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

Structure for

B.Tech in

Civil and Environmental Engineering

(To be Implemented w.e.f. Academic Year 2022-23)

Department of Civil and Environmental Engineering

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

Received 08/09/2022

Dept. of Civil & Environmental Engg.

08/09/2022

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Kolhapur

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

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Department of Civil and Environmental Engineering

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

VISION AND MISSION OF INSTITUTE

VISION:

- To be the Centre of Excellence in technical education and preferred choice of Faculty, Students, Industry and Society.

MISSION:

- To empower the faculty, staff and aspiring Engineers with essential technical knowledge and skills.
- To develop competence towards serving the ever changing needs of industry and society.
- To inculcate social and ethical values amongst the Students and Employees.
- To strengthen collaborative Research and Consulting Environment with industry and other institutions.

VISION AND MISSION OF DEPARTMENT

VISION

- To develop as a center of excellence in Civil and Environmental Engineering Education.

MISSION

- To impart essential technical knowledge, skills and Environmental ethics.
- To develop professional capabilities to meet changing societal and industrial needs.
- To build up base for Research and Consultancy activities.

PROGRAM EDUCATION OBJECTIVES (PEOs)

PEO 1: Solve Civil and Environmental Engineering problems and pursue higher studies using solid foundation in mathematics, science and technology.

PEO2: Design, execute and operate various Civil and Environmental Systems in related fields through participative education.

PEO3: Develop skills to communicate effectively and work in a team in multidisciplinary areas.

PEO4: Respond to the challenges of issues of Civil and Environmental Engineering through research and development.

PROGRAM OUTCOMES (POs)

Civil and Environmental Engineering Graduates will be able to:

1. Apply the knowledge of mathematics, Science and Engineering fundamentals for solution of problems of Civil and Environmental Engineering.
2. Identify, formulate, review research literature and analyze Civil and Environmental Engineering problems using fundamentals of mathematics, sciences and engineering.
3. Develop solutions for Civil and Environmental Engineering problems and design system components and processes to meet the specified needs with appropriate consideration for the public health and safety.
4. Make use of their knowledge to interpret the data by experimental analysis to provide valid conclusions.
5. Select and apply various engineering and IT tools and models to solve Civil and Environmental Engineering problems.
6. Assess societal, health, safety and legal issues by applying Civil and Environmental Engineering knowledge.
7. Assess the impact of Civil and Environmental Engineering solutions in Societal and Environmental context for Sustainable Development.
8. Practice ethical principles to fulfill responsibilities as Civil and Environmental Engineer**.**
9. Function effectively as an individual, and as member or leader in multidisciplinary areas.
10. Discuss effectively issues of Civil and Environmental Engineering and solutions through written and oral presentations to engineering communities and society.
11. Demonstrate knowledge and understanding of the engineering and management principles to manage Civil and Environmental Engineering projects.
12. Practice the need of lifelong learning through updating technical knowledge in the context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Identify and analyze the pollution related problems generated due to urbanization and industrialization.
2. Interpret the data using various tools and techniques to provide effective and applicable solutions.

MAPPING OF PROGRAM OUTCOMES TO PROGRAM EDUCATION OBJECTIVES

PEO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
PEO 1	3	1	2			1		1			1	2	1	3
PEO 2	2	1	3	2	1	2	1	1					2	3
PEO 3									2	3	2			2
PEO 4	2	3	2				2					2	1	3

Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur
Teaching and Evaluation scheme for

Second Year B. Tech. Program in Civil and Environmental Engineering Semester-III

Course Code	Course Name	Curriculum Component	Hours/Week				Evaluation Scheme			
			L	T	P	Credits	Component	Marks		
								Max	Min for Passing	
UCEC0301	Applied Mathematics	BS	3	1	-	**4**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0302	Surveying	ES	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0303	Fluid Mechanics	ES	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0304	Solid Mechanics	PC	3	1	-	**4**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0305	Building Materials and Concrete Technology	PC	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEA0361	Environmental Studies (Audit Course - III)	BS	2	-	-	-	ESE	100	40	40
UCEC0331	Surveying Laboratory	ES	-	-	2	**1**	ISE	50	20	
							ESE (POE)	25	10	
UCEC0332	Fluid Mechanics Laboratory	ES	-	-	2	**1**	ISE	25	10	
							ESE (POE)	25	10	
UCEC0333	Strength of Materials Laboratory	PC	-	-	2	**1**	ISE	25	10	
UCEC0334	Concrete Technology Laboratory	PC	-	-	2	**1**	ISE	25	10	
							ESE (OE)	25	10	
UCEC0335	Building Drawing Laboratory	PC	-	-	2	**1**	ISE	50	20	
			17	**2**	**10**	**22**	**500 + 250 = 750 + Audit Course**			

Total Credits - 22, Total Contact hours – 29

Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur
Teaching and Evaluation scheme for
Second Year B. Tech. Program in Civil and Environmental Engineering Semester-IV

Course Code	Course Name	Curriculum Component	Hours/Week				Evaluation Scheme			
			L	T	P	Credits	Component	Marks		
								Max	Min for Passing	
UCEC0401	Environmental Chemistry and Microbiology	BS	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0402	Hydrology and Water Resources Engineering	PC	3	1	-	**4**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0403	Structural Analysis	PC	3	1	-	**4**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE*	50	20	
UCEC0404	Hydraulics	PC	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0405	Surveying and Geospatial Technology	PC	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEA0461	Constitution of India (Audit Course - IV)	HS	2	-	-	-	ESE	100	40	40
UCEC0431	Environmental Chemistry and Microbiology Laboratory	BS	-	-	2	**1**	ISE	25	10	
							ESE (POE)	25	10	
UCEC0432	Building Planning and Design Laboratory	PC	-	-	2	**1**	ISE	25	10	
							ESE (POE)	25	10	
UCEC0433	Open Channel Hydraulics Laboratory	PC	-	-	2	**1**	ISE	25	10	
							ESE (OE)	25	10	
UCEC0434	Geospatial Laboratory	PC	-	-	2	**1**	ISE	50	20	
UCEC0451	Mini Project - I	PW	-	-	2	**1**	ISE	50	20	
			17	**2**	**10**	**22**	**500 + 250 = 750 + Audit Course**			

Total Credits - 22, Total Contact hours – 29

Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur
Teaching and Evaluation scheme for

Third Year B. Tech. Program in Civil and Environmental Engineering Semester- V

Course Code	Course Name	Curriculum Component	Hrs/Week				Evaluation Scheme			
			L	T	P	Credits	Component	Marks		
								Max	Min for Passing	
UCEC0501	Water Supply Engineering	PC	3	1	-	**4**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0502	Highway and Traffic Engineering	PC	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0503	Solid and Hazardous Waste Management	PC	4	-	-	**4**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEE05**	Program Elective - I	PE	3		-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEO05**	Open Elective - I	OE	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEA0561	Engineering Management (Audit Course - V)	HS	2	-	-	-	ESE	100	40	40
UCEC0531	Water Treatment Laboratory	PC	-	-	2	**1**	ISE	50	20	
							ESE (POE)	25	10	
UCEC0532	Transportation Engineering Laboratory	PC	-	-	2	**1**	ISE	25	10	
							ESE (OE)	25	10	
UCEC0533	Programming Laboratory	ES	-	-	2	**1**	ISE	25	10	
							ESE (POE)	25	10	
UCEC0534	Solid Waste Analysis Laboratory	PC	-	-	2	**1**	ISE	25	10	
UCEC0551	Mini Project - II	PW	-	-	2	**1**	ISE	50	20	
			18	**1**	**10**	**22**	**500 + 250 = 750 + Audit Course**			

Total Credits - 22, Total Contact hours – 29

Program Elective – I (PE-I)		**Open Elective – I (OE-I)**	
UCEE0521	Environmental Sanitation (PE-I)	UCEO0531	Environmental Policies and Laws (OE-I)
UCEE0522	Noise Pollution and Control (PE-I)	UCEO0532	Water Resources Management (OE-I)
UCEE0523	Construction Practices (PE-I)	UCEO0533	Sustainable Development (OE-I)

Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur
Teaching and Evaluation scheme for

Third Year B. Tech. Program in Civil and Environmental Engineering Semester- VI

Course Code	Course Name	Curriculum Component	Teaching Scheme				Evaluation Scheme			
			L	T	P	Credits	Components	Marks		
								Max	Min for Passing	
UCEC0601	Wastewater Engineering	PC	3	1	-	**4**	ISE-I	10	20	40
							ISE-II	10		
							MSE	30		
							ESE	50	20	
UCEC0602	Air Pollution and Control	PC	3	-	-	**3**	ISE-I	10	20	40
							ISE-II	10		
							MSE	30		
							ESE	50	20	
UCEC0603	Geotechnical Engineering	PC	3	-	-	**3**	ISE-I	10	20	40
							ISE-II	10		
							MSE	30		
							ESE	50	20	
UCEE06**	Program Elective - II	PE	3	1	-	**4**	ISE-I	10	20	40
							ISE-II	10		
							MSE	30		
							ESE	50	20	
UCEO06**	Open Elective - II	OE	3	-	-	**3**	ISE-I	10	20	40
							ISE-II	10		
							MSE	30		
							ESE	50	20	
UCEA0661	Transportation Infrastructure (Audit Course - VI)	PC	2	-	-	-	ESE	100	40	40
UCEC0631	Wastewater Engineering Laboratory	PC	-	-	2	**1**	ISE	25	10	
							ESE (POE)	25	10	
UCEC0632	Environmental Monitoring Laboratory	PC	-	-	2	**1**	ISE	25	10	
							ESE (OE)	25	10	
UCEC0633	Geotechnical Engineering Laboratory	PC	-	-	2	**1**	ISE	25	10	
							ESE (POE)	25	10	
UCEC0634	Design and Drawing of Environmental Systems	PC	-	-	2	**1**	ISE	50	20	
UCEC0651	Mini Project - III	PW	-	-	2	**1**	ISE	50	20	
			17	**2**	**10**	**22**	**500 + 250 = 750 + Audit Course**			

Total Credits - 22, Total Contact hours – 29

Program Elective – II (PE-II)		**Open Elective – II (OE-II)**	
UCEE0621	Renewable Energy Resources (PE-II)	UCEO0631	Environmental Impact Assessment (OE-II)
UCEE0622	Irrigation and Hydraulic Structures (PE-II)	UCEO0632	Waste Management (OE-II)
UCEE0623	Green Buildings (PE-II)	UCEO0633	Green Buildings (OE-II)
UCEE0624	Design of Steel Structures (PE-II)		

Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur
Teaching and Evaluation scheme for

Final Year B. Tech. Program in Civil and Environmental Engineering Semester-VII

Course Code	Course Name	Curriculum Component	Teaching Scheme				Evaluation Scheme			
			L	T	P	Credits	Components	Marks		
								Max	Min for Passing	
UCEC0701	Design of Concrete Structures	PC	3	1	-	**4**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0702	Advanced Water and Wastewater Treatment	PC	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEC0703	Quantity Surveying and Valuation	PC	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE *	50	20	
UCEC0704	Environmental Impact Assessment and Legislation	PC	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEO07**	Program Elective - III	PE	3	-	-	**3**	ISE I	10	20	40
							MSE	30		
							ISE II	10		
							ESE	50	20	
UCEA0761	Foundation Engineering (Audit Course - VII)	PC	2	-	-	-	ESE	100	40	40
UCEC0731	Treatability Studies Laboratory	PC	-	-	2	**1**	ISE	50	20	
							ESE (OE)	25	10	
UCEC0732	Quantity Surveying and Valuation Laboratory	PC	-	-	2	**1**	ISE	50	20	
							ESE (POE)	25	10	
UCEC0751	Project Phase - I	PW	-	-	4	**2**	ISE I	50	20	
							ISE II	50	20	
			17	**1**	**8**	**20**	**500 + 250 = 750 + Audit Course**			

