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

Final Year B.Tech. Civil Engineering

Academic Year 2020-2021

Under Graduate Programme

Approved in BoS Meeting on 25.06.2020

Submitted to Academic Council for Approval

INDEX

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	1	0	4	ISE-I	10		40
								ISE-II	10		
								MSE	30		
								ESE	50	20	
3	PC	UCVL 0703	Structural Dynamics and Earthquake Engineering	3	0	0	3	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 Lab	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	Internship & 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**

Special Note:

1. The students have to undergo internship at field (Site Work, Office Work, Research etc.) after Semester VII
2. The duration of internship shall be minimum of 6 weeks to maximum of 8 weeks
3. The assessment of internship shall be done during Semester VIII (In Project Phase II, ISE-I), for assessment of internship, students are required to present their work and submit the report.

Load Calculation for Project Phase-I and Phase-II (As Per AICTE and Shivaji University Guidelines):

1. Phase-I : Minimum load is 1 Hr./Week for one group of Four to Five Students.
2. Phase-II : Minimum load is 2 Hrs./Week for one group of Four to Five Students.

LIST OF OPEN ELECTIVES			
Offered By **CIVIL ENGINEERING DEPARTMENT**			
OPEN ELECTIVE-2			
1	OE	UOEL0706	Remote Sensing and GIS, GPS
2	OE	UOEL0707	Watershed Management

LIST OF PROFESSIONAL ELECTIVES

Sr No	*Course Code*	Professional Elective 2
1	UCVL0821	Structural Design & Drawing of Foundation & Retaining Wall
2	UCVL0822	Advanced 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

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	Advanced Hydrology
7	UCVL0877	Geoenvironmental Engineering
8	UCVL0878	Industrial Waste Treatment

Title of the Course:	**Quantity Surveying and Valuation**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0701**	**3**	**1**	**-**	**4**

Course Pre-Requisite:

Building Material, Building Planning, Surveying, RCC Detailing.

Course Description:

Preparation of Tender and Contract Document

Course Learning Objectives:

1. To choose types of Estimate & Specification as per requirement of Government & Private Organization.
2. To develop Bill Of Quantities, Rate analysis , Bar Bending Schedule for Building and other structure
3. To create tender & contract document.
4. To understand valuation types and depreciation methods.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	To understand valuation types and depreciation methods.	2	Understand
CO2	Choose types of Estimate & Specification as per requirement of Government & Private Organization.	3	Apply
CO3	Develop Bill Of Quantities, Rate analysis , Bar Bending Schedule for Building and other structure	6	Create
CO4	Create tender & contract document.	6	Create

CO-PO Mapping:

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

Course Contents:

Unit 1: Introduction General introduction to Quantity surveying – purpose of estimates. Administrative approval and technical sanction to estimates. Principles in selecting units of measurement for items, various units. Modes of measurement for different items. Specification-purpose and basic principle of general and detailed specification (writing the detailed specification for various constructions should be covered in term work).Types of Estimates, Various items to be included in estimates.	**8 Hrs.**
Unit 2: Estimation Prime cost, provisional sums and provisional quantities, taking out quantity – Long wall - short wall, centre line method. Measurement and abstract sheets and recording. I.S. 1200 and its Part .DSR: introduction, How to use D.S.R in preparation of BOQ. Bill of Quantities (BOQ). Detailed estimate of buildings.	**8 Hrs.**
Unit 3 : Rate Analysis Analysis of rates, factors affecting the cost of materials, labour. Task work, schedule as basis of labour costs. Plants and equipment – hour costs based on total costs and outputs. Transports, Overhead charges. Rates for various items of construction of civil engineering works. Standard schedule of rate, price escalation and Extra item and its billing.	**8 Hrs.**

Unit 4: Bar Bending Schedule, Other works and Approximate estimates. a) Preparation of Bar Bending Schedule for RCC foundation, column, Beam, Slab (one way, two way and Cantilever), Chajja and Lintel, Staircase. b) R.C.C works, culverts, earthwork for canals. Roads including hill roads and other civil engineering works. c) Approximate estimates, purpose, various methods used for buildings and other civil engineering works such as bridge, water supply, drainage, road project, school buildings, industrial sheds.	**6 Hrs.**
Unit 5: Tender and Contract Tender and Contracts, Types of Contracts, Essentials of legally valid contract. Contract between Engineer & Employers, Contract between Employer & Contractor, Appointment & authority of Engineer for execution of civil construction works, Category of contractor. Tender document- List of Tender document, invitation of tenders. Instruction to bidder, Tender notice, Condition of Contract, form of Tender, Schedule A, B and C. Tendering Process: Submission and envelop method. Scrutiny and acceptance, Opening of Tender. Award of jobs and Termination of Contract. E tender .Extra work and items, penalty and liquidated charges, Settlement of disputes, R.A. Bill and Final Bill, Payment of advance, insurance, claims. Introduction to non conventional contract such as B.O.T, B.O.O.T, B.O.L.T. Introduction to Indian Arbitration and conciliation Act 1996.	**4 Hrs.**
Unit 6: Valuation a) Principles of valuation, definition of value, price and cost. Attributes of value, Different types of values. Essential characteristics of market value. Valuer and his duties, purpose of valuation and its function. Factors affecting the valuation, Landed properties- free hold and leasehold properties, different types of lease. Valuation from yield and from life, gross yield and net yield, outgoing, capitalized value, Year's purchases-Single rate and dual rate, reversion value of land, annuity-perpetual, deferred. **b)** Valuation methods: a) Rental method of valuation. Form of rent, different types of rent, standard rent. b) Value of land, belting method of valuation, Valuation based on land and building. c) Development method of valuation for building estate. d) Valuation on profit base. e) Comparison method. f) Depreciation, different methods of calculating depreciation – straight line method, declining balance method, sinking fund method, quantity survey method. Depreciated cost, Obsolescence.	**6 Hrs.**

Recommended Textbooks:

1. Estimating and Costing – Dutta. Dhanpat Rai & Sons. 1682, Nai Sarak, Delhi-110006
2. Estimating and Costing – Birdi Dhanpat Rai & Sons 1682, Nai Sarak, Delhi- 110006
3. Estimating, Costing and Specification in civil engineering – Chakroborty M.21b, Bhabananda.
4. Elements of Estimating and Costing – S. C. Rangwala. Charotar Publishing house- Opp Amul Dairy court road Anand.388001 (west rly) India.
5. Civil Engineering Contracts and Estimates – B. S. Patil. Universities Press Private Ltd. 3-5-819 Hyderguda, Hyderabad. 500029(A.P), India.
6. Standard specifications Volumes I & II (P. W. D. Maharashtra) Govt. of Maharastra
7. Professional Practice (Estimating and Valuation) – Roshan Nanavati (1984 Edition)U.B.S. Publishers, Distributers PVT.Ltd
8. Valuation of real Properties – S. C. Rangwala Charotar Publishing Houseopposite Amul dairy, court Road Anand. 388001.India

References Books:

1. The A To Z of Practical Building Construction and its Management- Sandeep Mantri ,Satya Prakashan, New delhi.
2. C.P.W.D. specifications
3. C.P.W.D. schedules of rates
4. M.J.P. schedules of rates
5. W.R.D. schedules of rates

Unit wise Measurable Learning Outcomes:

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

1. Student will able to choose types of Estimate & Specification
2. Student will able to study and use Bill of Quantities ,IS 1200,DSR and Standard Specification
3. Student will able to develop, Rate analysis,
4. Bar Bending Schedule for Building and Estimation of other structure.
5. Student will able to understand Tender and Contract and its Types
6. Student will able to Valuation Methods

Title of the Course:	**Construction Project & Management**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL 0702**	**3**	**1**	**-**	**4**

Course Pre-Requisite:

Industrial Management & Economics

Course Description:

Construction Project & Management forms a core subject which is taught to students of all non-circuit disciplines of engineering. The study of this subject is aimed at developing a thorough understanding of the Construction Project & Management applications to solve engineering problems.

Course Learning Objectives:

1. To explain the important of Project Management and Project Planning.
2. To explain the Safety Engineering.
3. To explain the Mechanical v/s manual construction

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Understand the importance of Project Management tools.	II	Understand
CO2	Develop Plan and Schedule the Project by using CPM, PERT and MSP.	VI	Develop
CO3	Importance of working of various construction equipments.	V	Importance
CO4	Apply Safety and Risk Management in Construction and work study	III	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	2
CO2	-	2	1	2	1	-	-	-	2	2	2	-
CO3	-	-	-	1	-	-	-	-	2	2	2	-
CO4	-	1	-	1	-	2	1	-	2	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: a) Project Management – Objectives, Agencies, Phases; Work Breakdown Structure. b) Project Planning - Bar Chart, Mile Stone Chart, CPM c) Development of CPM Network – Time Estimates, Floats, Critical Path. d) Network Updating	**8 Hrs.**
Unit 2: a) PERT - Concept of Probability, Normal and Beta Distribution, Time Estimates, Slack, Probability of Project Completion b) Precedence Network: Concept only. c) Introduction to Management Software- MSP.	**8 Hrs.**
Unit 3 : a) Safety Engineering – Importance of Safety, Classification of Accidents, Causes of Accidents, Safety Policy, Safety Organization, Safety Plan, Safety Training, Various Safety Equipment used on site. b) Risk Management –Definition, Types, Risk Identification Process, Sources of Risk, Risk Classification, Risk Mitigation- Risk Reduction, Risk Acceptance, Risk Avoidance.	**4 Hrs.**

Unit 4: Mechanical v/s manual construction, Excavation in Earth: Earth moving equipment- Tractors, Bulldozers, Scrappers, Power shovel, Hoes, Drag line, Clamshell, Trenchers, Compactors, Tippers, Cranes. Excavation in hard rock: Rippers, Jack Hammers, Drills, Compressors and Pneumatic Equipment.	**10 Hrs.**
Unit 5: Work Study: a) Definition, Objectives, basic procedure, method study and work measurement, Work study applications in Civil Engineering. b) Method study – Definition, Objective, Procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, string diagrams. c) Work measurement – Time and motion studies, Concept of standard time and various allowances, time study, equipment performance rating. Activity sampling, time-lapse.	**6 Hrs.**
Unit 6: Site mobilization – demobilization aspects, various Resources management based on funds availability, coordinating, communicating & reporting Techniques, Training for Construction Managers, Engineers , Supervisors	**4 Hrs.**

Recommended Textbooks:

1. Project Planning and Control with PERT and CPM – Dr. B. C. Punmia and K. K. Khandelwal.
2. PERT and CPM: Principles and Applications – L. S. Srinath
3. Construction Project Management – K. K. Chitkara
4. Construction Engineering and Management – S. Seetharaman.
5. Construction planning equipment and methods—R.L. Peurifoy
6. Heavy Construction – Planning ,Equipment, Methods—Jagman Singh

References Books:

1. Construction Project Management – Kumar Neeraj Jha .
2. Construction Safety Manual Published by National Safety Commission of India.

