Kolhapur Institute of Technology's

COLLEGE OF ENGINEERING (AUTONOMOUS)

Gokul Shirgaon, Kolhapur

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

Curriculum Structure

For

T. Y. B. Tech Civil Engineering

Academic Year 2023-2024

Under Graduate Programme

Approved in BoS: ***15.07.2023***

Submitted to Academic Standing Committee for Approval

T.Y.B.Tech

Semester V

Academic Year 2023-2024

Teaching and Evaluation scheme for **Third Year Semester–V**

Sr. No	Curriculum Component	Course Code	Course	Teaching Scheme				Evaluation Scheme			
				L	T	P	Credit	Component	Marks: Max	Marks: Min for Passing	
1	PC	UCVC 0501	Design of Steel Structure	3	1	0	4	ISE-I	10	20	40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
2	PC	UCVC 0502	Theory of Structures	3	1	0	4	ISE-I	10	20	40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
3	PC	UCVC 0503	Geotechnical Engineering-I	3	0	0	3	ISE-I	10	20	40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
4	PC	UCVC 0504	Geotechnical Engineering-I Lab	0	0	2	1	ISE	25	10	
								ESE (POE)	50	20	
5	PC	UCVC 0505	Computer Aided Drawing and Drafting Lab	0	0	4	2	ISE	50	20	
								ESE(OE)	25	10	
6	PW	UCVC 0506	Professional Practices-II	0	0	2	1	ISE	50	10	
7	PE	UCVE 05**	Program Elective I	3	0	0	3	ISE-I	10	20	40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
8	PC	UCVC 05**	Program Elective –I Lab	0	0	2	1	ISE	25	10	
								ESE(OE)	25	10	
9	OE	UCVO 05**	Open Elective-I	3	0	0	3	ISE-I	10	20	40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
10		UCVA 0501	Building Planning & Design (Audit Course)	2	0	0	0	ESE	100		40
Total Contact Hrs. : 30			**Total**	**17**	**2**	**10**	**22**	**500+250+Audit Course**			

Title of the Course:	**DESIGN OF STEEL STRUCTURE**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0501**	**3**	**1**	**0**	**4**

Course Pre-Requisite:

Mechanics of Solids, Structural Analysis

Course Description:

This is the first and basic course to introduce concept of structural design and especially for Steel Structures. Number of problems on design of different steel member gives idea about designing process. This course acts as a prerequisite for the advanced design of steel structures.

Course Learning Objectives:

1. To introduce behavior and design of simple steel structures according to limit state design concept.
2. To impart basic knowledge about the design of steel structural members.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Identify the loads on steel structures as per Indian Standard codes.	3	Applying
CO2	Develop the connection details between different structural elements.	3	Applying
CO3	Asses the strength of structural members as per the Indian Standard codes	5	Evaluating
CO4	Design the members as per the Indian Standard codes.	6	Creating

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	3	2	2
CO3	3	2	2
CO4	3	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 modules)
- ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	
Unit 1: **Introduction:** Advantages and disadvantages of steel structures, Design Philosophy, elastic and plastic properties of sections, shape factor, stress distribution under tension, compression, bending and shear, types of steel structures, grades of structural steel, various rolled steel sections, loads and load combinations partial safety factors for load and materials. **Connections:** Types of bolts & welds, analysis and Design of axially and eccentrically loaded bolted and welded connections (subjected to bending and torsion).	**08 Hrs.**
Unit 2: Tension Members: Design of axially loaded tension members - Common sections, Net area, Types of tension members, modes of failures, shear lag effect, IS code provisions and design	**07 Hrs.**
Unit 3: Compression Members as Struts: Design of axially loaded compression members – section classifications - effective length - slenderness ratio – simple sections - built-up sections - design of lacings and battens - single angle and double angle strut.	**07 Hrs.**
Unit 4: Beams Flexural members –Types of sections, effective length, design of laterally restrained and unrestrained beams – rolled sections - built- up beams/compound beams - Design for strength and serviceability, web buckling, web crippling, curtailment of flange plates.	**06 Hrs.**
Unit 5: Columns and Column Bases **Columns:** Design of column subjected to axial and eccentric loading, built up column sections, design of lacing, battening system, column splices. **Column Bases:** Design of slab bases & gusseted base subjected to axial and eccentric load and design of concrete pedestal (dimensions only)	**06 Hrs.**

Unit 6: Gantry Girders	**06 Hrs.**
Forces acting on gantry girder, commonly used sections, design of gantry girder and connection.	

Recommended Textbooks:

1. Design of Steel Structures, by Dr. N. Subramanian, Oxford University Press, New Delhi.
2. Limit State Design of Steel Structures: V. L. Shah and Veena Gore, Structures Publication, Pune.
3. Limit State Design of Steel Structures: S.K. Duggal, Tata Mc-Graw Hill India Publishing House
4. Design of Steel Structures: K.S. Sairam, Pearson
5. Design of steel structure by Limit State Method as per IS: 800- 2007: Bhavikatti S. S., I K International Publishing House, New Delhi
6. Limit state design in structural steel: Dr. M. R. Shiyekar, PHI publications.

References Books:

1. IS: 800 – 2007, IS: 875 (part I, II and III), SP6 (1) & SP 6 (6), IS: 816, IS: 808.
2. LRFD Steel Design: William T. Segui, PWS Publishing
3. Design of Steel Structures: Edwin H. Gaylord, Charles N. Gaylord James, Stallmeyer, McGraw-Hill
4. Design of Steel Structures: Mac. Ginely T.
5. Design of Steel Structures: Dayaratnam, Wheeler Publications, New Delhi.
6. Design of Steel Structures: Punmia, A. K. Jain and Arun Kumar Jain, Laxmi Publication
7. Design of Steel Structures: Kazimi S. M. and Jindal R. S., Prentice Hall India.
8. Design of Steel Structures: Breslar, Lin Scalzi, John Willey, New York.
9. Steel Structure: Controlling Behaviour through Design, Englekirk, WILEY.

Unit wise Measurable students Learning Outcomes:

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

1. Explain theory of Limit State for design of steel structures and solve problems on bolted and welded connections.
2. Analyze and design of tension members
3. Analyze and design of compression members as strut.
4. Analyze and design of columns and built-up columns, column bases.
5. Analyze and design of beams.
6. Analyze and design of gantry girders.

Title of the Course:	**THEORY OF STRUCTURES**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0502**	**3**	**1**	**0**	**4**

Course Pre-Requisite:

Mechanics of Solids, Structural Analysis

Course Description:

Theory of Structures forms a core course which is especially taught to students of Civil Engineering disciplines of engineering. The study of this course is aimed at developing an application thinking of the basic material behavior towards behavior of complex structures. It aims at developing an approach to solve structural engineering problems.

Course Learning Objectives:

1. Make aware the concept of determinacy and indeterminacy.
2. Impart different solution techniques to a problem.
3. Analyze indeterminate structures by using different methods.
4. Compare suitability of different methods
5. Make aware of the limitations of the methods of solution and their outcomes

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Solve statically indeterminate structures by using appropriate force methods.	3	Analyzing
CO2	Solve kinematically indeterminate structures by using appropriate displacement methods.	3	Applying
CO3	Apply matrix concepts for structural analysis of indeterminate structures.	3	Applying
CO4	Recommend symmetry concepts in the analysis by force or displacement methods, wherever applicable.	5	Evaluating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	3	2	2	--	2	1	2
CO2	3	3	3	2	2	3	2	2	--	2	1	2
CO3	3	3	3	2	2	3	2	2	--	2	1	2
C04	3	--	3	2	2	3	3	2	--	2	1	2

CO	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	3	2	2
CO3	3	2	2
CO4	3	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 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) Concept of determinacy and indeterminacy:** Types of Indeterminacies, Degree of redundancy (D.O.R), Degrees of freedom (D.O.F), Effect of Support Yielding, Concept of elastic supports, Effect of symmetry and anti-symmetry, Methods of analysis. Comparison between the force methods and displacement methods. (No numerical). **b) Method of Consistent deformation:** Propped cantilever with uniform section, fixed beam with basic released structure as cantilever or simply supported beam.	**08 Hrs.**
Unit 2: Clapeyron's theorem of three moment: Continuous beams with single or double redundancy, sinking of supports , beam with different M.I	**04 Hrs.**
Unit 3: Slope deflection method: General and modified slope deflection equations, application to beams and portal frames without sway and requiring only two equilibrium equations.	**07 Hrs.**
Unit 4: Moment Distribution Method: Applications to beams and portal frames without sway. Sinking of supports may be applicable.	**07 Hrs.**
Unit 5: Kani's method: Applications to beams and portal frames without sway. Sinking of supports may be applicable.	**07 Hrs.**
Unit 6: Matrix Methods: a) Stiffness coefficients, development of stiffness matrix upto 4 x4. b) Analysis of beams and portals by stiffness matrix method, Degree of S.I. < 2. c) Introduction to flexibility matrix, Flexibility coefficients, development of flexibility matrix upto 4 x4. (No numerical on Flexibility matrix.)	**07 Hrs.**

Recommended Textbooks:

1. Basic Structural Analysis: C.S. Reddy, Tata McGraw Hill Publishing House, New Delhi.
2. Mechanics of Structures (Vol-I and II): S. B. Junnarkar H.J. Shah, Charotar Publishers.
3. Structural Analysis: L.S. Negi and R.S. Jangid, Tata McGraw Hills Publishing House, New Delhi
4. Analysis of Structures: Vol. I II, Vazirani and Ratwani, Khanna Publishers
5. Structural Analysis: S.S.Bhavikatti, Vikas Publishing House Pvt, ltd.
6. Structural Analysis: Devdas Menon, Narosa Publishing House.
7. Structural Analysis- Matrix approach by Pandit & Gupta.

References Books:

1. Matrix analysis of structures by Gere & Weaver.
2. Indeterminate structural analysis by C.K. Wang.

Unit wise Measurable students Learning Outcomes:

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

1. Infer the indeterminacy of structures and apply method of consistent deformations for structures having static indeterminacy upto two.
2. Analyze multi-span beams using the Clapeyron's theorem of three moments.
3. Analyze multi-span beams & portal frames using the Slope Deflection method.
4. Analyze multi-span beams & portal frames using the Moment Distribution method.
5. Analyze multi-span beams & portal frames using the Kani's method.3
6. Formulate stiffness & flexibility matrices for structures & adopt them for its analysis.

Title of the Course:	**GEOTECHNICAL ENGINEERING-I**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0503**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Elements of Civil Engineering & Mechanics; Strength of Materials, Engineering Hydraulics.

Course Description:

It introduces one of the basic branches in civil engineering – geotechnical engineering. By definition geotechnical engineering is concerned with the behavior of earth materials. Stability of building foundations is a key area of application of this area of civil engineering. This branch has a lot of potential for research and one can aspire for jobs as a geotechnical consultant. At the same time, this course is very relevant to all the other branches like structural, hydraulics and transportation engineering. The design of a structure in any of these fields is influenced by the underlying soil.
This course is a pre-requisite for the next course Geotechnical Engineering II. And further study leads to department electives like Foundation engineering, Geotechnical earthquake engineering, Physical modeling in geotechnics, and Advanced geotechnical analysis among others.