Total Credits – 20, Total Contact hours – 26

Sr. No.	Program Elective III (PE-III)
UCEE0721	Environment, Health and Safety (PE-III)
UCEE0722	Optimization Techniques (PE-III)
UCEE0723	Operation and Maintenance of Environmental Facilities (PE-III)

Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur
Teaching and Evaluation scheme for
Final Year B. Tech. Program in Civil and Environmental Engineering Semester-VIII

Course Code	Course Name	Curriculum Component	Teaching Scheme				Evaluation Scheme		
			L	T	P	Credits	Components	Marks	
								Max	Min for Passing
UCEC0851	Internship	PW	-	-	4	**2**	ISE I	50	20
							ISE II	50	20
UCEC0852	Project Phase - II	PW	-	-	8	**4**	ISE I	50	20
							ISE II	50	20
							ESE (OE)	100	40
UCEE08**	Program Elective - IV	PE	3	-	-	**3**	ISE-I	10	20
							ISE-II	10	
							MSE	30	
							ESE	50	20
UCEE08**	Program Elective - V	PE	3	-	-	**3**	ISE-I	10	20
							ISE-II	10	
							MSE	30	
							ESE	50	20
			6	**-**	**12**	**12**	**100 + 200 + 200 = 500**		

Total Credits-12, Total Contact hours – 18

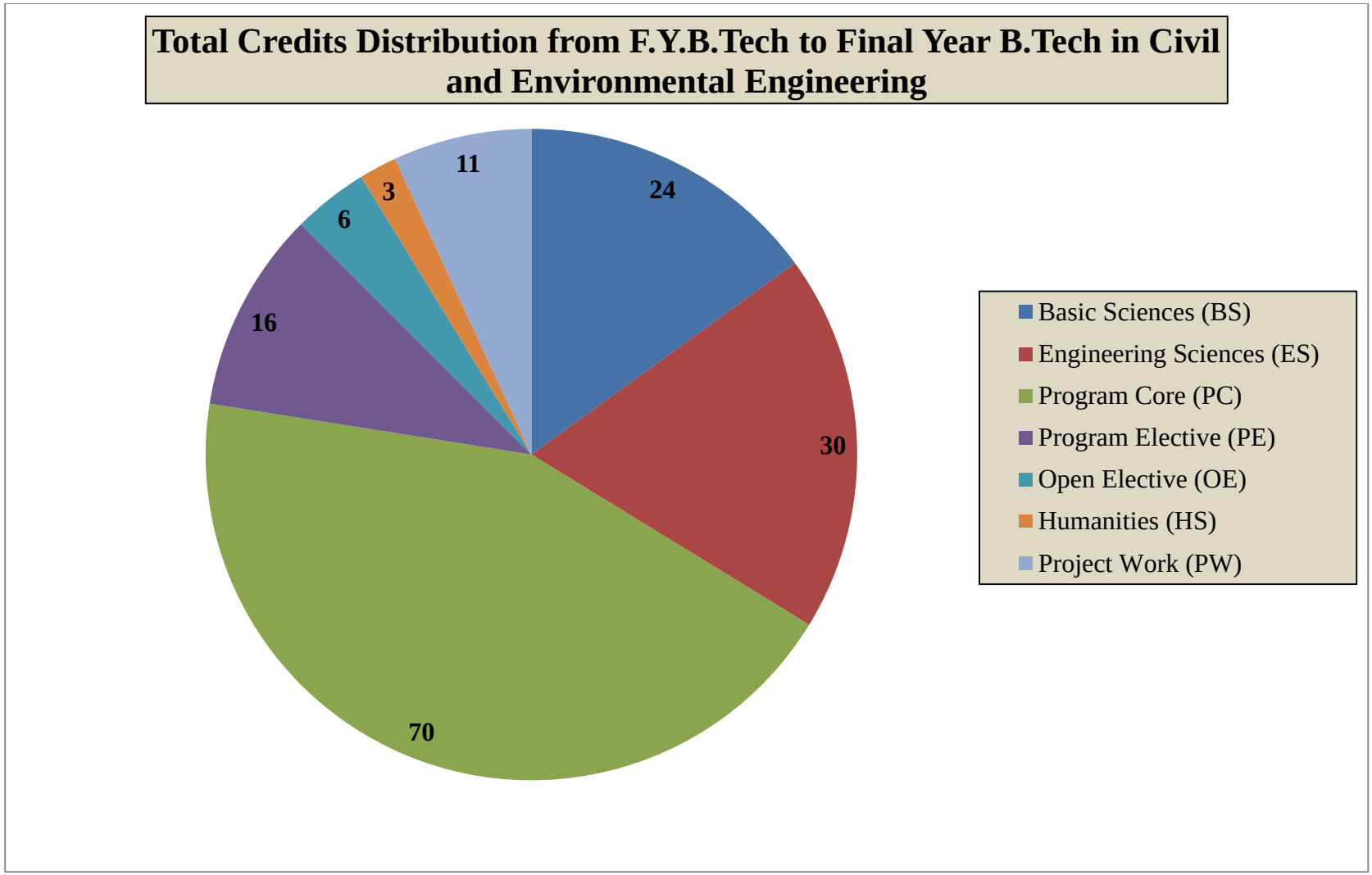
Program Elective – IV (PE-IV)		**Program Elective – V (PE-V)**	
UCEE0821	Industrial Wastewater Treatment (PE-IV)	UCEE0824	Environmental Management System (PE-V)
UCEE0822	Project Management (PE-IV)	UCEE0825	Advanced Construction Technology (PE-V)
UCEE0823	Urban Infrastructure and Smart Cities (PE-IV)	UCEE0826	Environmental Social Governance (PE-V)

Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur
B. Tech. Program in Civil and Environmental Engineering

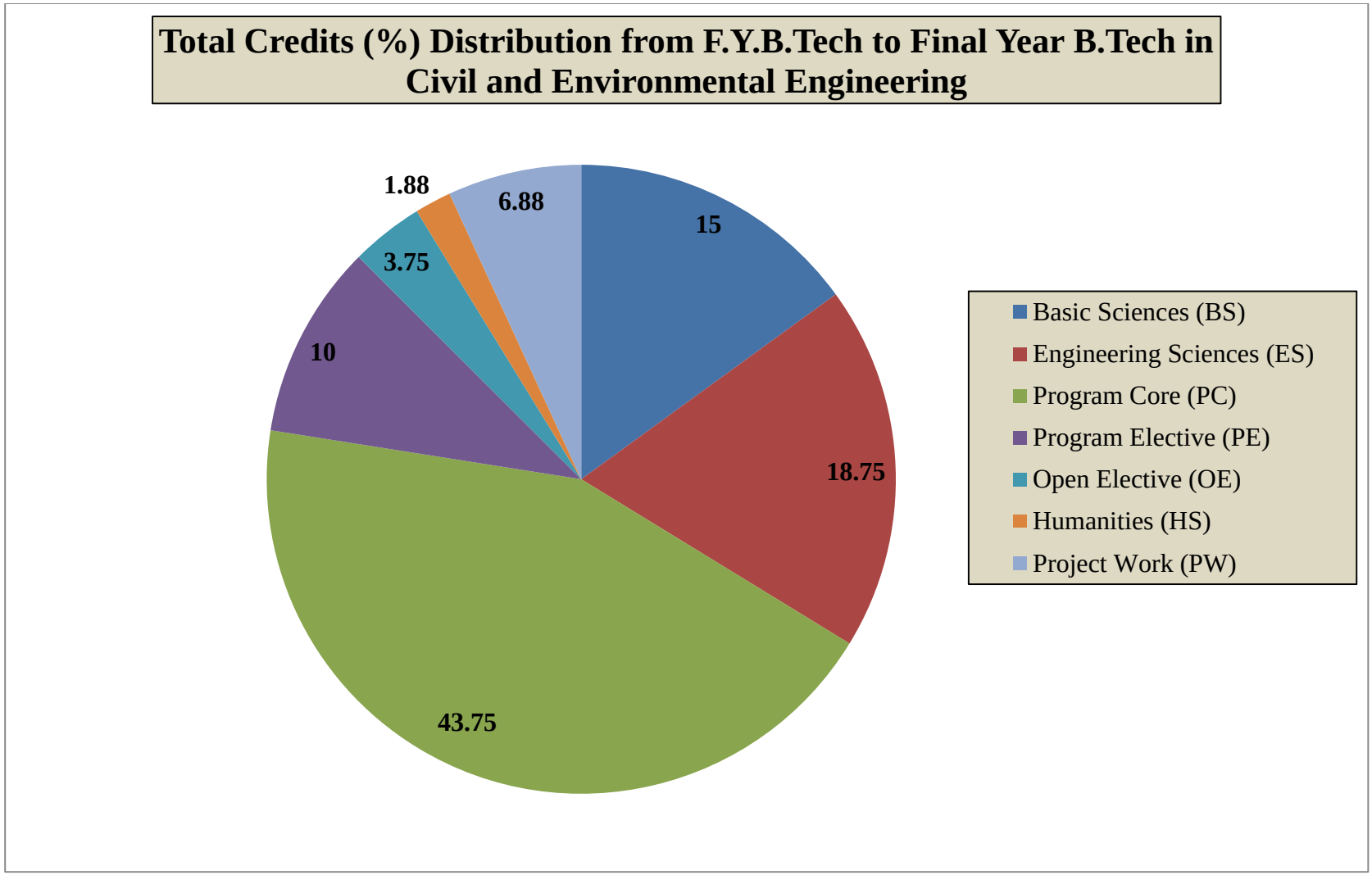
Total Credits Distribution from F.Y.B.Tech to Final Year B.Tech in Civil and Environmental Engineering

Component	F.Y.B.Tech		S.Y.B.Tech		T.Y.B.Tech		Final Year B.Tech		Total Credits	Percentage Distribution
	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Sem VII	Sem VIII		
Basic Sciences (BS)	8	8	4	4	-	-	-	-	24	15.00
Engineering Sciences (ES)	9	12	8	-	1	-	-	-	30	18.75
Program Core (PC)	-	-	10	17	14	14	15	-	70	43.75
Program Elective (PE)	-	-	-	-	3	4	3	6	16	10.00
Open Elective (OE)	-	-	-	-	3	3	-	-	6	3.75
Audit Course (MC)	UHV	ED	EVS	CI	EM	TI	FE	-	Non-Credit Courses	-
Humanities (HS)	3	-	-	-	-	-	-	-	3	1.88
Project Work (PW)	-	-	-	1	1	1	2	4+2	11	6.88
Total Credits	**20**	**20**	**22**	**22**	**22**	**22**	**20**	**12**	**160**	**100.00**

Note for Mandatory Audit Courses (MC):
UHV: Universal Human Values (HS), ED: Entrepreneurship Development (HS), EVS: Environmental Studies (BS), CI: Constitution of India (HS), EM: Engineering Management (HS), TI: Transportation Infrastructure (PC), FE: Foundation Engineering (PC)


Total Credits Distribution from F.Y.B.Tech to Final Year B.Tech in Civil and Environmental Engineering
24
30
70
16
6
3
11
Basic Sciences (BS)
Engineering Sciences (ES)
Program Core (PC)
Program Elective (PE)
Open Elective (OE)
Humanities (HS)
Project Work (PW)

Total Credits (%) Distribution from F.Y.B.Tech to Final Year B.Tech in Civil and Environmental Engineering



SYLLABUS

S. Y. B. Tech

Civil and Environmental Engineering

SEMESTER – III

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Applied Mathematics **Course No.:** UCEC0301	**L**	**T**	**P**	**Credits**
	03 hours per week	01 hour per week	---	04

Course Pre-Requisite:
Basic terminologies of differential equations, basic knowledge of probability, differential and integral calculus

Course Description:
This course contains linear differential equations and its applications, numerical methods, complex calculus, statistics and probability distributions.

