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 2019-2020

Under Graduate Programme

Submitted to Academic Council for Approval: ***01.03.2019***

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T. Y. B.Tech Semester - V

Academic Year 2019-2020

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

Sr. No	Curriculum Component	Course Code	Course	Teaching Scheme				Evaluation Scheme			
				L	T	P	Credit	Component	Marks Max	Min for Passing	
1	BS	UCVL 0301	Engineering Mathematics III	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
2	ES	UCVL 0302	Solid Mechanics	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
3	ES	UCVL 0303	Engineering Hydraulics	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
4	PC	UCVL 0304	Engineering Survey	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
5	PC	UCVL 0305	Building Sciences & Services	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
6	ES	UCVL 0331	Solid Mechanics Lab	0	0	2	1	ISE	25	10	
								ESE OE	25	10	
7	ES	UCVL 0332	Engineering Hydraulics Lab	0	0	2	1	ISE	25	10	
								ESE POE	50	20	
8	PC	UCVL 0333	Engineering Surveying	0	0	4	2	ISE	25	10	
								ESE POE	50	20	
9	PC	UCVL 0334	Building Sciences & Services Lab	0	0	2	1	ISE	50	20	
10		UCVL 0361	Environmental Studies (Audit Course)	2	0	0	0	ESE	100	40	
			Total	**17**	**2**	**10**	**22**	**Total Contact Hrs**			**29**

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

Sr. No	Curriculum Component	Course Code	Course	Teaching Scheme				Evaluation Scheme			
				L	T	P	Credit	Component	Marks Max	Marks Min for Passing	
1	PC	UCVL 0401	Structural Analysis	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
2	PC	UCVL 0402	Concrete Technology	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
3	PC	UCVL 0403	Environment Engineering -I	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
4	PC	UCVL 0404	Advance Surveying	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
5	PC	UCVL 0405	Hydrology & Water Resources Engineering	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
6	PC	UCVL 0431	Concrete Technology Lab	0	0	2	1	ISE	25	10	
								ESE OE	25	10	
7	PC	UCVL 0432	Environment Engineering -I Lab	0	0	2	1	ISE	50	20	
								ESE POE	50	20	
8	PC	UCVL 0433	Computer Aided Drawing LAB	0	0	4	2	ISE	25	10	
								ESE POE	50	20	
9	PC	UCVL 0434	Advance Surveying	0	0	2	1	ISE	25	10	
10		UCVL 0461	Building Planning and Design (Audit Course)	3	0	0	0	ESE	100	40	
			Total	**18**	**2**	**10**	**22**	**Total Contact Hrs**			**30**

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	UCVL 0501	Design of Steel Structure	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
2	PC	UCVL 0502	Theory of Structure	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
3	PC	UCVL 0503	Geotechnical Engineering-I	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
4	PC	UCVL 0504	Irrigation & Hydraulic Structures	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
5	PC	UCVL 0505	Environmental Engineering-II	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
6	PC	UCVL 0531	Geotechnical Engineering-1 Lab	0	0	2	1	ISE	25	10	
								ESE POE	50	20	
7	PC	UCVL 0532	Irrigation & Hydraulic Structures Lab	0	0	2	1	ISE	25	10	
								ESE OE	25	10	
8	PC	UCVL 0534	Environmental Engineering-2 Lab	0	0	2	1	ISE	50	20	
9	PW	UCVL 0541	Mini Project (Practical Case Studies)*	0	0	4	2	ISE	25	10	
								ESE OE	50	20	
10		UCVL 0561	Engineering Geology (Audit Course)	2	0	0	0	ESE	100	40	
			Total	**17**	**2**	**10**	**22**	**Total Contact Hrs**			**29**

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	UCVL 0601	Design of Concrete Structure-I	4	1	0	5	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
2	PC	UCVL 0602	Transportation Engineering- I	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
3	PC	UCVL 0603	Geotechnical engineering-II	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
4	PE	UCVL 06**	Professional Elective 1*	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
5	OE	UOEL 06**	Open Elective -1	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
6	PC	UCVL 0631	Steel Structure Design Lab	0	0	4	2	ISE	25	10	
								ESE OE	50	20	
7	PC	UCVL 0632	Transportation Engineering- I Lab	0	0	2	1	ISE	25	10	
								ESE OE	50	20	
8	PC	UCVL 0633	Geotechnical engineering-II Lab	0	0	2	1	ISE	25	10	
								ESE OE	25	10	
9	PW	UCVL 0641	Seminar	0	0	2	1	ISE	50	20	
10		UCVL 0661	Industrial Management & Economics (Audit Course)	2	0	0	0	ESE	100	40	
			Total	**18**	**1**	**10**	**22**	**Total Contact Hrs**			**29**

Teaching and Evaluation scheme for **Final Year Semester – VII**

Sr. No	Curriculum Component	Course Code	Course	Teaching Scheme				Evaluation Scheme			
				L	T	P	Credit	Component	Marks Max	Marks Min for Passing	
1	PC	UCVL 0701	Quantity Survey and Valuation	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
2	PC	UCVL 0702	Construction Project & Management	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
3	PC	UCVL 0703	Structural Dynamics and Earthquake Engineering	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
4	OE	UOEL 07**	Open Elective -2	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
5	PC	UCVL 0731	Quantity Survey and Valuation lab	0	0	4	2	ISE	50	20	
								ESE OE	50	20	
6	PC	UCVL 0732	Construction Project & Management	0	0	2	1	ISE	25	10	
								ESE OE	50	20	
7	PC	UCVL 0733	Concrete Structure Design LAB	0	0	4	2	ISE	25	10	
								ESE OE	50	20	
8	PW	UCVL 0751	Project Phase-I	0	0	2	1	ISE	100	40	
9		UCVL 0761	Transportation Engineering- II (Audit Course)	3	0	0		ESE	100	40	
			Total	**15**	**2**	**12**	**20**	**Total Contact Hrs**			**29**

Teaching and Evaluation scheme for **Final Year Semester – VIII**

Sr. No	Curriculum Component	Course Code	Course	Teaching Scheme				Evaluation Scheme			
				L	T	P	Credit	Component	Marks		
									Max	Min for Passing	
1	PE	UCVL 08**	Professional Elective 2*	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
2	PE	UCVL 08**	Professional Elective 3*	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
6	PW	UCVL 0851	Project Phase II	0	0	12	6	ISE-1	75	30	
								ISE-2	75	30	
								ESE OE	150	60	
			Total	**6**	**0**	**12**	**12**	**Total Contact Hrs**			**18**

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LIST OF OPEN ELECTIVES

Offered By
CIVIL ENGINEERING DEPARTMENT

OPEN ELECTIVE-1

Sr. No.	Curriculum Component	Course Code	Course Names
1	OE	UOEL0606	Buildings and Occupants
2	OE	UOEL0607	Non-Destructive Testing
3	OE	UOEL0608	Environmental Impact Assessment

OPEN ELECTIVE-2

1	OE	UOEL0706	Remote Sensing and GIS, GPS
2	OE	UOEL0707	Watershed Management

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LIST OF PROFESSIONAL ELECTIVES

Sr No	*Course Code*	Professional Elective I
1	UCVL0621	Water Power Engineering
2	UCVL0622	Transportation And Smart City Planning
3	UCVL0623	GIS And Geo-Informatics
4	UCVL0624	Legal Aspects In Construction Engineering
5	UCVL0625	Advanced Waste Water Management
6	UCVL0626	Advanced Construction Practices
7	UCVL0627	Human Resource Development

Sr No	*Course Code*	Professional Elective 2
1	UCVL0821	Structural Design And Drawing Of Foundation And Retaining Wall
2	UCVL0822	Adv. Structural Design
3	UCVL0823	Design Of Bridges
4	UCVL0824	Structural Health Monitoring And Retrofitting
5	UCVL0825	Advanced Traffic Analysis And Design
6	UCVL0826	Geodesy, Remote Sensing &Gnss
7	UCVL0827	Advanced Design Of Concrete Structures

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Sr No	*Course Code*	Professional Elective 3
1	UCVL0871	Design And Drawing Of Marine Structure
2	UCVL0872	Advanced Structural Analysis
3	UCVL0873	Introduction Of Finite Elements Methods
4	UCVL0874	Soil Conservation And Watershed Management
5	UCVL0875	Disaster Management
6	UCVL0876	Adv. Hydrology
7	UCVL0877	Environmental Geo-technology
8	UCVL0878	Industrial Waste Treatment

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T. Y. B.Tech
Semester - V

Academic Year 2019-2020

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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	UCVL 0501	Design of Steel Structure	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
2	PC	UCVL 0502	Theory of Structure	3	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
3	PC	UCVL 0503	Geotechnical Engineering-I	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
4	PC	UCVL 0504	Irrigation & Hydraulic Structures	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
5	PC	UCVL 0505	Environmental Engineering-II	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
6	PC	UCVL 0531	Geotechnical Engineering-1 Lab	0	0	2	1	ISE	25	10	
								ESE POE	50	20	
7	PC	UCVL 0532	Irrigation & Hydraulic Structures Lab	0	0	2	1	ISE	25	10	
								ESE OE	25	10	
8	PC	UCVL 0534	Environmental Engineering-2 Lab	0	0	2	1	ISE	50	20	
9	PW	UCVL 0541	Mini Project (Practical Case Studies)*	0	0	4	2	ISE	25	10	
								ESE OE	50	20	
10		UCVL 0561	Engineering Geology (Audit Course)	2	0	0	0	ESE	100	40	
			Total	**17**	**2**	**10**	**22**	**Total Contact Hrs**			**29**

Title of the Course:	**Design of Steel Structure**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0501**	**3**	**1**	**-**	**4**

Course Pre-Requisite:

Solid Mechanics, 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:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive 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	**Choose** the members as per the Indian Standard codes.	6	Creating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	2	--	--	--	--	--	--	--	--	--
CO2	2	2	2	--	--	--	--	--	--	--	--	--
CO3	2	2	2	2	--	--	--	--	--	--	--	--
CO4	2	--	3	2	--	--	--	--	--	--	--	--

Assessments :

Teacher Assessment:

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

Assessment	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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Introduction to Design of steel structures: 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. Types of bolts & welds, analysis and Design of axially and eccentrically loaded bolted and welded connections (subjected to bending and torsion).	**5 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.	**5 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 .	**5 Hrs**

Unit 4: Columns: Design of column subjected to axial and eccentric loading, 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)	**8 Hrs**
Unit 5: 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.	**6 Hrs**
Unit 6: Gantry girder: Forces acting on gantry girder, commonly used sections, design of gantry girder and connection.	**6 Hrs.**

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, Stuctures 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

6 International Publishing House, New Delhi

7 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, Mc-Graw-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 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. Analyse and design of tension members
3. Analyse and design of compression members as strut.
4. Analyse and design of columns and built-up columns, column bases.
5. Analyse and design of beams.
6. Analyse and design of gantry girders.