Course Learning Objectives:

1. To provide students necessary knowledge and skill required for Characterization of soil and shear strength determination.
2. To introduce students the process of soil compaction and consolidation with field control and application.
3. To inform student about estimation of stress in soil and earth pressure on retaining structures for different soil states.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Explain soil compaction and its field applications	2	Understating
CO2	Analyze the soil for different types of loading and for different civil engineering structures.	3	analyzing
CO3	Asses the characteristics of soil as per IS standard.	5	Evaluating
CO4	Estimate the flow through soils, consolidation characteristics and shear strength.	5	Evaluating

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	--	--	1
CO2	--	--	1
CO3	--	--	1
CO4	--	--	1

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 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: Soil, its properties and basic relationships Introduction, Soil formation, Importance of soil engineering, Major soil deposits of India. Basic Definitions and Relationships- Soil & soil structure, soil phase system, weight volume relationships. Index properties of soil - unit weight, water content, specific gravity, void ratio, porosity, air content, degree of saturation and their relationships, particle size analysis (introduction to mechanical analysis and wet mechanical analysis), Soil classification systems- I.S. classification, Casagrande's Plasticity chart, soil consistency and indices.	**07 Hrs.**
Unit 2: Permeability and Seepage: Darcy's law, Factors affecting permeability, introduction to Determination of coefficient of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I) - pumping in test and pumping out test. Permeability of layered soils. Concept of effective stress & total stress in soil mass, quick sand condition. Seepage forces, Laplace equation, Flow net construction and applications for determination of seepage.	**07 Hrs.**
Unit 3: Compaction and Consolidation (7 Hrs) Phenomenon. Factors affecting compaction, Standard Proctor test and Modified Proctor test as per IS – 2720- Dry density and moisture content relationship, Zero air voids line, Effect of compaction on soil structure, Field compaction equipment and methods and control. Spring analogy, Terzaghi's theory of one dimensional consolidation, Lab consolidation test- Lab consolidation test; cc cv, mv and av Determination of coefficient of consolidation-square root of time fitting method and logarithm of time fitting method. Rate of settlement, normally consolidated and over consolidated soils, Determination of pre consolidation pressure	**07 Hrs.**
Unit 4: Stress Distribution in Soil (7 Hrs) Boussinesq theory- point load, strip load, pressure distribution diagram on a horizontal, pressure bulb, introduction to Newmark chart, Westergaard's theory- uniformly loaded rectangular area, contact pressure, approximate stress distribution method- equivalent point load method and 2:1 method. Soil- Structure Interaction- Concept	**05 Hrs.**

Unit 5: Shear Strength (7 Hrs) Concept of shear stress and shear strength, Coulomb's theory and failure envelope, Total stress approach and effective stress approach, representation of stresses on Mohr's circle, Mohr-Coulomb's envelope for different types of soil such as c soil, phi soil and c-phi soil, Determination of Shear Strength: type of test - box shear test (UU, CU, CD), triaxial compression test (UU, CU, CD), unconfined compression test, vane shear test. Concept of critical state soil mechanics.	**07 Hrs.**
Unit 6: Earth Pressure (7 Hrs) Concept, Area of application, earth pressure at rest, active and passive condition. Rankines theory of earth pressure - dry/moist, submerged (partially and full), horizontal backfill with surcharge, backfill with inclined surcharge and Coulomb's theory of earth pressure. Advance methods of construction of retaining structure- Graviloft technology, diaphragm wall.	**07 Hrs.**

Recommended Textbooks:

1. Soil Mechanics and Foundation Engg. by V.N.S.Murthy
2. Soil Mechanics and Foundation Engg. By K.R.Arora
3. Soil Mechanics and Foundation Engg. by B.C. Punmia

References Books:

1. Soil Behaviour and Critical States Soil Mechanics: Wood, D. M. 1990 Cambridge University Press, Cambridge
2. Soil Mechanics. Concepts and Applications: Powrie, W. 1997 E & FN SPOON, London
3. Geotechnical Engineering – Prentice Hall, Delhi by Iqbal H Khan

Unit wise Measurable students Learning Outcomes:

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

4. Classify and explain all index properties of soil.
5. Estimate the flow through soils and explain application of floe net.
6. Explain the process of compaction and consolidation in soil.
7. Estimate the Stress Distribution in soil
8. Determination of shear strength of soil.
9. Determine the earth pressure on retaining structures.

Title of the Course:	**GEOTECHNICAL ENGINEERING- I LAB**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0504**	**0**	**0**	**2**	**1**

Course Pre-Requisite:

Knowledge of Basic Mathematics, Mechanics, Engineering Hydraulics, Structural Analysis

Course Description:

The course explores the principles Geotechnical Engineering through the laboratory experiments and determination of the various soil properties.

Course Learning Objectives:

1. Determination of index and engineering properties of soil.
2. Classification of soil on the basis of different classification systems.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Demonstrate the experiments for characterization of different soils.	3	Applying
CO2	Analyze the soil behavior based upon the experimental test results	4	Analyzing

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	1	--	1
CO2	--	--	1

Assessments :

Teacher Assessment:

Assessment	Marks
ISE	25
ESE POE	25

- ISE is based on practical performance and LAB experiment write up submission.
- ESE: Assessment is based on 100% skills and performance on the basis of practical and oral examination.

Course Contents:

Experiments

- **Experiment 1:** Determination of the water content of the given sample by oven drying method.
- **Experiment 2:** Determination of the specific gravity of the given soil sample by pycnometer/ density bottle method.
- **Experiment 3:** Grain size distribution analysis of soil by mechanical sieve analysis.
- **Experiment 4:** Determination of the Atterberg's Limits of the Soil Sample: liquid limit, plastic limits and shrinkage limit (at least two) of the given soil sample to classify the soil on the basis of plasticity chart.
- **Experiment 5:** Determination of the field density by Core Cutter / Sand Replacement Method
- **Experiment 6:** Determination of Coefficient of Permeability of the Given Soil Sample by falling head Permeability Test.
- **Experiment 7:** Determination of the maximum density and optimum moisture content of given soil sample by Proctor Test.
- **Experiment 8:** Determination of the shear strength of the given soil sample by Direct Shear Test.

Demonstration (Any TWO)

- Particle size distribution-Sedimentation analysis (hydrometer)
- Determination of co-efficient of permeability by constant head
- Unconfined Compression Test
- Triaxial shear test.

• Vane shear test • One dimensional consolidation test.	

Recommended Textbooks:

1. "Soil Mechanics and Foundation Engineering" by K. R. Arora, (Standard Publication)
2. "Text book of soil mechanics in theory and practice" by Dr. Alam Singh(Asian Publishing House, Bombay)

References Books:

1. "Soil mechanics and Foundation engineering" by V. N. S. Murthy. (U. B. S. Publishers and distributors New Delhi)
2. "Soil mechanics and Foundation engineering" by B. C. Punmia.(A Saurabh and Company Pvt. Ltd. Madras)
3. "Geotechnical Engineering" by P. Purushottam Raj. (Tata Mcgraw Hill Company Ltd. New Delhi)
4. "Soil mechanics" by Terzaghi and Peak.(John Willey and Sons, New-York)
5. "Soil Testing" by T.W. Lambe.(Willey Eastern Ltd., New Delhi)
6. Geotechnical Engineering" by B. J. Kasamalkar.(Pune Vidyarthi Griha)

Unit wise Measurable students Learning Outcomes:

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

1. Determination of water content of the sample
2. Determination the specific gravity of the soil sample
3. Determination of soil gradation by mechanical sieve analysis
4. Determination of Atterberg limits of the given soil sample
5. Computation of field density of the soil sample by core cutter and sand replacement method
6. Computation of coefficient of permeability of the soil sample
7. Calculation of the Optimum Moisture Content of the Soil sample
8. Computation of shear strength of the soil sample

Title of the Course:	**COMPUTER AIDED DRAWING, DRAFTING LAB**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0505**	**0**	**0**	**4**	**2**

Course Pre-Requisite:

CAD, Building Construction and Services, Building Planning and Design

Course Description:

Students will be developing drawings based on planning principles of all types of buildings on CAD platform. Submission and working drawings are to be developed for a project.

Course Learning Objectives:

1. To develop practice plans of public building
2. To develop project plans of public buildings
3. To develop Submission drawing and working drawings for a group Project
4. To efficiently use CAD platform for developing all types of drawing.
5. To efficiently use the concept of aesthetics in Elevation treatment for building drawing on CAD

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	To Utilize CAD platform to develop floor plans of non-residential building	3	Applying
CO2	To develop municipal submission layout drawings for public buildings	3	Applying
CO3	To develop working drawings for public building project	3	Applying

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	2	--	--
CO2	2	--	3
CO3	2	--	3

Assessments :

Teacher Assessment:

Assessment	Marks
ISE	50
ESE POE	25

- ISE will be based on plan of buildings prepared on CAD platform throughout semester as per timeline issued.
- ESE: Assessment is based on 80% Project work and 20% Weightage for Project report content
- POE will be based on drafting task issued for 1 hr. in presence of external examiner

Course Contents:

Drawing on CAD

1. Draw floor plans with annotations, dimensions and door-windows schedule for minimum 5 types of Non-residential buildings (Individual students' task)
2. Complete a project on any of the public building containing a layout drawing, submission drawing, center line foundation plan, furniture layout, plumbing drawing, electrification drawing (Students group task)

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 to Z of Practical Building Construction and Its Management- Sandeep Mantri
6. (Satya Prakashan, New Delhi)
7. A Course in Civil Engineering Drawing – V.B. Sikka (S.K.Kataria and Sons)
8. Engineering Materials – R.K. Rajput (S. Chand)

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. Design and draft 8 types of building plan based on functional use with its elevation, section passing through staircase, site plan and block plan on CAD platform.
2. Design and draft single submission drawing and 5 working drawings on CAD platform.

Title of the Course:	**PROFESSIONAL PRACTICES-II**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0506**	**0**	**0**	**2**	**1**

Course Pre-Requisite:

Environmental Engineering, Building Services

Course Description:

This course aims to make students perform practices followed in civil engineering profession in areas of Environmental Engineering, Project Planning and Management.

Course Learning Objectives:

1. To aware students about practices employed by Professionals for Construction projects.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Illustrate the safety and firefighting provisions applied on construction sites.	3	Apply
CO2	Interpret environmental & detailed project reports for construction projects.	3	Apply
CO3	Build awareness about professional ethics and responsibility towards society.	3	Apply

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	1	1	2
CO2	1	1	2
CO3	--	--	2

Assessments :

Teacher Assessment:

- One component of In Semester Evaluation (ISE)

Assessment	Marks
ISE	50

- ISE is based activities assigned in contents.

Course Contents:

Activity 1: Collect & study Environmental Impact Assessment (EIA) report for any proposed/in-progress construction project and present the same with justification/appropriate references. OR Contact the MPCB office and / or Officer. Collect environment related data of any relative project concerned for sanctioning and study, analyze & prepare adherence reports according to the norms.	**08 Hrs**
Activity 2: Collect construction safety plan for any construction site & present the execution details (eg. mock drills, signage, and use of safety equipment with geotagged site photos).	**08 Hrs**
Activity 3: Prepare a report on fire-fighting provisions provided for any special building (ex public buildings, hazardous industrial buildings, hospital buildings, residential / commercial buildings with height more than 15 m, etc) and present it.	**08 Hrs**
Activity 4: Collect & study Detailed Project Report (DPR) for any infrastructure project (eg – road, railways, bridge, irrigation, dam, etc) and present the same with justification/appropriate references.	**08 Hrs**

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE-I

Sr. No.	Curriculum Component	Course Code	Course Names
1	PE	UCVE0501	Municipal Wastewater Analysis and Treatment
2	PE	UCVE0502	Industrial Wastewater Treatment
3	PE	UCVE0503	Solid and Hazardous Waste Management

Title of the Course:	**MUNICIPAL WASTEWATER ANALYSIS AND TREATMENT (PE-I)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVE0501**	**3**	**0**	**0**	**3**

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 and air pollution and wastewater, solid waste disposal problems.

Course Description:

This course will help the students to understand the importance and seriousness about pollution of Water and designs of Waste water treatment facilities from Civil Engineering aspects.

Course Learning Objectives:

1. Understand the wastewater quality and the quantity for disposal as per CPCB and MPCB standards.
2. Develop sewerage system for area under consideration.
3. Explain and write low cost wastewater treatment processes.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Assess the quantity for disposal of wastewater as per CPCB and MPCB standards and develop sewerage system for area under consideration.	2	Applying
CO2	Sequence and design wastewater treatment units for various qualities of wastewater as per mentioned design parameters and make use of disposal standards and calculate the strength of wastewater as per mentioned parameters.	4	Analyzing
CO3	Calculate and / or Design various wastewater characteristics with the help of Streeter Phelp's Equation.	6	Design
CO4	Design low cost wastewater treatment operations.	4	Applying

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	3	1	--
CO2	2	1	2
CO3	2	3	1
CO4	1	1	1

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 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: **Wastewater:** Components of wastewater flows, wastewater sources and flow rate, Variations in flow rates and strength, wastewater constituents, Characteristic of Municipal waste water, Problems on B.O.D. calculations, Quantity of storm water, Ground water infiltration.	**07 Hrs.**
Unit 2: **Primary Treatment:** Screening, comminuting, Grit removal, Oil and Grease trap Primary settling tank. **Secondary Treatment:** Activated sludge process, Process design and operating parameters, modification of ASP, Operational problems, Concept and design of trickling filter and Secondary Settling Tank Design of activated sludge system for treatment of a ten storey apartment wastewater.	**10 Hrs.**
Unit 3: **Sludge:** Characteristics, Treatment and disposal, Concept of anaerobic digestion, types of reactors.	**04 Hrs.**
Unit 4: **Low cost wastewater treatment methods**: Principles of waste stabilization pond. Design and operation of oxidation pond, aerobic & anaerobic Lagoons, Aerated Lagoon, Oxidation ditch.	**06 Hrs.**
Unit 5: **Stream pollution:** Classification, Concept of Self Purification and DO sag curve. Streeter Phelp's Equation. **Disposal of wastewater:** methods, effluents standards for stream and land disposal as per MPCB and CPCB standards and legislation.	**07 Hrs.**
Unit 6:--- **Sewerage system:** Types, Layout, Types of sewers, Collection system, Appurtenances, Design of sanitary and storm water sewers, Maintenance of sewerage systems Sewage and	**06 Hrs.**

Sludge pumping, Location, Capacity, Types of pumps, Pumping station design	

Recommended Textbooks:

1. Waste water Engineering, P. N. Modi.
2. Waste Water Engineering By S K Garg
3. Water supply, Waste Disposal and Environmental Engineering, A.K.Chatterjee, Khanna Publishers

References Books:

1. Manual on sewerage and sewage Treatment-Government of India Publication.
2. Masters. G. M. Introduction to Environmental Engineering and Science.
3. Rao. M. N. and Rao H.V. Air pollution, Tata McGraw Hill, 1990.
4. Canter, Environmental Impact Assessment, TMH Publication.
5. Peavey, H. S. Rowe, D.R., Environmental Engineering, McGraw-Hill Book Company.
6. Viessman W. and Hammer M.J. Water supply and pollution Control, Harper Collins College publishers.
7. Hammer M.J. Water and Waste water Technology, Prentice-Hall of India Private Limited.
8. Manual on Municipal Solid Waste Management, Ministry of Urban Development Govt. of India.