Course Learning Objectives:

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

Course Outcomes:

COs	**After the completion of the course the student will be able to**	**Bloom's Cognitive Level**
CO1	Understand various concepts of differential equations, statistical techniques and numerical methods.	Cognitive (Understanding) (L2)
CO2	Solve LDE with constants coefficients and problems on bivariate data using statistical techniques	Cognitive (Applying) (L3)
CO3	Use numerical methods to obtain solution of algebraic and transcendental equations, differential equations.	Cognitive (Applying) (L3)
CO4	Apply the knowledge of probability distributions to the given data and select the appropriate method for testing of significance.	Cognitive (Analyzing) (L4)

CO-PO Mapping:

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

Assessments:

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

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

Course Contents:	
Unit 1: Linear Differential Equations with Constant Coefficients 1.1 Definition, general form, complete solution 1.2 Rules for finding complementary function 1.3 Short methods for finding particular integral 1.4 General rule for finding particular integral 1.5 Applications of Linear Differential Equations to deflection of beams (strut and cantilever problems)	8 Hrs.
Unit 2: Statistical Techniques for Civil and Environmental Engineering 2.1 Fitting of curves by method of least-squares 2.1.1 Fitting of straight lines 2.1.2 Fitting of exponential curves. 2.2 Correlation and Coefficient of correlation 2.3 Lines of regression of bivariate data 2.4 Applications of statistical techniques for civil and environmental engineering.	6 Hrs.
Unit 3: Probability Distributions 3.1 Random variable 3.2 Probability mass function and probability density function 3.3 Binomial distribution 3.4 Poisson distribution 3.5 Normal distribution 3.6 Civil and environmental engineering related problems	7 Hrs.
Unit 4: Test of Significance 4.1 Sampling distribution of mean and standard error 4.2 Large sample tests: Test for an assumed mean and equality of two population means. 4.3 Small sample tests: t-test for an assumed mean and equality of means of two populations, Paired t-test. 4.4 Test by using Chi – square distribution. 4.4.1 Goodness of fit test. 4.4.2 Test for independence of attributes Yates's Correction. 4.5 Civil and environmental engineering related problems	8 Hrs.
Unit 5: Numerical Methods 5.1 Solution of algebraic and transcendental equations using 5.1.1 Bisection method 5.1.2 Regula-false method 5.1.3 Newton-Raphson method 5.2 Numerical integration using 5.2.1 Trapezoidal rule 5.2.2 Simpson's 1/ 3-rule 5.2.3 Simpson's 3/8-rule	6 Hrs.
Unit 6: Numerical Solution of Ordinary Differential Equations 6.1 Numerical solution of first order and first degree ordinary differential equations using 6.1.1Picard'smethod 6.1.2Euler's method 6.1.3 Modified Euler's method 6.1.4 Runge-Kutta fourth order method 6.2 Numerical solution of second order ordinary differential equations using 6.2.1Picard's method 6.2.2 Runge-Kutta fourth order method	7 Hrs.

Textbooks:

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

Reference Books:

SN	Title	Edition	Author/s	Publisher	Year
1.	Advanced Engineering Mathematics	**10**	Erwin Kreyszig	John Wiley & Sons	**2011**
2.	Advanced Engineering Mathematics	**21**	H. K. Dass	S. Chand & Company Pvt. Ltd, New Delhi	**2014**
3.	A text book of Engineering Mathematics		N. P. Bali, Iyengar	Laxmi Publications (P) Ltd., New Delhi	
4.	Engineering Mathematics		Ravish R Singh and Mukul Bhatt	McGraw Hill Education (India) Private Limited, Chennai.	**2017**
5.	Introductory Methods of Numerical Analysis	**05**	S. S. Sastry	PHI Learning Pvt Ltd	**2012**

Unit wise Measurable students Learning Outcomes:
Students will be able to

1. Solve linear differential equations (LDE) with constant coefficients.
2. Apply the knowledge of LDE to strut and cantilever problems.
3. Fit the curve for given bivariate data using least square principle.
4. Obtainthe correlation coefficient and lines of regression for the given bivariate data.
5. Use appropriate probability distribution to find the probability of given uncertain conditions.
6. Test the significance of large and small samples using z-test and t-tests.
7. Use chi-square distribution to test goodness of fit for given samples.
8. Obtain the numerical solution of first and second order differential equations.
9. Find roots of algebraic and transcendental equations by numerical methods.
10. Apply Trapezoidal rule and Simpson's rule to evaluate the integrals numerically.

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Surveying **Course No.:** UCEC0302	**L**	**T**	**P**	**Credits**
	03 hours per week	-	-	03

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Basic Civil Engineering

Course Description:

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

Course Learning Objectives:

1. To introduce the principles of various surveying and levelling methods and applications in Civil and Environmental engineering projects.
2. To use the given surveying equipments, prepare contour maps and carryout surveying works related to land and civil engineering projects and to perform various area and volume calculations.
3. To use the various surveying methods to prepare topographical map as a conventional method.
4. To introduce the students to theodolite as an effective Surveying instruments.
5. To learn the principles of curves and hydrographic survey and its applications.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Taxonomy Descriptor**
CO.1	Apply basic knowledge of principles of surveying and levelling to conduct land survey.	Cognitive (Applying) L3
CO.2	Apply knowledge of contouring to read, prepare topographic maps including contours of any site and compute the areas and volumes of it.	Cognitive (Applying) L3
CO.3	Make use of skills for collection of field data using conventional and surveying instruments, and analyze the same.	Cognitive (Applying) L3
CO.4	Analyze the use of modern surveying instruments for collection of the field data	Cognitive (Analyzing) L4

CO-PO Mapping:

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

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

Assessments:

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

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

Course Contents:

Unit 1: Introduction and Basics of Surveying Introduction –Basic Principle of Surveying, Types of surveying, Classification of Survey-based on Instrument, Scale, purpose and place, Errors in Surveying, applications of Surveying	04 Hours
Unit 2: Levelling Introduction of Leveling, Study and use of various levels Dumpy level, Wye Level, Cookes Reversible Level, Cushings level, Modern tilting level, Auto level, field procedure in leveling, types of leveling, source and errors in leveling, difficulties in levelling, precautions and difficulties faced in leveling. Temporary and Permanent adjustment of dumpy level, various corrections used in leveling such as curvature correction, refraction correction, combined correction, visible horizon correction, dip of horizon, sensitiveness of the bubble, Determination of sensitiveness, problems on reciprocal levelling.	08 Hours
Unit 3: Contouring and Computations of Areas and Volumes Contours: Contour intervals, characteristics of contours, methods of contouring, Interpolation of contours, drawing contours, uses of contour maps, Interpretation of typical contour sheet. Area- Trapezoidal, Simpson's rule, mechanical and digital planimeter, Volume – Trapezoidal and Prismoidal rule for Earthwork,	07 Hours
Unit 4: Plane Table Surveying Principle, Accessories of plane table surveying, orientation, procedure of setting up plane table surveying over a station, methods of plane tabling, errors and precautions, applications , advantages and disadvantages.	06 Hours
Unit 5: Theodolite Surveying: Various parts and axis of transit, technical terms, temporary and permanent adjustments of a transit, horizontal and vertical angles, methods of repetition and reiteration. Precautions in using theodolite, sources of errors in theodolite survey, Use of Theodolite for various works such as prolongation of a straight line, setting out an angle, trigonometric levelling to find out the height of object.	08 Hours

Tacheometry: Principle, Uses of tacheometry, Instruments used in tacheometry, Determination of tacheometric constants, Systems of tacheometric surveying - stadia system fixed hair method, Errors.	
Unit 6: Introduction to Curves and Hydrographic Surveying **Curves:** Significance of curves and curve setting, Classification of curves, Elements of simple, compound, reverse, transition, combined curve, lemniscates and vertical curves, Introduction to setting out of curves. **Hydrographic Surveying:** Introduction, Purpose of hydrographic survey, Methods of hydrographic survey, mean sea-level, tide gauges, location of soundings, equipments for taking soundings.	07 Hours
Text Books: 1. A Text book of Advanced Surveying by R. Agor 2. Surveying and Leveling by Basak – Second Edition	
Reference Books: 1. Surveying Vol.I, II and III by Dr. B.C. Punamia 2. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni 3. Surveying Vol. I, II and III by Dr. K.R. Arora 4. Surveying Vol. I and II by S. K. Duggal 5. Surveying and Levelling by N.N. Basak 6. Surveying and Levelling by R. Agor 7. Surveying and Leveling by S.S. Bhavikatti 8. Surveying by S.K.DuggaL- Vol. I, Vol. II 9. Plane Surveying – Dr. Alok De, S. Chand Publications	

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Fluid Mechanics **Course No.:** UCEC0303	**L**	**T**	**P**	**Credits**
	03 hours per week	-	-	03

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Mathematics
- Engineering Physics
- Engineering Mechanics

Course Description:

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

Course Learning Objectives:

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

Course Outcomes:

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

CO-PO Mapping:

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

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

Assessments:

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

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

Course Contents:

Unit 1: **Introduction:** Physical Properties of Fluids (Mass Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity: Dynamic and Kinematic Viscosity, Compressibility, Surface Tension, Capillary Effect, Vapour Pressure and Cavitation), Effect of Temperature on Viscosity, Newton's Law of Viscosity, Types of Fluids. **Dimensional Analysis:** Dimensions and Dimensional Homogeneity, Importance and Use of Dimension Analysis, Buckingham Pi (π) Theorem, Dimensionless Numbers, Similitude, Types of Similarities	07 Hours
Unit 2: **Fluid Statics:** Types of Pressure, Pascal's Law, Hydrostatic Law, Pressure Measurement Devices, Concept of Pressure Diagram, Centre of Pressure, Forces on Plane and Curved Surfaces. **Buoyancy and Floatation:** Archimedes's Principle, Metacentre, Problems, Stability of Submerged and Floating Bodies.	08 Hours
Unit 3: **Fluid Kinematics:** Description of Fluid Motion, Velocity and Acceleration of Fluid Particles, Types of Flows, Stream lines, Equipotential lines, Steak Line, Path Line, Stream Tube, Stream Function and Velocity Potential Function, Flow Net, Properties and Uses, Continuity Equation in 3-D Cartesian Form.	05 Hours
Unit 4: **Fluid Dynamics:** Forces Acting on Fluid in Motion, Euler's Equation along a Streamline, Bernoulli's Theorem, Assumptions and Limitations, Bernoulli's Applications: Venturimeter (Horizontal and Vertical), Orificemeter, Discharge Derivation, Orifices, Time required for Emptying the Tank, Hydraulic Coefficients of Orifices, Concept of HGL and TEL, Velocity Measurement using Pitot Tube, Pitot Static Tube.	07 Hours
Unit 5: **Laminar Flow and Turbulent Flow:** Reynolds Experiment, Critical Reynolds Number, Hazen Poisulle's Equation for Viscous Flow through Circular Pipes, Introduction to Moody's Chart. **Boundary Layer Theory:** Concept, Boundary Layer along a Thin Plate, Various Thicknesses (Nominal, Displacement, Momentum, Energy), Hydraulically Smooth and Rough Boundaries, Separation of Boundary Layer, Control of Separation.	07 Hours

Unit 6: **Losses in Pipes:** Major and Minor Losses, Darcy-Weisbach Equation, Short and Long Pipe, Concept of Equivalent Pipe, Dupit's Equation. **Flow through Pipes:** Pipes in Series, Parallel and Siphon, Two Reservoir Problems, Concept of Water hammer, Surge Tanks (Function, Location and Uses).	06 Hours

Text Books:

1. Fluid Mechanics: Including Hydraulic Machines, A. K. Jain, Khanna Publishers, New Delhi.
2. Hydraulics and *Fluid Mechanics*, P. N. Modi and S. M. Seth, Standard Book House, New Delhi.
3. A Textbook of Fluid Mechanics and Hydraulic Machines, Dr. R. K. Bansal, Laxmi Publications, New Delhi, 2013.
4. A Textbook of Fluid Mechanics, R. K. Rajput, S. Chand and Company Pvt. Ltd., New Delhi.
5. Fluid Mechanics – I, M. M. Mujumdar and Akshay R. Thorvat, Electrotech Publications.