Note:

1. Use of IS: 800-2007, IS: 875 (All parts) and steel table is permitted for theory examinations.
2. The Design shall be as per IS: 800 – 2007 by limit state method.

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Title of the Course:	**Theory of Structures**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0502**	**3**	**1**	**-**	**4**

Course Pre-Requisite:

Solid Mechanics, 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:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive 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	PO 10	PO 11	PO 12
CO1	2	2	1	--	--	--	--	--	--	--	--	2
CO2	2	3	1	--	--	--	--	--	--	--	--	2
CO3	1	1	1	1	--	--	--	--	--	--	--	2
CO4	3	3	2	2	--	--	--	--	--	--	--	2

Assessments :

Teacher Assessment:

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

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

- ISE 1 and ISE 2 are based on 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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: **8 Hrs.**

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.

Unit 2: Clapeyron's theorem of three moment: Continuous beams with single or double redundancy, sinking of supports, beam with different M.I.	**4 Hrs.**
Unit 3: Slope deflection method: General and modified slope deflection equations, application to beams and portal frames with or without sway. Sinking of supports. (Degree of K.I. ≤2)	**7 Hrs.**
Unit 4: Moment distribution method: Applications to beams and portal frames without sway. Sinking of supports, Pure sway Frames.	**7 Hrs.**
Unit 5: Kani's method: Applications to beams and portal frames with and without sway. Sinking of supports.	**7 Hrs.**
Unit 6 : Matrix Methods: Flexibility and stiffness coefficients, development of flexibility and stiffness matrix, analysis of beams and portals by matrix formulations. (matrix size restricted to 2 x 2)	**7 Hrs.**

Recommended Textbooks:

1. Basic Structural Analysis: C.S. Reddy, Tata McGraw Hill Publishing House, New Delhi.
2. Theory of structures (Structural Analysis): S. G. Dige, Electrotech Publication Engineering Series
3. Mechanics of Structures (Vol-I and II) : S. B. Junnarkar H.J. Shah, Charotar Publishers.
4. Structural Analysis: L.S. Negi and R.S. Jangid, Tata Mc-Graw Hills Publishing House, New Delhi
5. Analysis of Structures: Vol. I II, Vazirani and Ratwani, Khanna Publishers
6. Structural Analysis: Bhavikatti, Vikas Publishing House Pvt, ltd.
7. Structural Analysis: Devdas Menon, Narosa Publishing House.
8. Basic Structural Analysis: K.U. Muthu, Azmi Ibrahim, M. Vijyan, Maganti Janadharn. I.K. International Publishing House Pvt. Ltd.
9. Structural Analysis- Matrix approach by Pandit and Gupta.

References Books:

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

Unit wise Measurable 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 02.
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.
6. Formulate stiffness & flexibility matrices for structures & adopt them for its analysis.

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Title of the Course:	**Geotechnical Engineering-I**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0503**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Elements of Civil Engineering & Mechanics; Structural Analysis; 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, 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:

COs	After the completion of the course the student will 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	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	1	1	2	-	-	-	-	-	-	-	-
CO2	2	1	1	2	-	-	-	-	-	-	-	-
CO3	2	2	2	2	-	-	-	-	-	-	-	-
CO4	2	2	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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Soil, its properties and basic relationships — **7 Hrs.**

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), I. S. classification of soil, Casagrande's Plasticity chart, soil consistency and indices.

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.	**7 Hrs.**
Unit 3: Compaction and Consolidation: 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	**7 Hrs.**
Unit 4: Stress Distribution in Soil: 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	**7 Hrs.**
Unit 5: Shear Strength: 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. Critical State Soil Mechanics- concept	**7 Hrs.**
Unit 6: Earth Pressure: 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.	**7 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 Learning Outcomes:

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

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

FINAL

Title of the Course:	**Irrigation and Hydraulic Structures**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0504**	**3**	**-**	**-**	**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 make the students to be able to know the different types of hydraulic structures.
2. To make a student visualize, know and understand the working of different hydraulic structures.
3. To bring awareness in students about the principles with which any and all hydraulic structures are designed.
4. To expose the students to the sites where hydraulic structures have been implemented.
5. To make the students to be able to compute the stresses in different hydraulic structures.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Demonstrate the theoretical and practical aspects of irrigation processes and structures.	2	Understanding
CO2	Explain the working of hydraulic structures.	2	Understanding
CO3	Assess the stresses in different irrigation structures	5	Evaluating
CO4	Test the stability of hydraulic structures.	6	Creating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	--	_	2	--	_	_	_	_	_	_	-	_
CO2	1	2	_	2	-	_	_	_	_	_	1	_
CO3	-	1	3	2	1				1	_	1	2
CO4	1	3	2	2	_	2-	--	_	_	_	2	_

Assessments :

Teacher Assessment:

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

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

- ISE 1 and ISE 2 are based on 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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: **a). Introduction to dams:** Types of dams, selection of site for dams, selection of type of dam, Storage Calculations using mass curves, Area elevation curve & Elevation capacity curve, Control levels, silting of reservoirs, control of Losses in reservoirs. **b). Earthen dam:** Types of earthen dams, Components and their functions, methods of construction of earthen dam, Design criterion, plotting of phreatic line, Modes of failure, seepage control measures-Drainage & filters, stability of slopes for sudden drawdown & steady seepage.	**8 Hrs.**
Unit 2: **a). Gravity Dams:** Forces acting on dam, Design Criterion-theoretical and practicle profile, high and low dam, fixing section of dam, stability analysis, and methods of construction, galleries and joints in dams. Arch dams- Introduction & types only. Introduction to instrumentation in dams.	**7 Hrs.**
Unit 3: **a). Spillway:** Necessity and function components of spillway, different types, factors affecting choice of type of spillway. Elementary hydraulic design, types of energy dissipation arrangements, gates for spillway. **b). Outlets in Dams:** Outlets through concrete and earth dams, different types.	**5 Hrs.**

Unit 4: **a). Diversion Head Works:** component parts & their functions, types of weir and barrages, Causes of failure and remedies, Introduction to Theory of seepage- Bligh's creep theory, critical exit gradient, Khosla's theory	**6 Hrs.**
Unit 5: **a). Canals:** Types, alignment, typical sections of canals, balancing depth Kennedy's and Lacey's silt theories, canal lining-purpose, types, selection and economics. **b). C. D. Works:** Necessity, Types. **c). Canal Regulatory Works:** head regulator, cross regulator, canal fall, canal escape, standing wave flume. **d). Introduction to MIKE, HECRAS and Bentley Softwares**	**7 Hrs.**
Unit 6: **a). River Engineering:** Classification and types of river, meandering phenomenon, **b). River training works:** Classification-Marginal bunds, Guide banks and Groynes. River navigation. Interlinking of rivers, National perspective plan. **c). Elements of hydro-power:** Hydro-power & importance, typical layout & functions of components parts-Intakes, conveyance system, surge tanks, Powerhouse, Tail race, Types of hydro-power plants.	**7 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.ForDams.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.

Unit wise Measurable Learning Outcomes:

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

1. Know different types of dams and their design.
2. Visualize, know and understand working and stability of gravity dams and earthen dams.
3. Understand hydraulic design of spillways and diversion headworks.
4. Explain the importance of river training works and hydro power plants.
5. Design canals and cross drainage works.
6. Compute the stresses in dams.

FINAL

Title of the Course:	**Environmental Engineering – II**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0505**	**3**	**-**	**-**	**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, Air and designs of Waste water treatment facilities and methods of Solid waste management from Civil Engineering aspects.

Course Learning Objectives:

1. Assess the quality and carry out quantification of the given source of water for drinking purpose as per standards of I.S.10500.
2. Sequencing and design the water treatment units for various qualities of water depending on water source as per mentioned design parameters.
3. Analyze the water distribution system numerically and computationally with respect to water quality, water pressure and pipe quality.
4. Acquire the basic information of Green building and distinguish between conventional and green building

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Assess the quality and carry out quantification of the given source of water for drinking purpose as per standards of I.S.10500.	2	Cognitive
CO2	Sequencing and design the water treatment units for various qualities of water depending on water source as per mentioned design parameters.	4	Cognitive
CO3	Analyze the water distribution system numerically and computationally with respect to water quality, water pressure and pipe quality.	5	Cognitive
CO4	Acquire the basic information of Green building and distinguish between conventional and green building.	4	Cognitive

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	1	3	--	1	--	3	--	--	--	--	1
CO2	3	2	2	3	1	3	3	1	--	--	--	1
CO3	3	2	2	2	1	3	3	1	--	--	--	1
CO4	1	--	2	1	--	--	3	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 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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: **06 Hrs.**

a). 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.

b). Sewerage system: Types, Layout, Types of sewers, Collection system, Appurtenances, Design of sanitary and storm water sewers, Maintenance of sewerage systems Sewage and Sludge pumping, Location, Capacity, Types of pumps, Pumping station design

Unit 2: **09 Hrs.**

a). Primary Treatment: Screening, comminuting, Grit removal, Oil and Grease trap Primary settling tank.

b). 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 an ten storey apartment wastewater.	
Unit 3: **a). Sludge:** Characteristics, Treatment and disposal, Concept of anaerobic digestion, types of reactors. **b). Low cost wastewater treatment methods**: Principles of waste stabilization pond. Design and operation of oxidation pond, aerobic & anaerobic Lagoons, Aerated Lagoon, Oxidation ditch.	**03 Hrs.**
Unit 4: **a). Stream pollution**: Classification, Concept of Self Purification and DO sag curve. Streeter Phelp's Equation. **b). Disposal of wastewater:** methods, effluents standards for stream and land disposal as per MPCB and CPCB standards and legislation.	**06 Hrs.**
Unit 5: **a). Solid waste management**: Definition, types, sources, characteristics. Functional outlines, Generation, storage, Collection, Processing techniques. **b). Air Pollution**-Definition, Sources and classification of pollutants, Effects on man material and vegetation. Introduction to Meteorological aspects such as atmospheric stability, mixing heights, and plume behavior. **c). Control of industrial air pollution**: Settling Chamber, Bag Filters, Cyclone separators, Scrubbers, Electrostatic precipitators,	**06 Hrs.**
Unit 6: **a). Environmental Impact Assessment (EIA):** Concept, outline and details of EIA report preparation. **b). EIA** Case Study for Civil Structures: 1) Dam 2) Commercial and Residential Project 3) Road Project 4) Industrial Project	**06 Hrs.**
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.	