Unit wise Measurable students Learning Outcomes:

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

1. Able to understand the wastewater characteristics and disposal limits.
2. Design the waste water treatment units.
3. Understand the importance of sludge and low cost wastewater options.
4. Able to predict the wastewater pollution by mathematical modeling and understand the wastewater disposal standards.
5. Understand the importance of Solid waste management and its application from Civil Engineering aspect and able to identify the air pollution aspects and suggest its treatments.
6. Able to prepare the environmental impact assessment report for various civil structures.

Title of the Course:	**INDUSTRIAL WASTE TREATMENT (PE-I)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVE0502**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Students must aware about present water and wastewater pollution problems and its related environmental problems. Importance of industrial waste treatment and the standards should be well known to students.

Course Description:

Students will understand industrial waste treatment such as Water pollution control act, Manufacturing processes in major industries, Different types of waste treatment, Water Quality monitoring ,Waste volume and strength reduction, Use of water in industry.

Course Learning Objectives:

1. Interpret knowledge and concepts of characterization and treatment for water and wastewater and sludge.
2. Predict the wastewater quality with the help of mathematical model.
3. Understand the codal provision for various industrial treatment processes and pollution control acts.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Know the quality of Industrial wastewater and qualitative and quantitative treatment process.	2	Understand
CO2	Calculate the wastewater quality with the help of Streeter-Phelps Equation for prediction.	4	Design
CO3	Illustrate and compare the codal provision for various industrial treatment processes and pollution control acts.	4	Identify

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	2	2	1
CO2	2	2	--
CO3	3	3	1

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 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: Use of water in industry, sources of wastewater, quality and quantity variations in waste discharge, water budgeting, characterization and monitoring of wastewater flow, stream	**08 Hrs.**

standards and effluent standards. Miscellaneous methods of dissolved solids removal, sludge disposal methods	
Unit 2: Waste volume and strength reduction, in-plant measure, good housekeeping, process change, leakage prevention, segregation and recycling Neutralization, equalization and proportioning of waste	**07 Hrs.**
Unit 3: Water Quality monitoring of Streams, Self purification of streams, B.O.D. reaction rate, D.O. sag curve and D.O. deficit calculations	**04 Hrs.**
Unit 4: Different types of waste treatment & their selections, Development of treatment flow diagram based on characteristics of waste Acclimatization of bacteria to toxic wastes, process sensitivity operation and maintenance requirements	**06 Hrs.**
Unit 5: Manufacturing processes in major industries, water requirements, wastewater sources, composition of wastes, Viz. sugar, distillery, dairy, pulps, paper mill, fertilizer, tannery, chemical, steel industry, power plants, textile Treatment flow sheets, alternative methods of treatment, factors affecting efficiency of treatment plant	**09 Hrs.**
Unit 6:--- Water pollution control act, organizational set up of central and state boards for water pollution control, classification of river on water use, minimal national standards, socio-economic aspects of water pollution control	**06 Hrs.**

Recommended Textbooks:

1. Waste Water Engineering Metcalf Eddy McGraw Hill Publications.
2. Industrial Waste Treatment Nelson Meneroo
3. Industrial Waste Treatment Rao&Datta
4. Khan, I. H., & Ahsan, N. (2012). Textbook of solid waste management. New Delhi: Satish Kumar Jain for CBS Publisher and Distributors.

References Books:

1. Industrial Wastewater manual

Unit wise Measurable students Learning Outcomes:

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

1. Understand and apply the knowledge of water utilization in industry.
2. Study & implement various waste reduction methods.
3. Study & understand the pollution effect of streams.
4. Apply the treatment options for various types of wastes.
5. Understand the processes of various industries.
6. Understand and apply various water pollution act and socioeconomic aspects.

Title of the Course:	**SOLID AND HAZARDOUS WASTE MANAGEMENT (PE-I)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVE0503**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Environmental Chemistry

Course Description:

Problems associated with solid waste management (SWM) in today's society are very complicate because of the quantity and varied nature of wastes. As a result, if SWM is to achieve a skillful approach, the fundamentals aspects need to be identified. Thus, there is need to study the activities from the generation to the disposal point. The six functional elements (generation, handing and separations, storage and processing at source, collection, the transformation of wastes, transfer and transport, and final disposal) for the engineering comparison and treatment need to be understood in detail. The understanding of the functional element is important because it helps in evaluating the impacts of projected changes and technological developments. Solid waste management is an essential part of every society, but it is also one of the most neglected one. Detailed understanding of the subject is required to tackle the current solid waste management problems effectively. This course attempts to teach various steps involved in solid waste management.

Course Learning Objectives:

1. To explain functional elements of SWM, generation rate and characteristics of solid waste.
2. To elaborate appropriate treatment and disposal option for solid waste.
3. To explain sources, characteristics, treatment and disposal options of hazardous waste.
4. To know the environmental legislations for SWM, Hazardous waste management etc.

Course Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive Level	Bloom's Cognitive Descriptor
CO1	Understand the solid waste and its types, generation, factors influencing.	2	Understanding
CO2	Analyzing sources, characteristics, separation and handling of solid waste.	4	Analyzing
CO3	Understanding the disposal of solid waste in various ways.	2	Understanding
CO4	Explanation of legislative details regarding solid waste disposal.	4	Analyzing

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	2	--	--
CO2	--	2	--
CO3	2	--	--
CO4	--	2	--

Assessments :

Teacher Assessment:

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

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

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

Course Contents:

Unit 1: **Evolution of Solid Waste Management:** Types and classification of wastes, Industrial waste, Municipal solid waste, Waste sources and generation rates, Traditional methods of waste collection and disposal, factors influencing waste generation and health hazards.	**06 Hrs.**
Unit 2: Sources/Types and Characteristics of Solid Waste: Waste composition, Waste collection, Characterization of wastes, Waste processing: Size and volume reduction, Waste minimization, waste hierarchy and waste audit.	**06 Hrs.**
Unit 3: Waste Handling, Separation, storage, and Processing: Handling, separation and storage at source, processing at source, primary collection, types of collection system, need and types of transfer station, transport means and methods, material recovery facilities (MRF), recycling and recovery of	**08 Hrs.**

plastic.	
Unit 4: **Disposal of solid waste:** a) **Biological Treatment:** Composting, Vermicomposting, Biogas production from solid waste. b) **Thermal Treatment:** Incineration/ Combustion Flue gas characteristics and treatment, Solid residue generation, characterization and treatment. c) **Sanitary Land filling:** Site selection and types of landfill, leachate collection and treatment, landfill gas collection and treatment,	**06 Hrs.**
Unit 5: **Hazardous waste:** Definition, sources, classification, collection and segregation. Hazardous waste characterization, treatment and disposal. Management of Radioactive waste, Bio-medical waste, and E-waste.	**08 Hrs.**
Unit 6: **ISWM and legislation:** Integrated solid waste management (ISWM), Introduction to Circular Economy, Solid waste management rules 2016, Hazardous and other waste (management and transboundary movement) rules 2016, E-waste management rules 2016, Plastic waste management rules 2016, Bio-Medical Waste (Management and Handling) Rules,2016.	**06 Hrs.**

Recommended Textbooks:

1. Solid Waste Management – Dr. A. D. Bhide
2. Hazardous Waste Management - Charles Wentz

References Books:

1. Integrated solid waste management - Tchobanoglous
2. Handbook and Solid Waste Disposal – George Tchobanoglous and Frank Kreith
3. Solid and Hazardous waste management- M. N. Rao
4. Solid and Hazardous waste management- S. Bhatia
5. CPHEEO Manual on Solid Waste Vol. I,II

Unit wise Measurable students Learning Outcomes:

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

1. To understand the composition of solid waste.
2. To calculate density of solid waste.
3. To analyze the moisture content of solid waste.
4. To examine the particle size distribution
5. To estimate energy content of solid waste
6. To identify moisture loss, volatile matter, ash and fixed carbon in solid waste.
7. To identify Carbon, Hydrogen, Oxygen, Nitrogen and Sulphur in solid waste.

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE-I LAB

Sr. No.	Curriculum Component	Course Code	Course Names
1	PE	UCVE0506	Municipal Wastewater Analysis and Treatment Lab
2	PE	UCVE0507	Industrial Wastewater Treatment Lab
3	PE	UCVE0508	Solid and Hazardous Waste Management Lab

Title of the Course:	**MUNICIPAL WASTEWATER ANALYSIS AND TREATMENT LAB (PE-I LAB)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVE0506**	**0**	**0**	**2**	**1**

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 and air pollution and wastewater, solid waste disposal problems.

Course Description:

This course will help the students to understand the importance and seriousness about pollution of Water and designs of Waste water treatment facilities from Civil Engineering aspects.

Course Learning Objectives:

1. Understand the wastewater quality and the quantity for disposal as per CPCB and MPCB standards.
2. Develop sewerage system for area under consideration.
3. Understand secondary treatment with design.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Explain the wastewater quality and assess the quantity for disposal as per CPCB and MPCB standards.	2	Discuss
CO2	Design sewerage system for area under consideration.	4	Design
CO3	Design secondary treatment i.e. activated sludge system in detail.	6	Applying

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	2	2	1
CO3	--	1	1

Assessments :

Teacher Assessment:

Assessment	Marks
ISE	25
ESE POE	25

- The component In Semester Evaluation (ISE) would consist of continuous evaluation of all experiments performed (40%), Design of activated sludge process residential apartment wastewater (10%), Design of sewerage system and treatment system for a small urban area (30%), and Site visit report (20%).

Course Contents:

A. Characterization of Municipal Waste water

(Any 5 of the following):

1. pH
2. Alkalinity
3. Solids
4. Chlorides
5. DO
6. BOD
7. COD
8. Sulphates
9. Oil & grease
10. Volatile acids

B. Design of activated sludge process residential apartment wastewater.

C. Design of sewerage system and treatment system for a small urban area

Visit to sewage treatment plant.

Recommended Textbooks:

1. Waste water Engineering, P. N. Modi.
2. Waste Water Engineering By S K Garg
3. Water supply, Waste Disposal and Environmental Engineering, A.K.Chatterjee, Khanna Publishers

References Books:

1. Manual on sewerage and sewage Treatment-Government of India Publication.
2. Masters. G. M. Introduction to Environmental Engineering and Science.
3. Rao. M. N. and Rao H.V. Air pollution, Tata McGraw Hill, 1990.
4. Canter, Environmental Impact Assessment, TMH Publication.
5. Peavey, H. S. Rowe, D.R., Environmental Engineering, McGraw-Hill Book Company.
6. Viessman W. and Hammer M.J. Water supply and pollution Control, Harper Collins College publishers.
7. Hammer M.J. Water and Waste water Technology, Prentice-Hall of India Private Limited.
8. Manual on Municipal Solid Waste Management, Ministry of Urban Development Govt. of India.

Unit wise Measurable students Learning Outcomes:

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

1. Able to understand the wastewater characteristics and disposal limits.
2. Design the waste water treatment units.
3. Understand the importance of sludge and low cost wastewater options.
4. Able to predict the wastewater pollution by mathematical modeling and understand the wastewater disposal standards.
5. Understand the importance of Solid waste management and its application from Civil Engineering aspect and able to identify the air pollution aspects and suggest its treatments.
6. Able to prepare the environmental impact assessment report for various civil structures.

Title of the Course:	**INDUSTRIAL WATSE TREATMENT LAB (PE-I LAB)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVE0507**	**0**	**0**	**2**	**1**

Course Pre-Requisite:

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

Course Description:

This course will help the students to understand the importance and seriousness about pollution of Water, due to industries from Civil Engineering aspects.

Course Learning Objectives:

1. Explain the wastewater quality and assess the quantity for disposal as per CPCB and MPCB standards.
2. Design components for industrial STP
3. Understand the codal provision for various industrial treatment processes and pollution control acts.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Identify the wastewater quality for disposal as per CPCB and MPCB standards.	2	Understand
CO2	design components for various industrial STP	6	Design
CO3	Understand the various industrial treatment processes after visit.	4	Understand

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	2	2	1
CO3	--	1	1

Assessments :

Teacher Assessment:

Assessment	Marks
ISE	25
ESE POE	25

- The component In Semester Evaluation (ISE) would consist of continuous evaluation of all experiments performed (40%), Design of activated sludge process residential apartment wastewater (10%), Design of sewerage system and treatment system for a small urban area (30%), and Site visit report (20%).