Reference Books:

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

Class: S.Y.B.Tech Civil and Environmental Engineering	**L**	**T**	**P**	**Credits**
Title of the Course: Solid Mechanics **Course Code:** UCEC0304	03 hours per week	01 hour per week	-	04

Course Pre-Requisite:

Students must know basic concepts

- Physics
- Engineering Mechanics
- Applied Mathematics

Course Description:

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

Course Learning Objectives:

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

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Explain Properties and behavior of different materials when subjected to loading.	Cognitive (Explain) L2
CO.2	Identify various forms of loads and effects on structural members.	Cognitive (Identify) L4
CO.3	Interpret properties and behavior of materials by experimental analysis.	Cognitive (Analyze) L4
CO.4	Evaluate structural members subjected to torsion and compressive load conditions.	Cognitive (Compare) L6

CO-PO Mapping:

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

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

Assessments:

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

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

Course Contents:

Unit 1: Simple Stresses and Strains Engineering properties of different materials, St. Venant's principle, Hooke's law, Behavior of matter subjected to uni-axial loading – Simple Bars, Compound Bars and Composite Bars with respect to Stresses, strains, change in dimensions and change in volume. Behavior of simple bars subjected to Shear Force, concept of complimentary shear stresses. Behavior of simple bars subjected to multi-axial loading, elastic constants, strain in three dimensions, Temperature stresses.	08 Hours
Unit 2: SFD and BMD of Statically Determinate Beams Analysis of statically determinate beams, Shear force diagrams and bending moment diagrams for concentrated loads, couples, uniformly distributed loading and uniformly varying loading in Simply supported beams, cantilever beams, overhanging beams, compound beams.	06 Hours
Unit 3: Stresses in Beams **Bending Stress in Beams** Concept of pure bending, Derivation of flexural formula, Section modulus, Moment of resistance, Lever arm, Simple design Problems for rectangular and flanged Sections. S**hear Stress in Beams** Derivation of shear stress formula, Stress distribution diagrams for Standard shapes, Relation between maximum and average shear stresses for rectangular, triangular, diamond and circular sections, simple design problems for rectangular, flanged and composite shapes.	07 Hours
Unit 4: Thin Cylinders and Strain Energy **Thin Cylinders** Behavior of thin-walled cylinders subjected to net internal pressure, study of stresses, strains, change in dimensions and change in volume. **Strain Energy in Elastic Bodies** Concept of strain Energy or Resilience, Proof Resilience, Modulus of Resilience, Work Energy Principle, Strain energy due to different types of axial loadings: Gradual, Sudden and Impact; Strain Energy due to different types of Stresses, Strain energy due to different types of actions	08 Hours
Unit 5: Analysis of Circular Shafts Subjected to Torsion Solid and Hollow circular shafts, Torsion formula, Polar modulus of Shaft, Power Transmitted through Shaft, Comparison of shafts.	06 Hours
Unit 6: Analysis of long columns Definition of column and strut, End conditions of columns, Analysis of long columns, Euler's theory and Rankine's theory.	07 Hours

Textbooks:

1. "Strength of Materials"- S. Ramamrutham, Dhanapat Rai Publications.
2. "Strength of Materials"- R. K. Bansal, Laxmi Publications.
3. Mechanics of Structure (Vol.I and II) - Dr. H. J. Shaha and Junnarkar S. B., Charotar Publication.

4. Mechanics of Materials Vol. I and II - B. C. Punmia and Jain, Laxmi Publications.
5. Strength of Materials - S. Ramamrutham, Dhanapat Rai Publications.
6. Strength of Materials - R. K. Bansal, Laxmi Publications.
7. Strength of Material – Debabrata Nag, A. Chanda, 2nd Edition, Wiley India publication.

Reference Books:

1. "Mechanics of Structure" (Vol. I and II) – Junnarkar S. B. and Advi, Charotar Publication.
2. "Mechanics of Materials" - R. C. Hibbler, Pearson Education.
3. "Mechanics of Materials" – Gere and Timoshenko, CBS publishers.
4. "Mechanics of Materials" Vol. I and II - Punmia, Jain, Laxmi Publications.
5. "Strength of Materials" – Bhavikatti S. S., New Age Publications.
6. "Strength of Materials" - R. K. Rajput, S. Chand Publications.
7. "Structural Analysis" – Bhavikatti S. S, Vikas Publications house New Dehli.
8. "Introduction to Mechanics of Solids" - J. B. Popov, Prentice–Hall publication.
9. "Strength of Material" - F. L. Singer and Pytel, Harper and Row publication.
10. "Mechanics of Material" - Beer and Johnston, M.
11. "Strength of Materials" - R. S. Khurmi and N. Khurmi, S. Chand Publications.

Class: S. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Building Materials and Concrete Technology **Course No.:** UCEC0305	**L**	**T**	**P**	**Credits**
	03 hours per week	-	-	03

Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Civil Engineering
- Engineering Chemistry

Course Description:

- The course comprises of engineering properties of various construction materials
- The course includes details of concrete technology
- The course also deals with various application construction materials

Course Learning Objectives:

1. Aware the student with a wide range of building materials, their properties and its use in construction.
2. Aware the student about concrete technology.
3. Aware the student about methods of construction and quality required for concrete works.
4. To develop a practical approach in choosing construction materials based on use, desired results, durability, availability and cost.
5. Aware the students about Green Materials.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	List the various building materials and their properties.	Remembering (L1)
CO.2	Illustrate green building materials.	Understanding (L2)
CO.3	Design concrete mix as per the field requirement using various codes	Create (L6)
CO.4	Analyze various factors affecting quality of fresh and hardened concrete	Analyzing (L4)

CO-PO Mapping:

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

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

Assessments:

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

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

• **ESE:** Assessment is based on 100% course content with 30% weightage for course content covered before MSE and 70% weightage for course content covered after MSE.	
Course Contents:	
Unit 1: Introduction: (A) Importance of building materials. (B) Stone masonry – principal terms & its types (C) Brick: -Manufacturing, Characteristics of good building bricks, IS specifications, types of bricks- Types (clay bricks, fly ash, cellular light weight concrete brick, aerated cement concrete brick or autoclave brick)Brick work – terms,Types of bonds& their construction procedure – English, Flemish, Stretcher, Header	06Hrs.
Unit 2: Building Materials-I (A) Materials of doors and windows, types, glazing, method of fixing doors and windows, fixtures and fastenings. (B) Flooring materials tests and IS specifications: Ground and upper floors; Flooring- functional requirements of flooring material, varieties of floor finishes and their suitability, construction details for concrete, tiles and stone flooring.	07 Hrs.
Unit 3: Building Materials-II (A) ROOF: Introduction, types of roof-Flat roof, Pitched Roof: -Components & It's Types. (B) Roofing materials: different types of roofing materials. (C) Plumbing & Drainage Materials. (D)Green building materials	07 Hrs.
Unit 4: Ingredients of Concrete (A) Cement: -Manufacture of Portland cement, Chemical composition, Hydration of cement, Classification and types of cement, Tests on cement. (B) Aggregate: -Classification, Mechanical and Physical properties, Deleterious Materials, Soundness, Alkali aggregate reaction, Grading of Aggregates, Tests on aggregate, Artificial and Recycled aggregate. (C) Admixtures in Concrete: types and its function	08 Hrs.
Unit 5: Fresh Concrete (A) Workability: - Factors affecting workability, measurement of workability, cohesion and segregation, bleeding, Mixing, Transporting, Placing, and Compaction of concrete Curing, Methods of curing, Influence of temperature, Maturity rule, Steam curing (B) Concrete mix design:- Factors to be considered, Statistical quality control, Methods of Mix Design, High strength concrete, Acceptance criteria for concrete as per IS specifications.	08 Hrs.
Unit 6: Special Concretes Special Concretes: Light weight concrete, Polymer concrete, Fiber reinforced concrete, High performance concrete, Pumped concrete, Ready mixed concrete, Roller compacted concrete, Ferro- cement, Green Concrete	06 Hrs.
Textbooks: 1. Neville M., Brooks J. J., "Concrete Technology", Pearson Education India, third edition, 2. M. S. Shetty, "Concrete Technology", S. Chand Publications, 2005 3. M. L. Gambhir, "Concrete Technology", Tata McGraw Hill Publications, Fifth edition 2013 4. Punmia B C "Building Construction".	
References: 1. R.S. Varshney, "Concrete Technology", Oxford and IBH. 2. P. Kumar Mehta, "Microstructure and properties of concrete", Prentice Hall. Tata McGraw Hill 3. IS Codes: -IS 10262:2009, IS 456:2000 4. Schild E, Casselmann H.F., Dahmen G., Pohlenz R. "Environmental Physics in Construction", Granada Publishing, London. 5. National Building Code of India 2005, Bureau of Indian Standard, New Delhi 6. Barrid, "Building Construction" Tata McGraw Hill, New Delhi	

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Environmental Studies (Audit Course – III) **Course Code:** UCEA0361	**L**	**T**	**P**	**Credits**
	02 hours per week	---	---	--

Course Pre-Requisite:

Students shall have knowledge of:

- Science
- Technology

Course Description:

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

Course Learning Objectives:

At the end of the course students will be able to

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

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive Descriptor**
CO1	Describe natural resources, importance of ecosystem and conservation of biodiversity with respect to multiple disciplines.	Cognitive (Understanding) L2
CO2	Explain causes, effects, solutions for various pollution problems and its minimization strategies.	Cognitive (Understanding) L2
CO3	Discuss environmental ethics and their implementation for betterment of environment and human life.	Cognitive (Analyzing) L4
CO4	Differentiate between requirements of laws and regulations for environmental conservation and applicability of legislations in society and industries.	Cognitive (Analyzing) L4

CO-PO Mapping:

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

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

Assessments:

Assessment	Weightage (Marks)
ESE	100

ESE: Assessment is based on 100% course content.