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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 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.

FINAL

Title of the Course:	**Geotechnical Engineering- I Lab**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0531**	**-**	**-**	**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:

To impart knowledge and skills to students for,

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

Course Outcomes:

COs	After the completion of the course the student will 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	PO 10	PO 11	PO 12
CO1	2	-	-	2	-	-	-	-	-	-	-	-
CO2	2	1	-	2	-	-	-	-	-	-	-	-

Assessments :

Teacher Assessment:

- Two components of Course Evaluation

Assessment	Marks
ISE	25
ESE POE	50

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

Course Contents:	
Experiment 1: To Determine the water content of the given sample	
Experiment 2: Determination of the specific gravity of the given soil sample	
Experiment 3 : Grain size distribution of soil by the Mechanical Sieve Analysis.	
Experiment 4: Determination of the Atterberg Limits of the Soil Sample : Liquid Limit, Plastic Limits and shrinkage limit(at least two) of the given soil sample	
Experiment 5: Determination of the field density by Core Cutter / Sand Replacement Method	
Experiment 6: To Determine Coefficient of Permeability of The Given Soil Sample By Permeability Test	
Experiment 7: To Determination of the Optimum Moisture Content by Proctor Test	
Experiment 8: To determine the shear strength of the soil by the Direct Shear Test	
Demonstration:- (Any 2) 1 Particle size distribution-Sedimentation analysis (hydrometer) 2 Determination of co-efficient of permeability by constant head 3 Unconfined Compression Test 4 Triaxial shear test. 5 Vane shear test 6 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)	

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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 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

FINAL

Title of the Course:	**Irrigation and Hydraulic Structure Lab**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0532**	**-**	**-**	**2**	**1**

Course Pre-Requisite:

Fluid Mechanics, Hydrology and Water Resources Engineering.

Course Description:

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

Course Learning Objectives:

1. To make the students to be able to know the different types of hydraulic structures.
2. To make a student visualize, know and understand the working of different hydraulic structures.
3. To bring awareness in students about the principles with which any and all hydraulic structures are designed.
4. To expose the students to the sites where hydraulic structures have been implemented.
5. To make the students to be able to compute the stresses in different hydraulic structures.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Demonstrate the theoretical and practical aspects of irrigation processes and structures.	2	Understanding
CO2	Explain the working of hydraulic structures.	2	Understanding
CO3	Assess the stresses in different irrigation structures	5	Evaluating
CO4	Test the stability of hydraulic structures.	6	Creating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	--	--	2	--	3	--	--	--	--	--	--	--
CO2	1	2	--	2	--	--	--	--	--	--	--	--
CO3	--	--	--	3	--	2	3	--	--	--	2	--
CO4	--	2	3	--	2	--	--	--	--	--	--	2

Assessments :

Teacher Assessment:

- Two components of Course Evaluation

Assessment	Marks
ISE	25
ESE OE	25

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

Course Contents:

Assignments: **Ten assignments of the following**

1 Determination of height of dam: demand/supply reservoir calculation and control levels and free board

2 Earthen dam: Determination of section (drawing of one plate), one slip circle calculations, Types of failure

3 Gravity dam: Forces acting, Modes of failure,

4 Gravity dam: Elementary and practical profile with stability calculations (drawing of one plate) types of arch dam.

5 Spillway: Geometrical section, energy dissipation arrangement and gates, Outlet through earth dam and gravity dam.

6 Typical section diversion headwork using Bligh's & Khosla's theory.

7 Typical sections of canal using Kennedy & Lacey's theory

8 Types of CD work and canal regulatory works

9 Different types of river training work, Interlinking of rivers

10 Atypical layout & components parts of Hydropower plant and its functioning

11 Report based on field visit to dam & CD work.

12 Introduction to MIKE, Bentley and HECRAS.

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.ForDams.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.

FINAL

Title of the Course:	**Environmental Engineering – II Lab**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0534**	**-**	**-**	**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, Air and designs of Wastewater treatment facilities and methods of Solid waste management from Civil Engineering aspects.

Course Learning Objectives:

1. Assess the quality of the given source of water for drinking purpose as per codal provision.
2. Design the water treatment units for various qualities of water depending on water source as per design parameters.
3. Analyze the water distribution system computationally with respect to water quality, water pressure and pipe quality.
4. Correlate the water treatment facility in the practice with theoretical knowledge.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Assess the quality of the given source of water for drinking purpose as per codal provision.	2	Cognitive
CO2	Design the water treatment units for various qualities of water depending on water source as per design parameters.	4	Cognitive
CO3	Analyze the water distribution system computationally with respect to water quality, water pressure and pipe quality.	5	Cognitive
CO4	Correlate the water treatment facility in the practice with theoretical knowledge.	4	Cognitive

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	1	3	--	1	--	3	--	--	--	--	1
CO2	3	2	2	3	1	3	3	1	--	--	--	1
CO3	3	2	2	2	1	3	3	1	--	--	--	1
CO4	1	--	2	1	--	--	3	1	--	--	--	1

Assessments :

Teacher Assessment:

- The component In Semester Evaluation (ISE) would consist of continuous evaluation of all experiments performed (40%), EIA Case Study for any one Civil Structure (10%), 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 (10%)

Assessment	Marks
ISE	50

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. EIA Case Study for any one Civil Structure

C. Design of activated sludge process residential apartment wastewater.

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

E. Visit to sewage treatment plant.

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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:

1. Peavey, H. S. Rowe, D.R., Environmental Engineering, McGraw-Hill Book Company.
2. Viessman W. and Hammer M.J. Water supply and pollution Control, Harper Collins College publishers.
3. Hammer M.J. Water and Waste water Technology, Prentice-Hall of India Private Limited.
4. Manual on Municipal Solid Waste Management, Ministry of Urban Development Govt. of India.

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 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:	**Mini Project**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0541**	**-**	**-**	**4**	**2**

Course Description:

1. The main aim of this course is to demonstrate the important attributes like critical thinking, creativity, collaborative efforts and communication skills in students.
2. The aim is also to make students aware with the process involved in making product from idea.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Identify the community needs	2	Aware
CO2	Convert the idea in to product/process/service	3	Covert
CO3	Analyze & design the physical /mathematical/ICT model in order to solve identified problem.	4	Analyze
CO4	Create and work in group	6	Create

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	--	--	--	--	3	--	--	--	--	--	--
CO2	--	2	3	2	--	--	--	--	--	--	--	--
CO3	--	--	--	1	3	--	--	--	--	--	1	--
CO4	--	--	--	--	--	--	--	--	3	1		1

Assessments :

Teacher Assessment:

- One In Semester Examination (ISE) and One End Semester Examination (ESE) having 33% - 67% weights respectively.

Assessment	Marks
ISE	25
ESE OE	50

- ISE: Assessment is based on presentation given by student groups after every 2 weeks.
- ESE: Assessment is based on completion of mini project and presentation given by student groups.

Mini projects shall consist of followings (but not limited to):	
Minor experimental work of various techno-social issues, computer based analysis and design, structural audit of various civil engineering works, health monitoring of structures, Innovative civil engineering materials, Environmental impact assessment, design of small water supply schemes, irrigation schemes, water harvesting, sewerage system, waste management system, transportation engineering etc. related to civil engineering.	
Guidelines:	
1 Mini-project is a group activity; each group should be of minimum 3 students and maximum 5 students. 2 Each batch shall consist of 4 to 5 groups. Not more than one batch should be assigned to a single faculty. 3 After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project. 4 Student is expected to detail out methodology, software required, critical issues involved in analysis /design and implementation and submit the proposal within one week of the semester. 5 Use of relevant software is preferred. 6 Completed mini project and documentation in the form of report and is to be submitted before the end of semester assessment. 7 Schedule for Presentation: 1 Synopsis Presentation 2 Presentation given by student groups after every 2 weeks – ISE Assessment 3 Final presentation – ESE Assessment	

FINAL

Title of the Course:	**Engineering Geology (Audit Course)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0561**	**2**	**-**	**-**	**-**

Assessments : ESE

Teacher Assessment : NOT APPLICABLE

Course Contents:

Unit 1: **7 Hrs.**

Introduction: Definition, subdivisions of geology, scope of Engineering Geology. Interior of the Earth. Weathering - Types and civil engineering significance. Geological work of river- Erosion and deposition processes and features, Transportation process, Civil Engineering Significance,
Mineralogy: Classification of minerals. Petrology: Igneous rocks: Origin, Structures, Classification - Concordant and discordant intrusions, Secondary rocks: Formation, Structures, Civil Engineering significance. Grain size classification of sedimentary rocks. Metamorphic rocks: Agents and Types of Metamorphism.

Unit 2: **6 Hrs.**

Structural Geology: Strike and Dip, Unconformity-Types. Fold and Fault: Parameters, Classification, Causes. Joint : Types, Civil Engineering considerations. Earthquake : Terminology, Causes, Seismic waves, Landslides : Types, Causes, Prevention of Landslides.

Unit 3: **7 Hrs.**

Surface and Sub-surface Investigations: Preliminary Geological Investigations, Steps in geological investigations for project site Geology of Tunnel and Bridge: Difficulties during tunneling, Influence of geological conditions on tunneling, Geological consideration while choosing tunnel alignment, Tunnel in folded strata, sedimentary rocks and Deccan traps. Dependence of types of bridges on geological conditions.

Unit 4: **6 Hrs.**

Ideal Geological conditions for Dams and Reservoirs: Influence of geological conditions on Location, Alignment, Design and Type of a dam, Suitable and Unsuitable geological conditions for locating a dam site, Dams on carbonate rocks, sedimentary rocks, folded strata and Deccan traps, Suitable and unsuitable geological conditions for reservoir site.

