | | | | | | 2 | | 1 | | | | |
| CO4 | | | | | | 2 | | 1 | | | | |

| CO | PSO1 | PSO2 |
|-----|------|------|
| CO1 | | |
| CO2 | | |
| CO3 | | |
| CO4 | | |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE 1 | 10 |
| MSE | 30 |
| ISE 2 | 10 |
| ESE | 50 |

ISE-1 and ISE-2: Assessment is based on Assignment/Declared Test/Quiz/Seminar/Group Discussions etc. (For each ISE two different tools are to be used).

MSE: Assessment is based on 50% of course content (Normally first three Units).

| | |
|---|----------------|
| ESE: Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE. | |
| Course Contents: | |
| Unit 1: Constitution of India: Fundamental rights and duties, Directive Principles of State Policy, 74th Amendment of the Constitution pertaining to local Governments. Specific Provisions for Environmental Protection in the Constitution of India, Provisions in the Directive Principles of State Policy | 6 Hours |
| Unit 2: How the Parliament functions- Bill to Act to Rules. How a Bill is issued in parliament and how it becomes an Act, How a rule is notified/Gazetted. Difference between Regulation, Law and Notification Bills. Introduction to Environmental Acts, Factory Act, Safety Related rules. | 6 Hours |
| Unit 3: Environmental Policy of the Government of India and the working of the Ministry of Environment and Forests, Central Pollution Control Board, State Pollution Control Boards. Annual Report of the Ministry of Environment and Forests (current year) | 6 Hours |
| Unit 4: Concept of Sustainable Development: From Stockholm to Rio to Johannesburg. The Rio Declaration on Environment and Development. Agenda 21: An Overview, World Summit on Sustainable Development. | 6 Hours |
| References: <ol style="list-style-type: none"> 1. Constitution of India – Dr P.K.Agraval & Dr.P.K.Chaturvedi 2. Constitution of India – P.M.Bakshi 3. Our Parliament - Subhash Kashyap. 4. Climate change & Sustainable Development – R.K Mishra & Laxmi Kumari | |
| Unit wise Measurable Students Learning Outcomes: | |
| Unit Outcomes: | |
| UO 1: Understand the essentials of Constitution of India. | |
| UO 2: Understand various policies of Govt. of India. | |
| UO 3: Know environmental governance in India. | |
| UO 4: Learn concept of Sustainable Development. | |

| | | | | |
|---|----------|----------|-------------------|---------------|
| Class: S. Y. B. Tech Environmental Engineering | L | T | P | Credit |
| Title of the Course: Surveying Laboratory | --- | --- | 02 hours per week | 1 |
| Course No.: UENV0431 | | | | |

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Fundamentals of science & mathematics
- Principles of Surveying
- Purpose of Surveying

Course Description:

The course describes the fundamental principles of Surveying, Leveling with the help of various conventional and advanced instruments through Surveying practicals.

Course Objectives:

1. To explain the students various methods and use of instruments of Surveying.
2. To operate various conventional and advanced instruments used for Surveying.
3. To compute field data from the Surveying observations.

Course Learning Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Taxonomy |
|------|--|------------------------------|
| | | Descriptor |
| CO.1 | Explain basic knowledge on minor and major surveying equipments. | Cognitive (Understanding) L2 |
| CO.2 | Apply equipments/instruments for conducting surveying, levelling, theodolite traversing for civil works. | Cognitive (Applying) L3 |

CO-PO Mapping:

| CO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-----|---|---|---|---|---|---|---|---|---|----|----|----|
| CO1 | | | | 2 | | | | | | | | 2 |
| CO2 | | | | | 1 | | | | | | | 2 |

| COs | PSO1 | PSO2 |
|-----|------|------|
| CO1 | | 2 |
| CO2 | | 1 |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE | 50 |
| ESE (OE) | 25 |

- **ISE:** Based on practicals performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on practical performed and oral examination.