Unit wise Measurable Learning Outcomes:

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

1. Understand the importance of Project Management.
2. Aware of PERT.
3. Understand the importance of Safety Engineering and Risk Management.
4. Understand the provisions made in Mechanical v/s manual construction.
5. Understand the importance of Work Study.
6. Understand the importance of Site mobilization – demobilization aspects.

Title of the Course:	**Structural Dynamics and Earthquake Engineering**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL 0703**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Engineering Mathematics, Structural Mechanics, Engineering Geology

Course Description:

This course makes students aware of causes & effects of earthquake on structures. The method of evaluation of lateral loads & design for the same is also discussed for RC & masonry buildings.

Course Learning Objectives:

1. To make students aware of the importance of earthquake engineering in civil engineering problems.
2. To introduce the basic principles of structural dynamics & their applications.
3. To explain lateral load evaluation & earthquake resistant design principles for RC & masonry buildings.
4. To introduce the modern techniques used to improve seismic performance of structures.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Illustrate the causes & effects of an earthquake.	2	Cognitive
CO2	Explain role of planning & other modern techniques in earthquake resistant design.	2	Cognitive
CO3	Apply the functional role of ductility in earthquake resistant design of RC & masonry buildings.	3	Cognitive
CO4	Solve different vibrating systems to find response by using fundamental laws of vibrations.	3	Cognitive
CO5	Evaluate lateral loads due to earthquake on multistory buildings by using IS 1893 (Part-1): 2016.	4	Cognitive

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	-	-	-	-	1	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	1	-	1	-	1
CO3	-	-	-	-	-	2	-	-	-	1	-	1
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	2	-	-	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: Engineering Seismology Elements of seismology – terminologies, internal structure of earth, causes of an earthquake, plate tectonic theory, continental drift theory, elastic rebound theory, seismic waves, Measurement of Earthquake - magnitude and intensity, energy released, seismograph, accelerogram. Strong motion earthquakes, Past earthquakes of India, Seismic zoning of India.	**5 Hrs.**
Unit 2: Introduction to Theory of Vibrations Fundamentals, Mathematical modeling, Damping Formation of Equation of motion & solution - Free and forced vibrations (harmonic loading) of single degree of freedom systems. Undamped and viscously damped vibrations, Resonance Earthquake response of SDOF system	**8 Hrs.**
Unit 3: Earthquake Load Calculations Earthquake response spectrum, tripartite spectrum, construction of design response spectrum Planning aspects, Load path, Stiffness and strength distribution, Lateral load resisting structural systems, Liquefaction and settlement. Evaluation of seismic force for a regular building as per Indian standards (Equivalent Static Load Method), Drift & its Limitations Rigid & Flexible Diaphragm	**8 Hrs.**

Unit 4: Earthquake Resistance Design Principles Design philosophy, Behavior of RC building, Role of ductility Ductile detailing of all structural members and joints as per IS 13920, Design of Shear Wall.	**8 Hrs.**
Unit 5: Masonry Structures Behavior of unreinforced masonry and reinforced masonry, RC bands, vertical reinforcement, openings, Provisions of I.S. 4326. Repair, Strengthening & Retrofitting Techniques	**6 Hrs.**
Unit 6: Earthquake resistant modern techniques Introduction to Earthquake resistant modern techniques – Base Isolation - Elastomeric, Sliding, Combined. Seismic Dampers - Friction Dampers, Tuned Mass Dampers, Visco elastic dampers.	**5 Hrs.**

Recommended Textbooks:

1. Dynamics of Structures-Theory and Applications to Earthquake Engineering by A.K. Chopra – Prentice Hall Publications.
2. Earthquake Resistance Design of Structure – S. K. Duggal , Oxford Uni. Press
3. Earthquake Engineering by Manish Shrikhande
4. Mechanical Vibrations – G. R. Grover Roorkee University, Roorkee.
5. Analyses and Design of Foundations for Vibrations – P. J. Moove. Oxford and I. B. H. Publication, Delhi
6. Foundation Design Manual – N. V. Nayak, Dhanpatrai and sons, Delhi
7. Manual of Earthquake Resistant Non engineering Construction, University of Roorkee
8. Elements of Earthquake Engineering – Jai Krishna, South Asian Pub.New Delhi
9. Earthquake Resistant, Design of Masonry and Timber Structures – A.S. Arya
10. Elements Seismology – Rochter
11. Earthquake Resistant Design of R. C. C. Structures – S. K. Gosh
12. Earthquake Resistance Design of Structure – Vinod Housr, Willey Publication
13. IS 1893-2016 –Part I,IS 13920 and 4326.
14. Government of Maharashtra Earthquake resistant Design of house guiding lines and assessment of damages.
15. EQ Tips BMTPC, IITK.

References Books:

1. Structural Dynamics - Mario Paz CBS Publication
2. Earthquake Resistant Structures –D.J. Dowrick John Wiely Publication
3. Dynamics of Structures – R. M. Clough and Ponian ,McGraw Hill co.New Delhi

Unit wise Measurable Learning Outcomes:

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

1. Explain the basic elements of seismology.
2. Determine the response of different vibrating systems.
3. Calculate earthquake forces on a building using IS 1893 (Part-I): 2016.
4. Explain the conceptual design aspects & detailing of structures using codal provisions.
5. Describe seismic behavior of masonry structures & its repair & strengthening.
6. Illustrate the modern techniques to improve seismic performance of structures.

LIST OF OPEN ELECTIVES			
Offered By **CIVIL ENGINEERING DEPARTMENT**			
OPEN ELECTIVE-2			
1	OE	UOEL0706	Remote Sensing and GIS, GPS
2	OE	UOEL0707	Watershed Management

Title of the Course:	**Remote Sensing GIS and GPS**	**L**	**T**	**P**	**Credit**
Course Code:	**UOEL0706**	**3**	**0**	**0**	**3**

Course Pre-Requisite:

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

Course Description:

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

Course Learning Objectives:

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

Course Outcomes:

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 the data capturing techniques of Aerial Survey, remote sensing and GPS data GIS.	IV	Analyzing
CO4	Apply GIS technology for the extraction of information from various data sources	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 Positioning System : Introduction to GPS; Types of GPS; GPS satellite; Differential GPS; Sources of GPS errors; Application of GPS 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, Hardware's and software's, future of GIS. Representation of Geographic features in Raster and Vector data model: Advantages	**6 Hrs.**

and Disadvantages	
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 sensing,(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

Title of the Course:	**Watershed Management**	**L**	**T**	**P**	**Credit**
Course Code:	**UOEL0707**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

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

Course Description:

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

Course Learning Objectives:

1. To make the students to be able to know the beneficial uses of water resources and other related resources are sustained
2. To make a student To appropriately manage other resources that impact on water, such as land.
3. To expose the students to the sites where water power houses have been implemented.
4. To make the students to be able to know social and economic development depends on Watershed Management and also To maintenance of biodiversity

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Identify and analyze the impact of Watershed Management on social and economic development	1	Identify
CO2	Relate the Watershed Management development of the economic and human resources through employment and income generating activities	4,6	analyze development
CO3	extend knowledge in watershed management is to maintain the social, economic and ecological watershed functions	4	extend
CO4	to develop society with environments consideration and conserving water quality standards	6	develop

CO-PO Mapping:

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

Assessments :

Teacher Assessment:

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

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

- ISE 1 and ISE 2 are based on Tutorial/Assignment/Declared test/Quiz/Seminar/Group Discussions etc.
- MSE: Assessment is based on 50% of course content (Normally first three Units)
- ESE: Assessment is based on 100% course content with 60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Introduction and basic concepts: Concept of watershed, Introduction to watershed management, different stack holders and their relative importance, Watershed management policies and decision making.	**6 Hrs**
Unit 2: Soil and water conservation measures. control runoff and thus prevent loss of soil by soil erosion, to reduce soil compaction; improve soil fertility, conserve or drain water;	**4 Hrs**
Unit 3 : Management of Water Quality: Water quality and pollution, types and sources of pollution, water quality modeling, environmental guidelines for water quality.	**4 Hrs**
Unit 4: Storm Water and Flood Management: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies of flood damage.	**4Hrs**
Unit 5: Drought Management: Drought assessment and classification, drought analysis techniques, drought mitigation planning.	**4 Hrs**

Unit 6:	**4 Hrs.**
Integrated Watershed Management: Introduction to integrated approach, conjunctive use of water resources, rainwater harvesting.	

Recommended Textbooks:

1. Hydrology and Soil Conservation Engineering By Ghanshyam Das, Prentice Hall India.
2. Watershed management By J. V. S. Murty New Age International Publishers Limited.

References Books:

1. "Watershed management: Guidelines for Indian Conditions" By E.M. Tideman, Omega Scientific Publishers.
2. "Hydrology and Soil Conservation Engineering" By Ghanshyam Das, Prentice Hall India.
3. "Watershed Planning & Management" By - Dr. Rajvir Singh,Y ash Pulishing House.
4. "Watersheds - Processes, Assessment and Management" By - Pau A. Debarry, John Wiley & Sons.
5. "Watershed Models" By V.P.Singh & Donald K. Frevert , Taylor & Francis.

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. Know beneficial use of water resources
2. Visualize, know and understand working effect of soil and water conservation measures.
3. Use the watershed development techniques which will sustain water quality
4. Understand and design storm water and flood management system
5. Assess the drought and can suggest appropriate drought management system
6. Compute the demand of water and suggest appropriate rainwater harvesting system.

Title of the Course:	**Quantity Surveying and Valuation Lab**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0731**	**-**	**-**	**4**	**2**

Course Pre-Requisite:

Building Material, Building Planning, Surveying, RCC Detailing.

Course Description:

Preparation of Tender and Contract Document

Course Learning Objectives:

1. To choose types of Estimate & Specification as per requirement of Government & Private Organization.
2. To develop Bill Of Quantities, Rate analysis , Bar Bending Schedule for Building and other structure
3. To create tender & contract document.
4. To understand valuation types and depreciation methods.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Choose types of Estimate & Specification as per requirement of Government & Private Organization.	3	Apply
CO2	Develop Bill Of Quantities, Rate analysis , Bar Bending Schedule for Building and other structure	6	Create
CO3	Create tender & contract document.	6	Create
CO4	To understand valuation types and depreciation methods.	2	Understand

CO-PO Mapping:

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

Assessments :

Teacher Assessment:

- Two components of In Semester Evaluation (ISE)

Assessment	Marks
ISE	50
ESE OE	50

- ISE based on Assignment
- ESE: oral exam assessment based on 100 % on Course Content.

Course Contents:

Experiment No 1:

Detailed specification for minimum ten civil engineering items. (One each from Roads, Irrigation works, Water Supply & Sanitation & seven from buildings)

Experiment No 2:

Mode of measurement for different components of building based on Red Book.