Course Contents:

1. Characterization of Municipal Waste water

(Any 5 of the following):

1. pH
2. Alkalinity
3. Solids
4. DO
5. BOD
6. COD
7. Oil & grease
8. Volatile acids

2. Design of STP for a selected Industry.

3. Visit at Industry for STP.

Recommended Textbooks:

1. Waste water Engineering, P. N. Modi.
2. Waste Water Engineering By S K Garg
3. Water supply, Waste Disposal and Environmental Engineering, A.K.Chatterjee, Khanna Publishers

References Books:

1. Manual on sewerage and sewage Treatment-Government of India Publication.
2. Masters. G. M. Introduction to Environmental Engineering and Science.
3. Rao. M. N. and Rao H.V. Air pollution, Tata McGraw Hill, 1990.
4. Canter, Environmental Impact Assessment, TMH Publication.
5. Peavey, H. S. Rowe, D.R., Environmental Engineering, McGraw-Hill Book Company.
6. Viessman W. and Hammer M.J. Water supply and pollution Control, Harper Collins College publishers.
7. Hammer M.J. Water and Waste water Technology, Prentice-Hall of India Private Limited.
8. Manual on Municipal Solid Waste Management, Ministry of Urban Development Govt. of India.

Unit wise Measurable students Learning Outcomes:

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

1. Understand and apply the knowledge of water utilization in industry.
2. Study & implement various waste reduction methods.
3. Study & understand the pollution effect of streams.
4. Apply the treatment options for various types of wastes.
5. Understand the processes of various industries.
6. Understand and apply various water pollution act and socioeconomic aspects.

Title of the Course:	**SOLID AND HAZARDOUS WASTE MANAGEMENT LAB (PE-I LAB)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVE0508**	**0**	**0**	**2**	**1**

Course Pre-Requisite:

Environmental Chemistry and Microbiology

Course Description:

The course explores knowledge of solid waste composition, characterization and standard procedures available for evaluation of different components. The course imparts the experimental skills in identifying various important characteristics of solid waste.

Course Learning Objectives:

1. To carry out the composition and characterization study of solid waste.
2. To carry out the proximate analysis of solid waste.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Identify sources and types of municipal solid waste and hazardous waste.	1	Cognitive
CO2	Explain characteristics of municipal solid waste and hazardous waste.	2	Cognitive
CO3	Discuss various environmental legislations for safe disposal of solid and hazardous waste.	2	Cognitive
CO4	Choose proper waste handling, separation, storage, processing and disposal methods for municipal solid waste and hazardous waste.	3	Cognitive

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	-	2	-
CO3	2	-	-
CO4	-	2	-

Assessments :

Teacher Assessment:

Assessment	Marks
ISE	25
ESE POE	25

- The component In Semester Evaluation (ISE) would consist of continuous evaluation of all experiments performed (80%) and Site visit report (20%).

Course Contents:

Experiment No. 1: Study of Composition of solid waste by Coning and Quartering method	**02 Hrs**
Experiment No. 2: Study of bulk density of solid waste	**02 Hrs**
Experiment No. 3: Determination of moisture content.	**02 Hrs**
Experiment No. 4: Determination of particle size distribution.	**02 Hrs**
Experiment No. 5: Determination of calorific value.	**02 Hrs**
Experiment No. 6: Determination of proximate analysis	**02 Hrs**
Experiment No. 7: Determination of Ultimate analysis	**02 Hrs**

Recommended Textbooks:

1. Solid Waste Management – Dr. A. D.Bhide

References Books:

1. Integrated Solid Waste Management by Tchobanoglous/Theisen/Vigil; Publisher: McGraw Hill
2. CPHEEO Manual on solid Waste Management part I, II.

Unit wise Measurable students Learning Outcomes:

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

1. To understand the composition of solid waste.
2. To calculate density of solid waste.
3. To analyze the moisture content of solid waste.
4. To examine the particle size distribution
5. To estimate energy content of solid waste
6. To identify moisture loss, volatile matter, ash and fixed carbon in solid waste.
7. To identify Carbon, Hydrogen, Oxygen, Nitrogen and Sulphur in solid waste.

LIST OF OPEN ELECTIVES

Offered By
CIVIL ENGINEERING DEPARTMENT

OPEN ELECTIVE-1
(Third Year Semester – V)

Sr. No.	*Curriculum Component*	*Course Code*	*Course Names*
1	OE	UCVO0501	Remote Sensing and GIS, GPS
2	OE	UCVO0502	Watershed Management

Title of the Course:	**REMOTE SENSING GIS AND GPS**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVO0501**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

- Basic computer skills
- Knowledge of geography
- Higher level Science of Physics, chemistry and biology
- Applied mathematics and trigonometry

Course Description:

Remote Sensing GIS and GPS is the study of science and technology in resonance with the domain of Geography and ICT. It deals with technology that develops and uses remote sensing of Earth objects – water, soil and land masses and man-made features. GIS is an ICT based tool essentially to extract information from the data captured by remote sensing techniques. GPS is a ground-based technique of obtaining the ground coordinates of all the data to match it geographically.

Course Learning Objectives:

1. Knowledge of fundamentals of satellite technology for remote sensing of earth and man- made objects.
2. Learn the importance of aerial Surveying and satellite remote sensing.
3. Extract ground coordinates using GPS as a receiver tool for absolute positioning and mapping.
4. Apply the GIS tool as an ICT based system for maximum information and modelling of raw data for various themes.

Course Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive Level	Bloom's Cognitive Descriptor
CO1	Outline the history of aerial photography, Remote sensing GIS and GPS technology.	I	Remembering
CO2	Classify according to types aerial photography, Remote sensing platforms, satellites and their sensors, GIS data models	II	Understanding
CO3	Distinguish the techniques of Aerial Survey, remote sensing and GPS data with Advantages and disadvantages.	IV	Analyzing
CO4	Apply aerial photography, Remote sensing, GPS technology and GIS technology for application in various fields.	III	Apply

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	1	1	3
CO3	1	1	3
CO4	1	1	3

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 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: Aerial photography Aerial photographs: types, scale, & resolution; Types of aerial cameras; Geometry of aerial photographs; Flight planning; Impact of season, time, & topography on aerial photographs; Parallax, relief displacement, and orthophotos.	**07 Hrs.**
Unit 2: Remote Sensing: Definition and scope, History and development of remote sensing technology; Electromagnetic radiation (EMR) and electromagnetic spectrum; EMR interaction with atmosphere and earth surface; Atmospheric window. Case study of Remote sensing interaction.	**07 Hrs.**
Unit 3 : Global Positioning System : Introduction to GPS; Types of GPS; GPS satellite; Differential GPS; Principle of Working of DGPS , Sources of GP/DGPS errors; Application of GPS in surveying, mapping and navigation. Advantages and disadvantages of GPS and DGPS.	**06 Hrs.**

Unit 4: Remote sensing platforms, satellites and sensors ,: Platform Types and their characteristics; Types of Sensors; Orbital and sensor characteristics of major earth resource satellites. Indian remote sensing satellite programme. Applications of Remote sensing in various Engineering and Science domains.	**06 Hrs.**
Unit 5: GIS: Definition of GIS, History and development of GIS, Components of GIS, Hardware's and software's, future of GIS. Georeferencing of raster Images, Representation of Geographic features in Raster and Vector data model: Advantages and Disadvantages. Map generation with legends-its importance.	**06 Hrs.**
Unit 6: ISRO-IIRS outreach edusat programs with online lectures on Remote Sensing, aerial photography, GNSS and GIS	**08 Hrs.**

Recommended Textbooks:

1. Introduction to Remote Sensing, James B. Campbell & Randolph H. Wynne., The Guilford Press, 2011.
2. Remote Sensing of the Environment: An Earth Resource Perspective (2nd Ed.), Jensen, J.R. (2006): Prentice Hall, New Jersey
3. Remote Sensing and Image Interpretation (2015 Ed.). John Wiley and sons, New Jersey.
4. Textbook of Remote Sensing and Geographical Information System (3rd Ed.), Reddy, M.A. (2008): BS Publications, Hyderabad.
5. Introduction to Geographic Information Systems, Chang, K. T. (2008), Avenue of the Americas, McGraw-Hill, New York.

References Books:

1. Nair, N. B. (1996): Encyclopaedia of Surveying, Mapping and Remote Sensing. Rawat Publications., Jaipur and New Delhi.
2. Bernhardensen, Tor. 1999. Geographic Information Systems: An Introduction. Toronto: John Wiley & Sons, Inc
3. Demers, M. N. (2000): Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi 6.
4. Burrough, P. A. and McDonnell, R. A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York

Websites:

1. Indian institute of remote sensing,(IIRS),
2. National Remote Sensing Centre (NRSC), India: http://www.nrsc.gov.in
3. National Aeronautics and Space Administration (NASA), USA: http://www.nasa.gov
4. United States Geological Survey (USGS), USA: http://www.usgs.gov
5. International Society for Photogrammetry and Remote Sensing (ISPRS): http://www.isprs.org
6. Bhuvan: http://www.bhuvan.nrsc.gov.in
7. Wikimapia: http://www.wikimapia.org

Unit wise Measurable students Learning Outcomes:

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

1. Able to emphasize the importance of aerial Surveying and satellite remote sensing.
2. Compare different satellite systems of the world and their capabilities.
3. Trace history and present day GIS
4. Choose the appropriate tool for data modelling
5. Learn and use Visual Image Interpretation

Title of the Course:	**WATERSHED PLANNING AND MANAGEMENT**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVO0502**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Fluid Mechanics, Geo-tech Engineering 1, Hydrology, Irrigation

Course Description:

The course mainly deals with Watershed Management, their functioning, components, practical application and significance.

Course Learning Objectives:

1. To impart basic knowledge of fundamental concepts of Engineering Hydrology.
2. To impart fundamentals of Irrigation Engineering and watershed management and their relevance to sustainability

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Explain basic concepts of hydrologic cycle, aquifers, irrigation systems, watershed management.	2	Understand
CO2	Describe prevailing irrigation water management practices, types of minor irrigation, government laws and water policy.	4	Understand
CO3	Analyze precipitation data and solve problems related to hydrograph, aquifers, irrigation, water requirement and crop yield.	6	Apply
CO4	Design canal structures and rainwater harvesting system.	4	Create

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	--	2	--
CO2	2	2	--
CO3	2	2	2
CO4	--	2	--

Assessments :

Teacher Assessment:

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

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

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

Course Contents:

Unit 1: Watershed - introduction and characteristics. Watershed development-problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, Present land use practices and socio-economic factors	**07 Hrs.**
Unit 2: Watershed management - concept, objectives, factors affecting, Integrated watershed management - concept, components	**05 Hrs.**

Unit 3: Watershed planning based on land capability classes. Hydrologic data for watershed planning, Water budgeting in a watershed. Watershed codification, delineation and prioritization of watersheds – sediment yield index	**04 Hrs.**
Unit 4: Management measures - rainwater conservation technologies - in-situ and ex-situ storage, Water harvesting and recycling. Dry farming techniques - inter-terrace and inter-bund land management Arable lands - agriculture and horticulture, Non-arable lands - forestry, fishery and animal husbandry.	**08 Hrs.**
Unit 5: Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation. Participatory watershed management - role of watershed associations, user groups and self-help groups.	**08 Hrs.**
Unit 6: Planning and formulation of project proposal for watershed management programme including cost-benefit analysis	**08 Hrs.**

Recommended Textbooks:

1. Soil Conservation and Land Management. S. K. Datta, International Book Distributors, Dehradun, 1985
2. Soil and Water Conservation Engg. R. Suresh, Standard Publishers Distributors, Delhi-6, Reprint Edition 2006
3. Watershed Planning and Management. Rajvir Singh. Yash Publishing House, Bikaner. 2000
4. Field Manual on Watershed Management. 2013. B. Venkateswarlu, Mohammed Osman, M.V. Padmanabhan, K. Kareemulla, P.K. Mishra, G.R. Korwar& K.V. Rao, CRIDA, Hyderabad
5. Hydrology and Soil Conservation Engineering : Including Watershed Management. Ghanshyam Das, 2008. Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
6. Hydrology. H. N. Raghunath. New Age International Publishers, 2004 reprint.
7. Watershed Management. V.V. DhruvaNarayana G. Sastry& U.S. Patnaik. ICAR, New Delhi, 1997
8. Watershed Management: Guidelines for Indian Conditions.

Tideman, E.M., Omega Scientific Publishers, New Delhi. 1996

9. Watershed Management: Design and Practice. P. K. Singh, 2000. E-media Publications, Udaipur
10. S.K. Garg, "Water resources Engg. Vol. I, Hydrology & water resources Engg.", Khanna publisher, Delhi,15th edition (2010)
11. M.J. Deodhar, " Elementary Engineering Hydrology", Pearson Education, 1st Edition(2009)
12. S.K. Garg, "Water resources Engg. Vol. II, Irrigation Engineering & hydraulic Structures",Khanna publisher, Delhi,24th edition (2011)

References Books:

1. Katyal, J.C., R.P. Singh, Shriniwas Sharma, S.K. Das, M.V. Padmanabhan and P.K. Mishra. 1995. Field Manual on Watershed Management. CRIDA, Hyderabad.
2. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi.
3. Sharda, V.N., A.K. Sikka and G.P. Juyal. 2006. Participatory Integrated Watershed Management: A Field Manual. Central Soil and Water Conservation Research and Training Institute, Dehradun.
4. Singh, G.D. and T.C. Poonia. 2003. Fundamentals of Watershed Management Technology. Yash Publishing House, Bikaner

Unit wise Measurable students Learning Outcomes:

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

1. Know the basic principles of watershed management.
2. Know the river basin management practices
3. Understand better different approaches for conservation of water.
4. Identify sustainable watershed approach for resources management, prevention of soil erosion etc.
5. Different methods of rainwater harvesting management systems and role of GIS.

