

Kolhapur Institute of Technology's

# **COLLEGE OF ENGINEERING (AUTONOMOUS)**

Gokul Shirgaon, Kolhapur



KOLHAPUR INSTITUTE  
OF TECHNOLOGY'S  
**COLLEGE OF  
ENGINEERING**  
(AUTONOMOUS),  
**KOLHAPUR**

**Curriculum**

**For**

**B. Tech. Civil Engineering**

**Under Graduate Programme**

**(With effect from Academic Year 2022-2023)**

*Approved in BoS: 03.06.2022*

*Submitted and Approved in Academic Standing Committee*



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Kolhapur

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# **S. Y. B. Tech Semester - III**

**Academic Year 2022-2023**

Teaching and Evaluation scheme for **Second Year Semester -III**

| Sr. No                 | Curriculum Component | Course Code | Course                                    | Teaching Scheme |   |    | Evaluation Scheme |                      |       |                 |    |  |
|------------------------|----------------------|-------------|---|-----------------|---|----|-------------------|----------------------|-------|-----------------|----|--|
|                        |                      |             |   | L               | T | P  | Credit            | Component            | Marks |                 |    |  |
|                        |                      |             |   |                 |   |    |                   |                      | Max   | Min for Passing |    |  |
| 1                      | BS                   | UCVC 0301   | Engineering Mathematics III               | 3               | 1 | 0  | 4                 | ISE-I                | 10    | 20              | 40 |  |
|                        |                      |             |   |                 |   |    |                   | ISE-II               | 10    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | MSE                  | 30    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | ESE                  | 50    | 20              |    |  |
| 2                      | BS                   | UCVC 0302   | Mechanics of Solid                        | 3               | 0 | 0  | 3                 | ISE-I                | 10    | 20              | 40 |  |
|                        |                      |             |   |                 |   |    |                   | ISE-II               | 10    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | MSE                  | 30    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | ESE                  | 50    | 20              |    |  |
| 3                      | ES                   | UCVC 0303   | Engineering Hydraulics-I                  | 3               | 0 | 0  | 3                 | ISE-I                | 10    | 20              | 40 |  |
|                        |                      |             |   |                 |   |    |                   | ISE-II               | 10    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | MSE                  | 30    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | ESE                  | 50    | 20              |    |  |
| 4                      | PC                   | UCVC 0304   | Engineering Surveying                     | 3               | 0 | 0  | 3                 | ISE-I                | 10    | 20              | 40 |  |
|                        |                      |             |   |                 |   |    |                   | ISE-II               | 10    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | MSE                  | 30    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | ESE                  | 50    | 20              |    |  |
| 5                      | PC                   | UCVC 0305   | Transportation Infrastructure Engineering | 3               | 0 | 0  | 3                 | ISE-I                | 10    | 20              | 40 |  |
|                        |                      |             |   |                 |   |    |                   | ISE-II               | 10    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | MSE                  | 30    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | ESE                  | 50    | 20              |    |  |
| 6                      | PC                   | UCVC 0306   | Building Construction & Services          | 3               | 0 | 0  | 3                 | ISE-I                | 10    | 20              | 40 |  |
|                        |                      |             |   |                 |   |    |                   | ISE-II               | 10    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | MSE                  | 30    |                 |    |  |
|                        |                      |             |   |                 |   |    |                   | ESE                  | 50    | 20              |    |  |
| 7                      | BS                   | UCVC 0307   | Mechanics of solid Lab                    | 0               | 0 | 2  | 1                 | ISE                  | 25    | 10              |    |  |
|                        |                      |             |   |                 |   |    |                   | ESEOE                | 25    | 10              |    |  |
| 8                      | ES                   | UCVC 0308   | Engineering Hydraulics Lab                | 0               | 0 | 2  | 1                 | ISE                  | 25    | 10              |    |  |
|                        |                      |             |   |                 |   |    |                   | ESE POE              | 25    | 10              |    |  |
| 9                      | PC                   | UCVC 0309   | Engineering Surveying Lab                 | 0               | 0 | 2  | 1                 | ISE                  | 25    | 10              |    |  |
|                        |                      |             |   |                 |   |    |                   | ESE POE              | 25    | 10              |    |  |
| 10                     |                      | UCVA 0301   | Environmental Studies (Audit Course)      | 2               | 0 | 0  | 0                 | ESE                  | 100   | 40              |    |  |
| Total Contact hrs.: 27 |                      |             | Total                                     | 20              | 1 | 06 | 22                | 600+150+Audit Course |       |                 |    |  |

|                      |                             |   |   |   |        |
|----------------------|-----------------------------|---|---|---|--------|
| Title of the Course: | Engineering Mathematics-III | L | T | P | Credit |
| Course Code:         | UCVC0301                    | 3 | 1 | 0 | 4      |

**Course Pre-Requisite:**

Basic terminologies of differential equations, basic knowledge of probability, differential and integral calculus

**Course Description:**

This course contains linear differential equations and its applications, numerical methods, Laplace transform, complex calculus, statistics and probability distributions.

**Course Learning Objectives:**

1. To make familiar the prospective civil engineers with techniques in ordinary differential equations, Laplace transform, complex analysis, probability distributions and statistics.
2. To enable students to use mathematical techniques learned for the analysis, modeling and solution of realistic engineering problems.
3. To develop abstract, logical and critical thinking and the ability to reflect critically upon their work.

**Course Outcomes:**

| COs | After the completion of the course the student will be able to  | Bloom's Cognitive |               |
|-----|---|-------------------|---------------|
|     |   | level             | Descriptor    |
| CO1 | Understand various terminologies in differential equations, complex analysis, probability and statistics and properties of Laplace transform,               | II                | Understanding |
| CO2 | Solve LDE with constants coefficients using analytical and numerical methods, problems of Laplace transform and complex analysis.                           | III               | Applying      |
| CO3 | Apply the knowledge of probability distributions and statistical techniques to the given data and Laplace transform method to solve differential equations. | III               | Applying      |
| CO4 | Analyse and interpret the solutions obtained of problems on deflection of beams and in statistical techniques.  | III               | Applying      |

### CO-PO-PSO Mapping:

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 2    | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 1  | 0     | 0  | 0  |
| C02             | 2    | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 1  | 0     | 0  | 0  |
| C03             | 2    | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 1  | 0     | 0  | 0  |
| C04             | 2    | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 1  | 0     | 0  | 0  |

### 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 | Marks |
|------------|-------|
| ISE 1      | 10    |
| MSE        | 30    |
| ISE 2      | 10    |
| ESE        | 50    |

- ISE 1 and ISE 2 are based on Tutorial/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

**8 Hrs.**

- Definition, general form, complete solution
- Rules for finding complementary function
- Short methods for finding particular integral
- General rule for finding particular integral
- Cauchy's homogeneous equation

#### Unit 2: Numerical Solution of Differential Equations and Applications of Linear Differential Equations

**8 Hrs.**

- 2.1 Numerical solution of second order ordinary differential equations using
- Picard's method
  - Runge-Kutta fourth order method

|  |               |
|--|---------------|
| <p>3. Milne's method</p> <ul style="list-style-type: none"> <li>Applications of Linear Differential Equations to deflection of beams and columns (strut and cantilever problems)</li> </ul>  |               |
| <p><b>Unit 3: Laplace Transform</b></p> <p>3.1 Definition, transforms of elementary functions, properties of Laplace transform</p> <p>3.2 Transforms of derivative and integral</p> <p>3.3 Inverse Laplace transform</p> <p>3.4 Inverse Laplace transforms by using partial fractions and convolution Theorem.</p> <p>3.5 Solution of linear differential equations with constant coefficients by Laplace transform method</p> | <b>6 Hrs.</b> |
| <p><b>Unit 4 : Curve Fitting</b></p> <p>4.1 Fitting of curves by Least – square method</p> <p>4.2.1 Fitting of Straight lines</p> <p>4.2.2 Fitting of Parabola</p> <p>4.2.3 Fitting of Exponential curves.</p> <p>4.2 Correlation coefficient of bivariate data</p> <p>4.3 Lines of Regression of bivariate data</p>   | <b>7 Hrs.</b> |
| <p><b>Unit 5: Laplace Transform</b></p> <p>5.1 Definition, transforms of elementary functions, properties of Laplace transform</p> <p>5.2 Transforms of derivative and integral</p> <p>5.3 Inverse Laplace transform</p> <p>5.4 Inverse Laplace transforms by using partial fractions and convolution theorem.</p> <p>5.5 Solution of linear differential equations with constant coefficients by Laplace transform method</p> | <b>8 Hrs.</b> |
| <p><b>Unit 6: Calculus of Complex Functions</b></p> <p>6.2 Functions of complex variable</p> <p>6.2 Analytic function, necessary and sufficient condition for <math>f(z)</math> to be analytic</p> <p>6.3 Milne – Thomson method to determine analytic function <math>f(z)</math></p> <p>6.4 Harmonic function</p> <p>6.5 Complex integration, Cauchy's theorem and Cauchy's integral formula</p>                              | <b>7 Hrs.</b> |

**Recommended Textbooks:**

| SN | Title  | Edition | Author/s                        | Publisher                            | Year         |
|----|--|---------|---------------------------------|--------------------------------------|--------------|
| 1. | Higher Engineering Mathematics                   | 42      | Dr. B. S. Grewal                | Khanna Publishers, Delhi             | 2012         |
| 2. | A Text Book of Applied Mathematics Vol. II & III | 6       | P. N. Wartikar & J. N. Wartikar | Pune Vidyarthi Griha Prakashan, Pune | Reprint 2007 |

**References Books:**

| SN | Title  | Edition | Author/s                       | Publisher   | Year |
|----|--|---------|--------------------------------|---|------|
| 1. | Advanced Engineering Mathematics             | 10      | Erwin Kreyszig                 | John Wiley & Sons                                       | 2011 |
| 2. | Advanced Engineering Mathematics             | 21      | H. K. Dass                     | S. Chand & Company Pvt. Ltd, New Delhi                  | 2014 |
| 3. | A text book of Engineering Mathematics       |         | N. P. Bali, Iyengar            | Laxmi Publications (P) Ltd., New Delhi                  |      |
| 4. | Engineering Mathematics                      |         | Ravish R Singh and Mukul Bhatt | McGraw Hill Education (India) Private Limited, Chennai. | 2017 |
| 5. | Engineering Mathematics-III (For Civil Engg) |         | G. V. Kumbhojkar               | C. Jamnadas & Co  |      |

**Unit wise Measurable students Learning Outcomes:**

**Students will be able to**

- a. Solve linear differential equations (LDE) with constant coefficients.
- b. Solve Cauchy's homogeneous equation.
- c. Obtain the numerical solution of second order differential equations.
- d. Apply the knowledge of LDE to strut and cantilever problems.
- e. State properties of Laplace and inverse Laplace transform and find Laplace and inverse Laplace transform of given problems.
- f. Use Laplace transform method to solve differential equations.
- g. Fit the curve for given bivariate data using least square principle.



- h.** Obtain the correlation coefficient and lines of regression for the given bivariate data.
- i.** Use appropriate probability distribution to find the probability of given uncertain conditions.
- j.** Determine the analyticity of the given function of complex variable and construct analytic function using Milne-Thomson method.
- k.** Evaluate the line integral and integrals involving complex functions using Cauchy's theorem and Cauchy's integral formula.

|                      |                            |          |          |          |               |
|----------------------|----------------------------|----------|----------|----------|---------------|
| Title of the Course: | <b>Mechanics of Solids</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0302</b>            | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b>      |

**Course Pre-Requisite:**

Applied Mechanics, Engineering Mathematics

**Course Description:**

Mechanics of Solids forms a core subject which is taught to students of all non-circuit disciplines of engineering. The study of this subject is aimed at developing a thorough understanding of the basic material behavior through principles of mechanics & its applications to solve engineering problems

**Course Learning Objectives:**

1. To explain the important engineering properties of materials and behavior.
2. To explain the behavior of materials subjected to pure axial loading.
3. To explain the behavior of materials subjected to pure transverse loading.
4. To explain the behavior of materials subjected to pure torsion.
5. To make aware of basic energy concepts.

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to   | Bloom's Cognitive |            |
|------------|--|-------------------|------------|
|            |  | Level             | Descriptor |
| <b>CO1</b> | Analyze members on the basis of their properties and behaviour to loading subjected to direct axial stresses | 4                 | Cognitive  |
| <b>CO2</b> | Analyze members on the basis of their properties and behaviour to loading subjected to Torque                | 4                 | Cognitive  |
| <b>CO3</b> | Analyze members on the basis of their properties and behaviour to loading subjected to Transverse load       | 4                 | Cognitive  |
| <b>CO4</b> | Apply appropriate expressions for strain energy estimation   | 3                 | Cognitive  |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 3    | 2 | 1 | 2 | 1 | 2 | 1 | 0 | 0 | 1  | 0  | 3  | 2     | 1  | 2  |
| C02             | 3    | 2 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 1  | 0  | 3  | 2     | 1  | 2  |
| C03             | 3    | 2 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 1  | 0  | 3  | 2     | 1  | 2  |
| C04             | 3    | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1  | 0  | 2  | 2     | 1  | 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 | Marks |
|------------|-------|
| ISE 1      | 10    |
| MSE        | 30    |
| ISE 2      | 10    |
| ESE        | 50    |

- ISE 1 and ISE 2 are based on Tutorial/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: Simple Stress and Strain**

Engineering properties of different materials, simple stress and strain, and Hook's law, elastic behavior of the body under external actions, simple and complementary shear stresses, temperature stresses, elastic constants, Relation among elastic constants, Stress strain behavior of mild and tor steel.

Simple Sections, Compound sections, composite sections, uni-axial loading, biaxial and triaxial loading.

**10 Hrs.**

**Unit 2: Analysis of Circular Shafts Subjected to Torsion**

Solid and Hollow circular shafts, Torsion formula, Polar modulus of Shaft, Power Transmitted through Shaft, Comparison of shafts.

**6 Hrs.**

**Unit 3: SFD and BMD of Statically Determinate Beams**

Shear force diagrams and bending moment diagrams for concentrated loads, couples, uniformly distributed loading and uniformly varying loading in Simply supported beams, cantilever beams, overhanging beams, compound beams.