Experiment No 3:

Detailed estimate of G + 1 Framed Structure.

Experiment No 4:

Preparing detailed estimate for any one of the following:

a) A stretch of a road about 1 Km. long including earthwork.
b) A reach of canal about 1 Km. long.
c) A factory shed of steel frame.

Experiment No 5:

Rate Analysis of ten civil engineering items.

Experiment No 6:

Schedule of reinforcement for the following

a) Beams
b) Slab,
c) Staircase
d) Column & footing
e) Chajja and Lintel,

Experiment No 7:

Preparation of contract document for building mentioned in Term Work

Experiment No 8:

Valuation reports for building of residential purpose or commercial purpose

Experiment No 9:

At least one assignment based on software application.

Recommended Textbooks:

1. Estimating and Costing – Dutta. Dhanpat Rai & Sons. 1682, Nai Sarak, Delhi-110006
2. Estimating and Costing – Birdi Dhanpat Rai & Sons 1682, Nai Sarak, Delhi- 110006
3. Estimating, Costing and Specification in civil engineering – Chakroborty M.21b, Bhabananda.
4. Elements of Estimating and Costing – S. C. Rangwala. Charotar Publishing house- Opp Amul Dairy court road Anand.388001 (west rly) India.
5. Civil Engineering Contracts and Estimates – B. S. Patil. Universities Press Private Ltd. 3-5-819 Hyderguda, Hyderabad. 500029(A.P), India.
6. Standard specifications Volumes I & II (P. W. D. Maharashtra) Govt. of Maharastra
7. Professional Practice (Estimating and Valuation) – Roshan Nanavati (1984 Edition)U.B.S. Publishers, Distributers PVT.Ltd
8. Valuation of real Properties – S. C. Rangwala Charotar Publishing Houseopposite Amul dairy, court Road Anand. 388001.India

References Books:

1. Quantity Surveying – P. L. Bhasin. S. Chand&Co-Ramnagar, Delhi-110055
2. Professional Practice (Estimating and Valuation) – Roshan Nanavati (1984 Edition) U.B.S. Publishers, Distributers PVT.Ltd.5 Ansari road New Delhi. Road,Kolkata-700026
3. Standard specifications Volumes I & II (P. W. D. Maharashtra) Govt. of Maharastra
4. C.P.W.D. specifications and schedules of rates.

Experiment wise Measurable students Learning Outcomes:

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

1. Student will able to understand Detailed specification
2. Student will able to understand Mode of measurement.
3. Student will able to prepare detailed estimate of G + 1 Framed Structure.
4. Student will able to prepare detailed estimate of other structure then building.
5. Student will able to prepare Rate Analysis.
6. Student will able to prepare Schedule of reinforcement.
7. Student will able to prepare Contract document.
8. Student will able to prepare valuation of building.
9. Student will able to use software for above experiments.

Title of the Course:	**Construction Project & Management Lab**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL 0732**	**-**	**-**	**2**	**1**

Course Pre-Requisite:

Industrial Management & Economics

Course Description:

Construction Project & Management forms a core subject which is taught to students of all non-circuit disciplines of engineering. The study of this subject is aimed at developing a thorough understanding of the Construction Project & Management applications to solve engineering problems.

Course Learning Objectives:

1. To explain the important of Project Management and Project Planning.
2. To explain the Safety Engineering.
3. To explain the Mechanical v/s manual construction

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Understand the importance of Project Management tools.	II	Understand
CO2	Develop Plan and Schedule the Project by using CPM, PERT and MSP.	VI	Develop
CO3	Importance of working of various construction equipments.	V	Importance
CO4	Apply Safety and Risk Management in Construction and work study	III	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	2
CO2	-	2	1	2	1	-	-	-	2	2	2	-
CO3	-	-	-	1	-	-	-	-	2	2	2	-
CO4	-	1	-	1	-	2	1	-	2	2	1	-

Assessments :

Teacher Assessment:

Teacher Assessment:

- Two components of In Semester Evaluation

Assessment	Marks
ISE	25
ESE OE	50

- ISE based on Assignment
- ESE: Assessment is based on 100% course content

Course Contents:

Assignment

1. Project management
2. Project planning-Bar chart and mild stone chart.
3. CPM Network
4. PERT
5. Precedence Network:
6. Introduction to Management Software- MSP.
7. Safety Engineering and Risk Management
8. Construction equipment
9. Work Study
10. Site mobilization – demobilization aspects

Recommended Textbooks:

1. Project Planning and Control with PERT and CPM – Dr. B. C. Punmia and K. K. Khandelwal.
2. PERT and CPM: Principles and Applications – L. S. Srinath
3. Construction Project Management – K. K. Chitkara
4. Construction Engineering and Management – S. Seetharaman.
5. Construction planning equipment and methods—R.L. Peurifoy
6. Heavy Construction – Planning ,Equipment, Methods—Jagman Singh

References Books:

1. Construction Project Management – Kumar Neeraj Jha .
2. Construction Safety Manual Published by National Safety Commission of India.

Measurable Learning Outcomes:

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

1. Understand the importance of Project Management.
2. Aware of PERT.
3. Understand the importance of Safety Engineering and Risk Management.
4. Understand the provisions made in Mechanical v/s manual construction.
5. Understand the importance of Work Study.
6. Understand the importance of Site mobilization – demobilization aspects.

Title of the Course:	**Concrete Structure Design Lab**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0733**	**-**	**-**	**4**	**2**

Course Pre-Requisite:

Elements of Civil Engineering & Mechanics, Strength of Materials, Theory of Structures, DCS-I.

Course Description:

Analysis, Design and Drawing of RCC Structural Elements

Course Learning Objectives:

1. Analyse, segment & design RCC building & other Civil Engineering Structures
2. Exposure to the methods of analysis & design of structures using software

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Classify the components of RCC structures and its behavior to check feasibility of architectural plan	2	Understanding
CO2	Analyze the individual RCC structural members and the RCC structure as a whole	4	Analyzing
CO3	Design and Detailing of reinforcement for RCC Structures	6	Creating

CO-PO Mapping:

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

Assessments :

Teacher Assessment:

- One component of In Semester Evaluation (ISE) and One End Semester Examination (ESE) having 34% and 66% weights respectively.

Assessment	Marks
ISE	25
ESE OE	50

- ISE is based on performance of student in laboratory, analysis and design write-up, Detailed Drawing etc.
- ESE: Assessment is based on performance in design write-up, drawing presentation, and oral.

Course Contents:

PROJECT 1 : Design of Residential Building

- Residential (G+1) building (Minimum 120 Sq.m)
- Analysis to be Done using any Structural Analysis Software
- Drawings prepared shall indicate ductility details as per the provision in IS: 13920

PROJECT 2 : Any ONE of Following

a) Retaining wall (cantilever or counter fort type)
b) Design of combined footing
c) Design of water tank resting on ground

PROJECT 3 : Retaining Structures

Analysis and design of RCC framed structure using structural engineering software

Recommended Textbooks:

1. Reinforced Concrete Structural Elements- Purushothaman. P, Tata Mc Graw Hill
2. Reinforced Concrete – Ashok K Jain, Nem Chand Bros. Roorkee
3. Plain and Reinforced Concrete – Jain & Jaikrishna, Vol. I & II, Nem Chand Bros. Roorkee
4. Reinforced Cement Concrete Design – Neelam Sharma, S.K. Kataria and Sons. New Delhi.
5. IIlustrated Design of Reinforced Concrete Buildings – Dr. V.L.Shah and Dr. S.R.Karve, Structures Publications, Pune

References Books:

1. IS 456-2000 - Plain And Reinforced Concrete - Code Of Practice
2. IS 3370- 2009- Part 1-4- Code of Practice for concrete structures for the storage of liquids

Title of the Course:	**Project Phase-I**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0751**	**-**	**-**	**2**	**1**

Course Pre-Requisite:

Course Description:

Course Learning Objectives:

1. To carry out extensive literature survey on the research topic
2. Identify the problem statement for the research work.
3. Decide methodology for the research work.
4. Develop the initial mathematical modeling or experimental set up.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Relate available knowledge with reference to specific problem	2	Understanding
CO2	Formulate problem and define systematic approach to arrive at solution.	6	Creating
CO3	Compose Collected data, analyze and arrive at solution to a defined problem.	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	2	2	2	1	1	3	2	2	-
CO2	3	3	3	2	3	-	1	-	3	2	2	-
CO3	3	2	3	3	3	2	1	2	3	3	3	-

Assessments :

Teacher Assessment:

- One component of In Semester Evaluation (ISE)

Assessment	Marks
ISE	50

- ISE is based on performance of student in Presentation and report submitted at the time of presentation.

Course Contents:

Every student has to work on a one year project in the final year under the guidance of a Guide allotted by the department. The project work will be a design project, experimental project, field surveying or computer oriented on any of the topics of civil engineering interest. The group is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem.

Project work shall be carried out at

A) Parent Institute

B) Industry

C) Research Institute

D) Incubation Centre at Institute

Depending on students' choice from above options, the group has to be formed accordingly.

The evaluation shall be done by Project Assessment Committee consist of Four to Six Faculty Members from the Department at the end of seventh semester. Project Group will have to submit

1. Synopsis of project in prescribed format to Project Assessment Committee at the time of Synopsis presentation.

   and

2. A detailed report based on the work done in prescribed format to Project Assessment Committee at time of Final Presentation.

Students are expected to define the problem and its scope, complete literature survey and finalize methodology for data collection.

The project guide will award the marks to the individual students depending on the group average awarded by the Project Assessment Committee.

For work load calculation minimum load is 1 Hr/week, for one group of THREE to FIVE students. (As per AICTE Guide Lines).

Guidelines:

1 Project group consists of a minimum THREE and maximum FIVE students.

2 One Project Guide shall be allotted maximum TWO groups for guidance.

3 After interactions with guide and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of project.

4 Student is expected to detail out methodology, software required, critical issues involved in analysis /design and implementation and submit the

	proposal within Two week of commencement of the semester
5	Completed 50% project work and documentation in the form of report and is to be submitted before the end of semester assessment.
6	Schedule for Presentation: 1 Synopsis Presentation 2 Monthly Presentation given by student groups– ISE Assessment.

Title of the Course:	**Transportation Engineering II (Audit Course)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0761**	**3**	**-**	**-**	**-**

Assessments : ESE

Teacher Assessment: NOT APPLICABLE

Course Contents:

Unit 1: Railway Planning: **6 Hrs**

Significance of Road, Rail, Air and Water transports Coordination of all modes to achieve sustainability– Elements of permanent way –Rails, Sleepers, Ballast, rail fixtures and fastenings,–Track Stress, coning of wheels, creep in rails, defects in rails–Route alignment surveys, conventional and modern methods—Soil suitability analysis–Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.

Unit 2: Railway Construction and Maintenance: **6 Hrs**

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

Unit 3 : Airport Planning: **8 Hrs**

Air transport characteristics , airport classification ,airport planning: objectives, components, layout characteristics, socio-economic characteristics of the catchment area, criteria for airport site selection and typical airport layouts, Runway Design, Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings Pavement and lighting.