Title of the Course:	**BUILDING PLANNING AND DESIGN**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVA0501**	**2**	**0**	**0**	**-**

Course Pre-Requisite:

Building Construction and service, CAD.

Course Description:

Student will able to functionally plan residential and public buildings with all comfort, services and regulatory aspects

Course Learning Objectives:

1. To select suitable site as per requirements of occupants of public buildings with General bye law requirements for planning all types of buildings.
2. To acquire knowledge of procedure to sanction a building proposal from local town planning authority.
3. To apply knowledge of public building principles to develop a plan.
4. To develop elevation and aesthetics of proposed building based architectural concept.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Develop submission drawing with knowledge of Bye laws for all types of public buildings	3	Cognitive
CO2	Identify occupant's requirements to prepare plan of public buildings.	3	Cognitive
CO3	Design building service requirements based on use of buildings	6	Cognitive
CO4	Create building plans as per building service requirement to give user friendly structure for public use.	6	Cognitive

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	2	--	--
CO2	2	--	3
CO3	2	--	3
CO4	2	--	--

Course Outcomes:

Assessments :

Teacher Assessment:

Assessment	Marks
ESE	100

- ESE: Assessment is based on 100% course content

Course Contents:

Unit 1: Introduction to Building bye laws Types of zones of development in a town. Layout requirements for township and plots more than 1 acre. Building bye laws includes open spaces, building line, control line, floor area ratios, height of building, parking and tenements requirements as per local authority.	**04 Hrs.**
Unit 2: Building spatial Planning Anthropometrics, access Route, ramps, staircases, handrails, corridor, lobby and pathways, doors, toilets, bathrooms and shower compartments. signage, public information or reception counters, illumination, lifts, escalators, other building services. Car parking.	**04 Hrs.**
Unit 3: Building planning services Types of Residential buildings, Principles of Planning for Residence of Govt. Officials, Hostels. Air conditioning: Purpose, Classification, Principles, Systems	**04 Hrs.**

and various components. Noise control: general consideration.	
Unit 4: Educational and Institutional buildings Types of Educational and institutional buildings, Principles of planning for primary & secondary schools, Colleges (All category), educational campus with residential arrangement.	**06 Hrs.**
Unit 5: Health care center and Hotels Types of Health centre and its planning principles includes clinics, dispensaries, hospitals classified based on bed count and specialization, multispecialty hospitals, Hospitals with educational & residential facility. All types of hotels based on star rating and its planning principles.	**06 Hrs.**
Unit 6: Recreational Buildings and Administrative Offices Types of recreational facility and planning principles for drama theatre, cinema halls, multiplex, auditorium, exhibition hall. Planning of government offices including collector office, Court building, post offices, banks etc.	**06 Hrs.**

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. A Course in Civil Engineering Drawing – V.B.Sikka (S.K.Kataria and Sons)

References Books:

1. A to Z of Practical Building Construction and Its Management- Sandeep Mantri(Satya Prakashan, New Delhi)
2. SP 7- National Building Code Group 1 to 10- B.I.S. New Delhi
3. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings
4. Time Saver Standard. Neuferts Data

Unit wise Measurable students Learning Outcomes:

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

1. Student will able to study building bye laws
2. Student will able to develop submission drawings
3. Student will able to develop working drawings.
4. Student will able to study public building planning

T.Y.B.Tech

Semester VI

Academic Year 2023-2024

Teaching and Evaluation scheme for **Third Year Semester–VI**

Sr. No	Curriculum Component	Course Code	Course	Teaching Scheme				Evaluation Scheme		
				L	T	P	Credit	Component	Marks: Max	Marks: Min for Passing
1	PC	UCVC 0601	Design of Concrete Structure	3	1	0	4	ISE-I	10	20 / 40
								ISE-II	10	
								MSE	30	
								ESE	50	20
2	PC	UCVC 0602	Concrete Technology	3	0	0	3	ISE-I	10	20 / 40
								ISE-II	10	
								MSE	30	
								ESE	50	20
3	PC	UCVC 0603	Geotechnical Engineering -II	3	0	0	3	ISE-I	10	20 / 40
								ISE-II	10	
								MSE	30	
								ESE	50	20
4	PC	UCVC 0604	Steel Structure Design Lab	0	0	4	2	ISE	25	10
								ESE (OE)	25	10
5	PC	UCVC 0605	Concrete Technology Lab	0	0	2	1	ISE	50	20
								ESE (OE)	25	10
6	PC	UCVC 0606	Studio Lab	0	0	2	1	ISE	25	10
								ESE (OE)	25	10
7	PW	UCVC 0607	Professional Practices-III	0	0	2	1	ISE	50	20
8	PE	UCVE 0607	Geotechnical Engineering-II Lab	0	0	2	1	ISE	25	10
9	PE	UCVE 06**	Program Elective –II	3	0	0	3	ISE-I	10	20 / 40
								ISE-II	10	
								MSE	30	
								ESE	50	20
10	OE	UCVO 06**	Open Elective-II	3	0	0	3	ISE-I	10	20 / 40
								ISE-II	10	
								MSE	30	
								ESE	50	20
11		UCVA 0601	Industrial Management & Economics (Audit Course)	2	0	0	0	ESE	100	40
Total Contact hrs. : 30			**Total**	**17**	**1**	**12**	**22**	**500+250+Audit Course**		

Title of the Course:	**DESIGN OF CONCRETE STRUCTURES**	**L**	**T**	**P**	**Credit**

Course Code:	**UCVC0601**	**3**	**1**	**0**	**4**

Course Pre-Requisite:

Engineering Mechanics, Engineering Mathematics, Structural Mechanics

Course Description:

Compare the different design philosophies , Analysis and Design of Structural Elements

Course Learning Objectives:

1. To impart the basic design philosophies followed in Reinforced Concrete Design and the stress-strain curve of concrete and steel.
2. To impart the concepts of design and detailing of RCC components under flexure, shear and bond using LSM.
3. To apply the design and detailing of RCC components for serviceability using LSM.
4. To apply the design and detailing of RCC Columns (rectangular and Circular) and Footing (Isolated and Combined) using LSM.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Classify the different design philosophies as per the provisions made in IS-456-2000	2	Understanding
CO2	Appraise various reinforced concrete components for shear, bond, development length etc.	5	Evaluating
CO3	Analyze and design of various reinforced concrete components for flexure, shear, bond etc.	6	Creating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	3	2	2	0	2	1	3
CO2	3	3	3	2	2	3	2	2	0	2	1	3
CO3	3	3	3	2	2	3	2	2	0	2	1	3

CO	PSO1	PSO2	PSO3

CO1	3	2	2	
CO2	3	3	3	
CO3	3	3	3	

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

Course Contents:

Unit 1: Introduction: Stress-strain behavior of RCC, Permissible stresses in steel and concrete, Different design philosophies, various limits states, Characteristic strength and Characteristic load, Load factor, Partial safety factors.	**04 Hrs.**
Unit 2: Limit state of collapse (flexure): Analysis and Design of Singly and Doubly Reinforced rectangular sections, Introduction of singly reinforced T and L beams(No numerical)	**06 Hrs.**
Unit 3: Limit state of collapse (shear, bond and torsion): Shear failure, Types of Shear reinforcement, Design of Shear reinforcement, Concept of Bond-types, Factors affecting bond	**06 Hrs.**

Resistance, Concept of development length and torsion. Limit state of serviceability: Significance of deflection, IS recommendations.	
Unit 4: Design of Slabs and Staircase: Simply supported One way slab, One way Cantilever Slab, Two way slab with different support conditions as per IS:456-2000. Design of Simply Supported single flight dog-legged staircase. (Numerical on single flight dog legged staircase only).	**10 Hrs.**
Unit 5: Analysis and Design of Columns: Axially Square, Rectangular and Circular columns, concept of eccentrically (uni-axial) loaded and bi-axially loaded columns and Interaction diagram. Circular column with links and helical reinforcement.	**07 Hrs.**
Unit 6: Design of Footing: Isolated rectangular column footing with constant depth, stepped/trapezoidal section subjected to axial loads, Design of combined rectangular footing.	**07 Hrs.**

Recommended Textbooks:

1. Limit state theory and Design –Karve and Shah , Structures publications, Pune
2. Reinforced Concrete Design – Limit state - A.K. Jain New Chand brothers Roorkee
3. Fundamentals of Reinforced Concrete –Sinha and Roy, S. Chand and company Ltd. Ram Nagar, New Delhi
4. Limit State Design of reinforced concrete P.C.Varghese, Prentice Hall, New Delhi
5. Reinforced Concrete Design- B.C. Punmia Laxmi publications New Delhi
6. Reinforced Concrete Design-M. L. Gambhir-Mc millan India Ltd. New Delhi

References Books:

1. IS 456-2000 - Plain And Reinforced Concrete - Code Of Practice

Unit wise Measurable students Learning Outcomes:

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

1. Student will able to understand the behavior of stress-strain curve of steel and concrete.
2. Student will able to Analysis and Design of Singly and Doubly RC Section
3. Student will able to understand the procedure of Design of Shear reinforcement and Bond.
4. Student will able to Design the One Way, Two Way Slab and Stair Case reinforcement.
5. Student will able to design the axial, Uni-Axial columns
6. Student will able to design the footing.

Title of the Course:	**CONCRETE TECHNOLOGY**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0602**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Basic Civil Engineering

Course Description:

This course broadly encompasses the study of properties of ingredients of concrete, design of concrete mix, production of concrete and various concreting operations. Cementing material is the vital component of the concrete, hence study of process of manufacturing of cement, types of cement and their properties are covered in this course. Study of properties of aggregates and water also finds their due coverage in the course. Process of concrete production and concreting operations also forms an essential component of the course

Course Learning Objectives:

1. To explain the important engineering properties of Concrete materials.
2. To explain the behavior of Fresh and harden concrete.
3. To explain the behavior of special concrete
4. To explain the Concrete mix design

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Identify the functional role of ingredients of concrete and apply fundamental knowledge in the fresh and hardened properties of concrete.	3	Identify/ Apply
CO2	Evaluate the effect on concrete by its service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure	5	Evaluate
CO3	Develop an awareness of the utilization of different materials as novel innovative materials for use in special concrete	6	Develop
CO4	Design the concrete mix which fulfills the required properties for fresh and hardened concrete	6	Demonstrate

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	--	2	--	2	2	--	--	--	1	--	--	2
CO2	2	2	3	--	3	--	--	--	1	2	--	--
CO3	--	2	--	2	3	--	--	--	2	3	--	2
CO4	--	2	--	--	3	--	2	--	2	2	--	--

CO	PSO1	PSO2	PSO3
CO1	3	2	3
CO2	3	2	3
CO3	3	3	3
CO4	3	3	3

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: • **Concrete Materials** • **Cement -** Ordinary Portland, Portland Pozzolana, chemical composition, grade of cement, hydration, tests for cement, fineness, soundness, compressive strength, setting time • **Aggregates -** Classification, requirements, size, shape, texture, Tests for coarse aggregates: specific gravity, grading of aggregate, Flakiness index, Elongation Index, Impact value, abrasion value, crushing value, alkali aggregate reaction. • **Tests for fine aggregates -** specific gravity, sieve analysis, fineness modulus, bulking of sand, Manufactured sand • **Water -** General requirements, quality of water	**05 Hrs.**
Unit 2: • **Fresh Concrete:** Workability, factors affecting, measurement of workability, different tests for workability, segregation, bleeding, process of manufacture of concrete - batching, mixing, transportation, compaction, curing of concrete, curing methods, • **Admixtures in concrete** - Air entraining agents, plasticizer and super plasticizer, accelerators, retarders, workability agents. Mineral admixtures: fly ash, silica flumes, Ground Glass Blast Furnace Slag, Metakoline.	**08 Hrs.**
Unit 3: • **Hardened Concrete -** Strength of concrete, w/c ratio, gel/space ratio, gain of strength with age, maturity concept of concrete, effect of maximum size of aggregate on strength, relation between compressive and tensile strength, factors affecting modulus of elasticity, definition and factors affecting creep and shrinkage.	**06 Hrs.**

Unit 4: • **Durability of concrete –** Strength and durability relationship, effect of w/c on durability, different exposure condition as per IS 456 minimum and maximum cement content, effect of permeability, sulphate attack, methods of controlling sulphate attack. Durability of concrete in sea water, Test on hardened concrete - flexural strength, comparison of cube test and cylinder test, Schmidt's rebound hammer, Ultrasonic pulse velocity method.	**08 Hrs.**
Unit 5: • **Special Concrete –** Light weight concrete, no-fines concrete, high density concrete, fiber reinforced concrete, self-compacting concrete, high strength concrete, high performance concrete, manufacturing of ready mix concrete, cold weather concreting, hot weather concreting, pavement quality concrete, Green concrete, Testing of special concrete for various properties.	**05 Hrs.**
Unit 6: • **Concrete Mix Design -** Objectives of mix design, different methods of mix design, factors affecting mix proportions, quality control of concrete, statistical methods, acceptance criteria as per IS 456, Numerical on mix design by ACI 211.1-91, IS 10262-2009. Mix design of fly ash concrete by IS 10262 – 2009. Introduction of design mix for high performance concrete.	**08 Hrs.**

Recommended Textbooks:

1. Naville, A.M., Concrete Technology, Pearson Education.
2. Santakumar, A.R., Concrete Technology, Oxford University Press.
3. Shetty, M.S., Concrete Technology, S. Chand Publication.
4. Gambhir, M.L., Concrete Technology, Tata McGraw Hill.