**6 Hrs.**

**Unit 4: Bending Stress in Beams**

Concept of pure bending, Derivation of flexural formula, Section modulus, Moment of resistance, Lever arm, Simple design Problems for rectangular and flanged Sections.

**6 Hrs.**

|   |               |
|---|---------------|
| <b>Unit 5: Shear Stress in Beams</b><br>Derivation of shear stress formula, Stress distribution diagrams for Standard shapes, Relation between maximum and average shear stresses for rectangular, triangular, diamond and circular sections, simple design problems for rectangular, flanged and composite shapes.   | <b>6 Hrs.</b> |
| <b>Unit 6: Concepts of Strain Energy</b><br>Work Energy Principle, Strain energy due to different types of axial loadings: Gradual, Sudden and Impact; Strain Energy due to Axial Stresses, Strain energy due to Bending Moment.  | <b>6 Hrs.</b> |
| <b>Recommended Textbooks:</b> <ol style="list-style-type: none"> <li>1. Mechanics of Structure (Vol. I and II), Dr.H.J.Shaha and Junnarkar S.B., Charotar Publication.</li> <li>2. Mechanics of Materials Vol I and II, B.C.Punmia and Jain, Laxmi Publications.</li> <li>3. Strength of Materials, S Ramamrutham, Dhanapat Rai Publications.</li> <li>4. Strength of Materials, Bhavikatti S.S., New Age Publications.</li> <li>5. Strength of Materials, R.K.Rajput., S.Chand Publications.</li> <li>6. Strength of Materials, R.K.Bansal., Laxmi Publications.</li> <li>7. Structural Analysis, Bhavikatti S.S, Vikas Publications house New Delhi.</li> <li>8. Strength of Material, Debabrata Nag, A. Chanda, 2nd Edition, and Wiley India publication.</li> </ol> |               |
| <b>References Books:</b> <ol style="list-style-type: none"> <li>1. Strength of Material, F. L. Singer and Pytel, Harper and Row publication.</li> <li>2. Introduction to Mechanics of Solids, J.B. Popov, Prentice – Hall publication.</li> <li>3. Mechanics of Materials, Gere and Timoshenko, CBS publishers.</li> <li>4. Mechanics of Materials, R.C. Hibbler, Pearson Education.</li> <li>5. Mechanics of Material, Beer and Johnston, M.</li> </ol>  |               |
| <b>Unit wise Measurable students Learning Outcomes:</b><br>After the completion of the course the student will be able to <ol style="list-style-type: none"> <li>1. List the different engineering properties and behavior of the materials and calculate the response of elastic bodies to pure axial loading.</li> <li>2. Evaluate response (SFD and BMD) of determinate beams under different external loading.</li> <li>3. Calculate the response of elastic bodies under pure bending.</li> <li>4. Calculate the response of elastic bodies under pure shear.</li> <li>5. Calculate the response of elastic bodies under torsion.</li> <li>6. Calculate strain energy due to different types of actions.</li> </ol>  |               |

|                      |                            |   |   |   |        |
|----------------------|----------------------------|---|---|---|--------|
| Title of the Course: | Engineering Hydraulics - I | L | T | P | Credit |
| Course Code:         | UCVC 0303                  | 3 | 0 | 0 | 3      |

**Course Pre-Requisite:**

A Student should undergo a course and understanding in subject's viz. Applied Mechanics, Physics, and Mathematics.

**Course Description:**

The material in this course will provide the student with a fundamental background in the statics and dynamics of fluids, laws of fluid mechanics and energy relationships. The basic conservation laws of mass, momentum and energy are analyzed in control volume and differential form. The student will learn how to choose the right formulation for fluid flow problems. The student will also learn how to analyze practical fluid flow phenomenon and apply basic principles / concepts in fluid mechanics to solve real life situations.

**Course Learning Objectives:**

1. To know the classification of fluids / flows and understand fluid properties and their importance in fluid flow phenomenon.
2. To understand the basic principles of fluid flow phenomenon and flow measurements through pipe.
3. To Apply principles of hydrostatics and hydrodynamics in the analysis of fluid flow phenomenon
4. To identify, formulate, and solve engineering problems related to fluid mechanics

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to   | Bloom's Cognitive |            |
|------------|--|-------------------|------------|
|            |  | Level             | Descriptor |
| <b>C01</b> | Classify the various types of fluids / flows and their characteristics by taking into consideration fundamental concepts of fluid mechanics. | II                | Understand |
| <b>C02</b> | Analyze problems to compute forces on fluid in steady state and in motion through numerical problems.  | IV                | Analyze    |
| <b>C03</b> | Demonstrate the use of basic laws and equations to derive functional relationships between various flow parameters                           | V                 | Evaluate   |
| <b>C04</b> | Adapt appropriate methods to work out practical fluid flow problems using analytical and computational methods.                              | VI                | Create     |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| CO1             | 2    | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2  | 0  | 0  | 0     | 0  | 0  |
| CO2             | 2    | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2  | 0  | 0  | 0     | 0  | 0  |
| CO3             | 2    | 1 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 2  | 0  | 0  | 0     | 2  | 0  |
| CO4             | 2    | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 2  | 0  | 0  | 0     | 2  | 0  |

**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 | Marks |
|------------|-------|
| ISE 1      | 10    |
| MSE        | 30    |
| ISE 2      | 10    |
| ESE        | 50    |

- ISE 1 and ISE 2 are based on Tutorial/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:**

**A) Introduction:** Physical Properties of Fluids (Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity: Dynamic and Kinematic Viscosity, Compressibility, Surface tension, Capillary Effect, Vapour Pressure and Cavitation), Newton's law of viscosity, Types of Fluids.

**B) Dimensional Analysis & Model Studies:** Dimensions of physical quantities, Dimensional homogeneity, Dimensional analysis using, Buckingham's Pi theorem, important dimensionless parameters and their significance. Geometric; Kinematic and Dynamic similitude; Model laws, Type of models, Applications of dimensional analysis and studies to fluid flow problems.

**08 Hrs.**

|   |                |
|---|----------------|
| <b>Unit 2:</b><br><br><b>A) Fluid static:</b> The basic equation of hydrostatics, concept of pressure head, Measurement of pressure datum (absolute, gauge), Piezometers, Simple and differential manometers, inclined manometers, Total pressure, Center of pressure for plane and curved surfaces, Pressure Diagrams<br><br><b>B) Principle of floatation and Buoyancy:</b> Equilibrium of floating bodies, Stability of Floating bodies, metacenter, metacentric height and its determination (experimental and analytical). | <b>08 Hrs.</b> |
| <b>Unit 3:</b><br><br><b>Fluid Kinematics:</b> Types of Flows, Stream lines, Equipotential lines, Steak Line, Path Line, Stream Tube, Stream Bundle, Stream Function and Velocity Potential Function, Flow Net- (Properties and Uses), Continuity Equation  | <b>06 Hrs.</b> |
| <b>Unit 4:</b><br><br><b>Fluid Dynamics:</b> Forces Acting on Fluid in Motion, Euler's Equation along a Streamline, Bernoulli's Theorem, Limitations , Bernoulli's Applications: Venturimeter (Horizontal and Vertical), Orifice meter, Nozzle meter, rotameter and pitot tube, Time required for Emptying the Tank, Concept of HGL and TEL.  | <b>06 Hrs.</b> |
| <b>Unit 5:</b><br><br><b>Flow through Pipes :</b> Reynold's Experiment, Hazen Poissulle's Equation for Viscous Flow through Circular Pipes, Major and Minor Losses, Concept of Equivalent Pipe, Dupit's Equation , Pipes in Series, Parallel and Syphon,  | <b>06 Hrs.</b> |
| <b>Unit 6:</b><br><br><b>Boundary Layer Theory:</b> Development of boundary layer on a flat plate, Nominal, displacement, momentum and Energy thicknesses. Laminar, turbulent and transitional boundary layer, Application of momentum equation for boundary layer development, Local and mean drag coefficient, Hydro dynamically smooth and rough boundaries, Boundary layer separation and its control.  | <b>06 Hrs.</b> |

**Recommended Textbooks:**

- 1) Fluid Mechanics – A.K. Jain – Khanna Pub., Delhi
- 2) Fluid Mechanics – Hydraulic and Hydraulic Mechanics -Modi/Seth – Standard Book House, Delhi
- 3) Fluid Mechanics – K. L. Kumar – Eurasia Publication House, Delhi
- 4) Fluid Mechanics – Arora
- 5) Dr. Jain A.K (2010); “Fluid Mechanics” Khanna Publishers.

**References Books:**

- 1) Fluid Mechanics – Streeter-McGraw-Hill International Book Co., Auckland
- 2) Elementary Fluid Mechanics – H. Rouse – Toppan C. Ltd. Tokyo
- 3) Fluid Mechanics – Shames - McGraw-Hill International Book Co., Auckland

**Unit wise Measurable students Learning Outcomes:**

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

- 1) Understand the important fluid properties and Dimensional Analysis using different theorems.
- 2) Application of hydrostatic law to determine the forces on plane and curved surfaces and behavior of floating body its equilibrium conditions.
- 3) Understand the Classification of flows, flow patterns and flow net.
- 4) Study behavior of fluid in motion its theories, application and discharge measuring devices.
- 5) Determine the energy losses in pipe flow and solve two reservoir problems.
- 6) Study boundary layer theory its development and applications.



|                      |                           |          |          |          |               |
|----------------------|---------------------------|----------|----------|----------|---------------|
| Title of the Course: | <b>Engineering Survey</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0304</b>           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b>      |

**Course Pre-Requisite:**

Basic Civil Engineering, Geometry and trigonometry.

**Course Description:**

The course mainly deals with the initial work in Construction of any work, Surveying. It involves in finding the Horizontal Positions and vertical positions of objects on the surface of the Earth.

**Course Learning Objectives:**

- 1) To recall basic principles, list types and define the practice of surveying.
- 2) To demonstrate use of conventional and modern survey equipment's.
- 3) To collect field data and prepare calculation of areas and volumes.
- 4) To recall mathematics of trigonometry for indirect Surveying works.
- 5) To select appropriate tool and technique for engineering works.

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to   | Bloom's Cognitive |            |
|------------|--|-------------------|------------|
|            |  | Level             | Descriptor |
| <b>C01</b> | State basic principles and tabulate survey types   | 1                 | Remember   |
| <b>C02</b> | Describe and classify levels, theodolites, levelling types, plane table methods and modern surveying instruments | 2                 | Understand |
| <b>C03</b> | Use mathematical formulas to compute areas, volumes and for trigonometric levelling                              | 3                 | Apply      |
| <b>C04</b> | Apply tools and techniques for Civil engineering works   | 3                 | Apply      |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 2    | 1 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 1  | 0  | 0  | 1     | 1  | 0  |
| C02             | 2    | 1 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0  | 1  | 2  | 2     | 2  | 1  |
| C03             | 2    | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1  | 1  | 0  | 0     | 1  | 1  |
| C04             | 2    | 0 | 1 | 2 | 3 | 0 | 2 | 0 | 1 | 1  | 1  | 1  | 2     | 1  | 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 | Marks |
|------------|-------|
| ISE1       | 10    |
| MSE        | 30    |
| ISE2       | 10    |
| ESE        | 50    |

- ISE 1 and ISE 2 are based on Tutorial/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%

**Course Contents:**

**Unit 1: Introduction to surveying**

Introduction, Basic Principle of Surveying, Errors in Surveying, Classification of Survey-based on Instrument, Scale, purpose and place, Practice of Surveying.

**2 Hrs.**

**Unit 2: Levelling and Contouring**

- A. Levelling- Types of levels, components, working and use of dumpy, tilting, auto, digital and laser level. Types of leveling, objectives and applications. Temporary Adjustments and Permanent Adjustments of levels. Corrections for curvature and refraction.
- B. Contouring- Definition, characteristics contour interval, equivalent, uses and characteristics of contour lines, direct and indirect methods of contouring.

**9 Hrs.**

**Unit 3: Areas and volumes**

- A. Area measurement- Trapezoidal rule, Simpson's rule, mechanical and digital planimeter.
- B. Volume measurement- Trapezoidal rule and Prismoidal rule for Earthwork. Capacity calculation using contour map.

**5 Hrs.**

**Unit 4: Plane Table Surveying**

- A. Principles, accessories, significance and adjustments, Telescopic Alidade. Methods and applications of plane table survey

**5 Hrs.**

**Unit 5: Theodolite Surveying**

- A. Component parts and technical terms, temporary and permanent adjustments of a transit Theodolite, Electronic Theodolite.

**9 Hrs.**

|   |                      |
|---|----------------------|
| <p>B. Uses of theodolite- measurement of horizontal angle-direct angle, methods of repetition and reiteration, vertical angle, prolongation of a straight line, extending a line, measuring magnetic bearing of a line, concept of traversing.</p> <p>C. Trigonometric leveling using theodolite-Problems on single- plane and double-plane methods</p>   |                      |
| <p><b>Unit 6: Engineering Applications</b></p> <p>A. Usage of minor instruments for preliminary and different surveys.</p> <p>B. Surveying for Road and Railway projects</p> <p>C. Surveying for Hydrographic survey</p> <p>D. Surveying for Tunnel survey</p>  | <p><b>5 Hrs.</b></p> |
| <p><b>Recommended Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. N. N. Basak, Surveying and Leveling, Tata McGraw Hill Publications, 1st Edition.</li> <li>2. B. C. Punmia, Surveying and Leveling, Vol I &amp; II, Laxmi Publications.</li> <li>3. S. K. Duggal, Surveying Vol. I and II, Tata McGraw Hill, New Delhi.</li> </ol>  |                      |
| <p><b>References Books:</b></p> <ol style="list-style-type: none"> <li>1. Surveying for Engineers- John Uren &amp; Bill Price, Palgrave Macmillan</li> <li>2. Surveying Vol. I- Dr. K. R. Arora</li> <li>3. Surveying: Theory and Practice- James M. Anderson, Edward M. Mikhail</li> <li>4. Surveying theory and practices- Devis R. E., Foot F. S.</li> <li>5. Plane and Geodetic surveying for Engineers. Vol. I -- David Clark</li> <li>6. Principles of Surveying. Vol. I by J.G.Olliver, J.Clendinning</li> <li>7. Plane Surveying- A.M.Chandra, New Age International Publishers</li> </ol>  |                      |
| <p><b>Unit wise Measurable students Learning Outcomes:</b></p> <p>After the completion of the course the student will be able to</p> <ol style="list-style-type: none"> <li>1. Understand the basic principles of surveying and types of survey.</li> <li>2. Understand types of levels, leveling, adjustments and Contour maps.</li> <li>3. Calculate the area and volume for Earthwork.</li> <li>4. Understand principles, methods and applications of Plane table surveying.</li> <li>5. Understand the construction, adjustments and uses of theodolite.</li> <li>6. Understand the use of surveying in different construction projects.</li> </ol> |                      |

|                      |   |   |   |   |        |
|----------------------|---|---|---|---|--------|
| Title of the Course: | Transportation Infrastructure Engineering | L | T | P | Credit |
| Course Code:         | UCVC0305                                  | 3 | 0 | 0 | 3      |

**Course Pre-Requisite:**

None

**Course Description:**

This course will help the students to understand the components of various transport systems such as Rail, Air and Water.