Recommended Textbooks:

1. Engineering and General Geology – By Prabin Singh, S. K. Katariya and sons, Delhi.

2. Engineering and General Geology-By Dr. P. T. Sawant,New India Publishing Agency, New Delhi.
3. Principles of Engineering Geology and Geotechnics- By D. P. Krynine & W. R. Judd, CBS Publishers & Distributors, New Delhi.
4. Engineering Geology for Civil Engineering – By Dr. D. V. Reddy, Oxfard & IBH Publishing Co. PVt. Ltd.,New Delhi.
5. Engineering Geology - By B. S. SathyaNarayanswami,Dhanpat Rai& Co.(P) Ltd, Delhi.
6. A Text Book of Engineering Geology–By R. B. Gupte, Pune Vidyarthi Griha Prakashan, Pune
7. Engineering Geology-By S. Ramamrutham, Dhanpat Rai Publishing company (P) Ltd. New Delhi.
8. Principles of Petrology – By G. W. Tyrrell, B.I.Publication Pvt.Ltd.,New Delhi.
9. Principles of Physical Geology – By A. Holmes, ELBS Chapman & Hall,London.
10. Structural Geology – By M. P. Billings, Prentice Hall of India Private Ltd., New Delhi.
11. Experiments in Engineering Geology – By K. V. G. K. Gokhale & D. M. Rao,TMN, NewDelhi. 12.Groundwater Hydrology- By Todd D. K., John Wiley & Son, New York.

FINAL

T. Y. B.Tech Semester - VI

Academic Year 2019-2020

FINAL

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	Min for Passing	
1	PC	UCVL 0601	Design of Concrete Structure-I	4	1	0	5	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
2	PC	UCVL 0602	Transportation Engineering- I	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
3	PC	UCVL 0603	Geotechnical engineering-II	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
4	PE	UCVL 06**	Professional Elective 1*	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
5	OE	UOEL 06**	Open Elective -1	3	0	0	3	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
6	PC	UCVL 0631	Steel Structure Design Lab	0	0	4	2	ISE	25	10	
								ESE OE	50	20	
7	PC	UCVL 0632	Transportation Engineering- I Lab	0	0	2	1	ISE	25	10	
								ESE OE	50	20	
8	PC	UCVL 0633	Geotechnical engineering-II Lab	0	0	2	1	ISE	25	10	
								ESE OE	25	10	
9	PW	UCVL 0641	Seminar	0	0	2	1	ISE	50	20	
10		UCVL 0661	Industrial Management & Economics (Audit Course)	2	0	0	0	ESE	100	40	
			Total	**18**	**1**	**10**	**22**	**Total Contact Hrs**			**29**

LIST OF PROFESSIONAL ELECTIVES

Sr No	Course Code	Professional Elective I
1	UCVL0621	Water Power Engineering
2	UCVL0622	Transportation And Smart City Planning
3	UCVL0623	GIS And Geo-Informatics
4	UCVL0624	Legal Aspects In Construction Engineering
5	UCVL0625	Advanced Waste Water Management
6	UCVL0626	Advanced Construction Practices
7	UCVL0627	Human Resource Development

FINAL

LIST OF OPEN ELECTIVES

Offered By
CIVIL ENGINEERING DEPARTMENT

OPEN ELECTIVE-1

Sr. No.	Curriculum Component	Course Code	Course Names
1	OE	UOEL0606	Buildings and Occupants
2	OE	UOEL0607	Non-Destructive Testing
3	OE	UOEL0608	Environmental Impact Assessment

Title of the Course:	**Design of Concrete Structure-I**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0601**	**4**	**1**	**-**	**5**

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:

COs	After the completion of the course the student will 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	5	Evaluating
CO3	Analyse and design of various reinforced concrete components for flexure	6	Creating

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	-	2	-	-	2	1	-	1	1	-	1
CO2	1	1	3	1	-	1	-	-	2	2	-	1
CO3	2	-	3	-	-	1	-	-	1	2	-	-

Assessments :

Teacher Assessment:

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

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

- ISE 1 and ISE 2 are based on Tutorial/Assignment/Declared test/Quiz/Seminar/Group Discussions etc.
- MSE: Assessment is based on 50% of course content (Normally first three Units)
- ESE: Assessment is based on 100% course content with60-70% Weightage for course content (Normally last three Units) 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.	**6 Hrs.**
Unit 2: Limit state of collapse (flexure): Analysis and Design of Singly and Doubly Reinforced rectangular sections, singly reinforced T and L beams	**6 Hrs.**
Unit 3: Limit state of collapse (shear, bond and torsion): Shear failure, Types of Shear reinforcement, Design of Shear reinforcement, Bond-types, Factors affecting bond Resistance, Check for development length and Design for torsion. Limit state of serviceability: Significance of deflection, IS recommendations.	**8 Hrs.**
Unit 4:Design of slabs and staircase: Cantilever Slab, Simply supported One way slab, Two way slab with different support conditions as per IS:456-2000 Design of Simply Supported single flight stair and concept of dog-legged/open well staircase.(Numerical on single flight only)	**8 Hrs.**

Unit 5: Analysis and Design of Columns: Axially and eccentrically (uni-axial) loaded circular and rectangular columns, concept of biaxially loaded columns and Interaction diagram, Circular column with links and/orhelical reinforcement	**6 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.	**6Hrs.**

Recommended Textbooks:

1. Limit state theory and Design –Karve and Shah , Structures publications, Pune
2. Reinforced Concrete Design – Limit state - A.K. Jain Nem 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
2. IS 1343: Code of Practice for Prestressed Concrete by Bureau of Indian Standards.

Unit wise Measurable 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:	**Transportation Engineering-I**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0602**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Students must have idea about Road Development in India, and present status of roads, Introduction of Geometric design , pavement Design.

Course Description:

This course will help the students to understand design of Horizontal and Vertical Curves. Types and function of pavement design, stresses in highway pavement, Joints in Pavement.

Course Learning Objectives:

1. Provides clear understanding the importance of transportation and characteristics of road transport and future development of highway and to know about pavement materials and design.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Recall about the history of highway development, classification of roads	1	Remembering
CO2	Design features such as Super-elevation, Sight distance section of road in Cutting and filling.	4	Analyse
CO3	Design of Flexible and Rigid pavementas per IRC.	6	Develop
CO4	Explain Procedures of different layers of Rigid & Flexible Pavement.	2	Understanding

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	--	--	--	--	1	--	--	--	--	--	2
CO2	3	--	2	1	--	--	--	--	--	--	--	2
CO3	3	2	2	1	--	--	--	--	--	--	--	2
CO4	3	3	2	2	--	--	--	--	--	--	--	2

Assessments :

Teacher Assessment:

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

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

- ISE 1 and ISE 2 are based on 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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Highway planning-Classification of roads, brief history of road development in India, present status of roads in India. NHAI, NHDP, PMGSY, MSRDC	**6 Hrs**
Unit 2: Geometric design of highways-Terrain classification, design speed, vehicular characteristics, highway cross-section elements Sight distance: introduction to sight distance, reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance. Design of horizontal alignment: horizontal curves, design of super elevation and its provision, radius at horizontal curves, widening of pavements at horizontal curves, analysis of transition curves. Design of vertical alignment: different types of gradients, grade compensation on curves, analysis of vertical curves, summit curves, valley curves.	**6 Hrs**
Unit 3 : Pavement materials- Stone aggregates: desirable properties, tests, requirements of aggregates for different types of pavements. Bituminous materials: types, tests on bitumen, desirable properties, selection of grade of bitumen. Bituminous mix design: principle, methods, modified binders.	**6 Hrs**

Unit 4: Design of pavements-Types of pavements, functions of pavement components, pavement design factors, design wheel load, equivalent single wheel load, repetition of loads, equivalent wheel load factors, strength characteristics of pavement materials, climatic variation; design steps of flexible highway pavement as per IRC 37-2001 and problems based on CBR method, Design of rigid pavement as per IRC 58-2002, Stresses in rigid highway pavements, , Joints in rigid pavements: transverse joints, longitudinal joints, fillers and sealers.	**6 Hrs**
Unit 5: Highway Construction- Types of roads: WBM, BBM, SDBC, DLC & PQC	**6 Hrs**
Unit 6: Highway Drainage: Significance and requirements, Surface drainage system and Design Examples, subsurface drainage system ,design of filter materials, Types of cross drainage structures ,their choice and location	**6 Hrs.**

Recommended Textbooks:

1 S K Khannaand CEG Justo, "Highway Engineering" ,Nem Chand Bros, Roorkee
2 L R Kadiyali," Highway Engineering", Khanna Publishers ,New Delhi.

References Books:

1 Khanna and Justo, 'Highway Engineering', Nemchand & Bros., Roorkee.
2 Khistry, C.J., 'Transportation Engineering – An Introduction', Prentice Hall of India Ltd., New Delhi.
3 S.K. Sharma, Highway Engineering
4 Partha Chakraborty and Animesh das, Principles of Transportation Engineering, Prentice Hall,
5 Wright, Highway Engineering, 7th Edition WILEY,
6 Relevant IRC codes

Unit wise Measurable Learning Outcomes:

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

1 Explain Classification of roads, road development in India, present status of roads in India.
2 Analyse of safe sight distance, analysis of overtaking sight distance, intersection sight distance. , analysis of transition curves etc.
3 Choose different types materials for pavement and their Mix design
4 Design of Rigid and Flexible pavements.
5 Differentiate between different components of pavements.
6 Choose and adopt proper drainage for highway

Title of the Course:	**Geotechnical Engineering-II**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0603**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Elements of Civil Engineering & Mechanics; Engineering Hydraulics, Structural analysis, Engineering Geology and 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.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive 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**	**PO 10**	**PO 11**	**PO 12**
CO1	1	1	2	--	1	--	--	--	--	--	--	--
CO2	1	2	2	--	1	--	--	--	--	--	-	--
CO3	3	2	1	--	--	--	--	--	--	--	--	--
CO4	3	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 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 with60-70% 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 drilling and sampling, Mechanical properties of rock, behaviour of rocks in uniaxial compression, tensile strength of rocks, Core barrels, Core boxes, core recovery, RQD.	**07 Hrs.**
Unit 2: Bearing Capacity Evaluation & Foundation Settlement 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) and pressure meter tests with detailed procedure.	**07 Hrs.**
Unit 3: Shallow Foundation 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: Pile Foundation 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: Stability of Slope 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	**07 Hrs.**
Unit 6: Well foundations, Caisson, Sheet pile, Coffer Dam 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, Electrokinetic treatment, Jet Grouting, Chemical grouting.RE structure, modern consolidation technique.	**07 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 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.

FINAL

LIST OF PROFESSIONAL ELECTIVES

Sr No	*Course Code*	Professional Elective I
1	UCVL0621	Water Power Engineering
2	UCVL0622	Transportation And Smart City Planning
3	UCVL0623	GIS And Geo-Informatics
4	UCVL0624	Legal Aspects In Construction Engineering
5	UCVL0625	Advanced Waste Water Management
6	UCVL0626	Advanced Construction Practices
7	UCVL0627	Human Resource Development

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Title of the Course:	**Water Power Engineering**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0621**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

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

Course Description:

The course mainly deals with Water Power House structures, their functioning, components, practical application and significance.