Course Contents:

| | |
|--|---------|
| <p>1. Experiment No. 1: Exercise based on use of Dumpy Level and Auto level:</p> <p>a) Revision Levelling exercise by Dumpy level.</p> <p>b) Levelling exercise by Auto level.</p> <p>Learning Outcome: To recall leveling procedure and operation of auto level.</p> | 4 Hours |
| <p>2. Experiment No. 2: Exercise based on use of Theodolite:</p> <p>a) Study of different components of Transit Theodolite.</p> <p>b) Measurement of Horizontal Angle by various methods, measurement of Vertical Angle by Theodolite</p> <p>Learning Outcome: To apply theodolite for field work surveying.</p> | 4 Hours |
| <p>3. Experiment No. 3: Exercise based on use of Tacheometer:</p> <p>a) Determination of Tacheometric constants.</p> | 4 Hours |

| | |
|--|---------|
| b) Determination of horizontal and vertical distances by Tacheometer. | |
| Learning Outcome: To compute horizontal and vertical distances by field data. | |
| 4. Experiment No. 5: Introduction of advanced instruments: a) Study of GPS b) Study of Total Station | 4 Hours |
| Learning Outcome: To explain various components and application of GPS and Total station. | |
| Field Projects: Any one of following 1. Block Contouring (Interpolation Calculations, Drawings, etc) 2. Theodolite Traversing. | 1 Day |
| Learning Outcome: To produce contours and traverse of given site. | |
| Text Books: 1. A Text book of Advanced Surveying by R.Agor 2. Surveying and Leveling by Basak – Second Edition | |
| Reference Books 1. Surveying Vol. I, II and III by Dr. B.C. Punamia 2. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni 3. Surveying Vol. I, II and III by Dr. K.R. Arora 4. Surveying Vol. I and II by S. K. Duggal 5. Surveying and Levelling by N.N. Basak 6. Surveying and Levelling by R. Agor 7. Advanced Surveying by R. Agor. 8. Advanced Surveying by Satish Gopi, R. Sathikumar and N. Madhu 9. Surveying and Leveling by S.S. Bhavikatti 10. Surveying by S.K.Duggal- Vol. I, Vol. II 11. Advanced Surveying by P. Som, B. N. Ghosh | |

| | |
|---|-----------------|
| Experiment No. 3: Detailed drawing for designed residential building on full imperial drawing sheet. Providing following details <ul style="list-style-type: none"> • Water supply and drainage plan. • Plumbing Plan • Electrification plan • Interior & Exterior Plan | 16 Hours |
| Experiment No. 4: Planning of Public buildings: Preparation of line plans on graph papers for Public buildings – two assignments on graph papers / Auto Cad | 4 Hours |
| Experiment No. 5: Detailed drawing for one public building on full imperial drawing sheet. Providing following details <ul style="list-style-type: none"> • Plan • Section • Elevation | 12 Hours |
| Experiment No. 6: Detailed drawing for designed public building on full imperial drawing sheet. Providing following details <ul style="list-style-type: none"> • Water supply and drainage plan. • Plumbing Plan • Electrification plan • Interior & Exterior Plan | 16 Hours |
| Experiment No. 7: Perspective Drawing: Concepts and method of drawing for two point perspective view. | 8 Hours |
| Experiment No. 5 Visit to a building complex and a report based on that. | 4 Hours |
| Text Books: 1. Building Planning by Shah Kale | |
| Reference Books: 1. Building Construction – B.C.Punmia (Laxmi Publications) 2. Text Book of Building Construction – S.P. Arora, S.P. Bindra (Dhanpat Rai Publications) 3. A to Z of Practical Building Construction and Its Management- Sandeep Mantri (Satya Prakashan, New Delhi) 4. SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi 5. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings 6. A Course in Civil Engineering Drawing – V.B.Sikka (S.K.Kataria and Sons) 7. Civil Engineering Drawing – M. Chakraborty. 8. Engineering Materials – R.K.Rajput (S. Chand) 9. Handbook of Building Construction- M. M. Goyal (Amrindra Consultancy (P) Ltd. | |