**Course Learning Objectives:**

1. Make the student aware of importance of rail transportation in development of a nation.
2. Enable the student to design the geometric features of rail infrastructure.
3. Understand the airport components and planning.
4. Plan and design water front structures.
5. Understand the bridge elements.
6. Understand the significance of tunnel engineering in infrastructure development.

**Course Outcomes:**

| CO  | After the completion of the course the student should be able to                                       | Bloom's Cognitive |            |
|-----|--|-------------------|------------|
|     |  | Level             | Descriptor |
| C01 | Design the geometrics for a railway track and calculate quantity of material required for construction | 6                 | Create     |
| C02 | Apply the principles of airport design   | 3                 | Apply      |
| C03 | Understand the bridge as a structure   | 1                 | Understand |
| C04 | Determine the tidal forces acting on a waterfront structure  | 4                 | Analyze    |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 2    | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0  | 1  | 0  | 0     | 0  | 0  |
| C02             | 1    | 2 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |
| C03             | 0    | 0 | 2 | 0 | 0 | 3 | 2 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |
| C04             | 2    | 0 | 1 | 1 | 1 | 3 | 3 | 0 | 0 | 1  | 1  | 0  | 0     | 0  | 0  |

**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 | Marks |
|------------|-------|
| ISE1       | 10    |
| MSE        | 30    |
| ISE2       | 10    |
| ESE        | 50    |

- ISE 1 and ISE 2 are based on Tutorial/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%

**Course Contents:**

**Unit 1: Introduction to Railways**

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Track Stress, coning of wheels, creep in rails, defects in rails–Route alignment surveys, conventional and modern methods

Geometric design of railways, gradient, super elevation, widening of gauge on curves–Points and Crossings. Electrification of railways, continuous track design, sleeper-less tracks, power requirement.

**7 Hrs.**

**Unit 2: Railway Construction and Maintenance:**

Calculation of Materials required for track laying– Construction and maintenance of tracks– Modern methods of construction & maintenance–Railway stations and yards and passenger amenities–Urban rail–Infrastructure for Metro, Mono and underground railways.

**6 Hrs.**

**Unit 3: Airport Planning:**

Air transport characteristics , airport classification ,airport planning: objectives, components, layout characteristics, socioeconomic characteristics of the catchment area, criteria for airport site selection and typical airport layouts, Runway Design, Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings Pavement and lighting. Short-take Off and landing phenomenon, recent development in International Airports.

**9 Hrs.**

|  |               |
|--|---------------|
| <p><b>Unit 4: Bridge Engineering:</b></p> <p>a) Classification of bridges, selection of site, Bridge Hydrology: determination of design discharge, linear water way, economical span, location of piers and abutments, afflux, scour depth, design problems on above topics.</p> <p>b) Types of bridge foundations, Bridge piers, Abutments, Wing walls, Bearings, Construction and maintenance of bridges-Introduction; Recent trends in bridges.</p>   | <b>6 Hrs.</b> |
| <p><b>Unit 5: Docks and Harbor:</b></p> <p>Definition of Basic Terms, Planning and Design of Harbors, Requirements, Classification, Harbor Layout and Terminal Facilities, Wave action on Coastal Structures and Coastal Protection Works. Dry dock and wet dock differentiation.</p>  | <b>6 Hrs.</b> |
| <p><b>Unit 6: Tunnel Engineering:</b></p> <p>Introduction, size and shape of the tunnel, tunneling methods in hard rock &amp; soft material, tunnel lining, tunnel lighting, drainage and ventilation, Tunneling using TBM, Trenchless Construction Method (TCM).</p>  | <b>6 Hrs.</b> |
| <p><b>Recommended Textbooks:</b></p> <ol style="list-style-type: none"> <li>1) Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.</li> <li>2) Satish Chandra and Agarwal M.M, "Railway Engineering", 2nd Edition, Oxford University Press, New Delhi.</li> <li>3) Khanna S K, Arora MG and Jain SS, "Airport Planning and Design", Nemchand and Brothers, Roorkee.</li> <li>4) S.P. Bindra, "Bridge Engineering", Dhanpat Raj Publications, New Delhi.</li> <li>5) Bindra S.P., "Docks &amp; Harbor Engineering", Dhanpat Raj Publications, New Delhi.</li> <li>6) R Shrinivasan, "Harbour, Dock and Tunnel Engineering", Dhanpat Raj Publications, New Delhi.</li> <li>7) S. C. Saxena, "Tunnel Engineering", Dhanpat Raj Publications, New Delhi.</li> </ol> |               |
| <p><b>References Books:</b></p> <ol style="list-style-type: none"> <li>1) Saxena and Arora, "A Course in Railway Engineering", Dhanpat rai &amp; Sons, New Delhi.</li> <li>2) Ponnuswamy S, "Bridge Engineering", Tata McGraw Hill India.</li> <li>3) C Venkatramaiah, "Transportation Engineering, Volume II: Railways, Airports, Docks and Harbours", Universities India Publisher.</li> <li>4) K. F. Antia, "Bridges and Railway Engineering", New Book Company Pvt. Ltd.</li> <li>5) Design codes of Metro</li> <li>6) Dr. SP Bindra "A Course in Docks and Harbour Engineering", Dhanpat Raj</li> <li>7) Publications</li> <li>8) J.S. Mundrey, "Railways Track Engineering", Tata McGraw Hill, New Delhi.</li> </ol>   |               |

**Unit wise Measurable students Learning Outcomes:**

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

- 1) To explain different elements of Railways
- 2) To understand the construction and maintenance methodology of railways.
- 3) Classification of airport and to design Runway and Taxiway.
- 4) Classify and explain different types of Bridges
- 5) Classify and explain different types of harbors
- 6) Classify and explain different types of tunnels



|                      |   |          |          |          |               |
|----------------------|---|----------|----------|----------|---------------|
| Title of the Course: | <b>Building Construction and Services</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0306</b>                           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b>      |

**Course Pre-Requisite:**

Basic Civil Engineering

**Course Description:**

Students will have knowledge about building Construction and its components with respect to climate, Planning principles, Bye laws, materials, services and finishes

**Course Learning Objectives:**

1. To study Building construction and statutory provisions
2. To apply National Building Code Provisions for Buildings

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to | Bloom's Cognitive |            |
|------------|--|-------------------|------------|
|            |  | Level             | Descriptor |
| <b>CO1</b> | Describe building construction components and material           | 2                 | Understand |
| <b>CO2</b> | Use planning principles and byelaws for building design.         | 3                 | Apply      |
| <b>CO3</b> | Apply provisions of national building code for buildings.        | 3                 | Apply      |
| <b>CO4</b> | Identify appropriate building services based on use of building  | 4                 | Analyze    |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 2    | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0  | 2  | 2  | 2     | 0  | 0  |
| C02             | 0    | 3 | 2 | 0 | 1 | 3 | 1 | 3 | 0 | 1  | 3  | 2  | 2     | 0  | 3  |
| C03             | 2    | 1 | 0 | 0 | 0 | 3 | 2 | 2 | 0 | 0  | 2  | 2  | 2     | 0  | 3  |
| C04             | 2    | 0 | 1 | 0 | 0 | 3 | 3 | 1 | 0 | 0  | 3  | 2  | 2     | 0  | 0  |



**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 | Marks |
|------------|-------|
| ISE 1      | 10    |
| MSE        | 30    |
| ISE 2      | 10    |
| ESE        | 50    |

- ISE1 and ISE 2 are based on Tutorial/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% weight age for course content (Normally last three Units) covered after MSE.

**Course Contents:**

**Unit 1: Building Components**

**8 Hrs.**

Types of building structure: Load bearing, Framed and composite.

Building Construction Stage wise process.

Building Components and types: Foundation, Floors, Door and window, Roof,

Stair case, masonry, Partition wall.

**Unit 2: Building planning and Bye laws**

**8 Hrs.**

Building site selection criteria and ergonomics.

Indian Climate and building orientation based on sun path comfort parameters.

Principles of planning and related bye laws (UDCPR 2020)

**Unit 3: Building Materials**

**4 Hrs.**

Following building materials with its use and physical, thermal properties to suit comfort conditions: stone, aggregate fine and coarse, bricks and blocks, wood, glass, steel and its types, concrete and mortar, floor, roofing and miscellaneous-aluminum, composite material, plastic and admixture, recycled material.

**Unit 4: Building ventilation and electrification (as per national building code)**

**8 Hrs.**

Types of ventilations: passive and active systems, air change per hour.

Air-conditioning, Principle, types, components.

Types of electrification system, flow diagram from source to end user, Earthing.

|   |                      |
|---|----------------------|
| <p><b>Unit 5: Plumbing and Sanitation Services</b> (as per national building code)</p> <p>Plumbing systems for potable, hot and cold water.</p> <p>Types of traps, fittings, chambers, septic tank and soak pit, concept of plumbing layout, Design of water tank and septic tank.</p> <p>Rain water harvesting (storage and ground water recharge),</p> <p>Introduction to firefighting and fire hydrant system (Internal and External).</p>   | <p><b>8 Hrs.</b></p> |
| <p><b>Unit 6: Building Finishes and Design</b></p> <p>Plastering, Pointing and its various techniques, types of wall claddings and its properties (glazing and stone claddings), skirting, dado work, POP, gypsum plaster, fall ceilings, paints etc.</p> <p>Waterproofing treatment (Sunk slabs, walls, balcony and terrace),</p> <p>Anti-termite treatment.</p>   | <p><b>4 Hrs.</b></p> |
| <p><b>Recommended Textbooks:</b></p> <ol style="list-style-type: none"> <li>1) Building Drawing – Shah, Kale, Patki (Tata McGraw- Hill)</li> <li>2) Building Design and Drawing – Y. S. Sane (Allied Book Stall, Pune)</li> <li>3) Civil Engineering Drawing – M. Chakraborty.</li> <li>4) Construction Technology (Volume 1 to 4) – R. Chudley (ELBS)</li> <li>5) A Course in Civil Engineering Drawing – V.B. Sikka (S.K. Kataria and Sons)</li> <li>6) Engineering Materials – R.K. Rajput (S. Chand)</li> <li>7) A to Z of Practical Building Construction and Its Management- Sandeep Mantri (Satya Prakashan, New Delhi)</li> </ol> |                      |
| <p><b>References Books:</b></p> <ol style="list-style-type: none"> <li>1) SP 7- National Building Code Group 1 to 10- B.I.S. New Delhi</li> <li>2) I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings</li> <li>3) Handbook of Building Construction- M. M. Goyal (Amrindra Consultancy (P)ltd.</li> <li>4) Unified Development Control Promotion Regulation (UDCPR), 2020</li> </ol>   |                      |
| <p><b>Unit wise Measurable students Learning Outcomes:</b></p> <p>After the completion of the course:</p> <ol style="list-style-type: none"> <li>1) Student will able to study building construction</li> <li>2) Student will able to study building Planning</li> <li>3) Student will able to study building material</li> <li>4) Student will able to study plumbing services</li> <li>5) Student will able to study services like Electrification, Fire Fighting and Ventilation.</li> <li>6) Students will able to study various building finishes.</li> </ol>  |                      |

|                      |                                |          |          |          |               |
|----------------------|--------------------------------|----------|----------|----------|---------------|
| Title of the Course: | <b>Mechanics of Solids Lab</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0307</b>                | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b>      |

**Course Pre-Requisite:**

Applied Mechanics, Engineering Mathematics

**Course Description:**

Mechanics of Solids forms a core subject which is taught to students of all non-circuit disciplines of engineering. The study of this subject is aimed at developing a thorough understanding of the basic material behavior through principles of mechanics & its applications to solve engineering problems

**Course Learning Objectives:**

1. To understand components of different equipments.
2. To study the behavior of materials subjected to axial loading.
3. To study the behavior of materials subjected to non-axial load effects such as shearing, bending and torsion.
4. To study important physical properties of materials such as water absorption, toughness, hardness.

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to                           | Bloom's Cognitive |            |
|------------|--|-------------------|------------|
|            |  | Level             | Descriptor |
| <b>CO1</b> | Explain the component parts of various equipments.   | 1                 | Cognitive  |
| <b>CO2</b> | Examine the engineering properties of material as per IS experimental norms and provisions | 3                 | Cognitive  |
| <b>CO3</b> | Classify material as adaptable or not for functional requirements.                         | 4                 | Cognitive  |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 1    | 0 | 1 | 1 | 3 | 2 | 0 | 0 | 1 | 0  | 0  | 2  | 2     | 0  | 2  |
| C02             | 3    | 2 | 2 | 3 | 2 | 2 | 0 | 3 | 2 | 3  | 0  | 2  | 3     | 3  | 2  |
| C03             | 1    | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 1 | 3  | 0  | 2  | 2     | 3  | 2  |

**Assessments :**

**Teacher Assessment:**

- Two components of Course Evaluation

| Assessment | Marks |
|------------|-------|
| ISE        | 25    |
| ESE OE     | 25    |

- ISE based on Tutorial/Assignment/Declared test/Quiz/Seminar/Group Discussions etc.
- ESE: Assessment is based on OE

**Course Contents:**

**Attempt any Seven Experiments :**

1. Study of Universal Testing Machine
2. Tensile test on Mild steel and Tor steel.
3. Compression test on M.S. and Cast Iron.
4. Compression test on timber.
5. Direct shear test on different metals.
6. Charpy or Izod Impact test on different metals.
7. Bending test on M.S. bar.
8. Water absorption and compression test on burnt bricks.
9. Hardness test on metals.
10. Torsion test Mild steel.