Unit 4: Bridge Engineering: **6 Hrs**

a) Classification of bridges, selection of site, Bridge Hydrology: determination of design discharge, linear water way, economical span, location of piers and abutments, afflux, scour depth, design problems on above topics.

b) Types of bridge foundations, Bridge piers, Abutments, Wing walls, Bearings, Construction and maintenance of bridges-Introduction; Recent trends in bridges.

Unit 5: Docks and Harbour: Definition of Basic Terms , Planning and Design of Harbours, Requirements , Classification, Location and Design Principles– Harbour Layout and Terminal Facilities , Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works.	**6 Hrs**
Unit 6: Tunnel Engineering: Introduction, size and shape of the tunnel, tunnelling methods in hard rock & soft material, tunnel lining, tunnel lighting, drainage and ventilation.	**4 Hrs**

Recommended Textbooks:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering",Dhanpat Rai and Sons,Delhi,
2. Satish Chandra and Agarwal M.M,"Railway Engineerin g",2nd Edition, Oxford University Press, New Delhi,
3. Khanna S K,Arora MG and JainSS,"Airport Planning and Design", NemchandandBrothers,Roorkee,
4. Bridge Engineering – S.P. Bindra
5. Bindra S.P., Docks & Harbor Engineering, Dhanpat Rai, New Delhi
6. R Shrinivasan, Harbour Dock and Tunnel Engineering
7. S. C. Saxena , Tunnel Engineering

References Books:

1. A Course in Railway Engineering - Saxena and Arora, Dhanpatrai& Sons, New Delhi
2. Bridge Engineering – Ponnuswamy S, , Tata McGraw Hill Publications 11 Bridge Co
3. C Venkatramaiah, "Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Railway Engineering – K. F. Antia.

Unit wise Measurable Learning Outcomes:

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

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

LIST OF PROFESSIONAL ELECTIVES

Sr No	*Course Code*	Professional Elective 2
1	UCVL0821	Structural Design And Drawing Of Foundation And Retaining Wall
2	UCVL0822	Advanced 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
8	UCVL0828	

Title of the Course:	**Structural Design and Drawing of Foundation and Retaining Structures**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0821**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Design of Concrete Structures, Geotechnical Engineering-II

Course Description:

This course makes students aware of analysis, design and detailing of various foundations – combined, raft, pile, well, pier and foundation for transmission tower. The syllabus content has direct application in the industry (consultancy offices).

Course Learning Objectives:

1. To make students aware of the importance of structural design of foundations in civil engineering problems.
2. To introduce the design of various types of foundations and retaining structures.
3. To impart estimation of forces on foundation for transmission tower.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Analyze Retaining structures	4	Cognitive
CO2	Estimate forces on foundation	5	Cognitive
CO3	Design foundations and other substructures	6	Cognitive

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	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: Shallow Foundation Detailed designing of RCC trapezoidal combined footing, RCC strap footing, Analysis and design of Raft Foundation	**5 Hrs**
Unit 2: Pile Foundation Structural Design of RCC piles and pile caps for upto 4 piles group.	**8 Hrs**
Unit 3: Retaining Wall Design of RCC cantilever type of retaining wall for a) With Horizontal backfill b) With Horizontal backfill and traffic load c) With Slopping backfill	**8 Hrs**
Unit 4: Bridge Substructure-1 Design of Pier, Design of Pier cap	**8 Hrs**
Unit 5: Bridge Substructure-2 Design of well cap, design of well steining, design of well curb, design of cutting edge, design of bottom plug	**6 Hrs**
Unit 6: Foundation for Transmission Tower Forces on tower foundation, general design criteria, choice and type of foundation, design procedure.	**5 Hrs.**

Recommended Textbooks:

1. Limit State Design of Reinforced Concrete – Dr B C Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications P (Ltd).
2. Limit state theory and Design –Karve and Shah , Structures publications, Pune
3. Reinforced Concrete Design – Limit state - A.K. Jain, Nem Chand brothers Roorkee
4. Design of Bridges – N. Krishna Raju, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi
5. Analysis & Design of Substructures – Limit State Design – Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi

References Books:

1. J.E. Bowles, "Foundation Analysis and Design" Tata McGraw Hill Book Company
2. W. C. Teng, "Foundation Design", Prentice Hall of India Pvt. Ltd., New Delhi
3. Poulos, H.G. and Davis, E.H. (1980). "Pile Foundation Analysis and Design", John Wiley and Sons, New York.

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. Design shallow footings.
2. Analyze pile caps & Design piles.
3. Analyze & Design cantilever retaining wall.
4. Design pier & pier cap for bridge substructure.
5. Design various components of well foundations.
6. Estimate various forces on tower foundation.

Title of the Course:	**Advanced Structural Design**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL 0822**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Design of Concrete Structures

Course Description:

This course demonstrates advanced reinforced concrete design method that is prestressed concrete. The course covers conceptual knowledge, analysis and design of prestressed systems. Prestressed concrete structure is a specialized stream of structural design & usually economical for long span structures. The application of this course can be found in design of long span beams, bridges, stadiums, large slabs etc.

Course Learning Objectives:

1. To impart advanced concrete design method
2. To introduce the basic principles of prestressed concrete and tensioning systems.
3. To make aware of losses of prestress
4. To explain analysis, design of prestressed concrete members like beams and slabs.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Choose appropriate tensioning system to implement on field	3	Cognitive
CO2	Analyze prestressed sections	4	Cognitive
CO3	Estimate losses of prestress	5	Cognitive
CO4	Design prestressed sections for beams and floor slabs	6	Cognitive

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	2	-	-	-	-	-	-	-	-	-	-
CO2	1	3	-	2	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	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: Introduction Basic concept of prestressing. Need for high strength steel in concrete, Advantage of prestressed concrete, Pre tensioning systems, post tensioning systems, types of prestressing.	**5 Hrs**
Unit 2: Analysis of prestress Basic assumptions, Concept of analysis of prestress sections, Different cable profiles, Analysis of rectangular, symmetrical and unsymmetrical I sections. Prestress line or thrust line.	**8 Hrs**
Unit 3: Losses of Prestress Nature of losses of prestress, Loss due to elastic deformation of concrete, Loss due to shrinkage of concrete, Loss due to creep of concrete, Loss due to relaxation of stress in steel, Loss of stress due to friction, Loss due to anchorage slip, Total losses allowed for design.	**5 Hrs**
Unit 4: Limit state Design of prestressed concrete members Philosophy of limit state design, criteria for limit states, Design of rectangular section for flexure, Design of rectangular section for the limit state of collapse in flexure	**8 Hrs**
Unit 5: Design of pre tensioned and post tensioned I sections for flexural members Dimensioning of flexural members, Estimation of self wt of the beam, Design of I section pretentioned beam, design of I section post tensioned beam.	**8 Hrs**

Unit 6: Prestressed Concrete Slab	**6 Hrs.**
Types of prestressed concrete floor slabs, design of prestressed concrete one way slab, design of prestressed concrete two way slab.	

Recommended Textbooks:

1. Fundamental of Prestressed Concrete - Sinha & Roy, S. Chand & Co. New Delhi
2. Prestressed Concrete – N Krishna Raju, Tata McGraw-Hill Publication Company ltd., New Delhi
3. Prestressed Concrete Structures - Dayaratnam P.
4. IS 1343: Code of Practice for Prestressed Concrete by Bureau of Indian Standards.

References Books:

1. Prestressed Concrete - T.Y. Lin, John Willey & sons Newyark
2. Prestressed Concrete - Guyon Y., Vol. I & II, John Wiley and Sons, New York.

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. Choose appropriate tensioning system for prestressed concrete.
2. Analyze different prestressed sections – rectangular, symmetrical & unsymmetrical I sections
3. Estimate losses of prestress
4. Design rectangular prestressed sections for flexure
5. Design I section of prestressed concrete for flexure
6. Design prestressed concrete slabs.

Title of the Course:	**Design of Bridges**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0823**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Knowledge of Basic Mathematics, Mechanics, Engineering Hydraulics, Structural Analysis, Transportation Engg.

Course Description:

The course explores the principles of bridge engineering, design of the components of the bridge, construction and maintenance of the bridges

Course Learning Objectives:

1. Understand the basics of the Bridge Engineering and type of the bridges.
2. Calculate the loads on the Bridge.
3. Understand the procedure for the design of the components of the bridges.
4. Develop maintenance scheme for the existing bridges.
5. Understand the construction techniques for the new bridges.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Classify different types of the bridges	L-2	Understand
CO2	Identify different loads and on the Bridges	L-3	Application
CO3	Develop maintenance scheme for an existing bridge	L-3	Application
CO4	Analyze the components of the bridge against different loadings	L-2	Analyze

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1	2	1	-	-	-	1	-	-	-	1
CO2	1	1	2	-		-	-	1	-	-	-	1
CO3	2	3	2	-	-	-	-	1	-	-	-	1
CO4	-	-	2	2	-	-	-	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: Introduction to Bridge Engineering Brief History of Bridges, Components of bridges, Classification, Investigation for Bridges. Case studies of prominent Bridge Failures	**4 Hrs**
Unit 2: Loads on the Bridges Standard specification for Road Bridges. I.R.C. bridge code, width of carriage way, clearances, loads to be considered i.e. D.L., L.L., Impact load, wind load, Earthquake load, Longitudinal force, Centrifugal force, buoyancy, Earth pressure, water current force, thermal force etc. Load Combinations	**6 Hrs**
Unit 3: Super Structure of the Bridges Bridge feasibility, Traffic considerations, and Design methods for the Bridges, Pigeaud's theory, beam and slab and T – beam, Courbon's theory. Design of the RCC bridge.	**10 Hrs**
Unit 4: Sub-Structure of the Bridges Introduction of the sub-structure, methods of the design and analysis of the substructure.	**8 Hrs**
Unit 5: Bearing and expansion joints Bearing and expansion joints – forces on bearings – Types of bearings, design of bearings, expansion joints its considerations	**5 Hrs**

Unit 6: Construction and Maintenance of bridges/ Design of 2 span bridge	**7 Hrs**
Construction techniques for the bridges, its applicability and feasibility, safety during construction, maintenance of the bridges, retrofitting techniques for the bridges to extend the life. Design problem of the 2-span bridge.	

Recommended Textbooks:

1. Reinforced Concrete Structures – Vol. II by Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications.
2. Concrete Bridge Practice, Analysis, Design and Economics by Dr. V. K. RAINA, Tata McGraw- Hills Publishing Company Limited.
3. Bridge Engineering by S. Ponnuswamy, Tata McGraw-Hills Publishing Company Limited.
4. Design of Bridges by N. Krishna Raju, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
5. IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83.