Course Learning Objectives:

1. To make the students to be able to know the different means of power generation.
2. To make a student visualize, know and understand the working of Hydro Power Plant.
3. To bring awareness in students about the principles with which any hydro power plant is designed.
4. To expose the students to the sites where water power houses have been implemented.
5. To make the students to be able to compute the hydro power potential of hydro power plants.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Explain different means of power generation.	2	Understanding
CO2	lllustrate the component parts of water power plants.	2	Understanding
CO3	Classify water power plants	4	Analysing
CO4	Assess the water power potential.	5	Evaluating

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	--	--	2	2	--	1	1	--	--	--	--	--
CO2	--	2	--	2	--	--	--	--	--	--	--	--
CO3	--	1	--	--	--	1	2	1	--	--	--	--
CO4	2	--	--	3	--	2	--	--	--	--	2	2

Assessments :

Teacher Assessment:

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

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

- ISE 1 and ISE 2 are based on 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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Introduction : Sources of energy, types of power station, types of hydro power schemes, Estimation of hydro power available, gross head, net head, storage and pondage, hydrographs, mass curves, flow duration curves. Nature of demand: Load curve, load duration curves, load factor, plant capacity factor, plant use factor, firm power, secondary power.	**06 Hrs.**
Unit 2: Intake: Types, Hydraulics of intake, Trash rack, Transition from gate to conduit, Intake gates. Surge Tank : Functions and behaviour of the surge tanks, location, types of surge tanks, basic design criteria of simple surge tank, forebay	**07 Hrs.**
Unit 3: Water Conveyance Systems : Power canals – Hydraulic Design Pen-stock : types , hydraulic design and economic diameter pipe, supports, anchor blocks, Tunnels : classification, location and hydraulic design, tunnel linings.	**07 Hrs.**
Unit 4: Power station : General arrangements of power station, power house, substructure and super structure, main dimensions underground power station – necessity, types, development and economics. Advantages and disadvantages.	**07 Hrs.**

Unit 5: Turbines: Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitation, Tail Race ,draft tubes, function and types, Hydraulic Design	**06 Hrs.**
Unit 6: Storage Plants and Power Station: a). Pumped storage plants: purpose and general layout of pumped storage schemes, types, economics of pumped storage plants. b). Tidal power stations: Classification, general description of different types, depression power plants.	**07 Hrs.**

Recommended Textbooks:

1. Punmia, Irrigation and water power engineering', 1986. Standard Publications, New Delhi.
2. P.N.Modi. Irrigation and water power engineering
3. SatyanarayanMurty, Water resources Engg', New age international private Ltd.

References Books:

1. Water Power Development – E. Mosoni, Vol. I & II
2. Hydro-electric Engineering Practice – G. Brown, Vol. I, II & III
3. Hydro – Electric Hand Book – Creager and Justin
4. Hydro Power Structures – Varshney
5. Water Power Engineering – M. M. Dandekar, Vikas Pub. House PVt. Ltd
6. Water Power Engineering – P. K. Bhattacharya, Khanna Pub., Delhi
7. Water Power Engineering – M. M. Deshmukh, DhanpatRai and Sons
8. Leliavsky, Design of hydraulic structures.

Unit wise Measurable Learning Outcomes:

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

1. Understand the types of hydro power schemes ,
2. Know basic design criteria for intake and surge tank.
3. Design penstock tunnels in economic way.
4. Visualize, know and understand the general arrangements of power station.
5. Compute the water power potential.
6. Understand the working of pumped storage plants and tidal power plants.

Title of the Course:	**Transportation and Smart city Planning**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0622**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Students must have idea about Design, conduct and administer surveys to provide the data required for transportation planning. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.

Course Description:

This course will help the students to understand Organisation of surveys And Analysis, Study Area. Trip Generation Analysis Zonal Models Basic Elements of Transport Networks, Coding ,Route Properties land use planning models, land use and transportation interaction.

Course Learning Objectives:

1. Provides clear understanding on conducting various types of traffic surveys, data collection analysis, interference and presentation.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Design, conduct and administer surveys to provide the data required for transportation planning.	3	Apply
CO2	Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.	4	Analyze
CO3	Develop and calibrate modal split, trip generation rates for specific types of land use developments.	6	Develop
CO4	Adopt the steps that are necessary to complete along -term transportation plan.	5	Appreciate

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	2	--	--	--	--	--	--	1	--	--	3
CO2	3	2	--	--	2	--	--	--	2	--	--	--
CO3	--	1	2	3	2	--	--	--	--	--	--	3
CO4	3	--	--	--	--	--	--	--	--	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 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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Urban transport planning: urban class groups, transportation, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems travel demand, types of transit systems ,public, private, para- transit transport ,mass and rapid transit systems, BRTS and Metro rails, capacity merits and comparison of systems ,coordination, types of coordination	**7 Hrs**
Unit 2: Data Collection And Inventories: Collection of data– Organization of surveys And Analysis, Study Area ,Zoning, Types and Sources of Data ,Road Side Interviews, Home Interview Surveys,	**6 Hrs**
Unit 3 : Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data– Income– Population– Employment– Vehicle OwnerShip.	**7 Hrs**
Unit 4: Trip Generation & Distribution :UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods	**7 Hrs**

Unit 5: Trip Distribution: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling :gravity model, opportunity models	**6 Hrs**
Unit 6: Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding ,Route Properties, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Vo Equilibrium Assignment .Introduction to land use planning models, land use and transportation interaction.	**7 Hrs.**

Recommended Textbooks:

1 Kadiyali. L.R., 'Traffic Engineering and Transportation Planning ',Khanna Publishers, New Delhi.

2 Hutchinson, B.G, 'Introduction to Urban System Planning', McGraw Hill.

3 Khisty C .J., 'Transportation Engineering– An Introduction 'Prentice Hall.

4 Papacostas, 'Fundamentals of Transportation Planning', Tata McGraw Hill.

References Books:

1 Mayer Mand MillerE,'Urban Transportation Planning: A decision oriented Approach ',Mc Graw Hill.

2 BrutonM.J., 'Introduction to Transportation Planning',Hutchins on of London.

3 Dicky,J.W., 'Metropolitan Transportation Planning' ,Tata McGraw Hill.

Unit wise Measurable Learning Outcomes:

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

1 Explain Urban mass transportation systems: urban transit problems travel demand, types of transit systems ,public, private, para- transit transport ,mass and rapid transit systems

2 Analysis, Study Area ,Zoning, Types and Sources of Data ,Road Side Interviews,

3 Analyse Economic data– Income– Population– Employment– Vehicle OwnerShip.

4 Analysis Trip Generation

5 Analysis of Travel demand modeling :gravity model, opportunity models

6 Analysis of Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks

Title of the Course:	**GeoInformatics**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0623**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

- Knowledge of fundamentals of Science, especially physics and basic mathematical ability - trigonometry.
- Good geographical clarity of places
- Basic computer skills and surveying basics

Course Description:

Geoinformatics is the study of science and technology in resonance with the domain of Geography and ICT. It deals with technology that develops and uses surveying, aerial survey, satellite remote sensing infrastructure to address the problems of Geography, cartography, geosciences and other related branches of science and engineering.

Course Learning Objectives:

1. Acquire knowledge of fundamentals of Geoinformatics.
2. Learn the importance of aerial Surveying and satellite remote sensing.
3. Use GPS concepts knowledge for absolute positioning mapping .
4. Trace the evolution of GIS and its components.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Outline the history of aerial photography and Remote sensing	II	Understanding
CO2	Classify Remote sensing satellites and their sensors	II	Understanding
CO3	Compare and use Aerial Survey, remote sensing and GPS data GIS.	IV	Analyzing
CO4	Illustrate the course finer nuances by referring webinar/guest lectures of scientist in the field	II	Understanding (Illustrate)

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	3	-	-	-	-	-	-	2	-	-	
CO2	3	3	-	-	1	-	-	-	2	-	-	-
CO3	3	1	1	2	-	-	-	-	1	-	1	-
CO4	-	1	2	2	3	-	1	-	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 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: 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.	**8 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.	**8__ Hrs**
Unit 3 : Global Navigational satellite System: Introduction to GNSS; Types of GNSS; GNSS satellite; Differential GPS; Sources of GNSS errors; Application of GNSS in surveying, mapping and navigation.	**6__ Hrs**
Unit 4: Remote sensing satellites: Types and their characteristics; Types of Sensors; Orbital and sensor characteristics of major earth resource satellites. Indian remote sensing satellite programme	**6__ Hrs**

Unit 5: GIS: Definition of GIS, History and development of GIS, Components of GIS, Hardwares and softwares, future of GIS. Representation of Geographic features in Raster and Vector data model: Advantages and Disadvantages	**6_ Hrs**
Unit 6: ISRO-IIRS outreach edusat programs with online lectures on Remote Sensing, aerial photography, GNSS and GIS	**8_ Hrs.**

Recommended Textbooks:

1 Jensen, J.R. (2006): Remote Sensing of the Environment: An Earth Resource Perspective (2nd Ed.), Prentice Hall, New Jersey

2 Lillesand, T.M., Kiefer, R.W., and Chipman, J.W. (2007): Remote Sensing and Image Interpretation (6th Ed.). Wiley, New Jersey

3 Reddy, M.A. (2008): Textbook of Remote Sensing and Geographical Information System (3rd Ed.), BS Publications, Hyderabad,

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

Websites:

3 Indian institute of remote sesnig,(IIRS),

4 National Remote Sensing Centre (NRSC), India: http://www.nrsc.gov.in

5 National Aeronautics and Space Administration (NASA), USA: http://www.nasa.gov

6 United States Geological Survey (USGS), USA: http://www.usgs.gov

7 International Society for Photogrammetry and Remote Sensing (ISPRS): http://www.isprs.org

8 Bhuvan: http://www.bhuvan.nrsc.gov.in

9 Wikimapia: http://www.wikimapia.org

Unit wise Measurable 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

FINAL

Title of the Course:	**Legal Aspects In Construction Engineering**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0624**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Students must have some idea about Problems/Dispute occur on Site. General knowledge about legal documentation and Laws.