**Recommended Textbooks:**

- 1) Mechanics of Structure (Vol. I and II) – Dr.H.J.Shaha and Junnarkar S.B., Charotar Publication.
- 2) Mechanics of Materials Vol I and II – B.C.Punmia and Jain, Laxmi Publications.
- 3) Strength of Materials - S Ramamrutham, Dhanapat Rai Publications.
- 4) Strength of Materials - Bhavikatti S.S., New Age Publications.
- 5) Strength of Materials - R.K.Rajput, S.Chand Publications.
- 6) Strength of Materials - R.K.Bansal, Laxmi Publications.
- 7) Structural Analysis - Bhavikatti S.S, Vikas Publications house New Delhi.
- 8) Strength of Material – Debabrata Nag, A. Chanda, 2nd Edition, and Wiley India publication.

**References Books:**

- 1) Strength of Material - F. L. Singer and Pytel, Harper and Row publication.
- 2) Introduction to Mechanics of Solids - J.B. Popov, Prentice – Hall publication.
- 3) Mechanics of Materials - Gere and Timoshenko, CBS publishers.
- 4) Mechanics of Materials - R.C. Hibbler, Pearson Education.
- 5) Mechanics of Material - Beer and Johnston, M.

**Unit wise Measurable students Learning Outcomes:**

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

- 1) List the different engineering properties and behavior of the materials.
- 2) Calculate the response of elastic bodies to pure axial loading.
- 3) Evaluate response (SFD and BMD) of determinate beams under different external loading.
- 4) Calculate the response of elastic bodies under pure bending.
- 5) Calculate the response of elastic bodies under pure shear.
- 6) Calculate the response of elastic bodies under torsion.

|                      |                                   |          |          |          |               |
|----------------------|-----------------------------------|----------|----------|----------|---------------|
| Title of the Course: | <b>Engineering Hydraulics Lab</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0308</b>                   | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b>      |

**Course Pre-Requisite:**

Fluid Mechanics and Basic Mathematics

**Course Description:**

The course explores the principles of fluid mechanics through laboratory experiments and verifies various hydraulic phenomena on laboratory setups.

**Course Learning Objectives:**

1. Operate fluid flow equipment and instrumentation.
2. Demonstrate principles discussed in Fluid Mechanics lecture course through experimentation
3. Develop skills for analyzing experimental data, designing and conducting experiments, and working in teams.

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to                       | Bloom's Cognitive |               |
|------------|--|-------------------|---------------|
|            |  | Level             | Descriptor    |
| <b>CO1</b> | Read and follow directions for laboratory experiments.                                 | I                 | Knowledge     |
| <b>CO2</b> | Collect and analyze data using fluid mechanics principles and experimentation methods. | IV                | Analysis      |
| <b>CO3</b> | Prepare reports following accepted writing and graphical techniques.                   | V                 | Synthesis     |
| <b>CO4</b> | Perform exercises in small teams.  | II                | Comprehension |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 2    | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2  | 0  | 0  | 0     | 0  | 0  |
| C02             | 2    | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2  | 0  | 0  | 0     | 0  | 0  |
| C03             | 2    | 1 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 2  | 0  | 0  | 0     | 2  | 0  |
| C04             | 2    | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 2  | 0  | 0  | 0     | 2  | 0  |

### Assessments :

#### Teacher Assessment:

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

| Assessment | Marks |
|------------|-------|
| ISE        | 25    |
| ESE POE    | 50    |

- ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- ESE POE: Assessment is based on Oral Examination

### Course Contents:

#### Attempt any Seven Experiments :

- 1) Experiment No. 1: Stability of Floating objects
- 2) Experiment No. 2: Verification of Bernoulli's Theorem
- 3) Experiment No. 3: Calibration of Orifice
- 4) Experiment No. 4: Calibration of Venturimeter
- 5) Experiment No. 5: Determination of Friction Factor for Given Pipe
- 6) Experiment No. 6: Determination of Minor Losses in a Given Pipe
- 7) Experiment No. 7: Reynolds Apparatus
- 8) Experiment No. 8: Study of Hydraulic Jump
- 9) Experiment No. 9: Flow visualization by using Hele-Shaw
- 10) Experiment No. 10: Calibration of V-Notches and Rectangular Notch

#### Recommended Textbooks:

- 1) Fluid Mechanics – A.K. Jain – Khanna Pub., Delhi
- 2) Fluid Mechanics – Hydraulic and Hydraulic Mechanics -Modi/Seth – Standard Book House, Delhi
- 3) Fluid Mechanics – K. L. Kumar – Eurasia Publication House, Delhi
- 4) Fluid Mechanics – Arora

**References Books:**

- 1) Fluid Mechanics – Streeter-McGraw-Hill International Book Co., Auckland
- 2) Elementary Fluid Mechanics – H. Rouse – Toppan C. Ltd. Tokyo
- 3) Fluid Mechanics – Shames - McGraw-Hill International Book Co., Auckland

**Unit wise Measurable students Learning Outcomes:**

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

- 1) Determination of metacentric height for a ship model
- 2) Determination the total energy of flow at different section in a test conduit
- 3) Determination of hydraulic coefficients of orifice and their interrelationship.
- 4) Determination of hydraulic coefficients of venturimeter and their interrelationship.
- 5) Determination of friction factor for given pipe computation of friction factor using Hazen-Poiselle equation
- 6) Computation of minor losses due to change in cross sectional area and pipe fittings
- 7) To study different patterns (laminar, transition, and turbulent regimes) of a flow through a pipe and correlate them with the Reynolds number of the flow computation of coefficient of discharge for v-notch / rectangular notch
- 8) Computation of H J elements viz. Sequent depths, power lost, length and height of jump
- 9) Study of flow pattern by using Hele-Shaw apparatus.
- 10) Computation of coefficient of discharge for rectangular / triangular weir determination of friction factor for different combinations of Reynolds number and relative roughness.



|                      |                               |          |          |          |               |
|----------------------|-------------------------------|----------|----------|----------|---------------|
| Title of the Course: | <b>Engineering Survey Lab</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0309</b>               | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b>      |

**Course Pre-Requisite:**

Basic Civil Engineering and Engineering Survey Theory

**Course Description:**

The course mainly deals with Experiments, field work, methods and instruments for the Surveying work of finding the Horizontal Positions and vertical positions of objects on the surface of the Earth.

**Course Learning Objectives:**

1. To understand basic principles of surveying.
2. To use conventional and modern survey equipments.
3. To analyze the field data.
4. To calculate area and volume from field data.
5. To apply in civil engineering project works at Primary Level.

**Course Outcomes:**

| CO         | After the completion of the course the students should be able to              | Bloom's Cognitive |            |
|------------|--|-------------------|------------|
|            |  | Level             | Descriptor |
| <b>CO1</b> | Experiment and compute distance, height, area, volume and angular measurements | 3                 | Apply      |
| <b>CO2</b> | Carryout fieldwork and enhance professional skills                             | 3                 | Apply      |
| <b>CO3</b> | Summarize plans and sections for civil engineering projects                    | 5                 | Evaluate   |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 2    | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 3 | 2  | 1  | 1  | 1     | 1  | 1  |
| C02             | 1    | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 3 | 1  | 1  | 1  | 3     | 2  | 2  |
| C03             | 1    | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 3 | 2  | 1  | 2  | 2     | 3  | 3  |

**Assessments :**

**Teacher Assessment:**

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

| Assessment  | Marks |    |
|-------------|-------|----|
| Experiments | 10    | 25 |
| PBL         | 15    |    |
| ESE (POE)   | 25    |    |

- Experiments assessment is based on practical performed/Group Discussion/ Internal oral etc.
- PBL is a mini-Project based on problem statement. The assessment is based on on-site fieldwork, office work and project presentation.
- ESE POE: Assessment is based on External Practical & Oral Examination

**Course Contents:**

**Experiments:**

1. Study of dumpy level, titling level, Auto level, digital level and laser level differential levelling
2. Balancing of Sight and Reciprocal levelling
3. Plane table survey-Radiation, Intersection and Resection
4. Measurement of Area by Mechanical and Digital planimeter
5. Vernier theodolite- horizontal angles and vertical angles
6. Trigonometric levelling – Single plane and double by theodolite
7. Electronic Theodolite- Measurement of angles

**Project Based Learning (PBL):**

1. Block contouring using level project for at least 100m x 100m Report on Various Topographic Features seen from Contour Maps.
2. Road Project- (Min. 500 m length)
  - a. Longitudinal Section of road.
  - b. Cross-section of road.
  - c. Computation of Earthwork using computer application.

**Recommended Textbooks:**

1. N.N.Basak, Surveying and Leveling, Tata McGraw Hill Publications, 1st Edition.
2. B C Punmia, Surveying and Leveling, Vol I & II, Laxmi Publications.
3. Surveying Vol. I and II - S. K. Duggal, Tata McGraw Hill, New Delhi.

**References Books:**

1. Surveying for Engineers- John Uren & Bill Price, Palgrave Macmillan
2. Surveying Vol. I- Dr. K. R. Arora
3. Surveying: Theory and Practice- James M. Anderson, Edward M. Mikhail
4. Surveying theory and practices- Devis R. E., Foot F. S.
5. Plane and Geodetic surveying for Engineers. Vol. I -- David Clark
6. Principles of Surveying. Vol. I by J.G.Olliver, J.Clendinning
7. Plane Surveying- A.M.Chandra, New Age International Publishers

**Experiment wise Measurable students Learning Outcomes:**

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

1. Understand the basic principles of surveying and types of levels.
2. Understand methods to improve accuracy in levelling.
3. Apply methods of plane table for drawing.
4. Compute area conventionally and electronically.
5. Measure horizontal and vertical angles
6. Apply trigonometry for levelling.
7. Use modern instrument for angle measurement.

|   |                              |          |          |          |               |
|---|------------------------------|----------|----------|----------|---------------|
| Title of the Course:  | <b>Environmental Studies</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:  | <b>UCVA0301</b>              | <b>2</b> | <b>0</b> | <b>0</b> | <b>0</b>      |
| <b>Assessments :</b><br><b>Teacher Assessment:</b> Not Applicable   |                              |          |          |          |               |
| <b>Course Contents:</b>   |                              |          |          |          |               |
| <b>Unit 1: Nature of Environmental Studies:</b><br>Definition, scope and importance. Multidisciplinary nature of environmental studies. Need for public awareness.  |                              |          |          |          | <b>4 Hrs.</b> |
| <b>Unit 2: Natural Resources and Associated Problems:</b><br>a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people.<br>b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.<br>c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources.<br>d) Food resources: World food problem, changes caused by effect of modern agriculture, fertilizer-pesticide problems.<br>e) Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy.<br>f) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification.<br>g) Role of individuals in conservation of natural resources. |                              |          |          |          | <b>4 Hrs.</b> |
| <b>Unit 3: Ecosystems:</b><br>Concept of an ecosystem. Structure and function of an ecosystem.<br>Producers, consumers and decomposers. Energy flow in the ecosystem.<br>Ecological succession. Food chains, food webs and ecological pyramids.<br>Introduction, types, characteristics features, structure and function of the following ecosystem :-<br>a. Forest ecosystem,<br>b. Grassland ecosystem<br>c. Desert ecosystem<br>d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).  |                              |          |          |          | <b>6 Hrs.</b> |

|  |                      |
|--|----------------------|
| <p><b>Unit 4:</b></p> <p>Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India.</p> <p>Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.</p> <p>India as a mega- diversity nation. Ghat as a biodiversity region. Hot-spot of biodiversity.</p> <p>Threats to biodiversity habitat loss, poaching of wildlife, man- wildlife conflicts. Endangered and endemic species of India.</p> <p>Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.</p> | <p><b>6 Hrs.</b></p> |
| <p><b>Unit 5: Environmental Pollution:</b></p> <p>Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.</p> <p>Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of a individual in prevention of pollution</p>  | <p><b>6 Hrs.</b></p> |
| <p><b>Unit 6: Social Issues and the Environment:</b></p> <p>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.</p> <p>Environmental ethics: Issue and possible solutions.</p> <p>Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation.</p> <p>Consumerism and waste products.</p>  | <p><b>8 Hrs.</b></p> |
| <p><b>Unit 7: Environmental Protection:</b></p> <p>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><b>8hrs</b></p>   |
| <p><b>Unit 8: Field Work:</b></p> <p>Visit to a local area to document environmental assets<br/>       River/Forest/Grassland/Hill/Mountain.<br/>       or<br/>       Visit to a local polluted site - Urban / Rural / Industrial /Agricultural.<br/>       Or<br/>       Study of common plants, insects, birds. or Study of simple ecosystems - ponds, river, hill slopes, etc.</p>  | <p><b>10 hrs</b></p> |

**Recommended Textbooks:**

1. Agarwal, K.C.2001, Environmental Biology, Nidi Pub. Ltd., Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380013, India, Email:mapin@icenet.net (R)
3. Brunner R.C.,1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
4. Clank R.S. Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H.Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Pub. Mumbai, 1196p
6. De A.K., Environmental Chemistry, Wiley Western Ltd.
7. Down to Earth , Centre for Science and Environment , New Delhi.(R)
8. Gleick, H.,1993, Water in crisis, Pacific Institute for studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H.& Watson, R.T.1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
11. Jadhav, H.and Bhosale, V.M.1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
12. Mickinney, M.L.and School. R.M.1196, Environmental Science Systems and Solutions, Web enhanced edition, 639p.
13. Miller T.G. Jr., Environmental Science. Wadsworth Publications Co.(TB).
14. Odum, E.P.1971, Fundamentals of Ecology, W.B.Saunders Co. USA, 574p.
15. Rao M.N.and Datta, A.K.1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd., 345p
16. Sharma B.K., 2001, Environmental Chemistry, Gokel Publ. Hkouse, Meerut
17. Survey of the Environment, The Hindu (M)
18. Townsend C., Harper, J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
19. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I and II, Environmental Media (R)
20. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno-Science Publications (TB)
21. Wagner K.D.,1998, Environmental management, W.B. Saunders Co. Philadelphia, USA 499p.
22. Paryavaran shastra – Gholap T.N.
23. Paryavaran Sahastra – Gharapure (M) Magazine (R) Reference (TB) Textbook