References Books:

6. Concrete Bridge Practice by Dr.V.K.Raina, Tata McGraw Hill
7. Reinforced Concrete Structures – Vol. II by Dr.B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. Explain different types of the bridges
2. Identify loads on the bridge
3. Design the superstructure of the RCC bridge
4. Analyze substructure against the applicable loadings
5. Assess suitability of the bearing and expansion joints
6. Assess the suitability of the construction technique and maintenance scheme for the bridge

Title of the Course:	**Structural Health Monitoring And Retrofitting**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0824**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Concrete Technology and Non-Destructive Testing

Course Description:

This Course contains Structural Health Monitoring Technique and Retrofitting Technique.

Course Learning Objectives:

1. To explain the importance of Structural Health Monitoring
2. To explain different technique of Structural Health Monitoring
3. To explain the importance of Retrofitting.
4. To explain different technique of Retrofitting.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Classify Structural Health Monitoring.	II	Understanding
CO2	Apply knowledge about Structural Health Monitoring.	III	Applying
CO3	Analyze the retrofitting	IV	Analyzing
CO4	Explain different Retrofitting Technique	V	Evaluating

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	-	-	-	2	-	-	-	-		1	-	-
CO2	-	-	-	2	-	2	-	-	2	-	-	-
CO3	-	-	1	2	-	2	-	-	2	1	-	-
CO4	-	-	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 with 60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Structural Health- factors affecting health of structures, Structural health monitoring-Various measures, regular maintenance, structural safety in alteration. Quality control & assurance of materials of structure, durability of concrete..	**5 Hrs**
Unit 2: Motivation and objectives of structural health monitoring, active and passive health monitoring techniques, Load testing of structures, Dynamic testing of Structures.	**5 Hrs**
Unit 3 : Introduction to system identification techniques; Sensors, Exciters, Data acquisition and data processing, filtering technique, Sampling rate, Application of Digital Signal Processing in structural health monitoring, Introduction to probabilistic structural health monitoring	**10 Hrs**
Unit 4: Repair and Retrofitting Technique-I Definitions, repair methodology, Methods of crack repair in masonry and concrete structures, routing and sealing of cracks, removal and surface preparation in masonry and concrete structures, cleaning of reinforcement steel, reinforcement repair, anchorage, bonding repair materials to existing concrete.	**6 Hrs**

Unit 5: Repair and Retrofitting Technique-II Repairs using Mortars and Dry Packs, Concrete Replacement, Surface Impregnation, Rust Eliminators and Polymers Coating for Rebar During Repair Foamed Concrete, Vacuum Concrete, Gunite and Shotcrete, Injection: Epoxy, Resin, Polymer Modified Cement Slurry; Shoring and Underpinning. Propping and Supporting: False Work, Requirement of Good False Work, Design Brief for False Work, Execution Procedure.	**8 Hrs**
Unit 6: Strengthening of Existing Structures General Principle, Relieving Loads, Stress Reduction, Strengthening of Super Structures (Beam, Column, Slab including Joints) for Tension, Compression, Flexural, and Shear respectively, Jacketing (RCC, Plate, Fiber ,Wrap), Bonded Overlays, Reinforcement Addition, Strengthening the Substructures, Increasing the Load Capacity of Footing, Strengthening of Masonry Structure.	**6 Hrs.**

Recommended Textbooks:

1. ShettyM.S., "Concrete Technology - Theory and Practice", S.Chand and Company.
2. Concrete Technology by M.L.Gambhir, Tata McGraw-Hill Education, Third Edition Professional Practice, RoshanNamavati.
3. Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India.
4. Concrete Microstructures, properties and materials - P Kumar Mehta and Paulo J. M. Monterio
5. V. Giurgiutiu, Structural Health Monitoring with Piezoelectric Wafer Active Sensors, Academic Press.
6. Fu Ko Chang, Structural Health Monitoring: Current Status and Perspectives.
7. Philip, W., Industrial sensors and applications for condition monitoring, MEP.
8. Armer, G.S.T (Editor), Monitoring and assessment of structures, Spon, London.

References Books:

1. Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India.
2. Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. Understand the importance of Structural health monitoring.
2. Aware of factors affecting health of structures
3. Understand the importance of system identification techniques for Structural health monitoring.
4. Understand the provisions made for Repair and Retrofitting.
5. Aware of Repair and Retrofitting Technique.
6. Understand the importance of Strengthening of Existing Structures.

Title of the Course:	**Advanced Traffic Engineering and Design**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0825**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Students must have idea and knowledge about NHDP and Asian Highways network. Students also have knowledge of Travel Demand Management, traffic Studies Traffic Control Aids, Intelligent Transportation system (ITS)

Course Description:

This course will help the students to understand importance of Traffic Studies and its Application , traffic regulation, congestion management, road Arboriculture, Factors governing trip generation and attraction, benefits of ITS.

Course Learning Objectives:

Provides clear understanding on various types of Traffic studies and its application, Traffic Signs and Road Markings. And ITS functional areas and role of Public transport system.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Descriptor
CO1	Explain and analyze various types of traffic surveys.	II	Understanding
CO2	Apply techniques used in Traffic systems management and travel demand management and congestion management	III	Applying
CO3	Design various elements of Traffic control aids, cost effective management measures, traffic control aids.	VI	Creating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1		1				1				1
CO2	1			2	1				1			1
CO3	3	2	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 with 60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Introduction: **5 Hrs**

Infrastructure &its role in developing society; Transport sector in India – policy framework; Development plans –Airports,Highways – National highway development program (NHDP); JNNURM, Asian highways network(AH).

Unit 2 : Traffic characteristics: **7 Hrs**

Traffic characteristics – Road user characteristics, General human characteristics, Physical characteristics. Vision eye – movement peripheral vision, Visual attention, Visual sensitivity to light and colour, glare vision and recovery perception of space. Hearing, Stability sensation, Time factor in response, Theory of PIEV modifying factors, conditional responses; Vehicular Characteristics – types, dimensions, resistance, power requirement for different resistance, change in direction – minimum turning radius, off tracking, slip angle.

Unit 3: **8 Hrs**

a) **Traffic Engineering & Speed Analysis:**

Introduction, Speed studies, journey time and delay studies, Sampling in traffic studies & application, Traffic surveys-types of volume count Planning, Problems on PCU, moving observer method and spot speed.

b) **Traffic operation and management:**

Traffic systems management and Travel demand management - Congestion management-Cost effective management measures, Traffic control aids, Street furniture, Road Arboriculture–Traffic Regulation, Traffic Sign and Road Markings.	
Unit 4: Trip Generation And Distribution: Factors governing trip generation and attraction –Application of Regression Analysis- Methods of trip distribution; Growth and Synthetic Models Calibration and Application of gravity model.- Category analysis.	**6 Hrs**
Unit 5: a) **Introduction to intelligent transportation systems (ITS):** Definition, Objectives,Historical Background, Benefits of ITS -ITS Data collection techniques –Detectors,Automatic vehicle location (AVL), Automatic Vehicle Identification (AVI), GeographicInformation Systems (GIS), Video data collection. b) **ITS Functional Areas:** Advanced traffic management systems (ATMS), Advancedtraveller information Systems (ATIS), Commercial vehicle operations (CVO), Advanced vehicle control systems (AVCS), Advanced Public transportation systems (APTS), Advancedrural transportation systems (ARTS).	**8 Hrs**
Unit 6: Public Transport System: History and role of Transit, Transit system and transit mode characteristics, Transportationtechnology Vision–2020, Role of various modes of Mass Transport and their Impact, Indian condition Bus Rapid Transit Systems (BRTS)-Rapid transit rail-Metro&Mono rails. .	**6 Hrs.**

Recommended Textbooks:

1. Kadiyali L.R. and N.B. Lal (2004): Principles and Practice of Highway Engineering Including Expressways and Airport Engineering), Khanna Publishers, New Delhi.
2. Kadiyali L.R. (1994): Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi.
3. ParthaChakroborty and Animesh Das (2003): Principles of Transportation Engineering, Prentice-Hall India, New Delhi.

References Books:

1. Black John (1981): Urban Transportation Planning. Croom Helm Ltd. London.
2. BPR (1970): Urban Transportation Planning: General Information and Introduction to System 360. Bureau of Public Roads, Washington D.C.
3. Bruton M.J. (1975): Introduction to Transportation Planning. II Edn. Hutchinson, London

4. Drew D.R. (1968): Traffic Flow Theory and Control, McGraw-Hill, New York.
5. Hutchinson B.G. (1974): Principles of Urban Transport Systems Planning. McGraw-Hill Book Co., New York.
6. McShane W.R. and Roess R.P. (1990): Traffic Engineering, Prentice-Hall Inc., New Jersey
7. Pignataro L.J. (1973): Traffic Engineering: Theory and Practice, Prentice- Hall Inc., New Jersey.
8. Putman S.H. (1983): Integrated Urban Models. Pion Ltd., London.
9. Wilson A.G. (1970): Entropy in Urban and Regional Modelling. Pion Ltd., London
10. Wells G.R. (1970): Traffic Engineering – An Introduction, Griffins, London.
11. Wohl M. and Martin B.V. (974): Traffic System Analysis of Engineers and Planners, McGraw-Hill Book Co., New York.
12. Papacostas, C.A., Fundamentals of Transportation Engineering', Prentice-Hall of India Private Limited, New Delhi.2000.
13. Road Development Plan, Indian Road Congress, November 2000.
14. www.nhai.org

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. To explain different elements of Development plans
2. To understand the Traffic characteristics.
3. To explain Traffic Studies Traffic operation and management.
4. To explain different factors governing trip generation.
5. To explain objectives of ITS
6. Classify and explain role of Transit system

Title of the Course:	**GEODESSY, Remote Sensing and GNSS**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0826**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

- Knowledge of fundamentals of Science, physics and basic mathematical ability - trigonometry.
- Good geographical clarity of places
- Surveying and levelling basics
- Knowledge of coordinate geometry and rectangular coordinate and Non-Destructive Testing

Course Description:

Geodesy 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 Geodesy and map projections.
2. Learn the importance of aerial Surveying and satellite remote sensing.
3. Use GNSS concepts knowledge for absolute positioning mapping.

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	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: Map Projection: The Earth: its shape and size; Datum and co-ordinate systems; Geographical and projected co-ordinate system and grid system; Choice and classification of map projections	**8 Hrs**
Unit 2 : 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.	**7 Hrs**
Unit 3: 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.	**7 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: Digital Image Processing: Digital image: Introduction and data formats; Introduction to image processing; Sources of Errors: Geometric ad radiometric; Image rectification; Image enhancement: methods and techniques; Image classification: supervised and unsupervised; Image accuracy assessment.	**8 Hrs**

Unit 6:	**8 Hrs.**
ISRO-IIRS outreach edusat programs with online lectures on Remote Sensing, aerial photography, GNSS and GIS	

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 completion of the course the student will be able to

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

Title of the Course:	**Advanced Design of Concrete Structures**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0827**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Elements of Civil Engineering & Mechanics, Strength of Materials, Theory of Structures, DCS-I.