Course Description:

This Course contains Tender and Contract its importance Documents, Arbitration Act, injunction, Different laws and provisions made under the Act applicable to construction industry, Safety Act and bailment

Course Learning Objectives:

1. To expose the students to Indian Contract and Arbitration act
2. To provide knowledge about bailment
3. To expose the students to Labour laws
4. To provide the knowledge about safety acts

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	List Indian contract act, Arbitration act and contract administration	I	Remembering
CO2	Gain knowledge about bailment and FIDIC	II	Understanding
CO3	Understand the labour laws	III	Applying
CO4	Exposed to safety engineering and relevant acts	V	Evaluating

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	--	1	--	--	--	--	--	1	2	2	--	2
CO2	--	--	--	2	--	--	--	--	--	2	--	--
CO3	--	2	--	--	--	--	--	--	2	2	--	--
CO4	--	--	3	--	--	3	2	--	--	2	--	2

Assessments :

Teacher Assessment:

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

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

- ISE 1 and ISE 2 are based on 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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Construction through Contracts: Types, Critical comparison, bid cycle, tender and contract documents, contract conditions, study of contract documents of FIDIC, State PWD and CPWD	**8 Hrs.**
Unit 2: Arbitration and Award: Indian Arbitration Act, Arbitration Agreement, Conduct of Arbitration, Power and Duties of Arbitration, Rules of Evidence, Preparation and publication of ward, Methods of Enforcement impending and Awards	**7 Hrs.**
Unit 3 : Injunction: Types Temporary, Perpetual, Mandatory when referred. Indemnity and Guarantee : Difference between the two, The Contract of Guarantee and Indemnity, Consideration of Guarantee, Surety's Liability, Discharge of Surety	**5 Hrs.**
Unit 4: Laws Applicable to Construction Industry: Need and Broad provisions of; Workmen's Compensation Act, Payment of Wages Act, Minimum Wages Act, Contract Labour Act, Industrial Disputes Act.	**10 Hrs.**

Unit 5: Safety Engineering : Sources, Classification, Cost of Accident and Injury, Safety Programme, Safety Organization. Employers Liability Act, Employers Insurance Act, Safety and Health Standards Occupations Hazards, personal Protective equipments, preventive measures Factory Act, Fatal accidents.	**6 Hrs.**
Unit 6: Bailment: Nature of Transactions, Delivery of Bailee, care to be taken, Bailee's Responsibility, Termination, Bailment of pledges.	**4 Hrs.**

Recommended Textbooks:

1. Indian arbitration Act by B. S. Patil
2. Indian Contract Act.
3. Safety Engineering, Govt. of India Publicaiton
4. Professional Practice, RoshanNamavati.
5. Legal Aspects of building and Engineering Contracts by B. S. Patil

References Books:

1. Indian contract Act Avatar singh
2. Indian contract Act Jhamb

Unit wise Measurable Learning Outcomes:

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

1. Understand the importance of Tender, Contract and Contract Documents
2. Aware of Indian Arbitration Act
3. Understand the importance of Injunction and its types
4. Understand the provisions made in different laws applicable to Construction Industry.
5. Aware of Safety Act and provisions made under the Act.
6. Understand the importance of Bailment

FINAL

Title of the Course:	**Advanced Wastewater Management**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0625**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

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

Course Description:

Students will understand the advance treatments of water and wastewater such as Basics of Advanced Treatment, Settling & Filtration, Adsorption & Disinfection, Growth Kinetics, Nitrogen & Phosphorous Removal & UASB Design, Chemical Precipitation &Wetlands

Course Learning Objectives:

1. Review basics of conventional treatment and understand need for advanced water and wastewater treatment.
2. understand concepts and design of advanced physico-chemical processes for treatment of water & wastewater.
3. Design kinetics of biological processes for treatment of wastewater.
4. Acquire basics of the fundamental scientific concepts and technical details of Wetland and aquatic treatment systems.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Summarize the need of advanced wastewater treatment.	2	understanding
CO2	Design physico-chemical processes.	3	Creating
CO3	Choose the type of the biological processe.	3	Applying
CO4	Utilize fundamentals of wetland treatment system for wastewater treatment.	3	applying

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	2	2	2	1	--	2	--	--	--	--	--
CO2	--	--	--	2	2	--	3	--	--	--	--	--
CO3	--	--	--	2	2	1	3	--	--	--	--	--
CO4	--	--	--	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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Need & Basics of Advanced Treatment: Review of conventional water treatment, Need for Advanced water and wastewater treatment, Reclamation and reuse of wastewater, Reactors and Reaction Kinetics: Types of Reactions and Reaction Kinetics, Types of reactors and Principles of Reactor Design	**4 Hrs.**
Unit 2: Settling & Filtration: Types of Settling, Hindered and Compression Settling, Filtration: Design and operation of Dual media filter, Head loss calculations in depth filtration Membrane Filtration: Terminology, Process Classification, Membrane configuration, specific membrane problems such as fouling and its control, application of membranes, Electro dialysis: Theory, Disposal of concentrate waste streams.	**8 Hrs.**
Unit 3: Ion Exchange, Adsorption & Disinfection: Ion Exchange: Process, Ion exchange resins, exchange capacity, ion exchange chemistry and reactions, Design of ion exchange units Adsorption: types of adsorption, adsorption isotherms, activated carbon adsorption kinetics, analysis and design of adsorption column, Disinfection with ozone: Chemistry, UV disinfection: System components.	**8 Hrs.**

Unit 4: Growth Kinetics, Nitrogen & Phosphorous Removal & UASB Design Modeling suspended and attached growth treatment processes for biological nitrification and denitrification, Nitrogen Removal by Physical and Chemical Processes, Biological phosphorous removal, Chemical precipitation for removal of phosphorous, anaerobic sludge blanket processes, Design considerations for up flow Anaerobic Sludge Blanket process.	**8 Hrs.**
Unit 5: Chemical Precipitation & Disposal of Contaminants Chemical precipitation for removal of heavy metals and dissolved inorganic substances, Removal of Refractory organics, Removal of dissolved inorganic substances, Ultimate disposal of contaminants	**3 Hrs.**
Unit 6: Wetlands Wetland and aquatic treatment systems; Types, application, Treatment kinetics and effluent variability in constructed wetlands and aquatic systems, Free water surface and subsurface constructed wetlands, Floating and emergent plants, Combination systems, Design procedures for constructed wetlands, Management of constructed wetlands and aquatic systems.	**6 Hrs.**

Recommended Textbooks:

1. Wastewater Engineering treatment and reuse – Metcalf Eddy, Published by TMH.
2. Environmental Engineering – Peavy Row, Published by
3. Physicochemical processes of water purification – W. J. Weber Published by Wiley Interscience
4. Wastewater Treatment for Pollution Control – Soli J. Arceivala, Published by
5. Theory and Practice of Water and Wastewater Treatment – Ronald Droste Published by

References Books:

1. Wastewater manual

Unit wise Measurable Learning Outcomes:

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

1. Understand and apply the reaction kinetics of processes involved.
2. Study & design the settling and filtration system of water treatment.
3. Select a proper process in case of Ion Exchange, disinfection process and adsorption.
4. Apply the UASB principles for UASB design.
5. Apply the advanced disposal methods of contaminants.
6. Understand and design wetland.

Title of the Course:	**Advanced Construction Practices**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0626**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Students must have idea about new materials of construction such as geosynthetics, Epoxy resins, Adhesives, MDF, FRC, FRP, Polymer-based composites.

Course Description:

This course will help the students to understand CONSTRUCTION of power-generation structures, Atomic Power stations, Thermal Power stations, wind-mills. Knowge about Necessity and methods of strengthening, preservation of bridges. and idea about new construction materials.

Course Learning Objectives:

1. Provides clear understanding idea about new materials of construction, Construction of concrete pavement by techniques like vaccum processing, revibrated concrete, Roller –compacted concrete.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Identyfy & understand the Importance of composite construction	2	compare
CO2	Determine the applicability of new construction materials.	1	select
CO3	Understand the need of advanced construction Techniques.	3	apply

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	-	2	-	-	-	-	-	-	-	-	2
CO2	3	2	3	2	3	-	-	-	-	-	-	3
CO3	3	3	2	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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: COMPOSITE CONSTRUCTION: Composite v/s non composite action; composite steel-concrete construction. FORMWORK: Material for formwork, special types of formwork, design of formwork	**7 Hrs**
Unit 2: NEW MATERIAL of construction such as geosynthetics, Epoxy resins, Adhesives, MDF, FRC, FRP, Polymer-based composites.	**7 Hrs**
Unit 3 : LAND RECLAMATION:- Technical progress, Drainage for land reclamation, structural improvement.	**6 Hrs**
Unit 4: CONSTRUCTION of power-generation structures, Atomic Power stations, Thermal Power stations, wind-mills.	**6 Hrs**
Unit 5: Rehabilitation of bridges: Necessity and methods of strengthening, preservation of bridges Retaining structures like diaphragm walls, advanced methods of their construction.	**6 Hrs**

Unit 6:	**8 Hrs.**
Construction of concrete pavement by techniques like vaccum processing, revibrated concrete, Roller –compacted concrete. Use of techniques like slip form paving in pavement construction; using WetMIX macadam in Road. Advanced Techniques, vaccum dewatering in concrete slab construction, Reinforced earth construction, foundation strengthening	

Recommended Textbooks:

1 Developing New Entrepreneurs - Entrepreneurship Development Institute of Formwork design and construction---- Wynn
2 Water power Engineering—Dandekarsharma
3 Bridge Engineering--- Raina
4 Concrete Technology--- M.S. Shetty S.Chand publication

References Books:

1 Handbook of Composite construction Engg--- G.M. Sabanis
2 Formwork design and construction---- Wynn
3 Water power Engineering—Dandekarsharma
4 Bridge Engineering--- Raina
5 Bridge engineering Punnuswamy
6 Concrete Technology--- M.S. Shetty S.Chand publication

Unit wise Measurable Learning Outcomes:

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

1 Differentiate the composite materials, and analysis of design of Form work.
2 Differentiate the Epoxy resins, Adhesives, MDF, FRC, FRP, Polymer-based composites.
3 To understand process of Land Reclamation.
4 Describe various elements of power generation structures and Wind Mill.
5 To interpret Rehabilitation of bridges and Retaining structures.
6 Make a use of techniques of vaccum processing and Slip form and Foundation Strengthening.

FINAL

Title of the Course:	**Human Resource Development**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0627**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Students must have some idea about organization and different position in the organization.

Course Description:

This Course contains objectives and functions of HRD, formulating human resource planning, recruitment and selection procedure, Individual and organizational development through training, employee bents and some legal laws.