COURSE OFFERED UNDER PROJECT BASED LEARNING

COURSE NAME: Building Planning and Design and Building Planning and Design Laboratory

COURSE CODE: UENV0403 and UENV0432

1. PROBLEM STATEMENT

- a. How will you provide better residential place for the people who are living in heavy rainfall area?
- b. How will you design a commercial building which includes
 - i. Theatre
 - ii. Mall
 - iii. Small Party Hall
 - iv. Food Zone

2. ABSTRACT / DESCRIPTION OF PROBLEM STATEMENT

Syllabus which covers

- a. Residential Building
 - Bungalow
 - Row House
 - Apartment
 - Duplex
- b. Public Building
 - Agricultural buildings
 - Civil buildings
 - Medical buildings
 - Educational buildings
 - Industrial buildings
 - Military buildings
 - Parking structures and storage
 - Religious buildings
 - Transport buildings

3. ACTIVITIES / STEPS WITH DURATION TO SOLVE THE PROBLEM

- a. Submission Drawing for Residential Building & Public Building
- b. Working Drawing for Residential Building & Public Building
 - i. Line Drawing
 - ii. Measurement Drawing
 - iii. Electrical Drawing
 - iv. Water Supply & Drainage Drawing
 - v. Interior & Exterior

4. ASSESSMENT SCHEME

- a. In Semester Exam (20 Marks)
- b. Mid Semester Exam (30 Marks)
- c. End Semester Exam (50 Marks)

5. EVALUATION SCHEME

| Outcomes / Level | Excellent (5 Marks) | Satisfactory (4 Marks) | Poor (3 Marks) |
|---|---|--|---|
| 6. Bye Laws | All bye laws covered (7 - 8) | Some bye laws covered (5 - 6) | Very less bye laws covered (4 - 5) |
| 7. Principle of Planning | Well Planned | Satisfactorily cover the principles (1 – 2 principles missing) | Not covered the principles (More than 2 principles missing) |
| 8. Components <ul style="list-style-type: none"> • Electrical Drawing, • Plumbing Drawing, • Interior & Exterior Drawing, • Water Supply & Drainage Drawing. | All drawing Covered | Some drawing missing | More than 2 drawing missing |
| 9. Drawing Details <ul style="list-style-type: none"> • North Direction, • Lettering, • Symbols, • Layers | All details Covered | Some details missing | More than 2 details missing |
| 10. Timely Submission | Before Submission Date / on time Submission | 1 -2 days late submission | One week or more late submission |

| | | | | |
|--|----------|----------|-------------------|---------------|
| Class: S. Y. B. Tech Environmental Engineering | L | T | P | Credit |
| Title of the Course: Open Channel Hydraulics Laboratory | --- | --- | 02 hours per week | 1 |
| Course No.: UENV0433 | | | | |

Course Pre-Requisite:

Students shall have the knowledge of:

- Algebra and Engineering Mathematics
- Engineering Physics
- Applied Mechanics
- Fluid Mechanics
- Environmental Hydraulics

Course Description:

The course explores the basic knowledge and fundamental principles of Environmental Hydraulics through laboratory experiments. The course imparts the experimental skills in flow measurement, real fluid flow problems and calibration of hydraulic devices.

Course Objectives:

1. To introduce the students to a wide variety of flow measurement through open channels.
2. To learn to conduct experiments to verify fundamental principles of hydraulics and calibrate measuring devices.
3. To analyze experimental data to develop empirical relations when appropriate.