Course Description:

Analysis and Design of Structural Elements

Course Learning Objectives:

1. Identify the provisions made in IS Codes
2. Understand behavior of the different RCC structures and structural elements.
3. Design the reinforced concrete Flat Slab, Deep Beam, Continuous beam, water tanks and retaining walls.
4. Analyze and Design of Slab by Using Yield Line Theory

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 provisions made in IS-456-2000, IS-3370-1984 and IS-1346	3	Applying
CO2	Develop the concept of Yield Line Theory	3	Applying
CO3	Analysis of different RCC structural elements, Water Tanks , retaining walls and slabs by using Yield Line Theory	4	Analyzing
CO4	Design of different RCC structural elements, Water Tanks , retaining walls and slabs by using Yield Line Theory	6	Creating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1				1			1	2		
CO2		2							2	2		
CO3	2	2	2	2	2	2			2	2		
CO4	2	2	3	2	2	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: Flat Slab Classification, Behaviour of Flat slabs, Direct design and equivalent frame method-, IS Codal provisions.	**6 Hrs.**
Unit 2: Deep Beams Analysis of deep beams- Design as per IS 456-2000.	**6 Hrs.**
Unit 3: Retaining Structures Analysis and Design of cantilever retaining walls and counter-fort retaining walls with horizontal and inclined surcharge.	**8 Hrs.**
Unit 4: Water Tanks Design of water tank - Introduction to working stress method for water tank design, Design criteria, permissible stresses, design of water tank resting on ground using IS code method – (i) circular water tanks with flexible and rigid joint between wall and floor, (ii) rectangular water tanks.	**8 Hrs.**
Unit 5: Continuous Beams Limit state Design of two span continuous beams and three span continuous beams using IS coefficient, concept of moment redistribution	**8 Hrs.**

Unit 6: Yield Line Theory Yield line analysis of slabs- virtual work and equilibrium method of analysis simply supported rectangular slabs with corners held down-uniform and concentrated loads- design of simply supported rectangular and circular slabs.	**4 Hrs.**

Recommended Textbooks:

1. Reinforced Concrete Structural Elements- Purushothaman. P, Tata Mc Graw Hill
2. Design and Construction of Concrete Shell Roofs-G.S.Ramaswamy
3. Reinforced Concrete – Ashok K Jain, Nem Chand Bros. Roorkee
4. Plain and Reinforced Concrete – Jain & Jaikrishna, Vol. I & II, Nem Chand Bros. Roorkee
5. Reinforced Concrete Chimneys- Taylor C Pere,
6. Yield Line Analysis of Slabs- Jones L L, Thomas and Hudson
7. Design of deep girders, Concrete Association of India
8. Reinforced Concrete, Mallick & Gupta- Oxford & IBH

References Books:

1. IS 456-2000 - Plain And Reinforced Concrete - Code Of Practice
2. IS 3370- 2009- Part 1 - 4 Code of Practice for concrete structures for the storage of liquids

Unit wise Measurable Learning Outcomes:

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

1. Student will able to Analyze and Design of Flat Slab.
2. Student will able to design the Simply supported and Continuous Deep Beam.
3. Student will able to Analysis the Retaining Structure and also design the Retaining Structures.
4. Student will able to Design the Water Tanks.
5. Student will able to design the Continuous Beam.
6. Student will able to understand the behavior of Yield Line pattern in slab.

LIST OF PROFESSIONAL ELECTIVES

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

Title of the Course:	**Design & Drawing of Marine Structures**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0871**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Design of Concrete Structures

Course Description:

This course makes students aware of analysis, design and detailing of various marine structures – breakwaters & wharfs. The syllabus content has direct application in the industry (consultancy offices which are working on on-shore structures).

Course Learning Objectives:

1. To introduce concept of marine structures, its analysis & design
2. To make aware students of loads acting on marine structures.
3. To introduce wave action & its evaluation.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Select appropriate type of marine structure	3	Cognitive
CO2	Estimate various loads acting on marine structures	5	Cognitive
CO3	Evaluate effect of waves on marine structures	5	Cognitive
CO4	Design breakwaters & wharf type of marine structures -	6	Cognitive

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	2	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-
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: Introduction Types of Marine structures, factors determining their selection, general code provision.	**5 Hrs.**
Unit 2: Design Loads Dead load, live load, lateral earth pressure, hydrostatic pressure, Berthig load, Mooring Load, Earthquake forces, Wind forces, Combined loads.	**7 Hrs.**
Unit 3: Wave Action Broken wave, unbroken wave, height of wave, length of wave, Wave pressure on vertical wall a) Molitare – Gaillard approach, b) Sainflon approach	**6 Hrs.**
Unit 4: Rubble Mound Breakwater Design & drawing of rubble mound breakwaters using Molitore wave pressure diagram.	**7 Hrs.**
Unit 5: Wall Type Breakwater Design & drawing of wall type breakwaters using wave pressure diagram proposed by Sainflon	**7 Hrs.**
Unit 6: Wharf structures Design of wharf structures, Ship impact of piled wharf structures, Design & drawing of piled wharf structures.	**8 Hrs.**

Recommended Textbooks:

1. Analysis & Design of Substructures – Limit State Design – Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi
2. US Army Corps of Engineers - Shore Protection Manual - 1984, C.E.M. - 2001
3. Design of Ports and Harbour Structures, Quinn

References Books:

1. Offshore Breakwaters and Shoreline Control, Pilarczyk and & Zeidler

Unit wise Measurable Learning Outcomes:

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

1. Select appropriate type of marine structure.
2. Estimate various loads acting on marine structures
3. Evaluate effect of waves on marine structures.
4. Design & draw rubble mound breakwater.
5. Design & draw wall type breakwater.
6. Design & draw wharf structures.

Title of the Course:	**Advanced Structural Analysis**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0872**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Elements of Engineering Mechanics, Solid Mechanics, Strength of Materials, Theory of Structures, Design of concrete structures.

Course Description:

Analysis and Design of Structural Elements

Course Learning Objectives:

1. Categorise complex structures and identify their distinct responses to loading
2. Apply mathematical concepts towards explaining structural behaviour
3. Analyse specific structures for their structural behaviour
4. Apply the basic behaviours in interpreting compex behaviours

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Construct the influence line curves for singly redundant structures or fixed beams	3	Applying
CO2	Solve complex indeterminate structures for the desired targets of study	3	Applying
CO3	Analyze asymmetric sections subjected to bending and / or torsion	4	Analyzing

CO-PO Mapping:

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

Assessments :

Teacher Assessment:

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

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

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

Course Contents:

Unit 1: Influence Line Diagrams Muller Breslau Principle, I.L.D. for Propped Cantilever, Fixed beam, 2-span Continuous beam, 2 hinged Arches.	**6 Hrs.**
Unit 2: Indeterminate Linear structures Beams Curved in Plan: Determinate and Indeterminate beams curved in plan. Fixed Arches : Analysis of fixed arches by Elastic Center Method	**9 Hrs.**
Unit 3: Approximate Analysis of Multi-storey Frames Analysis of multi-storey Frames subjected to lateral loads - Portal Method, Cantilever Method.	**6 Hrs.**
Unit 4: Beams on Elastic Foundations Analysis of infinite and semi-infinite beams. Standard Loading cases Specific Numerical examples on infinite beams	**8 Hrs.**
Unit 5: Space Trusses Member Forces by Tension Coefficient Method, Determination of change in angles	**7 Hrs.**
Unit 6: Flexure & Torsion of Asymmetric Section Unsymmetrical Bending and Shear Center	**4 Hrs.**

Recommended Textbooks:

1. Analysis of Structures Vol.II- Vazirani and Ratwani, Khanna Publishers,Delhi
2. Advanced Theory of Structures & Matrix Methods- Vazirani and Ratwani
3. Structural Analysis – Negi and Jangid, Tata McGraw Hill Pub. Co. Ltd.
4. Design of Steel Structures Vol.II– Ramchandra Standard Book House, Delhi
5. Strength of Materials Vol.II – Timshenko, East-West Press ltd. Delhi
6. Mechanics of Structures Vol. II & III- S. B. Junnerkar & Shah, Chartor Pub.House, Anand
7. Design of Steel Structures- B.C.Punmia, A.K.jain, Laxmi Publication(p) Ltd. Delhi

References Books:

1. Norris and Wilbur, "Elementary Structural Analysis", McGraw Hill Inc., 4th Edition
2. S.P. Timoshenko and J.N. Goodier, "Theory of Elasticity", Tata McGraw-Hill Publishing Co. Ltd., 3rd edition

Unit wise Measurable Learning Outcomes:

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

1. Construct the influence line curves for singly redundant structures and fixed beams.
2. Analyse linear structures curved either in plan or elevation
3. Solve multi-storey frames with lateral loads, manually and approximately
4. Analyse linear foundations on elastic soils
5. Analyse 3-D pin connected frames for member forces and change in angles
6. Solve sections for structural responses and / or geometric characteristics

Title of the Course:	**Introduction of Finite Element Analysis**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0873**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Knowledge of Basic Mathematics, Solid Mechanics, Structural Analysis, Matrix methods of Analysis

Course Description:

The course explores the principles underlying Finite Element Analysis, its applications, adoption of the different types of the elements and formulation of boundary conditions. The course also intends introduction to FEA based software.