Course Learning Objectives:

1. Acquire knowledge of Human Resource Planning
2. To learn current research in HRD.
3. To explain the Employee Management Relations

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	List major contemporary issues affecting HRD.	1	Remembering
CO2	Classify Human Resource Planning	2	Understanding
CO3	Develop Recruitment and Training	3	Applying
C04	Compare Employee Management Relations	5	Evaluating

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	--	2	--	--	--	1	--	--	--	1	--	--
CO2	--	--	--	3	--	1	--	--	2	1	--	1
CO3	--	2	--	3	--	1	--	--	2	3	--	1
CO4	--	--	--	--	--	1	--	--	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 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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Introduction – History of HRD, Objectives, Functions, HRD in Construction industry, status of construction labor.	**6 Hrs.**
Unit 2: Human Resource Planning – Formulating human Resource plans, various methods, job analysis, job specifications and job design in construction projects, forecasting personal needs and supply in construction sector.	**7 Hrs.**
Unit 3 : Recruitment & selection – selecting project manager & project team, external & internal recruitment. Data gathering methods, skill requirement of construction personnel.	**7 Hrs.**
Unit 4: Training & Development: The training Process, Individual and organizational development, change management, performance appraisal, use of performance appraisal information establishing the evaluation system.	**6 Hrs.**
Unit 5: Employee Benefits: Employee health and safety , wage and salary administration, incentive system, wages of construction industry, retirement and pensions.	**7 Hrs.**

Unit 6:	**7 Hrs.**
Employee Management Relations : Collective Bargaining ,basic unions connected with construction & construction industry , trade unions act, labor welfare act, ,payment of wages act ,workers compensation act ,contract labor act management of conflicts.	

Recommended Textbooks:

1. Human resource management Subbarao

References Books:

1. Personnel & Human resource Management – C.B. Mamoria
2. Human Resource Management— Ashwathapa
3. International Human Resource Management--- Gary Diesler

Unit wise Measurable Learning Outcomes:

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

1. Identify the role and importance of Tender HRD in Construction Industry.
2. Aware of Human Resource Planning
3. Study the recruitment and selection procedure.
4. Aware of importance of Training for development of individual and Organizational.
5. Study the Employee benefits, health and Safety requirements
6. Study the legal laws in Construction Industry and Employee-Management relations

FINAL

LIST OF OPEN ELECTIVES			
Offered By **CIVIL ENGINEERING DEPARTMENT**			
OPEN ELECTIVE-1			
Sr. No.	***Curriculum Component***	***Course Code***	***Course Names***
1	OE	UOEL0606	Buildings and Occupants
2	OE	UOEL0607	Non-Destructive Testing
3	OE	UOEL0608	Environmental Impact Assessment

FINAL

Title of the Course:	**Buildings and Occupants**	**L**	**T**	**P**	**Credit**
Course Code:	**UOEL0606**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

NIL

Course Description:

The students will study various aspects of Buildings and relative engineering strategies to make building as a comfort space to live , work and perform routine operations.

Course Learning Objectives:

1. To acquire knowledge about local building byelaws and Techno-legal requirements during procurement for a building
2. To explain the students about various components of climate and their effects on human health while occupying a building.
3. To study the various services offered within a building as a integrated system
4. To understand the use of natural resources during construction and maintenance of a building
5. To acquire knowledge about latest trends in green building technology

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Summarise rules and regulations relevant to building under occupancy	2	Understanding
CO2	Relate adaptive comfort parameters requirement with reference to building	1	Remembering
CO3	Decide systems to be designed for efficient delivery of building services	5	Evaluating
CO4	Decide the material and strategies to be implemented during maintenance phase of building	5	Evaluating
CO5	Apply Green building strategies for existing or proposed buildings	6	creating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	--	--	--	--	--	--	3	--	--	--	--
CO2	2	--	--	--	--	--	--	--	--	--	--	--
CO3	2	3	--	--	1	--	--	--	--	--	--	--
CO4	--	3	3	--	1		3		2	2	--	2
CO5	--	--	3	--	--	3	3	--	--	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 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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Rule and Bye laws laid by Urban development department and relative authorities for Building Projects. Study of Techno legal documents prior to procurement of real estate.	**6 Hrs**
Unit 2: Climate and building orientation, Passive Architecture, Natural ventilation and for Human comfort	**8 Hrs**
Unit 3 : Electrical, Plumbing, HVAC and safety against fire services within building with reference to national Building Code 2016.	**8 Hrs**

Unit 4: Energy audit of a building, planning of electrical and mechanical installations within building for energy conservation. Introduction to Energy Conservation Building Code 2017.	**6 Hrs**
Unit 5: Post occupancy evaluation of Buildings, building maintenance, Introduction to building space valuation.	**6 Hrs**
Unit 6: Introduction to Green building rating system like GRIHA and LEED	**6 Hrs.**

Recommended Textbooks:

1. Climate responsive architecture by Arvind Krishnan
2. Manual of solar passive architecture - by Nayak J.K. R. Hazra J. Prajapati.
3. Energy Efficient Buildings in India by Milli Mujumdar
4. Green Building Materials by Ross Spiegel and Dru Meadows
5. Publications from - CBRI – Roorkee, - IDC – Mumbai, NID – Ahmedabad
6. Solar Energy in Architecture and Urban Planning by Herzog Thomas
7. Energy - Manual for college teachers (CEE publications)
8. construction Practices by Sandip Mantri

References Books:

1. LEED Criteria MANUALS AND GUIDES.
2. GRIHA Manuals by TERI
3. National Building Code 2016
4. Development Control Regulations by Government of Maharashtra
5. Energy Conservation Building Code 2017

Unit wise Measurable Learning Outcomes:

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

1. Study of Building bye laws and regulations
2. Study of climatic parameters influencing building design
3. Design of building services like Plumbing electrification
4. Evaluating energy performance of building
5. Study of green building rating system.

FINAL

Title of the Course:	**Non-Destructive Testing**	**L**	**T**	**P**	**Credit**
Course Code:	**UOEL0607**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Basic Civil Engineering.

Course Description:

The course focuses on hardness testing methods and dynamic non-destructive methods which a student learns in this course. Tests will be carried out under laboratory conditions and in situ. The basic material is concrete, masonry construction, steel reinforcement.

Course Learning Objectives:

1. To impart knowledge of defects in concrete structures.
2. Overview of non-destructive testing methods.
3. Characteristics of non-destructive hardness testing methods: principles, useful instruments, reports on the results.
4. Characteristics of non-destructive ultrasonic pulse method: principles, useful instruments, reports on the results.
5. Characteristics of non-destructive resistivity method: principles, useful instruments, reports on the results.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	**List** and define different defects that occur in concrete. Compare destructive and non-destructive testing.	1	Remembering
CO2	**Identify** the types of equipment used for each Non-Destructive Testing of concrete.	3	Applying
CO3	**Explain** the purpose of the Equipment, Application, and standard techniques required to perform major non-destructive Testing of concrete.	2	Understanding

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	1	1	1	3					1		2
CO2	3	1	1	2	3					1		2
CO3	3	1	1	3	3					1		2

Assessments :

Teacher Assessment:

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

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

- ISE 1 and ISE 2 are based on Tutorial/Assignment/Declared test/Quiz/Seminar/Group Discussions etc.
- MSE: Assessment is based on 50% of course content (Normally first three Units)
- ESE: Assessment is based on 100% course content with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Introduction: Importance and need of non-destructive testing, Basic methods for NDT of concrete structures, manufacturing processes and defects of concrete structures, Composition of concrete, Properties of concrete and their control, Discontinuities and defects in concrete structures, NDT for situ concrete, Testing of concrete, Partial destructive tests, Other Comparison of NDT, The need for quality and quality control. Tools and equipment for visual inspection, procedure, applications, sketches of typical defects found.	**6 Hrs**
Unit 2: ULTRASONIC TESTING: Pulse velocity, principle, applications, procedure, factors influencing, , defects, Developments in ultrasonic tomography, Ultrasound pulse echo, Thickness measurement of concrete slabs with one sided access , Impact-echo/resonance frequency/stress wave test, principles, Equipment for impact-echo testing, applications. Range and limitations . Velocity versus rebound number curves, Accuracy of measurement of concrete properties using velocity rebound number curves.	**4 Hrs**
Unit 3 : SCHMIDT REBOUND HAMMER TEST: Fundamental, Equipment for Schmidt/rebound hammer, procedure, application, range and limitations. **CORE TEST:** diameter, length, number of core, Testing procedure, IS code recommendations, Equipments.	**6 Hrs**

Unit 4: **CARBONATION DEPTH MEASUREMENT TEST:** Fundamental principle, Equipment, procedure, Range and limitations. **PENETRATION RESISTANCE OR WINDSOR PROBE TEST:** Fundamental principle, Equipment , procedure applications, formwork removal as a substitute for core testing, advantages and limitations.	**6 Hrs**
Unit 5: **RESISTIVITY MEASUREMENT**: Fundamental principles, Equipment, procedure, Applications. **HALF-CELL ELECTRICAL POTENTIAL METHOD:** Fundamental, Equipment, procedure, range and limitations.	**5 Hrs**
Unit 6: **CORROSION TEST ON REINFORCEMENT:** principle, Equipment, procedure, Range and limitations. **REBAR LOCATOR:** principle, Equipment, procedure, Range and limitations.	**5 Hrs.**

Recommended Textbooks:

1. Guidebook on non-destructive testing of concrete structure, INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 2002.

References Books:

1. IS:516-1959(Reaffirmed in 1999).
2. USBR, Concrete Manual
3. Testing of Concrete in Structures: John H. Bungey, Stephen G. Millard & Michael G. Grantham, Taylor & Francis Publication

Unit wise Measurable Learning Outcomes:

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

1 Overview of non-destructive testing methods, Identify the defects in concrete, necessity of non-destructive test on concrete.

2 Use ultrasonic testing of concrete.

3 Do rebounds hammer test and core test permeability test.

4 Know and measure carbonation of concrete, do Windsor probe test.

5 Measure resistivity of concrete.

6 Use half-cell electrical potential method, corrosion of rebar.

FINAL

Title of the Course:	**Environmental Impact Assessment**	**L**	**T**	**P**	**Credit**
Course Code:	**UOEL0608**	**3**	**-**	**-**	**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.