Course Learning Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Cognitive Descriptor |
|------|--|------------------------------|
| | | CO.1 |
| CO.2 | Standardize various hydraulic measuring devices through experimental procedures. | Cognitive (Analyzing) L4 |
| CO.3 | Demonstrate the skills during experimentations individually and in teams. | Psychomotor (Set) L2 |

CO-PO Mapping:

| CO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-----|---|---|---|---|---|---|---|---|---|----|----|----|
| CO1 | | | | 3 | 1 | | | | | 2 | | |
| CO2 | | | | 3 | 1 | | | | | 2 | | |
| CO3 | | | | 2 | 1 | | | | 3 | 2 | | |

| COs | PSO1 | PSO2 |
|-----|------|------|
| CO1 | - | 1 |
| CO2 | - | 1 |
| CO3 | - | 1 |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE | 50 |
| ESE (OE) | 25 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on oral examination.

Course Contents:

| | |
|--|---------|
| Experiment No. 1: Study of Specific Energy Curve. | 2 Hours |
| Learning Outcome: To investigate the relationship between specific energy (E) and depth of flow (y) in a rectangular channel. | |

| | |
|--|---------|
| Experiment No. 2: Study of Hydraulic Jump. | 2 Hours |
| Learning Outcome: To compare measured flow depths with theoretical results based on the application of continuity and momentum principles. | |
| Experiment No. 3: Calibration of Rectangular and Triangular Notch. | 2 Hours |
| Learning Outcome: To determine the coefficient of discharge for a rectangular notch and 60° triangular notch using analytical and graphical methods. | |
| Experiment No. 4: Calibration of Trapezoidal Notch. | 2 Hours |
| Learning Outcome: To determine the coefficient of discharge for a trapezoidal notch using analytical and graphical methods. | |
| Experiment No. 5: Calibration of Weirs. | 2 Hours |
| Learning Outcome: To determine the coefficients of discharge for ogee and broad crested weir using analytical and graphical method. | |
| Experiment No. 6: Determination of Roughness Coefficients for Given Pipe Material. | 2 Hours |
| Learning Outcome: To compute Chezy's 'C' and Manning's 'N' for the given pipe material. | |
| Experiment No. 7: Determination of Roughness Coefficients for Open Channel. | 2 Hours |
| Learning Outcome: To compute Chezy's 'C' and Manning's 'N' in a Laboratory Flume. | |
| Textbooks: | |
| <ol style="list-style-type: none"> 1. Fluid Mechanics and Fluid Power Engineering, D. S. Kumar, S. K. Kataria and Sons, Delhi. 2. The Fluid Mechanics and Hydraulics, D. R. Malhotra and N. K. Malhotra, Satya Prakashan, New Delhi. 3. Engineering Fluid Mechanics, R. J. Garde and A. G. Mirajgaoker, Scitech Publications India Pvt. Ltd., Chennai. 4. Fluid Mechanics: Including Hydraulic Machines, A. K. Jain, Khanna Publishers, New Delhi. 5. Hydraulics and <i>Fluid Mechanics</i>, P. N. Modi and S. M. Seth, Standard Book House, New Delhi. 6. Engineering Fluid Mechanics, K. L. Kumar, S. Chand and Co, Eurasia Publishing House, New Delhi. 7. A Textbook of Fluid Mechanics and Hydraulic Machines, Dr. R. K. Bansal, Laxmi Publications, New Delhi, 2013. 8. A Textbook of Fluid Mechanics, R. K. Rajput, S. Chand and Company Pvt. Ltd., New Delhi. 9. Fluid Mechanics – I, M. M. Mujumdar and Akshay R. Thorvat, Electrotech Publications. 10. Water Supply and Sanitary Engineering, G. S. Birdie, J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi. 11. Environmental Engineering – 1, Water Supply Engineering, B. C. Punmia, Arun K. Jain and Ashok K. Jain, Laxmi Publications Pvt. Ltd., New Delhi. 12. Environmental Engineering – 2, Wastewater Engineering, B. C. Punmia, Arun K. Jain and Ashok K. Jain, Laxmi Publications Pvt. Ltd., New Delhi. 13. Analysis of Water Distribution Networks, Pramod Bhave, R. Gupta. Narosa Publishing House. | |
| References: | |
| <ol style="list-style-type: none"> 1. Fluid Mechanics, Frank .M. White, McGraw Hill Publishing Company Ltd, New Delhi. 2. Fluid Mechanics and Machinery, C. P. Kothandaraman and R. Rudramoorthy, New Age International Publishers. 3. Fluid Mechanics: Fundamentals and Applications, Yunus, A. Cengel and John M. Cimbala Adapted by S. Bhattacharya, Tata McGraw-Hill Publishing Company Ltd., New Delhi. 4. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som, Gautam Biswas, Suman Chakraborty, Tata McGraw Hill Education Pvt. Ltd., New Delhi. 5. Flow in Open Channels, K. Subramanya, McGraw Hill Education India Pvt. Ltd., New Delhi. 6. Open Channel Flow, M. Hanif Chaudhry, Pentice Hall, Boston. | |