Course Learning Objectives:

1. Understand the basics of Finite Element Analysis and its application
2. Enable derivation of the basic element formulations of 1-D and 2-D elements
3. Understand basics of the theory of elasticity
4. To apply Finite Element Analysis principles to the simple structural problems

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 mathematical background for FEA analysis	L-2	Understand
CO2	Formulate the characteristic matrices for common elements.	L-3	Application
CO3	Formulate boundary conditions for elements	L-3	Application
CO4	Model simple structures through adoption of appropriate elements	L-6	Create

CO-PO Mapping:

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

Course Contents:

Unit 01: Introduction to FEA Basic concepts of FEA, its applications, software's based on FEA, need of FEA, modelling considerations ,Types of elements for analysis, choice of element type, size and number of elements , Types of problems investigated and applications, steps in FEA, advantages of FEA.	**6 Hrs**
Unit 02 : 1-D element formuation Analysis of Skeletal portal frame by direct method; Co-ordinate System; Transformation matrix; Discretization structures: Formulation of element stiffness matrices for plane truss, beam and plane frames; Application of method to plane truss, continuous beam and plane portal frames	**7 Hrs**
Unit 03 : Introduction to 2-D Elements Principle of minimum potential energy; Variational method; Continuum problems; Two dimensional elements; Use of displacement functions; Pascal's triangle; Triangular and rectangular elements; Formulation of element stiffness matrix	**7 Hrs**
Unit 04 : Convergence Requirements Convergence requirement; Selection of order of polynomial; Conforming and non-conforming elements; Effect of element aspect ratio, Finite representation of infinite bodies, Gauss Quadrature	**6 Hrs**

Unit 05 : Shape Function and Introduction to 3- D elements Shape function in Cartesian and natural coordinate system; Lagrange's interpolation formulae; Concept of isoparametric element; Relation between Cartesian and natural Coordinate systems;	**7 Hrs**
Unit 06: Elementary Theory of Elasticity Elementary Theory of Elasticity: Stress-Strain relations; Strain Displacement relations; Plane stress and plane strain problems; Compatibility condition; Differential equations of equilibrium; Equations for two and three dimensional problems.	**7 Hrs**

Recommended Textbooks:

1. M. J. Fagan, Finite element analysis, Longman Scientific and Technical
2. D. L. Logan, A first course in finite element method, 4 ed. Cengage learning
3. J. N. Reddy, An introduction to the finite element method, 2 ed. McGraw Hill

References Books:

1. Introduction to Finite Element Method – Chandrakant C. Desai and J.F.Abel
2. Concept and Application of Finite Element Method – R D Cook.
3. Finite Element Method – J.N.Reddy
4. Finite Element Method – O.C.Zeinkiewicz and Taylor
5. Introduction to Finite Element in Engineering – T R Chandrupatla and A D Belegundu

Unit wise Measurable Learning Outcomes:

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

1. Demonstrate application of FEA in civil engineering
2. Construct the displacement relationship for a linear element
3. Construct the displacement relationship for a plane element
4. Identify the limitations of 1-D and 2-D elements and their application while modelling simple structures
5. Illustrate the displacement relationship for a space element
6. Discover the relationships between the material properties, loads and displacements on simple structure.

Title of the Course:	**Soil and Water Conservation and Watershed Management**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL 0874**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

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

Course Description:

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

Course Learning Objectives:

1. To make the students to be able to know the beneficial uses of water resources and other related resources are sustained
2. To make a student to appropriately manage other resources that impact on water, such as land.
3. To expose the students to the sites where water power houses have been implemented.
4. To make the students to be able to know social and economic development of Watershed Management.

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 and analyze the impact of Watershed Management on social and economic development	1	Identify
CO2	Relate the Watershed Management development Schemes with employment and income generating activities.	4	Relate
CO3	Extend knowledge in watershed management to maintain the social, economic and ecological watershed functions	4	extend
CO4	Develop society with environments consideration and conserving water quality standards	6	develop

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	2	-	-	-	-	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	-	-	-	-	-	2	-	-	-	-	-
CO4	-	-	-	-	-	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 and basic concepts: Introduction to watershed management, different stake holders and their relative importance, Watershed management policies and decision making.	**6 Hrs**
Unit 2: Soil and water conservation measures. Soil erosion - control runoff and thus prevent loss of soil, improve soil fertility, conservation of water; Ground Water Recharge and CGWB Regulations	**8 Hrs**
Unit 3 : Management of Water Quality: Water quality and pollution, types and sources of pollution, water quality modelling, environmental guidelines for water quality.	**6 Hrs**
Unit 4: Storm Water and Flood Management: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies of flood damage.	**6 Hrs**
Unit 5: Drought Management: Drought assessment and classification, drought analysis techniques, drought mitigation planning, Rural Development, Case Studies	**8 Hrs**
Unit 6: Integrated Watershed Management: Introduction to integrated approach, conjunctive use of water resources, rainwater harvesting, Case studies – Site Visit	**6 Hrs.**

Recommended Textbooks:

1. Watershed Management in India, Murthy

References Books:

2. "Watershed management: Guidelines for Indian Conditions" By E.M. Tideman, Omega Scientific Publishers.
3. "Hydrology and Soil Conservation Engineering" By Ghanshyam Das, Prentice Hall India.
4. "Watershed Planning & Management" By - Dr. Rajvir Singh,Y ash Pulishing House.
5. "Watersheds - Processes, Assessment and Management" By - Pau A. Debarry, John Wiley & Sons.
6. "Watershed Models" By V.P.Singh & Donald K. Frevert , Taylor & Francis.

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. Know beneficial use of water resources
2. Visualize, know and understand working effect of soil and water conservation measures.
3. Use the watershed development techniques which will sustain water quality
4. Understand and design storm water and flood management system
5. Assess the drought and can suggest appropriate drought management system
6. Compute the demand of water and suggest appropriate rainwater harvesting system.

Title of the Course:	**Disaster Management**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0875**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Students need to play an active role in preparing the development plan of an area. Specifications should be followed, structural analysis should be done using the latest techniques and advanced methods like performance based designs must be followed rather than simple code based approaches.

Course Description:

The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.

Course Learning Objectives:

As you work through this session you will learn to

1. Distinguish between disaster management and risk management
2. Explain selected models of disaster management
3. Describe the strategies for risk mitigation
4. List activities needed for post-disaster management

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Affirm the usefulness of integrating management principles in disaster mitigation work.	3	Application
CO2	Distinguish between the different approaches needed to manage pre- during and post- disaster periods.	4	Analysis
CO3	Explain the process of risk management.	2	Comprehension
CO4	Relate to risk transfer.	3	Application

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	1	-	2	-	-	-	2	-	-	-	1
CO2	-	-	1	1	2	-	1	-	2	-	2	-
CO3	-	-	-	2	2	-	-	-	-	1	-	-
CO4	1	-	2	-	-	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 with 60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Introduction on Disaster Different Types of Disaster : c) Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc d) Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc. e) Causes, effects and practical examples for all disasters.	**06 Hrs**
Unit 2: Risk and Vulnerability Analysis a) Risk : Its concept and analysis b) Risk Reduction c) Vulnerability : Its concept and analysis d) Strategic Development for Vulnerability Reduction	**04 Hrs**
Unit 3 : Disaster Preparedness a) Disaster Preparedness: Concept and Nature b) Disaster Preparedness Plan c) Prediction, Early Warnings and Safety Measures of Disaster. d) Role of Information, Education, Communication and Training, e) Role of Government, International and NGO Bodies.	**06 Hrs**

f) Role of IT in Disaster Preparedness g) Role of Engineers on Disaster Management.	
Unit 4: Disaster Response- a) Disaster Response : Introduction b) Disaster Response Plan c) Communication, Participation, and Activation of Emergency Preparedness Plan d) Search, Rescue, Evacuation and Logistic Management e) Role of Government, International and NGO Bodies f) Psychological Response and Management (Trauma, Stress, Rumor and Panic) g) Relief and Recovery h) Medical Health Response to Different Disasters	**07 Hrs**
Unit 5: Rehabilitation, Reconstruction and Recovery a) Reconstruction and Rehabilitation as a Means of Development. b) Damage Assessment c) Post Disaster effects and Remedial Measures. d) Creation of Long-term Job Opportunities and Livelihood Options, e) Disaster Resistant House Construction f) Sanitation and Hygiene g) Education and Awareness, h) Dealing with Victims' Psychology, i) Long-term Counter Disaster Planning j) Role of Educational Institute.	**08 Hrs**
Unit 6: **a) Techno-Legal Regime** Techno-Legal Regime Revision of Municipal Regulations Land Use Planning Safe Construction Practices Compliance Regime Enforcement **b) Capacity Development** Approach National Priorities Institutional Capacity Development Training of Communities	**09 Hrs.**

Professional Technical Education
DM Education in Schools
Training of Artisans
Training of Other Groups
Licensing and Certification

c) Financial Arrangements

Approach
DM to be in-built in Developmental Plans
National Disaster Response and Mitigation Funds
Responsibilities of the Central Ministries and Departments
State and District Level Arrangements
Mitigation Projects
Techno-Financial Regime

Recommended Textbooks:

1. Dr. Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
2. Tushar Bhattacharya Disaster Science and Management McGraw Hill Education(India) Pvt. Ltd.
3. Jagbir Singh Disaster Management : Future Challenges and Opportunities K W Publishers Pvt. Ltd.
4. J. P. Singhal Disaster Management Laxmi Publications.
5. Shailesh Shukla, Shamna Hussain Biodiversity, Environment and Disaster Management Unique Publications

References Books:

1. C. K. Rajan, Navale Pandharinath Earth and Atmospheric Disaster Management : Nature and Manmade B S Publication

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. Understand Disaster management
2. Study risk and vulnerability analysis
3. Study and implement disaster preparedness
4. Analyse the disaster response
5. To study and understand the rehabilitation, reconstruction and recovery.
6. To understand the financial aspects.

Title of the Course:	**Advanced Hydrology**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL 0876**	**3**	**--**	**--**	**3**

Course Pre-Requisite:

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

Course Description:

This course has been designed to present the principles of advanced hydrology at graduate level. At the end of the course, a student will be able to understand the fundamental mechanisms of various components of hydrologic cycle.

Course Learning Objectives:

1. To make the students to be able to understand the physics behind the hydrological processes.
2. To make a student to be able to use theoretical approaches on real data.
3. To make the students to be able with deep understanding to explain how water is stored and moves in nature.
4. To make the students to be able to approach hydrological problems of complex character and critically analyze them

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 and analyze the impact of Hydrologic Cycle and Water Balance on social and economic development	1	Identify
CO2	Relate the hydrological activities to agriculture growth.	4,6	Relate
CO3	Extend knowledge in hydrology to maintain the social, economic and ecological water resources development functions	4	Extend
CO4	Develop urban society with environments consideration and conserving water quality standards.	6	Develop

CO-PO Mapping:

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

Assessments :

Teacher Assessment:

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

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

- ISE 1 and ISE 2 are based on Tutorial/Assignment/Declared test/Quiz/Seminar/Group Discussions etc.
- MSE: Assessment is based on 50% of course content (Normally first three Units)
- ESE: Assessment is based on 100% course content with 60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Hydrological cycle and Water Balance Global and Regional Hydrological Cycle and Water Balance , Surface/Subsurface Hydrological Processes in a Basin ,Global Energy Balance , Atmospheric circulation Hydrologic model classification. density and adequacy of rain gauges;	**6 Hrs**
Unit 2: Infiltration Infiltration capacity, Horton's infiltration model , Green-Ampt equation,, Philip equation , parameter estimation, ponding time concepts.	**7 Hrs**
Unit 3 : Unsaturated-zone Processes Porosity, Soil moisture content, Relative saturation, Field capacity, Wilting point, Gravity force vs. Capillary force, Richards Equation , Evapo-transpiration processes, Albedo and Bowen ratio, Penman equation and Penman-Montieth equation ,Big-leaf models Isotope Hydrology	**7 Hrs**
Unit 4: Runoff and River Flow Runoff Generation mechanisms, River flow routing, Unit Hydrograph and Storm hydrograph. Hydrograph separation and Base flow recession, Geomorphology, Cloud and Precipitation , Cloud microphysics.	**6 Hrs**
Unit 5: Remote Sensing in Hydrology Rain drop size distribution, Weather radar , Global precipitation maps, Atmospheric circulations, Dynamic motion of Atmosphere;	**7 Hrs**

Unit 6: Urban Hydrology:	**7 Hrs.**
Alternative storm handling methods, green roofs, rain water harvesting, Agricultural rain water harvesting, River basin management	

Recommended Textbooks:

1. Hydrology: Principles, Analysis, Design : H.M. Raghunath
2. Text book of Hydrology : P.Jayrami Reddy
3. Engineering Hydrology : K.Subramanya

References Books:

1. K. Subramanya Tata McGraw-Hill Education
2. Jaromír Němec Macmillan, 1964
3. Rajesh srivastava, ASHU JAIN McGraw-Hill Education
4. Brutsaert, Wilfred, 2005, "Hydrology: An Introduction", Cambridge Univ. Press (both Japanese and English version are available)
5. Dingman, 2002, Physical Hydrology, Prentice-Hall, Inc.
6. Chow, V.T., D.R. Maidment, and L.W. Mays, 1988, Applied Hydrology, McGraw-Hill Book Company.