IS codes:

1. IS: 10262-2009, Recommended guidelines for Concrete Mix Design
2. IS: 456-2000, Indian Standard Plain and Reinforced Concrete

References Books:

1. Properties of concrete by A. M. Neville, Longman Publishers.
2. Concrete Technology by R.S. Varshney, Oxford and IBH.
3. Concrete technology by A. M. Neville, J.J. Brooks, Pearson.
4. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.

Unit wise Measurable students Learning Outcomes:

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

1. Evaluate the properties of Concrete materials.
2. Evaluate the properties of Fresh concrete
3. Evaluate the properties of Harden concrete
4. Factors of durability of concrete
5. Aware of special concrete.
6. Calculate mix design of concrete

Title of the Course:	**GEOTECHNICAL ENGINEERING-II**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0603**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Elements of Civil Engineering & Mechanics; Engineering Hydraulics, Structural analysis, Geotechnical Engineering-I.

Course Description:

Geotechnical Engineering-II forms a core course and study of this course is aimed at developing an application thinking of the basic geotechnical engineering terminologies and design philosophies. It aims at developing an approach to solve week and compressible soil problems.

Course Learning Objectives:

1. To provide students necessary knowledge and skill required for interpretation of bearing capacity and settlement of foundations
2. To introduce students the process of soil compaction and consolidation with field control and application.
3. To provide students knowledge and skills required to design shallow and pile foundation.
4. To provide the basic information about modern foundation and ground improvement techniques for different soil types as per different classification systems.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Explain the suitability of different soil exploration methods and various types of foundations.	2	Understanding
CO2	Demonstrate the understanding of the basic information about modern foundation and ground improvement techniques	2	Understanding
CO3	Analyze types of foundation and stability of slopes.	4	Analyzing
CO4	Estimate the bearing capacity and settlement of foundation for different soils as per IS standard.	5	Evaluating.

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	-	1	1
CO2	1	-	1
CO3	-	1	1
CO4	-	-	1

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: Soil & Rock Exploration Necessity, Planning, No & depth of bore holes, Exploration Methods- auger boring (hand and continuous flight augers), wash boring, rotary drilling, core drilling. Soil sampling- disturbed and undisturbed. Causes of sample disturbance, Rock classification based on strength, Drilling and sampling of rocks Mechanical characteristics of rocks, uniaxial compression behaviour of rocks, tensile strength of rocks, Core barrels, Core boxes, core recovery, and RQD.	**07 Hrs.**
Unit 2: Definitions, Modes of failure, Terzaghi's bearing capacity theory, I.S. Code method of bearing capacity evaluation & computation (IS 6403), Effect of various factors on bearing capacity (Size & Shape, Depth, WT, Eccentricity), Bearing capacity evaluation from Plate load test, S.P.T. (By I.S. Code method), rock cores and pressure meter tests with detailed procedure. and pressure meter tests with detailed procedure.	**07 Hrs.**
Unit 3: Types and their selection, minimum depth of footing, Assumptions & limitations of rigid design analysis. Design of Isolated, combined, strap footing (Rigid analysis), Raft foundation (elastic analysis), floating foundations (R.C.C. Design is not expected), Concept of total settlement, differential settlement and angular distortion. Effects, Causes and remedial measures. Computations from I.S. 8009- 1976 (Part I),	**07 Hrs.**
Unit 4: Classification and their uses, single pile capacity evaluation by static and dynamic methods, pile load test. Negative skin friction, Group action of piles, Design of pile group, Group efficiency. Pile integrity test- equipments, output, Under reamed piles – equipment, construction and precautions.	**07 Hrs.**

Unit 5: Slope classification, slope failure, modes of failure. Infinite slope in cohesive and cohesion less soil, Taylor's stability number, Swedish slip method and concept of Friction circle method , control and mitigation of Landslides, Effect of Earthquake Force: Pseudo Static and Pseudo dynamic Analysis	**06 Hrs.**
Unit 6: Element of wells, types, methods of construction, tilt and shift, remedial measures. Pneumatic caissons: sinking method- Sand island method, Caisson disease. sheet piling, Common types of cofferdams, Ground Improvement: Stone columns, Vibroflotation, Preloading technique. Use of Geo-synthetics and geotextiles, Electro-kinetic treatment, Jet Grouting, Chemical grouting. Reinforced Earth structure, modern consolidation technique.	**06 Hrs.**

Recommended Textbooks:

1. Foundation Engineering by B.J. Kasamalkar
2. Soil Mechanics and Foundation Engg. by V.N.S.Murthy
3. Soil Mechanics and Foundation Engg. By K.R.Arora
4. Soil Mechanics and Foundation Engg. by B.C. Punmia
5. Foundation Engineering by S.P.Brahma
6. Principles of Geotechnical Engg. By Braja Das
7. Geotechnical engineering – Cengage learning, New Delhi by Das, BM
8. Basic and applied soil mechanics – New age publication, Delhi by Gopal Ranjan, Rao ASR

References Books:

1. Geotechnical Engineering – Prentice Hall, Delhi by Iqbal H Khan
2. Foundation Design and Construction by M.J. Tomlinson
3. Foundation analysis & design by J.E.Bowles
4. Foundation design by W.C.Teng
5. Foundation design manual-Dr. N.V. Nayak. Dhanpat Rai and Sons

Unit wise Measurable students Learning Outcomes:

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

1. Illustrate the site exploration process and methods of site exploration.
2. Evaluate the bearing capacity by using different methods and settlement of foundations.
3. Classify and design shallow and deep foundations.
4. Evaluation of capacity of individual and pile group.
5. Demonstrate the understanding of the concepts of the stability of slopes and study various methods of evaluating the stability of slopes.
6. Explain modern foundation techniques and ground improvement methods and their suitability.

Title of the Course:	**STEEL STRUCTURE DESIGN LAB**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0604**	**0**	**0**	**4**	**2**

Course Pre-Requisite:

Design of steel structures

Course Description:

This course introduces design of Steel Structures. Industrial shed, Building Frame, Foot bridge, Plate girder are covered here. This lab course gives student the knowledge of designing of whole structure by hand calculations. it also gives idea of how to use IS codes in design practices. Designing of steel structures done for industrial shed will be checked using standard software.

Course Learning Objectives:

1. To impart design and detail Industrial Shed: Consisting of roof truss, roof sheets, purlin, connections, gantry girder, columns and column bases
2. To impart design and detail of welded plate girder/ building frame / foot bridge

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Analyze various types of steel structures as per Indian Standard codes.	4	Analyzing
CO2	Evaluate design forces in members of steel structures	5	Evaluating
CO3	Design various types of practical steel structures and develop detailed structural drawing	6	Creating

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2

Assessments :

Teacher Assessment:

- In Semester Evaluation (ISE) and One End Semester Examination (ESE) having 50% weight-age for each

Assessment	Marks
ISE	25
ESE OE	25

- ISE are based on performance of student in laboratory, analysis and design write- up, presentation, oral and test (surprise/declared/Quiz), Seminar/Group/Discussions etc. The course teacher shall use at least two assessment tools as mentioned above for ISE
- ESE: Assessment is based on performance in design write-up, drawing presentation, and oral.

Course Contents:

List of Designs:

The lab work shall consist of structural analysis, design and detailing of the following structures along with necessary drawings.

1. Industrial Shed:

Consisting of roof truss, roof sheets, purlin, connections, gantry girder, columns and column bases. Run analysis of truss on any structural design software (e.g., STAAD Pro, SAP2000, etc.)

2. Design of any one of the following:

a) Design of welded plate girder, design of cross section, curtailment of flange plates, stiffeners and connections. One full imperial size drawing sheet.

b) Design of building including primary and secondary beams, column, column base and connections. One full imperial size drawing sheet. c) Design of Foot Bridge: Influence lines, cross beam, main Truss, Raker joint details, support details.	

Recommended Textbooks:

1. Design of Steel Structures, by Dr. N. Subramanian, Oxford University Press, New Delhi.
2. Limit State Design of Steel Structures: V. L. Shah and Veena Gore, Structures Publication, Pune.
3. Limit State Design of Steel Structures: S.K. Duggal, Tata Mc-Graw Hill India Publishing House
4. Design of Steel Structures: K.S. Sairam, Pearson
5. Design of steel structure by Limit State Method as per IS: 800- 2007: Bhavikatti S. S., I K International Publishing House, New Delhi
6. Limit state design in structural steel: Dr. M. R. Shiyekar, PHI publications.

References Books:

1. IS: 800 – 2007, IS: 875 (part I, II and III), SP6 (1) & SP 6 (6), IS: 816, IS: 808.
2. LRFD Steel Design: William T. Segui, PWS Publishing
3. Design of Steel Structures: Edwin H. Gaylord, Charles N. Gaylord James, Stallmeyer, McGraw-Hill
4. Design of Steel Structures: Mac. Ginely T.
5. Design of Steel Structures: Dayaratnam, Wheeler Publications, New Delhi.
6. Design of Steel Structures: Punmia, A. K. Jain and Arun Kumar Jain, Laxmi Publication
7. Design of Steel Structures: Kazimi S. M. and Jindal R. S., Prentice Hall India.
8. Design of Steel Structures: Breslar, Lin Scalzi, John Willey, New York.
9. Steel Structure: Controlling Behaviour through Design, Englekirk, WILEY.

Unit wise Measurable students Learning Outcomes:

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

1. To design and detail Industrial Shed: Consisting of roof truss, roof sheets, purlin, connections, gantry girder, columns and column bases.
2. To design and detail of welded plate girder/ building frame / foot bridge.

Note:

The Design shall be as per IS: 800 – 2007 by limit state method.

Title of the Course:	**CONCRETE TECHNOLOGY LAB**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0605**	**0**	**0**	**2**	**1**

Course Pre-Requisite:

Basic Civil Engineering

Course Description:

The course includes experiments related to physical properties of concrete ingredients, properties of fresh concrete, properties of hardened concrete and durability properties of concrete. It also includes experiments based on non-destructive testing of concrete.

Course Learning Objectives:

1. To explain the important engineering properties of Concrete materials.
2. To explain the behavior of Fresh and harden concrete.
3. To explain the Concrete mix design.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Identify the properties of different cement, aggregates fresh concrete.	3	Identify
CO2	Evaluate the effect on hardened concrete by using destructive Non Destructive Testing	5	Evaluate
CO3	Demonstrate the knowledge of concrete mix design	6	Design

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	3	3	3

Assessments :

Teacher Assessment:

- Two components of In Semester Evaluation (ISE),

Assessment	Marks
ISE	25
ESE OE	25

- ISE 1 and ISE 2 are based on Tutorial/Assignment/Declared test/Quiz/Seminar/Group Discussions etc.
- ESE (OE): Assessment is based on 100% course content

Course Contents:

1. To determine the standard consistency, initial and final setting time of cement using Vicat's apparatus.
2. Determination of soundness of cement by Le-Chatelier's apparatus and Auto Clave.
3. To determine compressive strength of cement.
4. Determination of particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate) of Natural Aggregates and Manufactured Sand.
5. Determination of specific gravity and water absorption of aggregates of Natural Aggregates and Manufactured Sand.
6. To determine flakiness and elongation index of coarse aggregates.
7. To determine Workability of concrete by slump test, compaction factor, Vee Bee Consistometer test, effect of admixture and retarders on setting time concrete.
8. Non destructive test on concrete by:

   a) Rebound Hammer Test

b) Ultrasonic Pulse Velocity Test 9. Mix design and compressive strength of concrete cubes for M20 or M30 (ACI 211.1-91, IS 10262- 2009) 10. Mix design and compressive strength of self compacting concrete and High performance concrete	

Recommended Textbooks:

1. Naville, A.M., Concrete Technology, Pearson Education.
2. Santakumar, A.R., Concrete Technology, Oxford University Press.
3. Shetty, M.S., Concrete Technology, S. Chand Publication.
4. Gambhir, M.L., Concrete Technology, Tata McGraw Hill.

IS codes:

1. IS: 10262-2009, Recommended guidelines for Concrete Mix Design
2. IS: 456-2000, Indian Standard Plain and Reinforced Concrete

References Books:

1. Properties of concrete by A. M. Neville, Longman Publishers.
2. Concrete Technology by R.S. Varshney, Oxford and IBH.
3. Concrete technology by A. M. Neville, J.J. Brooks, Pearson.
4. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.