7. Open Channel Hydraulics, V. T. Chow, Tata McGraw Hill.
8. Flow Through Open Channels, K.G. Ranga Raju, Tata McGraw Hill.
9. Fundamentals of Hydraulic Engineering Systems, R. J. Houghtalen, A. Osman Akan, and Ned H. C. Hwang, Prentice Hall, Boston.

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|--|----------|----------|-------------------|---------------|
| Class: S. Y. B. Tech Environmental Engineering Title of the Course: Computational Laboratory Course No.: UENV0434 | L | T | P | Credit |
| | --- | --- | 02 hours per week | 1 |

Course Pre-Requisite:
Students shall have the knowledge of:

- Engineering Mathematics
- Basics of Computer

Course Description:
This course offers an introduction to spreadsheet design and application. The purpose of this course is to teach students to identify spreadsheet terminology and concepts; create formulas and functions; use formatting features; and generate charts, graphs, and reports.

- Course Objectives:**
1. To apply formatting options and handle worksheets.
 2. To use functions such as those associated with logical, statistical, financial and mathematical operations.
 3. To work with charts and tables and lists to analyze, filter and sort data.

Course Learning Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Cognitive |
|------|---|------------------------------|
| | | Descriptor |
| CO.1 | Develop a worksheet using an electronic spreadsheet application. | Cognitive (Applying) L3 |
| CO.2 | Analyze mathematical and logical formulas using standard spreadsheet functions. | Cognitive (Analyzing) L4 |
| CO.3 | Design an automated system for a user, including complete documentation. | Psychomotor (Origination) L7 |

CO-PO Mapping:

| CO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-----|---|---|---|---|---|---|---|---|---|----|----|----|
| CO1 | | | | | 3 | | | | 2 | 2 | | |
| CO2 | | | | | 2 | | | | 1 | 2 | | |
| CO3 | | | | 2 | 1 | | | | 2 | 2 | | |

| COs | PSO1 | PSO2 |
|-----|------|------|
| CO1 | - | 2 |
| CO2 | - | 1 |
| CO3 | - | 1 |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE | 50 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on oral examination.

Course Contents:

| | |
|---|----------------|
| Experiment No. 1: Start Excel and Navigate the Worksheet. a. Start Excel and identify the components of the Excel window. b. Locate and open an existing workbook. | 2 Hours |
|---|----------------|