Course Description:

Environmental impact assessment is a planning process that aims to predict, evaluate and mitigate the impact on the environment of a proposed project, program or policy priorities commencement, and to approve only environmentally acceptable undertakings. EIA is hence a mechanism for avoiding or mediating some of the potential costs of development. The purpose of this course is to help students develop a comprehensive and critical understanding of the theory and practice of EIA in the world including Central Asia countries. The course examines EIA in general and in specific jurisdictions. It also examines the technical and policy issues involved in the production and the appraisal of environmental impact assessments. Using a broad definition of "environment", various components of EIA are addressed, with an emphasis on principles, legal and institutional frameworks, stages in the process, and specific analytical techniques. Additionally, the course will focus on the ecology of human societies and the social impact of development on communities and regions.

Course Learning Objectives:

1. To provide a basic understanding of the EIA process as it is used for research, planning, project or program evaluation, monitoring, and regulatory enforcement.
2. To introduce students to the legal, economic, social, administrative and technical process of preparing and/or evaluating environmental impact documents.
3. To relate the uses of scientific research to practical situations in project planning and decision making.
4. To provide experience and training in environmental planning and related professions.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Evaluate environmental impact statements or comparable document for completeness and adequacy.	5	Evaluate
CO2	Prepare portions of environmental documents through administrative and legal requirements and standards of professional practice.	3	Applying
CO3	Fully participate in interdisciplinary environmental report preparation teams.	6	Combine
CO4	Utilize EIA documents for policy development, project planning or for legal or political action planning.	4	Applying

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	--	2	--	3	1	2	3	--	--	--	2	1
CO2	3	2	2	3	1	3	3	1	--	--	2	1
CO3	--	--	2	1	--	--	--	--	3	1	1	1
CO4	1	-1	3	3	--	--	3	--	--	--	2	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 with60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:	
Unit 1: INTRODUCTION Impact of development projects – Sustainable development- Need for Environmental Impact Assessment (EIA) – Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA-Stages of EIA, Types of EIA.	**05 Hrs.**
Unit 2: METHODOLOGIES Methods of EIA – Check lists – Matrices – Networks – Cost-benefit analysis of alternatives	**09 Hrs.**
Unit 3: PREDICTION AND ASSESSMENT Assessment of Impact on land, water, air, social & cultural activities and on flora & fauna- Mathematical models- Public participation	**06 Hrs.**
Unit 4: ENVIRONMENTAL MANAGEMENT PLAN Plan for mitigation of adverse impact on environment – Options for mitigation of impact on water, air, land and on flora & fauna –	**06 Hrs.**
Unit 5: Addressing the issues related to the Project Affected People. Post project monitoring	**03 Hrs.**
Unit 6: CASE STUDIES EIA for infrastructure projects – Dams – Highways – Multi-storey Buildings Water Supply and Drainage Projects – Waste water treatment plants, STP.	**08 Hrs.**

Recommended Textbooks:

1 Canter, R.L., "Environmental Impact Assessment", McGraw Hill Inc., New Delhi, 1996.

2 Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

References Books:

1 John G. Rau and David C Hooten "Environmental Impact Analysis Handbook", McGraw Hill Book Company, 1990.

2 "Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991.

3 Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999

Unit wise Measurable Learning Outcomes:

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

1 Understand EIA.
2 Study methods and analysis of EIA.
3 Assess the impacts on various natural and manmade structures.
4 Analyze the adverse effect on environment.
5 Carry out post project assessment.
6 Carry EIA of various important structures.

FINAL

Title of the Course:	**Steel Structures Design Lab**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0631**	**-**	**-**	**4**	**2**

Course Pre-Requisite:

Design of steel structures

Course Description:

This course introduce 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:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	**Analyse** various types of steel structures as per Indian Standard codes.	5	Analysing
CO2	**Evaluate** design forces in members of steel structures by hand calculations.	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**	**PO 10**	**PO 11**	**PO 12**
CO1	3	3		2	2				2			2
CO2	2	2	1	1					1			2
CO3	2	2	3		2				3	3	1	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	50

- 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 anlaysis, 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.

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 sheets.
   b) Design of building including primary and secondary beams, column, column base and connections. One full imperial size drawing sheets.
   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, Stuctures 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
6 International Publishing House, New Delhi
7 Limit state design in structural steel: Dr. M. R. Shiyekar, PHI publications.

References Books:

1 IS: 800 – 2007, IS: 875 (part I to V), SP6 (1) & SP 6 (6)(1995), IS: 816, IS: 808-1989.
2 LRFD Steel Design: William T. Segui, PWS Publishing
3 Design of Steel Structures: Edwin H. Gaylord, Charles N. Gaylord James, Stallmeyer, Mc-Graw-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 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:

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

FINAL

Title of the Course:	**Transportation Engineering-I Lab**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0632**	**-**	**-**	**2**	**1**

Course Pre-Requisite:

Students must have idea about desirable properties and requirements of aggregates & Bituminous materials as per IRC.

Course Description:

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

Course Learning Objectives:

1. Provides clear understanding on conducting various types of different test on aggregates and Bituminous materials and importance of IRC requirements.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Compare the properties of aggregates to IRC recommendations	3	Identify
CO2	Know stress in highway pavements	2	Define
CO3	Conduct CBR test and Bituminous mix design	3	Inspect

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	-	1	-	-	-	-	-	-	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	2
CO3	3	3	2	3	-	-	-	-	-	-	-	

Assessments :

Teacher Assessment:

- Two components of Course Evaluation

Assessment	Marks
ISE	25
ESE OE	25

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

Course Contents:

Experiment 1: Aggregate Impact Value	
Experiment 2: Los Angles Abrasion Test	
Experiment 3 : Crushing test of aggregate	
Experiment 4: Bitumen Penetration	
Experiment 5: Softening Point	
Experiment 6: Flash Point and Fire Point Test	
Experiment 7: Ductility test	
Experiment 8: Viscosity of bitumen	
Experiment 9: Flash Point and Fire Point Test	
Experiment 10: Stripping value	

Recommended Textbooks:

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

References Books:

1. Khanna and Justo, 'Highway Engineering', Nemchand & Bros., Roorkee.

Unit wise Measurable Learning Outcomes:

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

1. Evaluate the resistance of Impact of aggregates.
2. Measure the ease or difficulty with which aggregate particals will deteriorate under the action of traffic.
3. Find relative measure of resistance to crushing under gradually applied compression load.
4. Determine the consistency of material and grade the bituminous material.
5. Determine the softening point .
6. Find Flash and Fire point of bituminous binder.
7. Examine ductility value of bituminous binder.
8. Identify viscosity of bituminous binder.
9. Determine Flash and Fire point of Bituminous binder
10. Determine stripping value of road aggregates.

FINAL

Title of the Course:	**Geotechnical Engineering- II Lab**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0633**	**-**	**-**	**2**	**1**

Course Pre-Requisite:

Elements of Civil Engineering & Mechanics; Engineering Hydraulics, Structural analysis, Engineering Geology and 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:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Explain the suitability of different soil exploration methods and various types of foundations.	2	Understanding
CO2	Illustrate the basic information about modern foundation and types of coffer dam	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	PO 10	PO 11	PO 12
CO1	1	1	2	2	1	--	--	--	--	--	--	--
CO2	1	2	2	2	1	--	--	--	--	--	--	--
CO3	3	2	1	2	--	--	--	--	--	--	--	--
CO4	3	1	1	2	--	--	--	--	--	--	--	--

Assessments :

Teacher Assessment:

- Two components of Course Evaluation

Assessment	Marks
ISE	25
ESE OE	25

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

Course Contents:

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.
1. 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 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.

Title of the Course:	**Seminar**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0641**	**-**	**-**	**2**	**1**

Course Description:

This course is aimed at developing the skills like literature review, identification, analysis and presentation of issues in societal context in general and Civil Engineering perspective in particular. This course shall provide an opportunity to the student to develop self-learning, critical thinking and communication skills.

Course Learning Objectives:

1 To develop the student to apply the knowledge gained to solve the complex engineering problem.
2 To develop the student for the Self study and self learning ability.
3 To motivate students to think about real life problems and ideas

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Analyze the complex engineering problem	4	Analyzing
CO2	Study and prepare the solution for engineering problems.	5	Evaluating
CO3	Justify the relevance and importance of the seminar topic with current technology with proper presentation.	4	Analyzing

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	--	2	1	1	--	--	2	1	--	--	--
CO2	2	2	--	3	--	--	--	--	--	--	--	--
CO3	1	--	--	--	3	--	--	--	--	3	--	--

Assessments :

Teacher Assessment:

- ISE is based on performance of student in laboratory, experimental write-up, presentation, oral, and test (surprise/declared/quiz). The course teacher shall use at least two assessment tools as mentioned above for ISE.

Assessment	Marks
ISE	50

Course Contents:	
1. Seminar shall be delivered on one of the advanced topics chosen in control systems in consultation with the guide after compiling the information from the latest literature and other sources. 2. The concepts must be clearly understood and presented by the student. All modern methods of presentation should be used by the student. 3. A hard copy of the report (25 to 30 pages A4 size, 12 fonts, Times New Roman, single spacing both side printed, preferably in IEEE format) should be submitted to the Department before delivering the seminar. 4. A PDF copy of the report in soft form must be submitted to the guide along with other details if any.	
The topic for the Seminar shall be related to Civil Engineering areas such as	
Structural Engineering, Concrete Technology, Environmental Engineering, Geotechnical Engineering, Transportation Engineering, Infrastructural Engineering, Water Resources Engineering, Town & Country Planning, Construction Engineering, Surveying & Remote Sensing Techniques, Project Management, Legal Aspects in Civil Engineering, Earthquake Engineering, Disaster Management etc.	

FINAL

Title of the Course:	**Industrial Management & Economics (Audit Course)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0661**	**2**	**-**	**-**	**2**

Assessments :

Teacher Assessment: NOT APPLICABLE

Course Contents:

Unit 1: Engineering Economics: Introduction, Importance, Time value of Money, Mathematics of Interest – present worth, future sum, uniform series factors.	**5 Hrs.**
Unit 2: Economic Comparisons: Equivalent Annual Cost Method, Present Worth Method, Future Worth Method, Capitalized Cost Method, Net Present Value.	**8 Hrs.**
Unit 3 : Economic Comparisons: a). Rate of Return Method, Pat-Back Method, Benefit Cost Ratio b). Break Even Analysis	**5 Hrs.**
Unit 4: Resource Management: Material Management – Objectives, Functions Inventory Control – Necessity, Techniques such as ABC, EOQ, Safety Stocks.	**5 Hrs.**
Unit 5: Retirement and Replacement: Introduction, Factors for Replacement, Cost of Owning and Operation a Construction Equipment.	**5 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	**5 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

FINAL