# **S. Y. B.Tech Semester - IV**

**Academic Year 2022-2023**

**Teaching and Evaluation scheme for Second Year Semester -IV**

| Sr. No                 | Curriculum Component | Course Code | Course                                 | Teaching Scheme |   |    | Evaluation Scheme |           |       |                      |    |  |
|------------------------|----------------------|-------------|--|-----------------|---|----|-------------------|-----------|-------|----------------------|----|--|
|                        |                      |             |  | L               | T | P  | Credit            | Component | Marks |                      |    |  |
|                        |                      |             |  |                 |   |    |                   |           | Max   | Min for Passing      |    |  |
| 1                      | PC                   | UCVC 0401   | Structural Analysis                    | 3               | 1 | 0  | 4                 | ISE-I     | 10    | 20                   | 40 |  |
|                        |                      |             |  |                 |   |    |                   | ISE-II    | 10    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | MSE       | 30    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | ESE       | 50    | 20                   |    |  |
| 2                      | ES                   | UCVC 0402   | Engineering Hydraulics--II             | 3               | 0 | 0  | 3                 | ISE-I     | 10    | 20                   | 40 |  |
|                        |                      |             |  |                 |   |    |                   | ISE-II    | 10    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | MSE       | 30    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | ESE       | 50    | 20                   |    |  |
| 3                      | PC                   | UCVC 0403   | Water Treatment and Supply Systems     | 3               | 0 | 0  | 3                 | ISE-I     | 10    | 20                   | 40 |  |
|                        |                      |             |  |                 |   |    |                   | ISE-II    | 10    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | MSE       | 30    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | ESE       | 50    | 20                   |    |  |
| 4                      | PC                   | UCVC 0404   | Advance Surveying                      | 3               | 0 | 0  | 3                 | ISE-I     | 10    | 20                   | 40 |  |
|                        |                      |             |  |                 |   |    |                   | ISE-II    | 10    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | MSE       | 30    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | ESE       | 50    | 20                   |    |  |
| 5                      | PC                   | UCVC 0405   | Highway Engineering                    | 3               | 1 | 0  | 4                 | ISE-I     | 10    | 20                   | 40 |  |
|                        |                      |             |  |                 |   |    |                   | ISE-II    | 10    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | MSE       | 30    |                      |    |  |
|                        |                      |             |  |                 |   |    |                   | ESE       | 50    | 20                   |    |  |
| 6                      | PC                   | UCVC 0406   | Highway Material Testing Lab           | 0               | 0 | 2  | 1                 | ISE       | 25    | 10                   |    |  |
|                        |                      |             |  |                 |   |    |                   | ESEOE     | 25    | 10                   |    |  |
| 7                      | PC                   | UCVC 0407   | Water Treatment and Supply Systems Lab | 0               | 0 | 2  | 1                 | ISE       | 25    | 10                   |    |  |
|                        |                      |             |  |                 |   |    |                   | ESE POE   | 25    | 10                   |    |  |
| 8                      | BS                   | UCVC 0408   | Basic Computer Aided Drawing Lab       | 0               | 0 | 2  | 1                 | ISE       | 25    | 10                   |    |  |
|                        |                      |             |  |                 |   |    |                   | ESE POE   | 50    | 20                   |    |  |
| 9                      | PC                   | UCVC 0409   | Advance Surveying Lab                  | 0               | 0 | 2  | 1                 | ISE       | 25    | 10                   |    |  |
| 10                     | PW                   | UCVC 0410   | Professional Practices-I               | 0               | 0 | 2  | 1                 | ISE       | 50    | 20                   |    |  |
| 11                     |                      | UCVA 0401   | Indian Constitution (Audit Course)     | 2               | 0 | 0  | 0                 | ESE       | 100   | 40                   |    |  |
| Total Contact Hrs.: 29 |                      |             |  | Total           |   | 17 | 2                 | 10        | 22    | 500+250+Audit Course |    |  |



|                      |                     |   |   |   |        |
|----------------------|---------------------|---|---|---|--------|
| Title of the Course: | Structural Analysis | L | T | P | Credit |
| Course Code:         | UCVC0401            | 3 | 1 | 0 | 4      |

**Course Pre-Requisite:**

Applied Mechanics, Engineering Mathematics, Mechanics of Solids

**Course Description:**

Structural Analysis forms a core subject which is taught to students of all non-circuit disciplines of engineering. The study of this subject is aimed at developing the ability to interpret the response of structural elements towards combined straining effects in terms of static and kinematic aspect.

**Course Learning Objectives:**

1. To evaluate combined effect of direct and bending stresses.
2. To determine principal stresses and strains.
3. To determine buckling load on columns.
4. To determine slope and deflection of beams.
5. To draw ILD for beams and Truss.
6. To evaluate deflections of beams.

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to            | Bloom's Cognitive |            |
|------------|---|-------------------|------------|
|            |   | Level             | Descriptor |
| <b>C01</b> | Analyse the stresses due to combined loads.                                 | 4                 | Cognitive  |
| <b>C02</b> | Analyse the stresses for plane sections, long columns, Three hinged arch.   | 4                 | Cognitive  |
| <b>C03</b> | Analyse simple structures for deformation studies by conventional concepts. | 4                 | Cognitive  |
| <b>C04</b> | Evaluate the influence line curves for typical determinate structures.      | 5                 | Cognitive  |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 3    | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |
| C02             | 3    | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |
| C03             | 3    | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |
| C04             | 3    | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |

**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 | Marks |
|------------|-------|
| ISE 1      | 10    |
| MSE        | 30    |
| ISE 2      | 10    |
| ESE        | 50    |

- ISE 1 and ISE 2 are based on Tutorial/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:**

|  |               |
|--|---------------|
| <b>Unit 1: Combined direct and bending stresses</b><br><br>Combined direct and bending stresses, columns subjected to eccentric loading, chimney, Earth retaining wall, Masonry Dam, stability of masonry dam.                         | <b>8 Hrs.</b> |
| <b>Unit 2: Principal planes and stresses</b><br><br>Principal planes and stress in two dimensions, Analytical and Mohr's circle method. Principal stress in beams.   | <b>7 Hrs.</b> |
| <b>Unit 3: Analysis of long columns</b><br><br>Definition of column and strut, End conditions of columns, Analysis of long columns, Euler's theory and Rankine's theory.   | <b>7 Hrs.</b> |
| <b>Unit 4: Slope and deflection of determinate beams</b><br><br>Slope and deflection of determinate beams - Double integration method, Macaulay's method, moment-area method and conjugate beam method, three hinged parabolic arches. | <b>8 Hrs.</b> |
| <b>Unit 5: Influence line diagrams</b><br><br>Influence line diagrams for determinate beams, compound beams, through type bridge trusses and deck type bridge trusses.   | <b>6 Hrs.</b> |

|   |               |
|---|---------------|
| <b>Unit 6: Three hinged arches</b><br><br>Three hinged Parabolic arches with supports at same level and different level.<br>Three hinged Semi-Circular arches with supports at same level and different level.  | <b>6 Hrs.</b> |
| <b>Recommended Textbooks:</b> <ol style="list-style-type: none"> <li>1. Mechanics of Structure (Vol. I and II) – Dr.H.J.Shaha and Junnarkar S.B., Charotar Publication.</li> <li>2. Mechanics of Materials Vol I and II – B.C.Punmia and Jain, Laxmi Publications.</li> <li>3. Strength of Materials - S Ramamrutham, Dhanapat Rai Publications.</li> <li>4. Strength of Materials - Bhavikatti S.S., New Age Publications.</li> <li>5. Strength of Materials - R.K.Rajput., S.Chand Publications.</li> <li>6. Strength of Materials - R.K.Bansal., Laxmi Publications.</li> <li>7. Structural Analysis - Bhavikatti S.S, Vikas Publications house New Delhi.</li> <li>8. Strength of Material – Debabrata Nag, A. Chanda, 2nd Edition, and Wiley India publication.</li> </ol> |               |
| <b>References Books:</b> <ol style="list-style-type: none"> <li>1. Strength of Material - F. L. Singer and Pytel, Harper and Row publication.</li> <li>2. Introduction to Mechanics of Solids - J.B. Popov, Prentice – Hall publication.</li> <li>3. Mechanics of Materials - Gere and Timoshenko, CBS publishers.</li> <li>4. Mechanics of Materials - R.C. Hibbler, Pearson Education.</li> <li>5. Mechanics of Material - Beer and Johnston, M.</li> </ol>   |               |
| <b>Unit wise Measurable students Learning Outcomes:</b><br>After the completion of the course the student will be able to <ol style="list-style-type: none"> <li>1. To calculate combined effect of direct and bending stresses.</li> <li>2. To calculate principal stresses and strains.</li> <li>3. To study loading effects on typical structural elements.</li> <li>4. To calculate slope and deflection of beams.</li> <li>5. To plot ILD for simple structures.</li> <li>6. To calculate deflections of simple structures.</li> </ol>   |               |

|                      |                                    |          |          |          |               |
|----------------------|------------------------------------|----------|----------|----------|---------------|
| Title of the Course: | <b>Engineering Hydraulics - II</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0402</b>                    | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b>      |

**Course Pre-Requisite:**

A Student should undergone a course and understanding in subjects viz. Applied Mechanics, Engineering Hydraulics – I, Physics, Mathematics.

**Course Description:**

The material in this course will provide the student with a fundamental of open channel flow, its classification, discharge measurements. The detail analysis of GVF and RVF in open channel. The student will learn about theory and application of impact of jet. The student will also learn about canal regime theories. They will learn about the types of pumps and turbines as well as design process of selection of the same.

**Course Learning Objectives:**

5. To know the classification of open channel flow, understand elements of open channel and flow analysis.
6. To understand the basic principles of open channel flows and flow measurements through open channel
7. To apply principles of Impulse Momentum Principle in the analysis of impact of jet on plane and curved surfaces.
8. To identify, formulate, and solve engineering problems related to open channel flow as well as hydraulic machines.

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 2    | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2  | 0  | 0  | 0     | 0  | 0  |
| C02             | 2    | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2  | 0  | 0  | 0     | 0  | 0  |
| C03             | 2    | 1 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 2  | 0  | 0  | 0     | 2  | 0  |
| C04             | 2    | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 2  | 0  | 0  | 0     | 2  | 0  |

**Course Contents:**

**Unit 1:**

**Fundamental of open channel flow:** Difference between pipe flow and open channel flow. Types of open channel flow. Uniform and Non-uniform flow. Concept of specific energy and specific force. Sub-critical, critical and supercritical flow.

**06 Hrs.**

|  |                |
|--|----------------|
| <b>Unit 2:</b><br><b>Uniform Flow in Open Channel:</b> Geometric Elements, Chezy's and Manning's Formula, Uniform Flow Computations, Hydraulically Efficient Section (Rectangular, Triangular, Trapezoidal)  | <b>06 Hrs.</b> |
| <b>Unit 3:</b><br>A. <b>Gradually varied flow (GVF) :</b> definition, classification of channel slopes, dynamics equation of GVF (Assumption and equation), classification of GVF profiles<br>B. <b>Rapidly varied flow (RVF):</b> Definition, hydraulic jump phenomenon, conjugate depth relationship, characteristics uses and types of hydraulic jumps as an energy dissipater.   | <b>08 Hrs.</b> |
| <b>Unit 4:</b><br>A. <b>Notches and Weirs:</b> Types, Derivation of Discharge Equation, Velocity of Approach, Francis Formula, and Errors in Measurement of Discharge Sharp, Broad and Round Crested Weirs, Time of Emptying Tank with Weir. Introduction to Ogee spillway and energy dissipater<br>B. <b>Canals:</b> Types, alignment, typical sections of canals, balancing depth Kennedy's and Lacey's silt theories.   | <b>06 Hrs.</b> |
| <b>Unit 5:</b><br><b>Impact of Jet:</b> Impulse Momentum Principle, Impact of Jet on Vanes- Flat, Curved (Stationary and Moving), Inlet and Outlet Velocity Triangles, Series of Flat, Curved Vanes Mounted on Wheel.  | <b>06 Hrs.</b> |
| <b>Unit 6:</b><br><b>Pumps and Turbines</b><br>A. <b>Hydraulic Turbines:</b> Introduction to Hydro-Power plant, working of Pelton, Francis and Kaplan Turbine, Specific Speed, Selection of Type of Turbine, Small scale Modern Turbines<br>B. <b>Centrifugal Pump:</b> Working of Centrifugal Pump, Jet pump, submersible pump, turbine pump, and Rotary pump, Common Pump Troubles and Remedies, Net Positive Suction Head (NPSH). , Selection of commercial pumps | <b>06 Hrs.</b> |
| <b>Recommended Textbooks:</b><br>1) Fluid Mechanics – A.K. Jain – Khanna Pub., Delhi<br>2) Fluid Mechanics – Hydraulic and Hydraulic Mechanics -Modi/Seth – Standard Book House, Delhi<br>3) Fluid Mechanics – K. L. Kumar – Eurasia Publication House, Delhi<br>4) Fluid Mechanics – Arora  |                |

**References Books:**

- 1) Fluid Mechanics – Streeter-McGraw-Hill International Book Co., Auckland
- 2) Elementary Fluid Mechanics – H. Rouse – Toppan C. Ltd. Tokyo
- 3) Fluid Mechanics – Shames - McGraw-Hill International Book Co., Auckland

**Unit wise Measurable students Learning Outcomes:**

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

- 1) Understand the types of flows in open channel and concept of specific energy
- 2) Understand Energy-depth relationship in OCF and design hydraulically most efficient channel sections.
- 3) Analyze the GVF profiles and compute the energy loss in hydraulic jump and its efficiency as energy dissipating device.
- 4) To determine the discharge in OCF using notches / weirs. Canal types geometrical elements and silting theories.
- 5) To study the impulse momentum equation and its application.
- 6) To study about hydraulic machines its design principal and application in various civil engineering application.

|                      |   |          |          |          |               |
|----------------------|---|----------|----------|----------|---------------|
| Title of the course: | <b>Water Treatment and Supply Systems</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0403</b>                           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b>      |

**Course Pre-Requisite:**

Students must have basic idea about Environmental Problems and issues regarding the application of knowledge of the concepts which are essential for understanding correlation of Engineering and Environmental Issues like water pollution and disposal problems.