Unit wise Measurable students Learning Outcomes:

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

1. Evaluate the properties of Concrete materials.
2. Evaluate the properties of Fresh concrete
3. Evaluate the properties of Harden concrete
4. Calculate mix design of concrete.

Title of the Course:	**STUDIO LAB**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0606**	**0**	**0**	**2**	**1**

Course Pre-Requisite:

Knowledge of all Structural Engineering courses, Engineering Survey courses, Engineering Hydraulics and Water resources Engineering, and Transportation Engineering.
In addition, before the commencement of the VIth semester, students are required to complete a certification course/training on their own for the domains mentioned in the syllabus of this course.

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 make students aware about computational tools being used in industry.
2. To make hands-on experience on the various computational tools.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Analyze effectiveness of software tools for civil engineering problems.	4	Analyze
CO2	Adopt appropriate software tools to solve civil engineering problems.	6	Create

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	2	3	2
CO2	2	3	2

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.

Course Contents:

Problem 1: **Structural analysis using software (ETABS/STAAD.pro, any other suitable software)** – Preparation of Software input, Analysis of a simple 2D problem (a portal frame (single bay-single storey), a three span continuous beam or any similar problem), Result Interpretation & its presentation in the form of tables/graphical, Validation of results with manual calculations.	**10 Hrs**
Problem 2: **GIS Open source introduction (Quantum GIS) -** Prepare and compose a shapefile map using any five tools in QGIS. Use of any vector Geo-processing tool or geometry tool in open source QGIS (eg. contour, slope, hillshade, labels, intersect, buffer etc.) for region of your residence.	**10 Hrs**
Problem 3: **Application of Python programming language in Civil Engineering –** Develop programming language code using Python to solve total three civil engineering problems in three different domains - Structural Engineering, Engineering Hydraulics and Water resources Engineering, and Transportation Engineering.	**10 Hrs**

Title of the Course:	**PROFESSIONAL PRACTICES-III**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0607**	**0**	**0**	**2**	**1**

Course Pre-Requisite:

Environmental Engineering, Engineering Survey, Transportation Engineering, Structural Analysis, Building Services

Course Description:

This course aims to make students perform practices followed in civil engineering profession in areas of Environmental Engineering, Project Execution, Structural Engineering, Green Building etc.

Course Learning Objectives:

1. To aware students about practices employed by Professionals for 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**
CO1	Interpret environmental & data collection reports for construction projects.	3	Apply
CO2	Demonstrate the use of modern tools for execution of construction projects.	3	Apply
CO3	Make use of different computer tools for civil engineering problems.	3	Apply

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	-	1	1
CO2	3	2	3
CO3	2	3	2

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.

Course Contents:

Activity 1: Collect Water quality report from collected source, treated at WTP and available at consumer end from village or municipal authority and study, analyze & prepare adherence report according to norms. OR Collect Wastewater quality reports from any industry shared with MPCB/CPCB, study, analyze & prepare adherence reports according to norms.	**08 Hrs**
Activity 2: Setting out of centerline - Use autocad and prepare a Centreline Coordinates Plan compatible for total station input for a simple residential building. Mark the column center points (min. 4 columns) with centerline drawing on a plot using total station/manually using excavation plan.	**08 Hrs**
Activity 3: Collect and present data for Traffic Engineering Studies OR	**08 Hrs**

Collect accident data and demonstrate its use in road safety OR Collect & present Traffic Volume Study Simulation reports (simulation done using tools - SUMO, VISSIM etc.)	
Activity 4: Develop a spreadsheet (with linkage between minimum three sheets) for the following application areas (Any one)- 1) Green Building Criteria 2) Wastewater collection system design 3) Structural Analysis	**08 Hrs**

Title of the Course:	**GEOTECHNICAL ENGINEERING-II LAB**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVC0608**	**0**	**0**	**2**	**1**

Course Pre-Requisite:

Elements of Civil Engineering & Mechanics; Engineering Hydraulics, Structural analysis, Geotechnical Engineering-I.

Course Description:

Geotechnical Engineering-II forms a core course which is especially taught to students of Civil Engineering disciplines. The study of this course is aimed at developing an application thinking of the basic terminologies and design philosophies. It aims at developing an approach to solve week and compressible soil problems.

Course Learning Objectives:

1. To introduce students the process of soil exploration in different soil and rock strata as well as different ground improvement techniques.
2. To provide students necessary knowledge and skill required for interpretation of bearing capacity and settlement of foundations
3. To introduce students the process of soil compaction and consolidation with field control and application.
4. To provide students knowledge and skills required to design shallow and pile foundation

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Explain the suitability of different soil exploration methods and various types of foundations.	2	Understanding
CO2	Estimate the load-bearing capacity, stability of slopes with different forms of foundation, and settlement for different soils in accordance with I.S. standards.	5	Evaluate

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	1	-	1
CO2	-	-	1

Assessments :

Teacher Assessment:

- Two components of In Semester Evaluation (ISE),

Assessment	Marks
ISE	25
ESE OE	25

- ISE 1 and ISE 2 are based on Tutorial/Assignment/Declared test/Quiz/Seminar/Group Discussions etc.
- ESE (OE): Assessment is based on 100% course content

Course Contents:

Practical Exercises: (Assignment based on following)

1. Preparation of detailed bore log analysis at least for 2 different soil and rock strata.
2. Method of calculation of bearing capacity based on unconfined compressive strength of rock core samples.
3. Calculate bearing capacity by Terzaghi's method
4. Calculate bearing capacity by IS code method
5. Detailed description and calculation of bearing capacity and settlement using plate load test data with critical comment on load settlement curve.
6. Design of shallow foundation – isolated, combined, raft foundation with settlement
7. Design of pile foundation – individual and group action.
8. Calculation of factor of safety for infinite slope.
9. Calculation of factor of safety for finite slopes.
10. Visit to foundation construction sites and preparation of the report.

Recommended Textbooks:

1. Foundation Engineering by B.J. Kasamalkar
2. Soil Mechanics and Foundation Engg. by V.N.S.Murthy
3. Soil Mechanics and Foundation Engg. By K.R.Arora
4. Soil Mechanics and Foundation Engg. by B.C. Punmia
5. Foundation Engineering by S.P.Brahma
6. Principles of Geotechnical Engg. By Braja Das
7. Geotechnical engineering – Cengage learning, New Delhi by Das, BM
8. Basic and applied soil mechanics – New age publication, Delhi by Gopal Ranjan, Rao ASR

References Books:

1. Geotechnical Engineering – Prentice Hall, Delhi by Iqbal H Khan
2. Foundation Design and Construction by M.J. Tomlinson
3. Foundation analysis & design by J.E.Bowles
4. Foundation design by W.C.Teng
5. Foundation design manual-Dr. N.V. Nayak. Dhanpat Rai and Sons

Unit wise Measurable students Learning Outcomes:

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

1. Illustrate the site exploration process and methods of site exploration.
2. Evaluate the bearing capacity by using different methods and settlement of foundations.
3. Classify and design shallow and deep foundations.
4. Evaluation of capacity of individual and pile group.
5. Explain the concepts of the stability of slopes and study various methods of evaluating the stability of slopes. Use of geo-textile in civil engineering.
6. Generate site visit report with detail description of site exploration, design, field testing, and foundation type and construction process.

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE-II

Sr. No.	*Curriculum Component*	*Course Code*	*Course Names*
1	PE	UCVE0601	Water Resource Engineering
2	PE	UCVE0602	Irrigation Engineering
3	PE	UCVE0603	Water Resources Utilization and Irrigation Development

Title of the Course:	**WATER RESOURCE ENGINEERING**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVE0601**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Fluid Mechanics, Geotechnical Engineering-I, Hydrology

Course Description:

The course mainly deals with different hydraulic structures, their functioning, components, practical application, and significance.

Course Learning Objectives:

1. To evaluate average rainfall, runoff, evaporation loss and other losses from a reservoir/ watershed, crop water requirement, reservoir capacity,
2. To equip the students with capabilities required for identifying, formulating and management of water resources related issues and problems.
3. To impart the students with knowledge required for planning design, and development of different types of dams and reservoirs.
4. To understand the basic concepts and importance of river engineering works.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Understand the features of the primary hydrological processes and various hydraulic structures; and explain various terms related to irrigation engineering.	2	Understand
CO2	Identifying, formulating and management of water resources related issues and problems.	3	Analyze
CO3	Adopt suitable methods for planning design, and development of different types of dams and reservoirs.	4	Create
CO4	Evaluate water requirement for irrigation work and analysis of runoff, flood flow	5	Evaluate

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	--	--	--
CO2	--	--	--
CO3	--	2	--
CO4	--	2	--

Assessments :

Teacher Assessment:

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

Assessment	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: Introduction to Hydrology, Hydrological cycle, and application of hydrology. Precipitation, measurement, analysis of Precipitation data, mass rainfall curves, intensity-duration curves. Elementary concepts of evaporation, transpiration, evapotranspiration, and infiltration.	**06 Hrs.**
Unit 2: Runoff-Factors affecting runoff, rainfall-runoff relationships, runoff hydrograph, unit hydrograph theory, S-curve hydrograph, synthetic unit hydrograph, use of unit hydrograph Floods- Estimation of peak flow, rational formula and other methods, flood frequency analysis.	**06 Hrs.**
Unit 3: Occurrence and distribution of ground water, Darcy's Law and permeability, specific yield of aquifers, movements of ground water, safe yield of basin. Hydraulics of well under steady flow condition in confined and unconfined aquifers. Water requirement of crops, duty and delta, soil moisture and crop water relationship, factors governing consumptive use of water, Causes of water logging, preventive and curative measures	**08 Hrs.**
Unit 4: Reservoir: Types, selection of site, estimation of required storage and safe yield, mass curve, reservoir sedimentation, GCA, CCA, NCA Dam: Types of Dams, Choice of dam, earthen dam, causes of failure of earth dam, various components of dam, Forces acting on gravity dam, stress analysis of dam, failure of gravity Dams, automation of dams.	**08 Hrs.**

Unit 5: Types, Design and drawing of spillways and energy dissipaters, weirs, and barrages. Pipe Irrigation Network, Cross drainage works: need, types, canal regulatory work. River training works: Classification-Marginal bunds, Guide banks and Groynes.	**06 Hrs.**
Unit 6: Lift irrigation schemes - Various components and their design principles. General features of Hydro-power, general layouts of different types Case study on determination of flood line using HEC-RAS Software.	**06 Hrs.**

Recommended Textbooks:

1. Punmia, Irrigation and water power engineering_, 1986. Standard Publications, New Delhi.
2. S.K.Garg, Irrigation Engg.
3. P.N.Modi. Irrigation and water power engineering
4. SatyanarayanMurty, Water resources Engg_, New age international private Ltd.

References Books:

1. Justinn, Creager and Hinds, Engg. For Dams. Vol. I, II, III
2. Varshney, Design of hydraulic structures
3. U.S.B.R., Oxford and IBH Publ. Co. Design of small dams
4. Varshney, Design of hydraulic structures
5. Leliavsky, Design of hydraulic structures
6. Irrigation Engineering, by Subramanyam

Unit wise Measurable students Learning Outcomes:

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

1. To understand different aspects of Hydrological Science.
2. To evaluate runoff and flood flow analysis by using different methods.
3. To adopt the basic knowledge of ground water hydrology and water requirement of crops.
4. To determine forces acting on dam and stability of dam.
5. To understand canal irrigation supplementary work and its design aspects.
6. To interpretate lift irrigation its design and application of software tools in water resources engineering.

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Title of the Course:	**IRRIGATION ENGINEERING**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVE0602**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Fluid Mechanics, Geotechnical Engineering-I, Hydrology

Course Description:

The course mainly deals with different hydraulic structures, their functioning, components, practical application, and significance.