| | |
|---|----------------|
| <ul style="list-style-type: none"> c. Navigate a worksheet. d. Select cells, columns, and rows. e. Insert, reposition, and delete worksheets. f. Save a workbook. | |
| <p>Experiment No. 2: Enter, Edit Data and Build Worksheets.</p> <ul style="list-style-type: none"> a. Create new workbooks. b. Enter text and numbers in cells. c. Edit cell contents. d. Copy the content of a cell, cell range and Move the cell content. e. Rename a sheet tab. f. Create and revise formulas. g. Copy formulas with relative, absolute, and mixed cell references. h. Use basic functions. | 2 Hours |
| <p>Experiment No. 3: Enhance, Preview and Print Worksheets.</p> <ul style="list-style-type: none"> a. Arrange cells, rows, and columns. b. Use Paste Special. c. Manipulate rows, columns, and cells. d. Filter lists using AutoFilter. e. Use Find and Replace. f. Set print options and print worksheets. g. Print an entire workbook. | 2 Hours |
| <p>Experiment No. 4: Linking and Managing Worksheets and Workbooks.</p> <ul style="list-style-type: none"> a. Group worksheets to share data, formatting, and formulas. b. Consolidate data from multiple worksheets. c. Work with multiple workbooks. d. Insert, delete rows and columns. e. Modify column widths, row heights to a specified value, to optimal width or height. f. Freeze, unfreeze row and/or column titles. | 2 Hours |
| <p>Experiment No. 5: Formulas and Functions.</p> <ul style="list-style-type: none"> a. Recognize good practice in formula creation: refer to cell references rather than type numbers into formulas. b. Create formulas using cell references and arithmetic operators (addition, subtraction, multiplication, division). c. Use sum, average, minimum, maximum, count, counta, round functions. d. Use the logical function if (yielding one of two specific values) with comparison operator: =, >, <. e. Autosum, value, if, hyperlink, count, max, vlookup , IF, AND, OR, Nested IF & NOT, etc. | 2 Hours |
| <p>Experiment No. 6: Formatting.</p> <ul style="list-style-type: none"> a. Format cells to display numbers to a specific number of decimal places, to display numbers with, without a separator to indicate thousands. b. Format cells to display a date style, to display a currency symbol. c. Format cells to display numbers as percentages. d. Change cell content appearance: font sizes, font types. | 2 Hours |

| | |
|---|----------------|
| <ul style="list-style-type: none"> e. Apply text wrapping to contents within a cell, cell range. f. Alignment, Merge cell and Border effects. g. Conditional Formatting | |
| <p>Experiment No. 7: Create Charts and Share Information.</p> <ul style="list-style-type: none"> a. Use the Chart Wizard to create a chart. b. Format and modify a chart. c. Insert, resize, and move a graphic. d. Create different types of charts from spreadsheet data: column chart, bar chart, line chart, pie chart etc. e. Add, remove, edit a chart title, add data labels, change chart area, edit layout etc. f. Preview and print charts. g. Use Go To. | 2 Hours |
| <p>Experiment No. 8: Tracking, Reviewing and Security.</p> <ul style="list-style-type: none"> a. Turn on, off track changes. Track changes in a worksheet using a specified display view. b. Accept, reject changes in a worksheet. c. Compare and merge spreadsheets. d. Add, remove password protection for a spreadsheet: to open, to modify. e. Protect, unprotect cells, worksheet with a password. f. Hide, unhide formulas. | 2 Hours |
| <p>Term Work:</p> <ul style="list-style-type: none"> • Spreadsheet Assignments based on syllabus content. | |
| <p>Textbook:</p> <ol style="list-style-type: none"> 1. Microsoft Excel 2016: Comprehensive, Freund, Starks, and Schmieder, Cengage Learning, 2017, ISBN: 9781305870727. | |

| | | | | |
|--|----------|----------|-------------------|---------------|
| Class: S. Y. B. Tech Environmental Engineering Title of the Course: Instrumentation Laboratory Course No.: UENV0435 | L | T | P | Credit |
| | --- | --- | 02 hours per week | 1 |

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Basic Chemistry
- Engineering Physics
- Applied Mechanics
- Fluid Mechanics

Course Description:

The course explores the fundamental principles as well as practical applications of field instruments used in various environmental plants through industrial visits.