**Course Description:**

This course will help the students to understand the importance and seriousness about pollution of Water and water treatment facilities and water supply network.

**Course Objectives :**

1. To provide the pertinent knowledge on water supply and treatment systems.
2. To impart necessary skill for the design and operation of water treatment units.
3. To prepare students for higher studies and research in the field of water treatment technology.
4. To familiarize the students with latest trends in water treatment.

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to  | Bloom's Cognitive |            |
|------------|---|-------------------|------------|
|            |   | level             | Descriptor |
| <b>CO1</b> | Assess the quality and carry out quantification of the given source of water for drinking purpose as per standards of I.S.10500.      | 2                 | Understand |
| <b>CO2</b> | Design the water treatment units for various qualities of water depending on water source as per mentioned design parameters.         | 4                 | Create     |
| <b>CO3</b> | Analyze the water distribution system numerically and computationally with respect to water quality, water pressure and pipe quality. | 5                 | Solve      |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| CO1             | 2    | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 1 | 2  | 1  | 2  | 0     | 1  | 1  |
| CO2             | 3    | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1  | 1  | 1  | 1     | 1  | 1  |
| CO3             | 3    | 1 | 1 | 2 | 3 | 2 | 2 | 1 | 2 | 2  | 1  | 1  | 1     | 1  | 1  |



|  |                |
|--|----------------|
| <b>Unit 1:</b><br><b>Water:</b> Sources of water, quantity & quality of sources, demand of water, factors affecting demand, fluctuations in demand, rate of water consumption, design period & population forecast.<br><b>Water quality parameters:</b> Characteristics & significance in water treatment, drinking water quality standards- BIS, WHO.<br><b>Intake Works:</b> Concepts of Intake well, Jack well and Rising main. Design of Intake well.<br><b>Reservoirs:</b> necessity and types  | <b>08 Hrs.</b> |
| <b>Unit 2:</b><br>Concept of water treatment process.<br><b>Aeration-</b> Types of aerators, design of cascade aerator<br><b>Coagulation &amp; Flocculation:</b> Theory of coagulation and flocculation, destabilization of colloidal particles, factors affecting coagulation, types of coagulants, methods of dosing of coagulants, Jar tests, design of rapid mixer & flocculator.<br><b>Sedimentation-</b> Theory, types of settling, types of sedimentation tanks. Design of vertical flow sedimentation tank. Concept and design of clariflocculator. Concept of tube & plate settler. | <b>09 Hrs.</b> |
| <b>Unit 3:</b><br><b>Filtration-</b> Mechanism, head loss development, negative head loss.<br><b>Types of filters-</b> Slow sand, Rapid sand, Multimedia & Pressure filters. Operation & design of rapid sand filter.<br><b>Disinfection-</b> Mechanism, factors affecting disinfection, methods of disinfection, chemistry of chlorination, Forms of chlorination and practices.  | <b>06 Hrs.</b> |
| <b>Unit 4:</b><br><b>Water softening processes</b> - lime-soda process, ion exchange<br><b>Demineralization</b> - Reverse osmosis, electro dialysis.<br>Layout of water treatment units as per source..  | <b>04 Hrs.</b> |
| <b>Unit 5:</b><br><b>Transmission of water:</b> pumping & gravity mains, choice of pipe materials, forces acting on pressure pipes, design of thrust block, corrosion types & control measures. Leakage & pressure testing of pipes.   | <b>05 Hrs.</b> |
| <b>Unit 6:</b><br><b>Water Distribution System:</b> basic requirements, methods of distribution, layout patterns, And methods of network analysis: Equivalent pipe, Hardy-Cross method, design problems. Water appurtenances   | <b>06 Hrs.</b> |



**Textbooks:**

- 1) Water and Waste water Technology by Mark J. Hammer, John Wiely and Sons.
- 2) Introduction to Environmental Engineering by M. L. Davis and Davis A.
- 3) Cornwell, Mc Graw Hill.
- 4) Environmental Engineering: A design approach by A.P. Sincero and G.A. Sincero.
- 5) Prentice Hall of India.
- 6) Environmental Engineering by H.S. Peavy, D.R. Rowe. McGraw Hill
- 7) Water Supply Engineering by Dr. P. N. Modi, Standard Book House, New Delhi.
- 8) Water Supply Engineering by S. K. Garg, Khanna Publishers, New Delhi
- 9) Water Supply Engineering by Dr. B. C. Punmia, Laxmi Publishers, New Delhi
- 10) Raju, B.S.N., "Water Supply and Wastewater Engineering" Tata McGraw Hill Private limited, New Delhi, 2nd Edition, 2000.

**References:**

- 1) "Manual on Water Supply and Treatment", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 1999.
- 2) Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 7 Th Edition, 2018.
- 3) Davis, M, L, and Cornwell, D, A, "Introduction to Environmental Engineering", Tata McGraw Hill Publishing Company, Special Indian Edition, 2010.
- 4) Nathanson, J. A., "Basic Environmental Technology", PHI Learning private limited, 5th Edition, 2009

**Unit wise Measurable students Learning Outcomes: Students will.**

- 1) Understand the water quality parameters and acceptance standards.
- 2) Study and design the aeration, coagulation flocculation and sedimentation.
- 3) Able to design the filtration process.
- 4) Understand the water softening and demineralization.
- 5) Understand transmission and leakages in pipes,
- 6) Understand the details of distribution system.

|   |   |                   |            |   |        |
|---|---|-------------------|------------|---|--------|
| Title of the Course:  | Advance Surveying   | L                 | T          | P | Credit |
| Course Code:  | UCVC0404  | 3                 | 0          | 0 | 3      |
| <b>Course Pre-Requisite:</b><br>UCVC0305-Engineering Survey.  |   |                   |            |   |        |
| <b>Course Description:</b><br>The course mainly deals with survey of large areas, also called geodetic survey where curvature of earth is taken into consideration. Indirect methods of surveying and trigonometry are studied. This course also has a focus on design and setting out Curves for road and railway. Modern tool of surveying are introduced in this course.   |   |                   |            |   |        |
| <b>Course Learning Objectives:</b><br><div>1. To learn how to use theodolite instrument functions in traversing.</div> <div>2. To learn indirect and speedy method for distance and elevation calculations.</div> <div>3. To differentiate Curve Setting methods in Engineering Survey of roads, railways.</div> <div>4. To determine surveying of larger Area by method of triangulation, as in geodetic Surveying.</div> <div>5. To perceive higher methods of surveying using contemporary Techniques.</div> |   |                   |            |   |        |
| <b>Course Outcomes:</b>   |   |                   |            |   |        |
| CO  | After the completion of the course the student should be able to                      | Bloom's Cognitive |            |   |        |
|   |   | Level             | Descriptor |   |        |
| C01   | Apply conventional and modern tacheometry systems for indirect surveying              | 3                 | Apply      |   |        |
| C02   | Employ theodolite traversing and prepare Gales' traverse table                        | 3                 | Apply      |   |        |
| C03   | Classify and combine various Curve setting for setting out roads and railways         | 2                 | Understand |   |        |
| C04   | Compare stages of triangulation for very large to medium areas for geodetic surveying | 2                 | Understand |   |        |
| C05   | Describes Aerial surveying, RS, GNSS and GIS as tools for surveying                   | 2                 | Understand |   |        |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| CO1             | 2    | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0  | 1  | 1  | 2     | 1  | 1  |
| CO2             | 2    | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0  | 1  | 1  | 3     | 2  | 1  |
| CO3             | 2    | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0  | 1  | 1  | 2     | 2  | 1  |
| CO4             | 2    | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0  | 1  | 1  | 2     | 2  | 1  |
| CO5             | 2    | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0  | 1  | 2  | 2     | 2  | 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 | 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: Tachometry and EDM**

A) Principles, suitability, methods of Tachometry to determine horizontal distances and elevations of points. Contouring by Tachometry  
 B) Electronic distance measurements – principle, evolution and use of EDM's and Total station.

**7 Hrs.**

**Unit 2: Theodolite Traversing**

A) Close traverse- Objectives, traverse table, plotting, Area Calculation of Traverse, Different methods of theodolite traverse, Gales' traverse table, balancing of traverse by transit rule and Bowditch's rule, Omitted measurements.  
 B) Open traverse- uses, deflection angles, open traverse survey, and checks in open traverse.

**7 Hrs.**

|  |               |
|--|---------------|
| <b>Unit 3: Curves</b><br>Significance of curves and curve setting<br>A) Horizontal Curve- types, elements of simple, compound, transition and combined curve, setting out of simple curve by linear and angular methods.<br>B) Vertical curves- types, lengths of vertical curves.   | <b>7 Hrs.</b> |
| <b>Unit 4: Geodetic Surveying</b><br>Triangulation- Principle, Classification system, Selection of station, Base line Measurement. Signals and towers, phase correction, satellite station, reduction to center, spherical excess, angular observations, Trilateration.  | <b>6 Hrs.</b> |
| <b>Unit 5: Aerial Photogrammetry</b><br>Types of photogrammetry, scale of vertical photographs, flight planning and mosaic. Use of UAV (drones) in aerial mapping. Stereoscopy and interpretations.  | <b>4 Hrs.</b> |
| <b>Unit 6: RS, GIS and GNSS</b><br>A) Remote sensing- Definition, relevance, types, electromagnetic radiation and spectrum, energy sources and its characteristics, image acquisition, applications.<br>B) GIS- Terminology, advantages, basic components of GIS, data types, applications.<br>C) GNSS- Basic principles, GPS segments, receivers, types of GNSS systems, applications, concept of DGPS. | <b>5 Hrs.</b> |
| <b>Recommended Textbooks:</b><br>1. N. N. Basak, Surveying and Leveling, Tata McGraw Hill Publications, 1st Edition.<br>2. B. C. Punmia, Surveying and Leveling, Vol I & II, Laxmi Publications.<br>3. S. K. Duggal, Surveying Vol. I and II, Tata McGraw Hill, New Delhi.   |               |
| <b>References Books:</b><br>1. Surveying for Engineers- John Uren & Bill Price, Palgrave Macmillan<br>2. Surveying Vol. I- Dr. K. R. Arora<br>3. Surveying: Theory and Practice- James M. Anderson, Edward M. Mikhail<br>4. Surveying theory and practices- Devis R. E., Foot F. S.<br>5. Plane and Geodetic surveying for Engineers. Vol. I, David Clark.   |               |

**Unit wise Measurable students Learning Outcomes:**

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

1. Apply tachymetry and EDM.
2. Employ theodolite traversing and calculate omitted measurements.
3. Classify and set out types of Curves.
4. Understand geodetic surveying.
5. Understand aerial Photogrammetry and Aerial photograph interpretations.
6. Understand definition, terminologies, principles and uses of RS, GIS and GNSS

|                      |                            |          |          |          |               |
|----------------------|----------------------------|----------|----------|----------|---------------|
| Title of the Course: | <b>Highway Engineering</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0405</b>            | <b>3</b> | <b>1</b> | <b>0</b> | <b>4</b>      |

**Course Pre-Requisite:**

Basic Civil Engineering: UHSC0109/ UHSC209

**Course Description:**

This course will help the students to understand planning, geometric design of a highway in horizontal and vertical plane, the construction procedure of various component layers and their design method.

**Course Learning Objectives:**

1. Acknowledge the current schemes of development and surveys of alignment
2. Solve the complex problems in geometric design of highways.
3. Understand the basic concepts of traffic engineering needed for pavement design.
4. Develop efficient pavement crust through strain dependent design.
5. Understand the construction methodology of various pavement layers.
6. Understand the drainage requirements of pavement.

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to  | Bloom's Cognitive |               |
|------------|---|-------------------|---------------|
|            |   | Level             | Descriptor    |
| <b>CO1</b> | Acknowledge the current schemes of development and the basics of engineering surveys for highways.  | 1                 | Remember      |
| <b>CO2</b> | Perform geometric design of elements such as super elevation, horizontal and vertical curves, etc. and understand role of traffic in pavement design. | 4                 | Analyze       |
| <b>CO3</b> | Characterize materials for pavement construction and design bituminous mixes & design Flexible and Rigid pavement as per IRC method.                  | 6                 | Design        |
| <b>CO4</b> | Explain procedures of construction of different layers of Rigid & Flexible Pavement and understand the remedial procedure of pavement distress.       | 2                 | Understanding |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| CO1             | 2    | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0  | 1  | 0  | 0     | 0  | 0  |
| CO2             | 1    | 2 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |
| CO3             | 0    | 0 | 2 | 0 | 0 | 3 | 2 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |
| CO4             | 2    | 0 | 1 | 1 | 1 | 3 | 3 | 0 | 0 | 1  | 1  | 0  | 0     | 0  | 0  |

**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 | Marks |
|------------|-------|
| ISE1       | 10    |
| MSE        | 30    |
| ISE2       | 10    |
| ESE        | 50    |

- ISE 1 and ISE 2 are based on Tutorial/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%

**Course Contents:**

**Unit 1: Introduction to Highways**

**4 Hrs.**

Brief history of road development in India, current road network statistics. Objects of Planning, Planning Surveys and their interpretation. Introduction to NHAI agency, IAHE, NHIDCL, NHDP Phases, MSRDC. Current schemes of government such as Bharatmala - I & II, SARDP-NE, LWE.