Course Contents:

Unit 1: Nature of Environmental Studies Definition, scope and importance, Multidisciplinary nature of environmental studies, Need for public awareness.	4 Hours
Unit 2: Natural Resources and Associated Problems a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. f) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of individuals in conservation of natural resources.	4 Hours
Unit 3: Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem: - a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).	4 Hours
Unit 4:Biodiversity and its conservation Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega- diversity nation, Western Ghat as a biodiversity region. Hot-spot of biodiversity. Threats to biodiversity habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	4 Hours

Unit 5: Environmental Pollution Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.	4 Hours
Unit 6: Social Issues and the Environment Disaster management: floods, earthquake, cyclone, tsunami and landslides. Urban problems related to energy Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issue and possible solutions. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.	4 Hours
Unit 7: Environmental Protection From Unsustainable to Sustainable development. Environmental Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Population Growth and Human Health, Human Rights.	4 Hours
Textbooks: 1. Environmental Studies by Dr. P. D. Raut (Shivaji University, Kolhapur)	
Reference Books: 1. Miller T.G. Jr., Environmental Science. Wadsworth Publications Co.(TB). 2. Odum, E.P.1971, Fundamentals of Ecology, W.B.Saunders Co. USA,574p 3. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. I and II, Environmental Media (R)	

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Surveying Laboratory **Course No.:** UCEC0331	**L**	**T**	**P**	**Credits**
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Course Pre-Requisite:

Students shall have the basic knowledge of:

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

Course Description:

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

Course Learning Objectives:

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

Course Outcomes:

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

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO.1				2								2
CO.2					1							2

COs	**PSO1**	**PSO2**
CO.1		2
CO.2		1

Assessments:

Assessment	**Weightage (Marks)**
ISE	50
ESE (POE)	25

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

Course Contents:

Experiment No. 1: Exercise based on use of Dumpy Level and Auto level: a) Revision Levelling exercise by Dumpy level. b) Levelling exercise by Auto level. **Learning Outcome:** To recall leveling procedure and operation of auto level.	2 Hours
Experiment No. 2: Exercise based on use of Theodolite: a) Study of different components of Transit Theodolite. b) Measurement of Horizontal Angle by various methods, measurement of Vertical Angle by Theodolite **Learning Outcome:** To apply theodolite for field work surveying.	2 Hours

Experiment No. 3: Exercise based on Horizontal Angle Measurement by using theodolite a) Measurement of Horizontal Angle by direct method b) Measurement of Horizontal Angle by repetition method c) Measurement of Horizontal Angle by reiteration method **Learning Outcome:** To apply theodolite for field work surveying	2 Hours
Experiment No. 4: Exercise based on Vertical Angle Measurement by using theodolite a) Measurement of Vertical Angle by direct method **Learning Outcome:** To apply theodolite for field work surveying	2 Hours
Experiment No. 5: Exercise based on use of Tacheometer: a) Determination of Tacheometric constants. b) Determination of horizontal and vertical distances by Tacheometer. **Learning Outcome:** To compute horizontal and vertical distances by field data.	2 Hours
Experiment No. 6: Demonstration of Plane table surveying a) Study of different components of plane table surveying b) Determination of various points by using Plane TableSurvey-Radiation **Learning Outcome:** To plot various points by using plane table surveying.	2 Hours
Experiment No. 7: Introduction of advanced instruments: a) Study of EDM, Electronic Theodolite b) Study of Total Station **Learning Outcome:** To explain various components and application of GPS and Total station.	2 Hours
Field Projects: 1. Block Contouring (Interpolation Calculations, Drawings, etc) 2. Theodolite Traversing. **Learning Outcome:** To produce contours and traverse of given site.	1 Day
Text Books: 1. A Text book of Advanced Surveying by R.Agor 2. Surveying and Leveling by Basak – Second Edition	
Reference Books 1.Surveying Vol.I, II and III by Dr. B.C. Punamia 2. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni 3. Surveying Vol. I, II and III by Dr. K.R. Arora 4. Surveying Vol. I and II by S. K. Duggal 5. Surveying and Levelling by N.N. Basak 6. Surveying and Levelling by R. Agor 7. Advanced Surveying by R. Agor. 8. Advanced Surveying by Satish Gopi, R. Sathikumar and N. Madhu 9. Surveying and Leveling by S.S. Bhavikatti 10. Surveying by S.K.DuggaL- Vol. I, Vol. II 11. Advanced Surveying by P. Som, B. N. Ghosh	

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Fluid Mechanics Laboratory **Course No.:** UCEC0332	**L**	**T**	**P**	**Credits**
	---	---	02 hours per week	01

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Applied Mathematics
- Engineering Physics
- Engineering Mechanics
- Fluid Mechanics

Course Description:

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

Course Learning Objectives:

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

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Taxonomy Descriptor**
CO.1	Exhibit basic principles and equations of fluid mechanics through experimentation.	Cognitive (Understanding) L2
CO.2	Calibrate various hydraulic measuring devices through standard laboratory procedures.	Cognitive (Analyzing) L4

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO.1				3	1					2		
CO.2				3	1					2		

COs	**PSO1**	**PSO2**
CO.1	-	-
CO.2	-	1

Assessments:

Assessment	**Weightage (Marks)**
ISE	25
ESE (POE)	25

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

Course Contents:

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

Experiment No. 3: Verification of Bernoulli's Theorem. **Learning Outcome:** To illustrate Bernoulli's theorem by demonstrating the relationship between pressure head and kinetic energy head for a conduit of varying cross-section.	2 Hours
Experiment No. 4: Calibration of Venturimeter and Orificemeter. **Learning Outcome:** To determine the coefficients of discharge for given venturimeter and orificemeter using analytical and graphical methods.	2 Hours
Experiment No. 5: Calibration of Orifice. **Learning Outcome:** To evaluate the hydraulic coefficients (C_d, C_v, C_c and C_R) of orifice and their interrelationships.	2 Hours
Experiment No. 6: Pipe Friction Experiment. **Learning Outcome:** To determine the Darcy's Coefficient (Friction Factor) for different pipe materials.	2 Hours
Experiment No. 7: Reynolds Experiment. **Learning Outcome:**To demonstrate laminar, transitional (intermittently turbulent), and fully turbulent pipe flows, and the conditions under which these types of flow occur.	2 Hours
Experiment No. 8: Study of Moody's Chart. **Learning Outcomes:** To relates the Darcy-Weisbach friction factor f, Reynolds number Re, and relative roughness (K/D) for fully developed flow in a circular pipe.	2 Hours

Text Books:

1. Fluid Mechanics: Including Hydraulic Machines, A. K. Jain, Khanna Publishers, New Delhi.
2. Hydraulics and *Fluid Mechanics,* P. N. Modi and S. M. Seth, Standard Book House, New Delhi.
3. A Textbook of Fluid Mechanics and Hydraulic Machines, Dr. R. K. Bansal, Laxmi Publications, New Delhi, 2013.
4. A Textbook of Fluid Mechanics, R. K. Rajput, S. Chand and Company Pvt. Ltd., New Delhi.
5. Fluid Mechanics – I, M. M. Mujumdar and Akshay R. Thorvat, Electrotech Publications.

Reference Books:

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

Class: S. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Strength of Materials Laboratory **Course No.:** UCEC0333	**L**	**T**	**P**	**Credits**
	---	---	02 hours per week	01

Course Pre-Requisite:

Students must know basic concepts

- Applied Science
- Engineering Mechanics and
- Applied Mathematics

Course Description:

The course makes students understand experimental analysis of stress and strain in various structural materials. Study of behavior of structural materials, when subjected to different types of loads such as Bending, Shear, Torsion, Deflection, Energy absorption etc.

Course Learning Objectives:

- Study the basic properties of material when subjected to loading.
- Study the various stresses and strains in different types of structural material under individual action of load.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Demonstrate the properties of materials under action of various loads.	Cognitive (Explain) L2
CO.2	Interpret the behavior of various structural materials in terms of stress and strain and energy.	Cognitive (Identify) L4

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1	-	-
CO2	-	1

Assessments:

Assessment	**Weightage (Marks)**
ISE	25

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

Course Contents:

Experiment No. 1: Study of Universal Testing Machine **Learning Outcome:** To Identify the components and understand the operation of Universal Testing Machine.	2 Hours
Experiment No. 2: Tensile test on Mild steel and TMT steel. **Learning Outcome:** To determine tensile strength, percentage of elongation and other mechanical properties of Mild steel.	2 Hours

Experiment No. 3: Compression test on M.S. and C.I, cement bricks or paving blocks. **Learning Outcome:** Determine crushing strength of different materials.	2 Hours
Experiment No. 4: Compression test on timber. **Learning Outcome:** To determine compressive strength of timber.	2 Hours
Experiment No. 5: Direct shear test on M.S. **Learning Outcome:** To determine shear strength of mild steel.	2 Hours
Experiment No. 6: Charpy or Izod Impact test on different metals. **Learning Outcome:** Find out energy absorption by Charpy and Izod impact test on metal specimen.	2 Hours
Experiment No. 7: Torsion test on different metals. **Learning Outcome:** Find out effect of torsional force by torsion test on metal specimen.	2 Hours

Textbooks:

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

Reference Books:

1. "Mechanics of Structure" (Vol. I and II) – Junnarkar S. B. and Advi, Charotar Publication.
2. "Mechanics of Materials" - R. C. Hibbler, Pearson Education.
3. "Mechanics of Materials" – Gere and Timoshenko, CBS publishers.
4. "Mechanics of Materials" Vol. I and II - Punmia, Jain, Laxmi Publications.
5. "Strength of Materials" – Bhavikatti S. S., New Age Publications.
6. "Strength of Materials" - R. K. Rajput, S. Chand Publications.
7. "Structural Analysis" – Bhavikatti S. S, Vikas Publications house New Dehli.
8. "Introduction to Mechanics of Solids" - J. B. Popov, Prentice–Hall publication.
9. "Strength of Material" - F. L. Singer and Pytel, Harper and Row publication.
10. "Mechanics of Material" - Beer and Johnston, M.
11. "Strength of Materials" - R. S. Khurmi and N. Khurmi, S. Chand Publications.

Class: S. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Concrete Technology Laboratory **Course No.:** UCEC0334	**L**	**T**	**P**	**Credits**
	---	---	02 hours per week	1

Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Civil Engineering
- Building Materials

Course Description:

The course explores the basic knowledge and fundamental principles of concrete testing. In this course students will be introduced to various properties of concrete through laboratory testing.

Course Learning Objectives:

- To develop technical skills for handling concrete through Laboratory experiments.
- Impart practical consideration for selection of appropriate materials for concrete work.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Demonstrate properties of concrete ingredients. .	Cognitive (Understanding) L2
CO.2	Test concrete as per standards.	Cognitive (Create) L5

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1	-	1
CO2	-	1

Assessments:

Assessment	**Weightage (Marks)**
ISE	25
ESE (OE)	25

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

Course Contents:

Experiment No. 1: Particle size distribution of fine aggregates **Learning Outcome:** Understand the particle size distribution of fine aggregate and its importance in concrete making.	2 Hours
Experiment No. 2: Flakiness & Elongation index of aggregates **Learning Outcome:** Identify suitable aggregate shape for concrete manufacturing.	
Experiment No. 3: Crushing strength of aggregates **Learning Outcome:** Understand the importance of crushing strength of aggregate and its application in concrete design.	2 Hours

Experiment No. 4: Determination Specific gravity of aggregates **Learning Outcome:** Determine the specific gravity of aggregate and its understand its application in concrete mix design.	2 Hours
Experiment No. 5: Experiment on Silt content of fine aggregates **Learning Outcome:** Determine the silt content and understand the limits of silt content as per standards.	2 Hours
Experiment No. 6: Test on bulking of sand **Learning Outcome:** Understand the phenomenon of bulking of sand and its impact on volume of concrete.	2 Hours
Experiment No. 7: Consistency test of cement **Learning Outcome:** Determine the percentage of water content required for concrete manufacturing	2 Hours
Experiment No. 8: Initial and final settling time of cement **Learning Outcome:** Understand the concept of initial and final setting time and its importance	
Experiment No. 9: Soundness Test of cement **Learning Outcome:** Determine soundness property of cement and understand its importance in determining volume of concrete.	2 Hours
Experiment No. 10: Concrete mix design **Learning Outcome:** Able to do concrete mix design	2 Hours
Experiment No. 11: Workability (Slump) test **Learning Outcome:** Understand the workability concept and define the suitability of concrete for placement.	2 Hours
Experiment No. 12: Compressive Strength Test on concrete mix **Learning Outcome:** Understand the compressive strength determination procedure and define the grade of concrete.	2 Hours

Textbooks:

1. M. S. Shetty, “Concrete Technology”, S. Chand Publications, 2005
2. M. L. Gambhir, “Concrete Technology”, Tata McGraw Hill Publications, Fifth edition 2013

References:

1. Neville A. M., "Properties of Concrete", Pearson Education India,
2. R.S. Varshney, “Concrete Technology”, Oxford and IBH.
3. P. Kumar Mehta, “Microstructure and properties of concrete”, Prentice Hall. Tata McGraw Hill
4. IS codes: - IS 10262:2009, IS 456:2000
5. Schild E, Casselmann H.F., Dahmen G., Pohlenz R. “Environmental Physics in Construction”, Granada Publishing, London.
6. National Building Code of India 2005, Bureau of Indian Standard, New Delhi.