Course Objectives:

1. To understand principle and working of various environmental field instruments.
2. To know applicability and calibration of each field instrument.
3. To study errors in the instruments and control measures for the same.

Course Learning Outcomes:

| COs | After the completion of the course the students will be able to | Bloom's Taxonomy |
|------|--|-----------------------------------|
| | | Descriptor |
| CO.1 | Understand fundamentals of Instrumentation. | Cognitive (Understanding) Level 2 |
| CO.2 | Explain various techniques used for the measurement of environmental parameters. | Cognitive (Understanding) Level 2 |
| CO.3 | Explain field application and errors control measures for various field instruments. | Cognitive (Understanding) Level 2 |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 2 | - | - | - | - | - | - | - | - | - | 1 | - |
| CO2 | - | - | - | - | 3 | - | - | - | - | - | 2 | - |
| CO3 | - | - | - | - | - | - | - | - | - | 2 | 2 | - |

| COs | PSO1 | PSO2 |
|-----|------|------|
| CO1 | - | - |
| CO2 | - | 2 |
| CO3 | - | 2 |

Assessments :

| Assessment | Weightage (Marks) |
|------------|-------------------|
| ISE | 25 |

- **ISE:** Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- **ESE (OE):** Assessment is based on oral examination.

Course Contents:

| | |
|---|---------|
| Experiment No. 1: Fundamentals of Instrumentations. Learning Outcome: To study various principles and types of instruments used in Environmental Plants. | 2 Hours |
| Experiment No. 2: Process & Instrumentation Diagram. Learning Outcome: To Study instrumentation symbols used in Process & Instrumentation Diagram. | 2 Hours |

| | |
|--|---------|
| Experiment No. 3: Pressure Instruments. | 2 Hours |
| Learning Outcome: To Study various Pressure Indicators and Pressure Indicating Transmitters used in Environmental Plants. | |
| Experiment No. 4: Level Instruments. | 2 Hours |
| Learning Outcome: To Study various Level Indicators and Level Indicating Transmitters used in Environmental Plants. | |
| Experiment No. 5: Flow Instruments. | 2 Hours |
| Learning Outcome: To Study various Flow and Flow Indicating Transmitters used in Environmental Plants. | |
| Experiment No. 6: Temperature Instruments. | 2 Hours |
| Learning Outcome: To Study various Temperature Indicators and Temperature Indicating Transmitters used in Environmental Plants. | |
| Experiment No. 7: Analytical Instruments. | 2 Hours |
| Learning Outcome: To study various Analytical Instruments (like Conductivity, pH, Turbidity, Silica, Boron etc) used in Environmental Plants. | |
| Experiment No. 8: Instrument Metallurgy Selection | 2 Hours |
| Learning Outcomes: To study Instrument Metallurgy Selection based on the Process Fluid. | |
| Experiment No. 9: Control Vales. | 2 Hours |
| Learning Outcome: To study various control valves and characteristic of control valve with and without positioned. | |
| Experiment No. 10: Interlinking of Instruments with Mechanical Equipments. | 2 Hours |
| Learning Outcomes: To study Interlinking of various instruments (like Pressure, Flow, Level, Temperature and other analytical) with Mechanical Equipments (like Pumps, Various Tanks & other environmental equipments) | |
| Reference Books: | |
| <ol style="list-style-type: none"> 1. Bentley J.P., Principles of measurement systems, Third Edition, Pearson education Asia pvt.ltd, 2000. 2. Doebelin, E.O., Measurement Systems, McGraw Hill Book Co., 1998 3. Patranabis D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997. 4. Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Pvt. Ltd., New Delhi, 1995. 5. Neubert, H.K.P., Instrument Transducers, Clarendon Press, Oxford, 1988 6. Mechanical & Industrial Measurements R.K. Jain 7. Principles of Industrial Instrumentation D. Patranabis 8. Handbook of Analytical Instrument R.S. Khandpur | |