**Unit 2: Geometric Design**

**8 Hrs.**

Terrain classification, design speed, vehicular characteristics, highway cross-section elements Sight distance: introduction to sight distance, reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance.

Design of horizontal alignment: Highway alignment & Surveys, horizontal curves, design of super elevation and its provision, radius at horizontal curves, widening of pavements at horizontal curves, analysis of transition curves.

Design of vertical alignment: different types of gradients, grade compensation on curves, analysis of vertical curves, summit curves, valley curves. Introduction to Hill Roads.



|   |               |
|---|---------------|
| <b>Unit 3: Introduction to Traffic Engineering</b><br>Traffic Engineering: Definition, objectives and scope of Traffic Engineering, factors affecting road traffic; Traffic Studies, Concepts of passenger car units for mixed traffic flow, Signal design by Webster's method.   | <b>5 Hrs.</b> |
| <b>Unit 4: Pavement Design</b><br>Types of pavements, functions of pavement components, pavement design factors, design wheel load, equivalent single wheel load, repetition of loads, equivalent wheel load factors, strength characteristics of pavement materials, climatic variation; design steps of flexible highway pavement as per IRC 37 and problems based on CBR method, Design of rigid pavement as per IRC 58, Stresses in rigid highway pavements, , Joints in rigid pavements: transverse joints, longitudinal joints, fillers and sealers.  | <b>9 Hrs.</b> |
| <b>Unit 5: Highway Materials, Construction, Maintenance &amp; Economics</b><br>Stone aggregates: desirable properties, requirements of aggregates for different types of pavements.<br>Bituminous materials: types, desirable properties, selection of grade of bitumen. Bituminous mix design using Marshall Stability.<br>Water Bound Macadam, Bitumen Bound Macadam, SDBC, and Dry Lean Concrete & Pavement Quality Concrete construction methodology. Stabilization of roads.<br>Significance of maintenance, distresses in flexible and rigid pavements and their measures. Pavement Evaluation using BBD and FWD.<br>Introduction, user benefits, costs, economic analysis, financing of highways – BOT, Annuity, HAM and EPC projects. | <b>8 Hrs.</b> |
| <b>Unit 6: Highway Drainage</b><br>Significance and requirements, Surface drainage system and Design Examples, subsurface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.   | <b>6 Hrs.</b> |
| <b>Recommended Textbooks:</b> <ol style="list-style-type: none"> <li>1. S K Khanna and CEG Justo," Highway Engineering", Nem Chand Bros, Roorkee</li> <li>2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.</li> </ol>  |               |
| <b>References Books:</b> <ol style="list-style-type: none"> <li>1. O'Flaherty, C.A., "Highways Vol 2", Edward Arnold, London.</li> <li>2. Khistry, C.J., "Transportation Engineering – An Introduction", Prentice Hall of India Ltd., New Delhi.</li> <li>3. S.K. Sharma, "Principles, Practice and Design of Highway Engineering", S. Chand Publishing, New Delhi.</li> <li>4. Partha Chakraborty and Animesh das, "Principles of Transportation Engineering", Prentice</li> </ol>   |               |



Hall

5. Paul H. Wright, "Highway Engineering", 7th Edition WILEY
6. Subramanyam. K.P, "Transportation Engineering", Scitech Publications, Chennai.
7. Relevant IRC codes

**Unit wise Measurable students Learning Outcomes:**

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

1. Explain Road development in India, present status of roads in India and alignment surveys to be conducted for construction.
2. Analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance, and analysis of transition curves etc.
3. Choose different types materials for pavement and their Mix design
4. Design of Rigid and Flexible pavements.
5. Explain the procedures of construction of various layers and suggest remedial measures for distresses.
6. Choose and adopt proper drainage system for highway.

|                      |                                      |          |          |          |               |
|----------------------|--------------------------------------|----------|----------|----------|---------------|
| Title of the Course: | <b>Highway Materials Testing Lab</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0406</b>                      | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b>      |

**Course Pre-Requisite:** None

**Course Description:**

Experiments will help the students to understand types of Bituminous materials and selection of grade of bituminous and aggregates, for different types of pavements.

**Course Learning Objectives:**

1. Make the student able to perform experiments as per standard procedure.
2. Draw inference from conducted experiments.
3. Apply the knowledge in real life practices.

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to | Bloom's Cognitive |            |
|------------|--|-------------------|------------|
|            |  | Level             | Descriptor |
| <b>CO1</b> | Compare the properties of aggregates to IRC recommendations      | 3                 | Apply      |
| <b>CO2</b> | Know stress in highway pavements                                 | 2                 | Understand |
| <b>CO3</b> | Conduct CBR and Bituminous mix design                            | 3                 | Apply      |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| CO1             | 2    | 2 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0  | 1  | 0  | 0     | 0  | 0  |
| CO2             | 1    | 2 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |
| CO3             | 0    | 0 | 2 | 0 | 0 | 3 | 2 | 0 | 0 | 0  | 0  | 0  | 0     | 0  | 0  |
| CO4             | 2    | 0 | 1 | 1 | 1 | 3 | 3 | 0 | 0 | 1  | 1  | 0  | 0     | 0  | 0  |

**Assessments:**

**Teacher Assessment:**

- Two components of Course Evaluation

| Assessment | Marks |
|------------|-------|
| ISE        | 25    |
| ESE OE     | 25    |

- ISE Internal Marks based on Assignments, Declared test/Quiz/Site Visit Report, Discussions etc.
- ESE OE: Assessment is based on OE.

**Course Contents:**

Experiment 1: Shape test on aggregates

Experiment 2: Aggregate Impact Value

Experiment 3: Los Angeles Abrasion Test

Experiment 4: Crushing test of aggregate

Experiment 5: Specific gravity of binder

Experiment 6: Bitumen Penetration

Experiment 7: Softening Point

Experiment 8: Flash Point and Fire Point Test

Experiment 9: Ductility test

Experiment 10: Viscosity of bitumen

Experiment 11: Stripping value of aggregate

Experiment 12: Mix Design using Marshall Machine

**Recommended Textbooks:**

1. Khanna and Justo, \_Highway Engineering Lab manual, Nemchand & Bros., Roorkee.
2. Khistry, C.J., "Transportation Engineering – An Introduction ", Prentice Hall of India Ltd., New Delhi.
3. S.K. Sharma, Highway Engineering
4. IRC 37-2001 and IRC 58-2002

**References Books:**

1. Paul H. Wright, "Highway Engineering", 7th Edition WILEY
2. Subramanyam. K.P, "Transportation Engineering", Scitech Publications, Chennai.
3. AASHTO codes
4. Relevant IS and IRC Specifications

**Unit wise Measurable students Learning Outcomes:**

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

4. Group the aggregates under classifications.
5. Evaluate the resistance of Impact of aggregates.
6. Measure the ease or difficulty with which aggregate particles will deteriorate under the action of traffic.

7. Find relative measure of resistance to crushing under gradually applied compression load.
8. Determine the specific gravity of aggregates.
9. Determine the consistency of material and grade the bituminous material.
10. Determine the softening point.
11. Find Flash and Fire point of bituminous binder.
12. Examine ductility value of bituminous binder.
13. Identify viscosity of bituminous binder.
14. Determine stripping value of road aggregates.
15. Perform mix design of bituminous material using Marshall Apparatus.

| Title of the Course:   | Water Supply and System Lab   | L                 | T          | P  | Credit |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|--|---|-------------------|------------|----|--------|-----------------|--|-------------------|---|-------|------------|-----|---|----|----------|-----|--|---|----------|-----|---|---|------------|---|---|---|---|---|---|---|----|----|----|----|----|----|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Code:   | UCVC0407  | 0                 | 0          | 02 | 01     |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Course Pre-Requisite:</b><br>Engineering Hydraulics-I, Engineering Hydraulics-II.   |   |                   |            |    |        |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Course Description:</b><br>This course will help the students to understand the importance and seriousness about pollution of water and water treatment facilities and water supply network.  |   |                   |            |    |        |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Course Objectives :</b><br><div>1. To provide the students hands-on practice for physical, chemical and bacteriological quality of water.</div> <div>2. To develop the skills required for applying knowledge to decide the chemical dose requirements.</div> <div>3. 3. To expose the students for computer applications in water network analysis.</div>  |   |                   |            |    |        |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>Course Outcomes:</b> <table><tr><th rowspan="2">CO</th><th rowspan="2">After the completion of the course the student should be able to</th><th colspan="2">Bloom’s Cognitive</th></tr><tr><th>level</th><th>Descriptor</th></tr><tr><td>CO1</td><td>Apply the analysis techniques to determine the physical, chemical and bacteriological water quality parameters.</td><td>2</td><td>Applying</td></tr><tr><td>CO2</td><td>Apply modern engineering tool/software to analyze water distribution system.</td><td>3</td><td>Applying</td></tr><tr><td>CO3</td><td>Analyze and interpret the results to assess the quality of water for portability.</td><td>4</td><td>Analyzing.</td></tr></table>  |   |                   |            |    |        | CO              | After the completion of the course the student should be able to | Bloom’s Cognitive |   | level | Descriptor | CO1 | Apply the analysis techniques to determine the physical, chemical and bacteriological water quality parameters. | 2  | Applying | CO2 | Apply modern engineering tool/software to analyze water distribution system. | 3 | Applying | CO3 | Analyze and interpret the results to assess the quality of water for portability. | 4 | Analyzing. |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO   | After the completion of the course the student should be able to  | Bloom’s Cognitive |            |    |        |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  |   | level             | Descriptor |    |        |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO1  | Apply the analysis techniques to determine the physical, chemical and bacteriological water quality parameters. | 2                 | Applying   |    |        |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO2  | Apply modern engineering tool/software to analyze water distribution system.                                    | 3                 | Applying   |    |        |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO3  | Analyze and interpret the results to assess the quality of water for portability.                               | 4                 | Analyzing. |    |        |                 |  |                   |   |       |            |     |   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <b>CO-PO-PSO Mapping:</b> <table><tr><th rowspan="2">Course Outcomes</th><th colspan="12">PO's</th><th colspan="3">PSO's</th></tr><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th></tr><tr><td>CO1</td><td>3</td><td>0</td><td>0</td><td>1</td><td>1</td><td>2</td><td>2</td><td>0</td><td>1</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>CO2</td><td>2</td><td>2</td><td>0</td><td>1</td><td>1</td><td>2</td><td>1</td><td>0</td><td>1</td><td>2</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td></tr><tr><td>CO3</td><td>2</td><td>1</td><td>0</td><td>1</td><td>1</td><td>3</td><td>2</td><td>1</td><td>1</td><td>2</td><td>1</td><td>1</td><td>1</td><td>2</td><td>1</td></tr></table> |   |                   |            |    |        | Course Outcomes | PO's   |                   |   |       |            |     |   |    |          |     |  |   | PSO's    |     |   | 1 | 2          | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | CO1 | 3 | 0 | 0 | 1 | 1 | 2 | 2 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | CO2 | 2 | 2 | 0 | 1 | 1 | 2 | 1 | 0 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | CO3 | 2 | 1 | 0 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 |
| Course Outcomes  | PO's  |                   |            |    |        |                 |  |                   |   |       |            |     | PSO's   |    |          |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  | 1   | 2                 | 3          | 4  | 5      | 6               | 7  | 8                 | 9 | 10    | 11         | 12  | 13  | 14 | 15       |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO1  | 3   | 0                 | 0          | 1  | 1      | 2               | 2  | 0                 | 1 | 2     | 0          | 0   | 0   | 0  | 1        |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO2  | 2   | 2                 | 0          | 1  | 1      | 2               | 1  | 0                 | 1 | 2     | 1          | 1   | 2   | 2  | 2        |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| CO3  | 2   | 1                 | 0          | 1  | 1      | 3               | 2  | 1                 | 1 | 2     | 1          | 1   | 1   | 2  | 1        |     |  |   |          |     |   |   |            |   |   |   |   |   |   |   |    |    |    |    |    |    |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

**Course Contents:**

**A. Analysis of any 08 of the following test parameters for water**

1. pH
2. Acidity
3. Alkalinity
4. Chlorides content
5. Hardness – Total, temporary and permanent
6. Turbidity
7. Residual Chlorine
8. Total dissolved solids through measurement of electrical conductivity
9. Dissolved Oxygen
10. Most Probable Number
11. Optimum dose of alum by jar test.

**B. Design/ Analysis problems on water treatment unit**

**C. Analysis of distribution system using software**

**D. Visit to a water treatment plant**

**Recommended Textbooks:**

- 1) Water and Waste water Technology by Mark J. Hammer, John Wiely and Sons.
- 2) Introduction to Environmental Engineering by M. L. Davis and Davis A. Cornwell, Mc Graw Hill.
- 3) Environmental Engineering: A design approach by A.P. Sincero and G.A. Sincero.
- 4) Prentice Hall of India.
- 5) Environmental Engineering by H.S. Peavy, D.R. Rowe. McGraw Hill
- 6) Water Supply Engineering by Dr. P. N. Modi, Standard Book House, New Delhi.
- 7) Water Supply Engineering by S. K. Garg, Khanna Publishers, New Delhi
- 8) Water Supply Engineering by Dr. B. C. Punmia, Laxmi Publishers, New Delhi, Delhi

**Recommended References:**

- 1) Manual of water supply and treatment by Government of India publication.