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Building Drawing Laboratory **Course No.:** UCEC0335	**L**	**T**	**P**	**Credits**
	---	---	02 hours per week	01

Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Civil Engineering
- Basic building components and building services
- Principles of building planning
- AutoCAD software

Course Description:

The course explores the basic knowledge and fundamental principles of building planning through drawing building drawings during lab sessions. The course imparts the drawing skills in submission drawing, drawing various components of building.

Course Learning Objectives:

- To develop technical drawing skills of students
- Impart practical consideration in planning a building through site exposure and drawings

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Plan different components of building.	Cognitive (Applying) L3
CO.2	Design Residential building using Auto-CAD.	Cognitive (Creating) L6

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1		
CO2		1

Assessments:

Assessment	**Weightage (Marks)**
ISE	50

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

Course Contents:

Exercise No. 1: Building Components Study of Building Components (Draw the sketches of various types of foundation)	2 Hours
Exercise No. 2: Principles of planning Assignments based upon Principles of planning and building Bye laws.	2 Hours
Exercise No. 3: Door and Window Detail drawing of door and window showing all components of door and window (Section and Elevation)	2 Hours
Exercise No. 4: Design and drawing of Staircase: Dog legged and Open well Staircase	2 Hours

Exercise No. 5: Drawing of Measurement plan of any residential building	2Hours
Exercise No. 6: Building drawing Detailed Design and drawing for one residential building Using AutoCAD. Providing following details • Plan • Foundation / Centre Line Drawing. • Furniture layout plan. • Electrification plan • Water supply and drainage plan.	6 Hours
Textbooks: 1. Building Planning by Shah Kale 2. Building Construction – B.C.Punmia (Laxmi Publications) 3. Text Book of Building Construction – S.P. Arora, S.P. Bindra (DhanpatRai Publications) 4. Civil Engineering Drawing – M. Chakraborty.	
Reference Books: 1. A to Z of Practical Building Construction and Its Management- SandeepMantri (SatyaPrakashan, New Delhi) 2. SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi 3. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings 4. A Course in Civil Engineering Drawing – V.B.Sikka (S.K.Kataria and Sons)	

SYLLABUS

S. Y. B. Tech

Civil and Environmental Engineering

SEMESTER – IV

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Environmental Chemistry and Microbiology **Course Code:** UCEC0401	**L**	**T**	**P**	**Credits**
	03 hours per week	---	---	03

Course Pre-Requisite:

Students shall have knowledge of:

- Engineering Chemistry
- Applied Mathematics
- Biology

Course Description:

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

Course Learning Objectives:

At the end of the course students will be able to

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

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive Descriptor**
CO1	Explain the concepts of quantitative, physical, colloidal and bio-chemistry required in Environmental Engineering and environmental significance of various parameters.	Cognitive (Understanding) L2
CO2	Illustrate working principles of different instruments related to Environmental Engineering and to identify the environmental characteristics of organic compound.	Cognitive (Understanding) L2
CO3	Identify the effect of toxic and trace contaminants on environment.	Cognitive (Understanding) L2
CO4	Examine applications of environmental microbiology in water and wastewater engineering.	Cognitive (Analyzing) L4

CO-PO Mapping:

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

CO	**PSO1**	**PSO2**
CO1		
CO2		
CO3	1	
CO4	1	

Assessments:

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

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

Course Contents:

Unit 1: Significance of Chemistry in Environmental Engineering, Basic concepts from general chemistry: Properties of chemical compounds- atomic structure, molecular weight, equivalent weight, normality, molarity, standard solutions, Introduction to Stoichiometric reactions, oxidation-reduction equations, basics of mass balance. Environmental significance of pollutant parameters- Temperature, pH, Hardness, Iron, Manganese, Fluoride, Nitrogen, Phosphorous, Carbon, Sulphate, DO, BOD, COD, TOC.	7 Hours
Unit 2: **Basic Concepts from Colloidal Chemistry:** Size, methods of formation, general properties, environmental significance, colloidal dispersion in liquids, colloidal dispersion in air **Basic concept from Instrumental Analysis:** Absorption Spectroscopy- UV-visible, atomic absorption spectroscopy, flame photometry, Mass Spectroscopy and Gas Chromatography- Chromatography and its types, mass spectroscopy and gas chromatography. Colourimetric analysis: Lambert's and Beer's law, photoelectric colourimeters, Spectrophotometers, colour comparison tubes, Flame photometer,	7 Hours
Unit 3: **Toxic effects of organic compound** such as phenols, pesticides, surfactants, tannin, lignin and hydrocarbon. Heavy metals and trace contaminants- significance and health effects, Characteristics of hazardous material. **Environmental Characteristics of organic compounds:** saturation concentration, solubility, hydrolysis, photolysis. **Bio-Geo Cycles:** Phosphorous Cycle, Carbon Cycle, Nitrogen Cycle.	6 Hours
Unit 4: **Basic Concepts from Quantitative Chemistry:** Significance of quantitative measurements, gravimetric analysis, volumetric analysis, physical methods of analysis **Basic Concepts from physical chemistry**: Thermodynamics – Heat and work, energy, enthalpy, entropy, Vapour pressure of liquids, Binary mixtures, Solutions of solids in liquids, Oxidation, reduction, Osmosis, Dialysis, Electrodialysis, Principles of solvent extraction, Electro Chemistry, Chemical Kinetics Catalysis, Adsorption, Ion exchange.	8 Hours
Unit 5: **General Microbiology:** Microscopic flora and fauna concerned to environmental engineering, classification and characteristics of bacteria, (cytology, cells structure, chemical composition, metabolism (photosynthesis, chemosynthesis, autotrophic and hetrotopic), and morphology of bacteria, reproduction and growth of bacteria-modes of cell division, normal growth cycle of bacteria. **Culture techniques-** selective methods, pure cultures, methods of isolating pure cultures, culture characteristics, gram staining, microscopic examination of microorganisms **Indicator organisms of water pollution:** Coliform group, their significance in	6 Hours

environmental engineering, bacteriological techniques-MPN, Standard plate count, microorganisms other than coliform group.	
Unit 6: **Biochemistry:** Classification, Characteristics, Environmental significance of carbohydrates, high energy compounds, proteins, lipids. **Enzyme catalysis-** characteristics, chemical and physical properties, its Classification, the nature and mechanism of enzyme action (Enzyme catalyzed reaction, energy diagram, Michalius - Menten equation), Factors affecting rate of enzymatic reaction. Enzyme inhibition, source enzyme and enzyme formation, dissociation, denaturation,	6 Hours

Textbooks:

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

Reference Books:

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

Class: S.Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Hydrology and Water Resources Engineering **Course No.:** UCEC0402	**L**	**T**	**P**	**Credits**
	03 hours per week	01 hours per week	---	04

Course Pre-Requisite:

Students shall have knowledge of:

- Applied Mathematics
- Elements of Hydrological Cycle

Course Description:

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

Course Learning Objectives:

1. To emphasize the importance of study of Hydrology and necessity of conservation of Water Resources.
2. To develop the ability among students to synthesize data and understanding technical concepts of Water Resource Engineering
3. To build up the skills to determine discharge of flood, Runoff.

Course Outcomes:

CO	**After the completion of the course the student will be able to**	**Bloom's Cognitive Descriptor**
CO 1	Explain the elements of Hydrological Cycle and Surface Water Hydrology.	Cognitive (Understanding) L2
CO 2	Summarize the concepts of Groundwater Hydrology, Groundwater Flow to Wells and Groundwater Contamination.	Cognitive (Understanding) L2
CO 3	Illustrate the components and requirements of Water Resources Structures, Irrigation Systems and measures to control Water Logging.	Cognitive (Understanding) L2
CO 4	Make use of data for calculating Average Rainfall, Runoff, Flows to Wells and Water Requirements for Irrigation.	Cognitive (Applying) L3

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO 1	2								2			
CO 2	2								2			
CO 3	2								2			
CO4	2								2			

CO	**PSO1**	**PSO2**
CO 1		
CO 2		
CO 3		
CO4		

Assessments:

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

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

Course Contents:

Unit 1: Hydrology Definition, Importance and Scope of Hydrology, Hydrologic Cycle, Forms and Types of Precipitation, Methods of Measurement, Hyetograph, Mass Rainfall Curve, Factors Affecting Precipitation, Estimating Missing Data, Double Mass Curve Analysis, Determination of Average precipitation over a catchment, Evaporation and Evapotranspiration and Factors affecting, Infiltration: Process, Measurement and Factors affecting, Infiltration Indices.	7 Hours
Unit 2: Runoff Classification of Runoff, Factors affecting Runoff, Catchment Yield Calculations, Hydrograph: Storm Hydrograph, Base flow and Separation of Base flow, Direct Runoff Hydrograph, Unit Hydrograph Theory – Assumptions and Limitations, Derivation and Use of Unit Hydrograph, S-Curve, Design Flood Hydrograph, Introduction to Synthetic Unit Hydrograph (SUH).	7 Hours
Unit 3: Water Resources Structures Reservoir Planning, Sediment Control, Floods Routing, Introduction to Dams, Spillways, Energy Dissipation, Diversion Head Works, Canal Structures, Cross Drainage Works, River Training.	6 Hours
Unit 4: Groundwater Hydrology Occurrence and Distribution of Groundwater, Types of Aquifers, Specific Yield of Aquifer, Movement of Groundwater, Darcy‘s law, Permeability, Hydraulics of Well under Steady Flow Conditions in Confined and Unconfined Aquifers, Estimation of flows to wells. Sources of Groundwater Contamination, Contaminant Plumes, Transport Mechanism, Control of Groundwater Contamination.	8 Hours
Unit 5: Irrigation Definition and Necessity of Irrigation, Types of Irrigation, Different Systems of Irrigation, Methods of Application of Water to Soil for Irrigation, Concept of Lift irrigation. Classes and Availability of Soil water, Depth and Frequency of Irrigation, Crops Classification and Crop Rotation, Command Area-Calculations. Duty, Delta, Factors affecting Duty, Methods of improving Duty, Assessment and Efficiencies of Irrigation Water.	8 Hours
Unit 6: Water Logging and Control Water logging and Salinity, Causes (Natural and Artificial), Effects, Remedial Measures, Soil Efflorescence, Drainage Arrangement, Management of Saline and Alkaline Soils.	4 Hours

Textbooks:

1. Water Resources Engg. – Dr. P.N.Modi (Standard Book House)
2. Engineering Hydrology – H. M . Raghunath
3. Engineering Hydrology – K. Subramanya
4. Engineering Hydrology – Jay rami Reddy

Reference Books:

1. Applied Hydrology – V. T. Chaw
2. Hydrology and Soil Conservation – Ghanshyam Das, (PHI)
3. Water resources systems – R. S. Varshney.