Course Learning Objectives:

1. To evaluate average rainfall, runoff, evaporation loss and other losses from a reservoir/ watershed, crop water requirement, reservoir capacity,
2. To equip the students with capabilities required for identifying, formulating and management of water resources related issues and problems.
3. To impart the students with knowledge required for planning design, and development of different types of dams and reservoirs.
4. To understand the basic concepts and importance of river engineering works.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Understand the features of the primary hydrological processes and various hydraulic structures; and explain various terms related to irrigation engineering.	2	Understand
CO2	Identifying, formulating and management of water resources related issues and problems.	3	Analyze
CO3	Adopt suitable methods for planning design, and development of different types of dams and reservoirs.	4	Create
CO4	Evaluate water requirement for irrigation work and analysis of runoff, flood flow	5	Evaluate

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	--	--	--
CO2	--	--	--
CO3	--	2	--
CO4	--	2	--

Assessments :

Teacher Assessment:

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

Assessment	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: Types, Design and drawing of spillways and energy dissipaters, weirs, and barrages. Pipe Irrigation Network, Cross drainage works: need, types, canal regulatory work.River training works: Classification-Marginal bunds, Guide banks and Groynes.	**06 Hrs.**
Unit 2: Lift irrigation schemes - Various components and their design principles. General features of Hydro-power, general layouts of different types Case study on determination of flood line using HEC-RAS Software.	**06 Hrs.**
Unit 3: Reservoir: Types, selection of site, estimation of required storage and safe yield, mass curve, reservoir sedimentation, GCA, CCA, NCA Dam: Types of Dams, Choice of dam, earthen dam, causes of failure of earth dam, various components of dam, Forces acting on gravity dam, stress analysis of dam, failure of gravity Dams, automation of dams.	**08 Hrs.**
Unit 4: Introduction to Hydrology, Hydrological cycle, and application of hydrology. Precipitation, measurement, analysis of Precipitation data, mass rainfall curves, intensity-duration curves. Elementary concepts of evaporation, transpiration, evapotranspiration, and infiltration.	**06 Hrs.**
Unit 5: Runoff-Factors affecting runoff, rainfall-runoff relationships, runoff hydrograph, unit hydrograph theory, S-curve hydrograph, synthetic unit hydrograph, use of unit hydrograph Floods- Estimation of peak flow, rational formula and other methods, flood frequency analysis.	**06 Hrs.**

Unit 6:	**08 Hrs.**
Occurrence and distribution of ground water, Darcy's Law and permeability, specific yield of aquifers, movements of ground water, safe yield of basin. Hydraulics of well under steady flow condition in confined and unconfined aquifers. Water requirement of crops, duty and delta, soil moisture and crop water relationship, factors governing consumptive use of water, Causes of water logging, preventive and curative measures	

Recommended Textbooks:

1. Punmia, Irrigation and water power engineering_, 1986. Standard Publications, New Delhi.
2. S.K.Garg, Irrigation Engg.
3. P.N.Modi. Irrigation and water power engineering
4. SatyanarayanMurty, Water resources Engg_, New age international private Ltd.

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2. Varshney, Design of hydraulic structures
3. U.S.B.R., Oxford and IBH Publ. Co. Design of small dams
4. Varshney, Design of hydraulic structures
5. Leliavsky, Design of hydraulic structures
6. Irrigation Engineering, by Subramanyam

Unit wise Measurable students Learning Outcomes:

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

1. To understand canal irrigation supplementary work and its design aspects.
2. To interpretate lift irrigation its design and application of software tools in water resources engineering.
3. To determine forces acting on dam and stability of dam.
4. To understand different aspects of Hydrological Science.
5. To evaluate runoff and flood flow analysis by using different methods.
6. To adopt the basic knowledge of ground water hydrology and water requirement of crops.

Title of the Course:	**WATER RESOURCES UTILIZATION AND IRRIGATION DEVELOPMENT**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVE0603**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Fluid Mechanics, Geotechnical Engineering-I, Hydrology

Course Description:

The course mainly deals with different hydraulic structures, their functioning, components, practical application, and significance.

Course Learning Objectives:

1. To evaluate average rainfall, runoff, evaporation loss and other losses from a reservoir/ watershed, crop water requirement, reservoir capacity,
2. To equip the students with capabilities required for identifying, formulating and management of water resources related issues and problems.
3. To impart the students with knowledge required for planning design, and development of different types of dams and reservoirs.
4. To understand the basic concepts and importance of river engineering works.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Understand the features of the primary hydrological processes and various hydraulic structures; and explain various terms related to irrigation engineering.	2	Understand
CO2	Identifying, formulating and management of water resources related issues and problems.	3	Analyze
CO3	Adopt suitable methods for planning design, and development of different types of dams and reservoirs.	4	Create
CO4	Evaluate water requirement for irrigation work and analysis of runoff, flood flow	5	Evaluate

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	--	--	--
CO2	--	--	--
CO3	--	2	--
CO4	--	2	--

Assessments :

Teacher Assessment:

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

Assessment	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: Reservoir: Types, selection of site, estimation of required storage and safe yield, mass curve, reservoir sedimentation, GCA, CCA, NCA Dam: Types of Dams, Choice of dam, earthen dam, causes of failure of earth dam, various components of dam, Forces acting on gravity dam, stress analysis of dam, failure of gravity Dams, automation of dams.	**06 Hrs.**
Unit 2: Types, Design and drawing of spillways and energy dissipaters, weirs, and barrages. Pipe Irrigation Network, Cross drainage works: need, types, canal regulatory work.River training works: Classification-Marginal bunds, Guide banks and Groynes.	**08 Hrs.**
Unit 3: Introduction to Hydrology, Hydrological cycle, and application of hydrology. Precipitation, measurement, analysis of Precipitation data, mass rainfall curves, intensity-duration curves. Elementary concepts of evaporation, transpiration, evapotranspiration, and infiltration.	**08 Hrs.**
Unit 4: Runoff-Factors affecting runoff, rainfall-runoff relationships, runoff hydrograph, unit hydrograph theory, S-curve hydrograph, synthetic unit hydrograph, use of unit hydrograph Floods- Estimation of peak flow, rational formula and other methods, flood frequency analysis.	**06 Hrs.**
Unit 5: Occurrence and distribution of ground water, Darcy's Law and permeability, specific yield of aquifers, movements of ground water, safe yield of basin. Hydraulics of well under steady flow condition in confined and unconfined aquifers. Water requirement of crops, duty and delta, soil moisture and	**06 Hrs.**

crop water relationship, factors governing consumptive use of water, Causes of water logging, preventive and curative measures.	
Unit 6: Lift irrigation schemes - Various components and their design principles. General features of Hydro-power, general layouts of different types Case study on determination of flood line using HEC-RAS Software.	**06 Hrs.**

Recommended Textbooks:

1. Punmia, Irrigation and water power engineering_, 1986. Standard Publications, New Delhi.
2. S.K.Garg, Irrigation Engg.
3. P.N.Modi. Irrigation and water power engineering
4. SatyanarayanMurty, Water resources Engg_, New age international private Ltd.

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2. Varshney, Design of hydraulic structures
3. U.S.B.R., Oxford and IBH Publ. Co. Design of small dams
4. Varshney, Design of hydraulic structures
5. Leliavsky, Design of hydraulic structures
6. Irrigation Engineering, by Subramanyam

Unit wise Measurable students Learning Outcomes:

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

1. To determine forces acting on dam and stability of dam.
2. To understand canal irrigation supplementary work and its design aspects.
3. To understand different aspects of Hydrological Science.
4. To evaluate runoff and flood flow analysis by using different methods.
5. To adopt the basic knowledge of ground water hydrology and water requirement of crops.
6. To interpretate lift irrigation its design and application of software tools in water resources engineering.

LIST OF OPEN ELECTIVES

Offered By
CIVIL ENGINEERING DEPARTMENT

OPEN ELECTIVE-2
(Third Year Semester – VI)

Sr. No.	*Curriculum Component*	*Course Code*	*Course Names*
1	OE	UCVO0601	Appropriate Technology
2	OE	UCVO0602	
3	OE	UCVO0603	

Title of the Course:	**APPROPRIATE TECHNOLOGY**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVO0601**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

Basic engineering concepts, Operation Management, sustainable development,

Course Description:

This course introduces students to the principles, concepts, and applications of Appropriate Technology in engineering. It explores sustainable and contextually appropriate solutions for addressing the needs of underserved communities, emphasizing resource efficiency, environmental impact, and social inclusivity.

Course Learning Objectives:

1. Understand the principles and philosophies of Appropriate Technology.
2. Explore the role of engineering in sustainable development and social equity.
3. Develop critical thinking and problem-solving skills to design context-specific engineering solutions.
4. Analyze the environmental, social, and economic implications of implementing Appropriate Technology.
5. Familiarize with case studies and real-world examples of successful Appropriate Technology projects.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Understand the Concept of Appropriate Technology, comprehensive understanding of the concept, principles, and philosophies of Appropriate Technology	2	Understand
CO2	Critically reflect on the ethical, cultural, and social implications of technology interventions,	5	Evaluate
CO3	Design context-specific engineering solutions that align with the principles of Appropriate Technology.	6	Design
CO4	Able to critically analyze and evaluate various technological solutions within the context of Appropriate Technology, considering their environmental, social, and economic implications.	3	Analyze

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	--	--	--
CO2	--	--	--
CO3	--	2	--
CO4	--	--	--

Assessments :

Teacher Assessment:

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

Assessment	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:	
Unit1: Development and Society Knowledge and action, Scientific method, Ethical problems, Societal goals, Changes in societal forms, Development, World-National-Sate level statistics on inequality, unemployment, migration and pollution	**06 Hrs.**
Unit2: Introduction to Appropriate Technology Definitions of technology, Systemic views of Technology-Society relationships Definition, principles, and philosophies of Appropriate Technology Historical and cultural context of Appropriate Technology Comparison with conventional technology and its limitations	**06 Hrs.**
Unit 3: Needs Assessment and Stakeholder Engagement Understanding the needs and aspirations of target communities Participatory approaches and community engagement Identifying stakeholders and building collaborative partnerships	**06 Hrs.**
Unit4: Design Principles for Appropriate Technology Design thinking and human-centered design approaches Materials selection and utilization of local resources Design for affordability, maintainability, and scalability	**08 Hrs.**
Unit5: Alternative frameworks for conscious linking Choice of Technology Intermediate/ Appropriate Technology, Scanning spectrum of technology alternatives, Analytical hierarchy process (AHP) for ranking alternatives, case studies on AHP	**08 Hrs.**

Unit6: Influence of development perspectives on rankings Case Studies:	**06 Hrs.**
Illustration of Technology Innovation-chain through conception-generation-transfer-use stages in the form of case studies in several technologies from domestic, agricultural, energy, transport sectors.	

Recommended Textbooks:

1. "Appropriate Technology: Tools, Choices, and Implications" by K.V. Nagarajan
2. "Appropriate Technology for Water Supply and Sanitation: A Handbook for Water Utilities, Engineers, and Development Practitioners" by Sean Furey
3. "The Barefoot Architect: A Handbook for Green Building" by Johan van Lengen
4. "Appropriate Technology: Technology with a Human Face" by Michael Hobbs
5. "Appropriate Technology: Science and Tools" by David Shearman and Joseph Wayne Smith

References Books:

1. "Small is Beautiful: Economics as if People Mattered" by E.F. Schumacher
2. "Appropriate Technology: Problems and Promises" by Chris Wood
3. "The Human-Powered Home: Choosing Muscles Over Motors" by Tamara Dean
4. "Appropriate Technology in Rural Development: A Manual for Workers" by David Clements
5. "Appropriate Technology and Social Values: A Critical Appraisal" edited by Simon Bell and Stephen Morse

Unit wise Measurable students Learning Outcomes:

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

1. To understand the meaning of development, societal problems
2. To understand concepts, principles and philosophy of appropriate technology
3. To understand the needs of target communities, importance of participatory approaches
4. To understand design principles of appropriate technology
5. To analyze Analytical hierarchy process (AHP) for ranking alternatives
6. To evaluate the Technology Innovation-chain in various technologies and development sector

Title of the Course:	**INDUSTRIAL MANAGEMENT & ECONOMICS (AUDIT COURSE)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVA0601**	**2**	**0**	**0**	**-**

Assessments :

Teacher Assessment:

Assessment	Marks
ESE	100

- ESE: Assessment is based on 100% course content

Course Contents:

Unit 1: Engineering Economics: Introduction, Importance, Time value of Money, Mathematics of Interest – present worth, future sum, uniform series factors	**05 Hrs.**
Unit 2: Economic Comparisons: Equivalent Annual Cost Method, Present Worth Method, Future Worth Method, Capitalized Cost Method, Net Present Value.	**05 Hrs.**
Unit 3: Economic Comparisons: A.) Rate of Return Method, Pat-Back Method, Benefit Cost Ratio B.) Break Even Analysis	**05 Hrs.**
Unit 4: Resource Management: Material Management – Objectives, Functions Inventory Control – Necessity, Techniques such as ABC, EOQ, Safety Stocks.	**05 Hrs.**
Unit 5: Retirement and Replacement: Introduction, Factors for Replacement, Cost of Owning and Operation a Construction Equipment.	**05 Hrs.**
Unit 6: Quality Control: Concept of quality and quality control, statistical methods variable and attributes, Control Charts (X & R, P and C Chart), Acceptance Sampling, Sampling Plans	**05 Hrs.**

Recommended Textbooks:

1. Quantitative Techniques in Management – Vol. I, L.C.Zhamb
2. Material Management – Gopal Krishnan, Sdueshan
3. Executive Decisions & Operation Research by Miller and Stars, Prentice Hall of India, Publisher.
4. Principles of Construction Management by Roy Pilcher.
5. Project Cost Control in Construction by Roy Pilcher.
6. Projects by Prasanna Chandra
7. Management and Engineering Economics by G.A.Taylor.
8. Engineering Economics – Layland Blank and Torquin.
9. Engineering Economics by Pannerselvam
10. Industrial Engineering and Production management by Martand Telsang

References Books:

1. John L.Ashford, "The Management of Quality in Construction ", E & F.N Spon, New York, 1989.
2. Juran Frank, J.M. and Gryna, F.M. " Quality planning and Analysis ", Tata McGraw Hill, 1982.
3. James, J.O Brian, "Construction Inspection Handbook - Quality Assurance and Quality Control ", Van Nostrand, New York, 1989.
4. Relevant Acts .