**Unit wise Measurable students Learning Outcomes: Students will...**

- 1) Understand the water quality parameters and acceptance standards.
- 2) Design/ Analysis problems on water treatment unit
- 3) Analysis of distribution system using software
- 4) Understand a water treatment plant through visit.

|                      |   |          |          |          |               |
|----------------------|---|----------|----------|----------|---------------|
| Title of the Course: | <b>Basic Computer Aided Drawing Lab</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0408</b>                         | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b>      |

**Course Pre-Requisite:**

Basic Civil Engineering, Building Construction and Services, CAD

**Course Description:**

Students will draw building components with respect to NBC provisions

**Course Learning Objectives:**

1. To draw Working drawings for Building Components and construction
2. To draw Municipal Submission drawing for residential building

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to  | Bloom's Cognitive |            |
|------------|---|-------------------|------------|
|            |   | Level             | Descriptor |
| <b>CO1</b> | Develop Working drawings for Building Components and construction | 5                 | Create     |
| <b>CO2</b> | Develop Municipal Submission drawing for residential building     | 5                 | Create     |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| CO1             | 2    | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0  | 0  | 2  | 2     | 0  | 0  |
| CO2             | 0    | 3 | 2 | 0 | 1 | 3 | 1 | 3 | 0 | 1  | 0  | 2  | 2     | 0  | 3  |

**Assessments:**

**Teacher Assessment:**

| Assessment | Marks |
|------------|-------|
| ISE        | 25    |
| ESE POE    | 50    |

- ISE are based on practical performed/ Quiz/Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
- ESE POE: Assessment is based on Practical & Oral Examination

**LAB. Course Contents:**

**Draw on CAD Sheets:**

Types of drawings and plans:

- 1) Building Components: Door, Window, Stair case
- 2) Submission drawing for residential building.
- 3) Detail working drawing of foundation and center line plan of residential building.
- 4) Drawing on electrification system of residential building.
- 5) Drawing on plumbing system of residential building.

**Recommended Textbooks:**

- 1) Building Drawing – Shah, Kale, Patki (Tata McGraw- Hill)
- 2) Building Design and Drawing – Y. S. Sane (Allied Book Stall, Pune)
- 3) Civil Engineering Drawing – M. Chakraborty.
- 4) Construction Technology (Volume 1 to 4) – R. Chudley (ELBS)
- 5) A Course in Civil Engineering Drawing – V.B. Sikka (S.K. Kataria and Sons)
- 6) Engineering Materials – R.K. Rajput (S. Chand)
- 7) A to Z of Practical Building Construction and Its Management- Sandeep Mantri (Satya Prakashan, New Delhi)

**References Books:**

- 1) SP 7- National Building Code Group 1 to 10- B.I.S. New Delhi
- 2) I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings
- 3) Handbook of Building Construction- M. M. Goyal (Amrindra Consultancy (P)ltd

**Unit wise Measurable students Learning Outcomes:**

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

- 1) Draw Working drawings for Building Components and construction.
- 2) Draw Municipal Submission drawing for residential building.



|                      |                              |          |          |          |               |
|----------------------|------------------------------|----------|----------|----------|---------------|
| Title of the Course: | <b>Advance Surveying Lab</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVC0409</b>              | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b>      |

**Course Pre-Requisite:**

Engineering Surveying theory and Lab & Advanced Survey Theory

**Course Description:**

The course mainly deals with Experiments, field work, methods and instruments for the Geodetic Surveying work with focus on finding the positions of objects on the surface of the Earth using indirect methods of surveying and trigonometry. Setting out curves for road and railway and survey. Modern tool of surveying are introduced in this course.

**Course Learning Objectives:**

1. To understand indirect and speedy method for distance and elevation calculations.
2. To practice methods for Curve Setting in engineering Survey of roads, railways.
3. To prepare for use of modern Engineering Tools especially for Larger Areas, i.e. geodetic Surveying. To perceive higher methods of surveying using contemporary Techniques.

**Course Outcomes:**

| CO         | After the completion of the course the student should be able to        | Bloom's Cognitive |            |
|------------|---|-------------------|------------|
|            |   | Level             | Descriptor |
| <b>CO1</b> | Apply conventional and modern tachometric system for indirect surveying | 3                 | Apply      |
| <b>CO2</b> | Set out curves by linear and angular method                             | 3                 | Apply      |
| <b>CO3</b> | Use mobile and drone for mapping  | 3                 | Apply      |
| <b>CO4</b> | Analyse field data for traverse and achieve professional skill-sets     | 4                 | Analyse    |
| <b>CO5</b> | Check and evaluate traverse for survey control points                   | 5                 | Evaluate   |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 3    | 1 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 3  | 1  | 0  | 2     | 1  | 0  |
| C02             | 2    | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0  | 1  | 0  | 2     | 0  | 0  |
| C03             | 2    | 1 | 2 | 2 | 3 | 0 | 0 | 2 | 0 | 0  | 1  | 1  | 2     | 0  | 0  |
| C04             | 2    | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 3 | 0  | 2  | 1  | 3     | 0  | 2  |
| C05             | 2    | 2 | 2 | 2 | 3 | 0 | 0 | 0 | 3 | 3  | 2  | 2  | 3     | 2  | 3  |

**Assessments :**

**Teacher Assessment:**

- Two component of In Semester Evaluation (ISE) and one (ISE-I) and (ISE-II) having 40%, and 60% weights respectively.

| Assessment  | Marks |    |
|-------------|-------|----|
| Experiments | 10    | 25 |
| PBL         | 15    |    |

- Experiments assessment is based on practical performed/Group Discussion/ Internal oral etc.
- PBL is a mini-Project based on problem statement. The assessment is based on on-site fieldwork, office work and project presentation.

**Course Contents:**

**Experiments:**

1. Tacheometry- Determination of tachometric constants
2. Tacheometry- Determination of grade of a given line
3. Total station - Basic measurement
4. Total station – Rectangular coordinates for advance survey
5. Setting out of simple circular curves – Linear method (any one)
6. Setting out of simple circular curves –Angular method (any one)
7. Aerial photography by Drone survey and observation of stereo pair photos under stereoscope.
8. Use of GNSS system to measure and map waypoints and integrate in Google earth.

**Project Based Learning (PBL):**

1. Theodolite Traversing and Gales Traverse table
2. Radial Contouring by Tachometer

**Recommended Textbooks:**

1. N.N.Basak, Surveying and Leveling, Tata McGraw Hill Publications, 1st Edition.
2. B C Punmia, Surveying and Leveling, Vol I & II, Laxmi Publications.
3. Surveying Vol. I and II - S. K. Duggal, Tata McGraw Hill, New Delhi.

**References Books:**

1. Surveying for Engineers- John Uren & Bill Price, Palgrave Macmillan
2. Surveying Vol. I- Dr. K. R. Arora
3. Surveying: Theory and Practice- James M. Anderson, Edward M. Mikhail
4. Surveying theory and practices- Devis R. E., Foot F. S.
5. Plane and Geodetic surveying for Engineers. Vol. I -- David Clark
6. Principles of Surveying. Vol. I by J.G.Olliver, J.Clendinning
7. Plane Surveying- A.M.Chandra, New Age International Publishers

**Experiment wise Measurable students Learning Outcomes:**

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

1. Carry out permanent adjustment for tachometer.
2. Find gradient of line using tachometer.
3. Use modern instrument TS for basic surveying.
4. Use modern instrument TS for advance surveying.
5. Set out curve using linear method.
6. Set out curve using angular method.
7. Survey using drone.
8. Use of Mobile for mapping.

|                      |                          |    |    |    |        |
|----------------------|--------------------------|----|----|----|--------|
| Title of the Course: | Professional Practices-I | L  | T  | P  | Credit |
| Course Code:         | UCVC0410                 | 00 | 00 | 02 | 01     |

**Course Pre-Requisite:**

Building Science and Services, Concrete Technology, Structural Analysis, Engineering Hydraulics, Engineering Surveying

**Course Description:**

This course aims to make students perform practices followed in civil engineering profession in areas of building permissions, building services, material testing and use of computer aided calculations.

**Course Learning Objectives:**

1. To aware students about practices employed by Professionals from Construction projects.
2. To demonstrate application of computer tools for civil engineering problems.

**Course Outcomes:**

| CO  | After the completion of the course the student should be able to                  | Bloom's Cognitive |            |
|-----|---|-------------------|------------|
|     |   | Level             | Descriptor |
| C01 | Summarize administrative and technical Information required for building project. | II                | Understand |
| C02 | Investigate Quality parameters for basic construction materials                   | III               | Apply      |
| C03 | Apply computer tools for engineering calculations                                 | III               | Apply      |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             | 2    | 3 | 3 | 0 | 0 | 3 | 2 | 3 | 0 | 3  | 3  | 2  | 3     | 0  | 2  |
| C02             | 2    | 3 | 1 | 3 | 0 | 0 | 0 | 3 | 3 | 2  | 2  | 2  | 3     | 3  | 0  |
| C03             | 3    | 3 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 2  | 2  | 2  | 0     | 3  | 3  |

**Assessments :**

**Teacher Assessment:**

- Two components of In Semester Evaluation (ISE), having 50 - 50% weights respectively.

| Assessment | Marks |
|------------|-------|
| ISE 1      | 25    |
| ISE 2      | 25    |

- ISE-1 and ISE- 2 are based activities assigned in contents.
- The students are required to visit the sites, offices, authorities (if required) , after college hours or on holidays. During practical session, the batch teacher shall guide the students and assess their work.
- The students shall work in group of 4 to 5 students. However, the assessment shall be done individually.

**Course Contents:**

**Activity 1:**

Prepare Municipal submission file containing documents listed in prevailing Byelaws for a case assigned by license professional (Architect/ Engineer)

**Activity 2:**

Collect Working drawings (foundation, masonry layout, opening details, electrification, Plumbing and other if applicable) for any building from a consultant and prepare adherence report with respect to National Building Code 2016 Volume II

**Activity 3:**

Prepare a quality report for a construction material (course and fine aggregate, bricks, water, cement etc.) collected from under construction projects

**Activity 4:**

Prepare a spreadsheet for calculations involved in courses learned in semester-III and Semester-IV (Any Two)

**References Books:**

- 1) Unified Development and Control Promotion Regulations (UDCPR) 2020
- 2) National Building Code 2016
- 3) Relevant Indian Standards for Construction Materials

|                      |   |          |          |          |               |
|----------------------|---|----------|----------|----------|---------------|
| Title of the Course: | <b>Constitution of India (Audit Course)</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit</b> |
| Course Code:         | <b>UCVA0401</b>                             | <b>2</b> | <b>0</b> | <b>0</b> | <b>0</b>      |

**Course Pre-Requisite:**

Basics of Indian History, Independence Movement, Fundamentals of Civics.

**Course Description:**

This Course is an introduction of Indian Constitution and basic concepts highlighted in this course for understanding the Constitution of India. This course is structured to give a deeper insight for making the nexus between the other law subjects.

**Course Learning Objectives:**

At the end of the course the student is expected to have acquired:

1. A basic understanding of Constitution of India.
2. Builds the ability to apply the knowledge gained from the course to current social legal issues.
3. Ability to understand and solve the contemporary challenges.
4. Understanding constitutional remedies.

**Course Outcomes:**

| CO  | After the completion of the course the student should be able to  | Bloom's Cognitive |                        |
|-----|---|-------------------|------------------------|
|     |   | Level             | Descriptor             |
| CO1 | <b>Explain</b> the significance of Indian Constitution as the fundamental law of the land                                     | II                | Cognitive (Understand) |
| CO2 | <b>Exercise</b> his fundamental rights in proper sense at the same time Identifies his responsibilities in national building. | II                | Cognitive (Applying)   |
| CO3 | <b>Analyze</b> the Indian political system, the powers and functions of the Union, State and Local Governments in detail      | II                | Cognitive (Understand) |
| CO4 | <b>Understand</b> Electoral Process, Emergency provisions and Amendment procedure.  | II                | Cognitive (Understand) |

**CO-PO-PSO Mapping:**

| Course Outcomes | PO's |   |   |   |   |   |   |   |   |    |    |    | PSO's |    |    |
|-----------------|------|---|---|---|---|---|---|---|---|----|----|----|-------|----|----|
|                 | 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13    | 14 | 15 |
| C01             |      |   |   |   |   | 3 |   | 3 |   |    |    | 3  |       |    |    |
| C02             |      |   |   |   |   | 3 |   | 3 | 3 | 3  |    | 3  |       |    |    |
| C03             |      |   |   |   |   | 3 |   |   | 3 |    |    | 3  |       |    |    |
| C04             |      |   |   |   |   | 3 |   |   | 3 |    |    | 3  |       |    |    |

**Assessments :**

**Teacher Assessment:**

One End Semester Examination (ESE) having 100% weights respectively.

| Assessment | Marks |
|------------|-------|
| ESE        | 100   |

- ESE: Assessment is based on 100% course content

**Course Contents:**

|  |         |
|--|---------|
| <b>Unit 1:- Constitution – Structure and Principles</b><br>1.1: Meaning and importance of Constitution<br>1.2: Making of Indian Constitution – Sources<br>1.3: Salient features of Indian Constitution                         | 03 Hrs. |
| <b>Unit 2:- Fundamental Rights and Directive Principles</b><br>2.1: Fundamental Rights & Fundamental Duties<br>2.2: Directive Principles of State Policy   | 10 Hrs. |
| <b>Unit 3:- Union Government &amp; Executive</b><br>3.1: President of India – Qualification, Powers and Impeachment<br>3.2: Lok Sabha & Rajya Sabha- Composition, Powers & Functions, Scope to amendment in Constitution       | 04 Hrs. |
| <b>Unit 4:- State Government &amp; Executive</b><br>4.1: Governor – Qualification, Appointment, Powers & Functions<br>4.2: Legislative Assembly & Legislative Council – Composition, Powers & Functions                        | 03 Hrs. |
| <b>Unit 5:- The Judiciary</b><br>5.1: Features of Judicial System in India<br>5.2: Hierarchy of Courts, Composition and Jurisdiction   | 03 Hrs. |
| <b>Unit 6:- Local Self Government and other constitutional Organizations</b><br>6.1: 73rd and 74th Constitutional Amendments<br>6.2: Public Service Commission, Election Commission, CAG, National Commissions for SC, ST etc. | 03 Hrs. |

**Textbooks:**

1. M.P. Jain, Indian Constitutional Law
2. M.P. Singh (ed.), V.N. Shukla, Constitutional Law of India
3. D.D. Basu, Commentary on the Constitution of India
4. S.S. Desai, Constitutional Law--I & II

**References:**

1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)
2. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)
3. Shripad Shridhar Desai, Constitutional Law--I, S.S. Law Publication, 2021
4. Shripad Shridhar Desai, Constitutional Law --II, S.S. Law Publication, 2021
5. Constitution of India (Full Text), India.gov.in., National Portal of India,  
[https://www.india.gov.in/sites/upload\\_files/npi/files/coi\\_part\\_full.pdf](https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf)
6. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015