Class: S. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Structural Analysis **Course No.:** UCEC0403	**L**	**T**	**P**	**Credits**
	03 hours per week	01 hour per week	-	04

Course Pre-Requisite:

- Engineering Mechanics
- Applied Mathematics
- Solid Mechanics

Course Description:

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

Course Learning Objectives:

1. To evaluate combined effect of direct and bending stresses.
2. To study effect of Two Dimensional stresses and principal stresses and strains.
3. To analyze the fixed beams.
4. To determine slope and deflection of beams due to different loads.
5. To study the analysis of continuous beams.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Extend the responses towards combined effect of loads and stresses.	Cognitive (Understanding) L2
CO.2	Analyze the stresses due to perpendicular load effects on structural parts and sections.	Cognitive (Analyzing) L4
CO.3	Analyze simple structures for deformation studies by conventional and/or energy concepts.	Cognitive (Evaluating) L5
CO.4	Evaluate the continuous beams and frames for typical determinate structures.	Cognitive (Evaluating) L5

CO-PO Mapping:

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

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

Assessments:

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

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

Course Contents:

Unit 1: Combined direct and bending stresses Direct and Eccentric loads, Stress distribution at base, No Tension condition, Middle Third rule, Limit of Eccentricity, Combined direct and bending stresses, Columns subjected to eccentric loading, Chimney, Earth Retaining wall, Masonry Dam, Stability of masonry dam.	08 Hours
Unit 2: Principal planes and stresses Principal planes and stress in two dimensions, Analytical and Mohr's circle method. Principal stress in beams. Combined bending, torsion and axial thrust effects on Solid and Hollow Shafts. Concept of Equivalent moment and equivalent torque.	06 Hours
Unit 3: Analysis of Fixed Beams Definition of Fixed beam, Comparison with simply supported beams, Advantages and Disadvantages of Fixed beams, Principle of Super-position. Analysis of Fixed beams (SFD and BMD of fixed beams).	06 Hours
Unit 4: Slope and deflection of determinate beams: Slope and deflection of determinate beams-Double integration method, Macaulay's method, moment-area method and conjugate beam method, three hinged parabolic arches.	08 Hours
Unit 5: Continuous Beams **Three Moment Theorem:** Introduction to continuous beams, Advantages and Disadvantages of continuous beams, Claporon's Three Moment theorem, Analysis of continuous beams (SFD and BMD of continuous beams) **Moment Distribution Method:** Introduction to moment distribution, Flexural rigidity, Stiffness factor, Distribution factor, Carry over, Moment distribution table. BMD and SFD of beams, Portal frames	08 Hours
Unit 6: Energy Theorem Castiglione's theorem, Betti'slaw, Maxwell's reciprocal theorem. Deformations of determinate beams, bents and portal frames by unit load method. Simple examples	04 Hours

Textbooks:

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

10. Strength of Material – Debabrata Nag, A. Chanda, 2nd Edition, Wiley India publication.

Reference Books:

1. "Mechanics of Structure" (Vol. I and II) – Junnarkar S. B. and Advi, Charotar Publication.
2. "Mechanics of Materials" - R. C. Hibbler, Pearson Education.
3. "Mechanics of Materials" – Gere and Timoshenko, CBS publishers.
4. "Mechanics of Materials" Vol. I and II - Punmia, Jain, Laxmi Publications.
5. "Strength of Materials" – Bhavikatti S. S., New Age Publications.
6. "Strength of Materials" - R. K. Rajput, S. Chand Publications.
7. "Structural Analysis" – Bhavikatti S. S, Vikas Publications house New Dehli.
8. "Introduction to Mechanics of Solids" - J. B. Popov, Prentice–Hall publication.
9. "Strength of Material" - F. L. Singer and Pytel, Harper and Row publication.
10. "Mechanics of Material" - Beer and Johnston, M.
11. "Strength of Materials" - R. S. Khurmi and N. Khurmi, S. Chand Publications.

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Hydraulics **Course No.:** UCEC0404	**L**	**T**	**P**	**Credits**
	03 hours per week	---	---	03

Course Pre-Requisite:

Students shall have the knowledge of:

- Applied Mathematics
- Engineering Physics
- Engineering Mechanics
- Fluid Mechanics

Course Description:

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

Course Learning Objectives:

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

Course Outcomes:

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

CO-PO Mapping:

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

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

Assessments:

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

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

Course Contents:

Unit 1: **Uniform Flow in Open Channel:** Difference between Pipe Flow and Open Channel Flow, Types of Open Channel, Types of Open Channel Flows, Geometric Elements of Open Channel, Velocity Distribution, Measurement of Velocity using Chezy's and Manning's Formula, Hydraulically Efficient Section (Rectangular, Triangular, Trapezoidal and Circular), Depth Energy Relationship, Specific Energy, Specific Energy Curve, Concept of Froude Number, Critical, Sub-Critical, Super-Critical Flows.	07 Hours
Unit 2: **Fundamentals of Fluid Flow:** **Gradually Varied Flow (GVF):** Classification of Channel Slopes, Dynamic Equation of GVF (Assumption and Derivation), Classification of GVF Profiles, Direct Step Method of Computation of GVF Profiles, Circular Arc Method. **Rapidly Varied Flow (RVF):** Definition, Hydraulic Jump: Phenomenon, Conjugate Depth Relationship, Characteristics, Uses and Types of Hydraulic Jump.	07 Hours
Unit 3: **Notches and Weirs:** Types, Derivation of Discharge Equation, Errors in Measurement of Discharge, Time of Emptying Tank with Notch or Weir, Calibration of Notches and Weirs, Velocity of Approach, Francis Formula, Effect of End Contraction, Sharp Crested, Broad Crested, Narrow Crested and Ogee Weir.	06 Hours
Unit 4: **Impact of Jet:** Impulse Momentum Principle, Impact of Jet on Vanes- Flat, Curved (Stationary and Moving), Series of Flat, Curved Vanes Mounted on Wheel, Inlet and Outlet Velocity Triangles.	06 Hours
Unit 5: **Water Distribution System:** Classification of Distribution System: Pumping, Gravity and Dual System, Layout of Distribution Pipe Network: Dead End, Ring, Grid, Radial System, Continuous and Intermittent Water Supply, Pressure in the Distribution System, Capacity of Distribution, Mass Curve Method, Design of Distribution System, Design Period and Factors Affecting, Methods of Networks Analysis.	07 Hours
Unit 6: **Sewerage System:** Types of Sewer Systems, Types of Sewerage System: Combined, Separate and Partially Separate System, Patterns of Collection Systems:	07 Hours

Perpendicular, Zone, Interceptor, Radial, Fan Pattern, Design Period, Design Discharge, Quantity of Sewage, Infiltration, Storm Runoff, Hydraulic Formulae, Free Board, Minimum and Maximum Velocity, Nomograms and Tables of Hydraulic Computations, Hydraulic Characteristics of Circular Sewer.	

Textbooks:

1. Fluid Mechanics: Including Hydraulic Machines, A. K. Jain, Khanna Publishers, New Delhi.
2. Hydraulics and Fluid Mechanics, P. N. Modi and S. M. Seth, Standard Book House, New Delhi.
3. A Textbook of Fluid Mechanics and Hydraulic Machines, Dr. R. K. Bansal, Laxmi Publications, New Delhi, 2013.
4. Water Supply and Sanitary Engineering, G. S. Birdie, J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.
5. Environmental Engineering – 1, Water Supply Engineering, B. C. Punmia, Arun K. Jain and Ashok K. Jain, Laxmi Publications Pvt. Ltd., New Delhi.
6. Environmental Engineering – 2, Wastewater Engineering, B. C. Punmia, Arun K. Jain and Ashok K. Jain, Laxmi Publications Pvt. Ltd., New Delhi.

Reference Books:

1. Fluid Mechanics, Frank.M. White, McGraw Hill Publishing Company Ltd, New Delhi.
2. Fluid Mechanics and Machinery, C. P. Kothandaraman and R. Rudramoorthy, New Age International Publishers.
3. Flow in Open Channels, K. Subramanya, McGraw Hill Education India Pvt. Ltd., New Delhi.
4. Open Channel Flow, M. Hanif Chaudhry, Pentice Hall, Boston.
5. Open Channel Hydraulics, V. T. Chow, Tata McGraw Hill.

Class: S. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Surveying and Geospatial Technology **Course No.:** UCEC0405	**L**	**T**	**P**	**Credits**
	03 hours per week	-	-	03

Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Civil Engineering
- Engineering Physics
- Surveying

Course Description:

The course will impart knowledge about basic principles of field surveying procedures and practices for Civil and Environmental Engineering applications and also impart knowledge on advanced surveying, photogrammetric survey, remote sensing, and Geographic Information Systems (GIS).

Course Learning Objectives:

1. To understand the working principle and use of GPS in Surveying.
2. To perceive the knowledge of photogrammetric survey and its use in Remote Sensing.
3. To learn the process of Remote Sensing and its use in Surveying.
4. Understand different components of GIS and Learn about map projection and coordinate systems.

Course Outcomes:

COs	**After the completion of the course, the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Explain the Use of GPS in Surveying	Cognitive (Understanding) L2
CO.2	Apply their knowledge in using Photogrammetric process in surveying.	Cognitive (Applying) L3
CO.3	Make use of their knowledge and select appropriate process of remote sensing in surveying	Cognitive (Applying) L3
CO.4	Utilize their knowledge of GIS technology in surveying process.	Cognitive (Applying) L3

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO.1		
CO.2		
CO.3		
CO.4		2

Assessments:

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

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

Course Contents:

Unit 1: **Triangulation**: Figures or systems, Signals, Satellite station, Baseline and its importance, corrections, Trigonometric leveling, Accessible and inaccessible objects. Global Positioning System (GPS)- Introduction, principle, and applications of GPS in different fields of Surveying.	06 Hrs.
Unit 2: **Photogrammetric Survey**: basic principles, aerial camera, the scale of a vertical photograph, relief displacement of a vertical photograph, the height of the object from relief displacement, flight planning for aerial photography, selection of altitude, the interval between exposures, crab and drift, stereoscope and stereoscopic views.	06 Hrs.
Unit 3: **Remote Sensing:** Concepts and physical basis of Remote Sensing, Electromagnetic spectrum, atmospheric effects, image characteristics. Remote sensing systems, spectral signatures and characteristics spectral reflectance curves. Salient features of some of Remote Sensing satellites missions.	06 Hrs.
Unit 4: **Visual & Digital image processing:** Types of pictorial data products, Interpretation of aerial photograph, general procedure, three-dimensional interpretation, basic elements of image interpretation. Basic character of a digital image, Geometric correction method, Radiometric correction method.	07 Hrs.
Unit 5: **Geographical Information System:** Introduction, Definition, Objectives, Components (people, procedure, hardware, software, and data), and functions (input, manipulation, management, query and analysis, and visualization) of GIS. Coordinate systems and projections, Georeferencing, GIS data – spatial (Raster and vector), and spatial data. Introduction to vector and raster data Applications of GIS, Limitations of GIS.	07 Hrs.
Unit 6: **Data input & Editing:** Introduction, data stream, existing datasets & creation, Data input methods, capturing coordinate data, GPS advantage. **Applications:** Applications of aerial photo interpretation, IS applications Forestry, Bio-diversity, Environment, Soil resource management, Hydrological modelling, Public utilities	06 Hrs.