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. Know beneficial use of hydrological processes included in Hydrologic cycle.
2. Visualize, know and understand effect of infiltration on soil.
3. Use the principles of unsaturated zone processes in agriculture.
4. Understand the runoff process in design of storm water and flood management system.
5. Apply remote sending for complex applications in hydrology.
6. Compute the demand of urban water and suggest appropriate rainwater harvesting system.

Title of the Course:	**Geoenvironmental Engineering**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL 0877**	**3**	**--**	**--**	**3**

Course Pre-Requisite:

Geotechnical Engineering-I, Environmental Engineering and Engineering Hydraulics.

Course Description:

Geoenvironmental Engineering is the special stream of Geotechnical engineering has grown in past few decades, dealing with a wide range of problems. Nowadays geotechnical engineer need to deal with environmental problems related to the reduction of waste, waste disposal facilities and cleanup of contaminated sites. To effectively take up these new challenges, there is a need to acquaint with the knowledge of soil physics, soil chemistry, hydrogeology, and biological processes along with the principles of soil mechanics. The proposed course on Geoenvironmental engineering is a blend of geotechnical engineering and environmental concepts and introduces multidisciplinary problem domains to the undergraduate students.

Course Learning Objectives:

1. Know scope and fundamental of Geoenvironmental Engineering.
2. Understand the Understand the Soil-Water-Contaminant Interaction and evolution of unsaturated soil.
3. Understand the waste containment facilities and disposal practices.
4. Understand the concept of Contaminant site remediation and advanced Soil characterization.

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 scope and fundamentals of Geoenvironmental engineering.	2	Understanding
CO2	Illustrate the basic information about advanced Soil characterization	2	Understanding
CO3	Analyze soil-water-contaminant interaction in saturated and un saturated zone.	4	Analyzing
CO4	Evaluate the waste containment system and site Remediation	5	Evaluating.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1	1	1	1	1	1	-	-	-	-	-
CO2	3	2	2	2	3	1	1	-	-	-	-	-
CO3	3	2	2	2	1	1	1	-	-	-	-	-
CO4	3	2	2	2	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 with 60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit 1: Fundamentals of Geoenvironmental Engineering: **3Hrs**

Scope of Geoenvironmental engineering - multiphase behavior of soil – role of soil in Geoenvironmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of ground contamination – impact of ground contamination on Geoenvironment - case histories on Geoenvironmental problems.

Unit 2: Soil-Water-Contaminant Interaction : **8Hrs**

Soil mineralogy characterization and its significance in determining soil behavior – soil-water interaction and concepts of double layer – forces of interaction between soil particles.
Concepts of unsaturated soil – importance of unsaturated soil in Geoenvironmental problems - measurement of soil suction - water retention curves - water flow in saturated and unsaturated zone.
Soil-water-contaminant interactions and its implications – Factors effecting retention and transport of contaminants.

Unit 3 : Concepts of unsaturated soil: Importance of unsaturated soil in Geoenvironmental problems - measurement of soil suction - water retention curves - water flow in saturated and unsaturated zone. Soil-water-contaminant interactions and its implications – Factors effecting retention and transport of contaminants.	**8Hrs**
Unit 4: Waste Containment System: Evolution of waste containment facilities and disposal practices – Site selection based on environmental impact assessment –different role of soil in waste containment – different components of waste containment system and its stability issues – property evaluation for checking soil suitability for waste containment – design of waste containment facilities.	**11Hrs**
Unit 5: Contaminant Site Remediation: Site characterization – risk assessment of contaminated site - remediation methods for soil and groundwater – selection and planning of remediation methods – some examples of in-situ remediation.	**6Hrs**
Unit 6: Advanced Soil Characterization: Contaminant analysis - water content and permeability measurements – electrical and thermal property evaluation – use of GPR for site evaluation - introduction to geotechnical centrifuge modeling.	**6Hrs**

Recommended Textbooks:

1. Rowe R.K., "Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, 2000.
2. Reddi L.N. and Inyang, H. I., "Geoenvironmental Engineering, Principles and Applications" Marcel Dekker Inc. New York, 2000.
3. Yong, R. N., "Geoenvironmental Engineering, Contaminated Soils, Pollutant Fate, and Mitigation" CRC Press, New York, 2001.
4. Sharma H.D. and Reddy K.R., "Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, Inc., USA, 2004.
5. Fredlund D.G. and Rahardjo, H., "Soil Mechanics for Unsaturated Soils" Wiley-Interscience, USA, 1993.
6. Mitchell, J. K., "Fundamentals of Soil Behavior" Wiley, 2005.
7. Hillel D., "Introduction to Environmental Soil Physics" Academic Press, New York, 2003

References Books:

1. Hillel D., "Introduction to Soil Physics" Academic Press, New York, 1982.
2. Sparks, D.L., "Environmental Soil Chemistry" Academic Press, New York, 2002.
3. Bagchi, A., "Design of landfills and integrated solid waste management" John Wiley &

Sons, Inc., USA, 2004.

4. Alvarez-Benedi J. and Munoz-Carpena, R., "Soil-Water-Solute Process Characterization: An Integrated Approach" CRC Press, New York, 2005.
5. Berkowitz, B. Dror, I. and Yaron, B., "Contaminant Geochemistry" Springer, Germany, 2008.
6. Mohamed, A. M. O., "Principles and Applications of Time Domain Electrometry in Geoenvironmental Engineering" Taylor and Francis, New York, 2006.

Additional Readings

7. NPTL study material.
8. Journal/ Conference publications.
9. Freely downloadable reports pertained to above topics

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

1. Understand the scope and fundamental of Geoenvironmental Engineering.
2. Understand the Soil-Water-Contaminant Interaction
3. Evolution of unsaturated soil.
4. Evolution of waste containment facilities and disposal practices.
5. Understand the concepts of Contaminant site remediation.
6. Understand Advanced Soil Characterization

Title of the Course:	**Industrial Waste Treatment**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL 0878**	**3**	**--**	**--**	**3**

Course Pre-Requisite:

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

Course Description:

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

Course Learning Objectives:

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

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Interpret knowledge and concepts of characterization and treatment for water and wastewater and sludge.	2	Cognitive
CO2	Predict the wastewater quality with the help of mathematical model.	4	Cognitive
CO3	understand the codal provision for various industrial treatment processes and pollution control acts.	4	Cognitive

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	2	1	2	1	2	3	1	--	--	--	--
CO2	1	2	2	3	--	--	--	--	--	--	--	--
CO3	--	2	1	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 with 60-70% Weightage for course content (Normally last three Units) covered after MSE.

Course Contents:

Unit : 1 Use of water in industry, sources of wastewater, quality and quantity variations in waste discharge, water budgeting, characterization and monitoring of wastewater flow, stream standards and effluent standards. Miscellaneous methods of dissolved solids removal, sludge disposal methods	**8 Hrs.**
Unit 2: Waste volume and strength reduction, in-plant measure, good housekeeping, process change, leakage prevention, segregation and recycling Neutralization, equalization and proportioning of waste	**7 Hrs.**
Unit 3: Water Quality monitoring of Streams, Self purification of streams, B.O.D. reaction rate, D.O. sag curve and D.O. deficit calculations	**3 Hrs.**
Unit 4: Different types of waste treatment & their selections, Development of treatment flow diagram based on characteristics of waste Acclimatization of bacteria to toxic wastes, process sensitivity operation and maintenance requirements	**6 Hrs.**
Unit 5: Manufacturing processes in major industries, water requirements, wastewater sources, composition of wastes, Viz. sugar, distillery, dairy, pulps, paper mill, fertilizer, tannery, chemical, steel industry, power plants, textile Treatment flow sheets, alternative methods of	**9 Hrs.**

treatment, factors affecting efficiency of treatment plant	
Unit 6: Water pollution control act, organizational set up of central and state boards for water pollution control, classification of river on water use, minimal national standards, socio-economic aspects of water pollution control Construction and Demolition waste and its reuse.	**5 Hrs.**

Recommended Textbooks:

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

References Books:

5. Industrial Wastewater manual

Unit wise Measurable Learning Outcomes:

After completion of the course the student will be able to

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

Title of the Course:	**Project Phase-II**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVL0851**	**-**	**-**	**12**	**6**

Course Pre-Requisite:

Internship, Project Phase-I

Course Description:

Course Learning Objectives:

1. To carry out extensive literature survey on the research topic
2. Identify the problem statement for the research work.
3. Decide methodology for the research work.
4. Develop the initial mathematical modeling or experimental set up.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Relate available knowledge with reference to specific problem	2	Understanding
CO2	Formulate problem and define systematic approach to arrive at solution.	6	Creating
CO3	Compose Collected data, analyze and arrive at solution to a defined problem.	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	2	2	2	1	1	3	2	2	-
CO2	3	3	3	2	3	-	1	-	3	2	2	-
CO3	3	2	3	3	3	2	1	2	3	3	3	-

Assessments :

Teacher Assessment:

- One component of In Semester Evaluation (ISE)

Assessment	Marks
ISE-1	75
ISE-2	75
ESE OE	150

- ISE-1 is based on performance of student in Internship and Presentation of Internship
- ISE-2 is based on performance of student in Presentation and report submitted at the time of pre final presentation.
- ESE is based on the performance of student in Final Presentation and Final Oral.

Course Contents:

In Project Phase-II, students shall continue working on allotted project to analyze data, validate results and conclude.
In the final stage student has to submit a report in standard format indicating work done and conclusions drawn for final evaluation.

Guidelines:

1 The ISE-1 and ISE-2 evaluation shall be done by Project Assessment Committee consist of Four to Six Faculty Members from the Department.

2 Project report based on the work done have to be submitted in prescribed format to Project Assessment Committee at time of on or before Pre Final Presentation.

3 Schedule of Evaluation(Presentation):

1 Internship Work Presentation – ISE-1 Assessment

2 Project Work Presentation – ISE-2 Assessment

3 Pre Final Presentation – ESE Assessment

4 Final Presentation and Oral – OE Assessment