Textbooks:

1. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
2. Arora, K.R., Surveying, Vol- III, Standard Book House.
3. Punmia BC et al: Surveying Vol. II, Laxmi Publication

Reference Books:

1. Chandra AM and Ghosh SK: Remote Sensing and Geographical Information System, Alpha Science
2. Ghosh SK: Digital Image Processing, Alpha Science

Class: S.Y.B.Tech Civil and Environmental Engineering	**L**	**T**	**P**	**Credits**
Title of the Course: Constitution of India (Audit Course – IV) **Course Code:**UCEA0461	02 hours per week	--	--	--

Course Pre-Requisite: Basics of Indian History, Independence Movement, Fundamentals of Civics.

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

Course Learning Objectives:

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

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

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive Descriptor**
CO1	**Explain** the significance of Indian Constitution as the fundamental law of the land	Cognitive (Understand) L2
CO2	Exercise his fundamental rights in proper sense at the same time **Identifies** his responsibilities in national building.	Cognitive (Applying) L2
CO3	**Analyze** the Indian political system, the powers and functions of the Union, State and Local Governments in detail	Cognitive (Understand) L2
CO4	**Understand** Electoral Process, Emergency provisions and Amendment procedure.	Cognitive (Understand) L2

CO-PO Mapping:

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

CO	**PSO1**	**PSO2**
CO1		
CO2		
CO3		
CO4		

Assessments:

Assessment	**Weightage (Marks)**
ESE	100

ESE: Assessment is based on 100% course content.

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

Textbooks:

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

References:

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

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Environmental Chemistry and Microbiology Laboratory **Course Code:**UCEC0431	**L**	**T**	**P**	**Credits**
	-	-	02 hours per week	01

Course Pre-Requisite:

Students shall have knowledge of:

- Engineering Chemistry
- Biology

Course Description:

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

Course Learning Objectives:

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

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive Descriptor**
CO1	Carry out water or wastewater quality analysis through physical, chemical, biological methods.	Cognitive (Understanding) L2
CO2	Identify types of cells, bacteria by using staining methods.	Cognitive (Understanding) L2

CO-PO Mapping:

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

CO	**PSO1**	**PSO2**
CO1	1	
CO2		

Assessments:

Assessment	**Weightage (Marks)**
ISE	25
ESE (POE)	25

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

Course Contents:

Experiment No. 1: Alkalinity and Acidity **Learning Outcome:** To determine alkalinity and acidity of given water sample by pH meter	2 Hours

Experiment No. 2: Turbidity and Conductivity **Learning Outcome:** To determine turbidity and conductivity of given water sample	2 Hours
Experiment No. 3: Solids **Learning Outcome:** To determine total solids, suspended solids and dissolved solids of given water sample	2 Hours
Experiment No. 4: Dissolved Oxygen **Learning Outcome:** To determine dissolved oxygen of given water sample by Winkler method	2 Hours
Experiment No. 5: Biochemical Oxygen Demand **Learning Outcome:** To determine Biochemical Oxygen Demand of given sample	2 Hours
Experiment No. 6: Demonstration of Atomic Absorption Spectroscopy **(AAS)** **Learning Outcome:** To determine Iron and Manganese (Demonstration using Atomic Absorption Spectroscopy)	2 Hours
Experiment No. 7: Gram staining **Learning Outcome:** To study gram's characteristics of given bacterial suspension	2 Hours
Experiment No. 8: Introduction to Microscope **Learning Outcome:** To understand parts, function and working of microscope	2 Hours
Experiment No. 9: Standard Plate Count **Learning Outcome:** To estimate bacterial density by plate count method	2 Hours
Experiment No. 10: Most Probable Number **Learning Outcome:** To determine bacteriological quality of potable water	2 Hours

Textbooks:

1. Sawyer. C.N. and Mc Carty. P.L., "Chemistry for Environmental Engineers", Tata McGraw-Hill Publishing Company Limited, 4th Edition, 1994.

Reference Books:

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

Class: S. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Building Planning and Design Laboratory **Course No.:** UCEC0432	**L**	**T**	**P**	**Credits**
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Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Civil Engineering
- Basic Building Components and Building Services
- Principles of Building Planning
- AutoCAD Software

Course Description:

The course explores the basic knowledge and fundamental principles of building planning through drawing building drawings during lab sessions. The course imparts the drawing skills in submission drawing, drawing various working drawings of buildings.

Course Learning Objectives:

- To develop technical drawing skills of students for public buildings & Working drawings
- Impart practical consideration in planning a building through site exposure & drawings

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Plan Public buildings.	Cognitive (Applying) L3
CO.2	Design public buildings as per standards using Auto CAD software.	Cognitive (Create) L6

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1	-	-
CO2	-	1

Assessments:

Assessment	**Weightage (Marks)**
ISE	25
ESE (POE)	25

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

Course Contents:

Assignment No. 1: Study of requirements of different public buildings. (Principles, Site selection & Amenities)	2 Hours
Drawing No. 1: Planning of public buildings: Design & Drawing of line plans on graph papers for public buildings – four assignments on graph papers	4 Hours

Drawing No.2: Building Drawing: Detailed design &drawing for\any one public building using. Providing following details Submission drawing Foundation / Centre Line Drawing. Furniture layout plan. Electrification plan Water supply and drainage plan	4 Hours
Drawing No. 3: 3D Drawing of a public building plan using AutoCAD	2 Hours
Assignment No. 2: Visit to a public building and a report based on that.	2 Hours
Textbooks: 1. Building Planning by Shah Kale 2. Building Construction – B.C. Punmia (Laxmi Publications) 3. Text Book of Building Construction – S.P. Arora, S.P. Bindra (Dhanpat Rai Publications) 4. Civil Engineering Drawing – M. Chakraborty.	
References: 1. A to Z of Practical Building Construction and Its Management- Sandeep Mantri (Satya Prakashan, New Delhi) 2. SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi 3. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings 4. A Course in Civil Engineering Drawing – V.B.Sikka (S.K.Kataria and Sons)	

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Open Channel Hydraulics Laboratory **Course No.:** UCEC0433	**L**	**T**	**P**	**Credits**
	---	---	02 hours per week	01

Course Pre-Requisite:

Students shall have the knowledge of:

- Applied Mathematics
- Engineering Physics
- Engineering Mechanics
- Fluid Mechanics

Course Description:

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

Course Learning Objectives:

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

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Exhibit hydraulic principles, laws and equations through experimentation.	Cognitive (Understanding) L2
CO.2	Standardize various hydraulic measuring devices through experimental procedures.	Cognitive (Analyzing) L4

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO.1				3	1					2		
CO.2				3	1					2		

COs	**PSO1**	**PSO2**
CO.1	-	-
CO.2	-	1

Assessments:

Assessment	**Weightage (Marks)**
ISE	25
ESE (OE)	25

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

Course Contents:

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

Experiment No. 2: Study of Hydraulic Jump. **Learning Outcome:** To compare measured flow depths with theoretical results based on the application of continuity and momentum principles.	2 Hours
Experiment No. 3: Calibration of Rectangular and Triangular Notch. **Learning Outcome:** To determine the coefficient of discharge for a rectangular notch and 60° triangular notch using analytical and graphical methods.	2 Hours
Experiment No. 4: Calibration of Trapezoidal Notch. **Learning Outcome:** To determine the coefficient of discharge for a trapezoidal notch using analytical and graphical methods.	2 Hours
Experiment No. 5: Calibration of Weirs. **Learning Outcome:** To determine the coefficients of discharge for ogee and broad crested weir using analytical and graphical method.	2 Hours
Experiment No. 6: Determination of Roughness Coefficients for Given Pipe Material. **Learning Outcome:** To compute Chezy's 'C' and Manning's 'N' for the given pipe material.	2 Hours
Experiment No. 7: Determination of Roughness Coefficients for Open Channel. **Learning Outcome:** To compute Chezy's 'C' and Manning's 'N' in a Laboratory Flume.	2 Hours

Textbooks:

1. Fluid Mechanics: Including Hydraulic Machines, A. K. Jain, Khanna Publishers, New Delhi.
2. Hydraulics and *Fluid Mechanics*, P. N. Modi and S. M. Seth, Standard Book House, New Delhi.
3. A Textbook of Fluid Mechanics and Hydraulic Machines, Dr. R. K. Bansal, Laxmi Publications, New Delhi, 2013.
4. Water Supply and Sanitary Engineering, G. S. Birdie, J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.
5. Environmental Engineering – 1, Water Supply Engineering, B. C. Punmia, Arun K. Jain and Ashok K. Jain, Laxmi Publications Pvt. Ltd., New Delhi.
6. Environmental Engineering – 2, Wastewater Engineering, B. C. Punmia, Arun K. Jain and Ashok K. Jain, Laxmi Publications Pvt. Ltd., New Delhi.

Reference Books:

1. Fluid Mechanics, Frank.M. White, McGraw Hill Publishing Company Ltd, New Delhi.
2. Fluid Mechanics and Machinery, C. P. Kothandaraman and R. Rudramoorthy, New Age International Publishers.
3. Flow in Open Channels, K. Subramanya, McGraw Hill Education India Pvt. Ltd., New Delhi.
4. Open Channel Flow, M. Hanif Chaudhry, Pentice Hall, Boston.
5. Open Channel Hydraulics, V. T. Chow, Tata McGraw Hill.

Class: S.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Geospatial Laboratory **Course No.:** UCEC0434	**L**	**T**	**P**	**Credits**
	---	---	02 hours per week	01

Course Pre-Requisite:

Students shall have the basic knowledge of:

- Applied Mathematics
- Surveying
- Surveying and Geospatial Technology

Course Description:

This course offers an opportunity for the students to understand the basics of geospatial technology for developing an interest in the principles, practical uses, and resources related to geospatial technologies. This course will enable the students to get an insight into the diverse geospatial database concepts, creating and implementing of the same, GIS theory and spatial analysis, supplemented by extensive practical exercises. Also, it will help the students to acquire skills for further studies and to enter the professional world.

Course Learning Objectives:

1. To impart the basic knowledge to students to compile, analyze, and present geospatial data.
2. To develop creative thinking among students for solving real problems commonly addressed with Geospatial Technology.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Taxonomy Descriptor**
CO.1	Classify the maps, coordinate systems and projections to process spatial and attribute data.	Cognitive (Analyzing) L4
CO.2	Create maps and other geographic representations to extract, analyze, interpret and present spatial information.	Cognitive (Creating) L6

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1		
CO2		2

Assessments:

Assessment	**Weightage (Marks)**
ISE	50

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

Course Contents:

Experiment No. 1: Introduction to GIS Environment **Learning Outcome:** Installing GIS, working with navigation tools, visualizing attribute and spatial data, coordinate system types, map projection and distortion.	2 Hours
Experiment No. 2: Working with Symbology, Styling and Labelling **Learning Outcome:** Layer Properties, styling vector layers, displaying labels, setting up scale based visibility.	2 Hours

Experiment No. 3: Georeferencing **Learning Outcome:** Use of toposheets, activating Georeferencing tool in GIS, adding control points, transformation settings.	2 Hours
Experiment No. 4: Data Creation and Editing (Digitization) **Learning Outcome:** Introduction to vector layers, creating shape files in GIS, editing tools and functionalities.	2 Hours
Experiment No. 5: Integrating Google Earth data - Integrating data created using Google Earth and its integration in GIS, working with KML files.	2 Hours
Experiment No. 6: Spatial data gathering techniques (Mobile/ GPS) **Learning Outcome:** GPS data collection and mapping, use of smart phone for data collection, settings for initialization, geo tagging, integration in GIS.	2 Hours
Experiment No. 7: Digital Elevation Model (DEM) and Terrain Analysis **Learning Outcome:** Preparation of DEM, contour map, slope map and other terrain maps.	2 Hours
Experiment No. 8: Merging of Raster Layers, Importing and Exporting Data **Learning Outcome:** Merging of raster layers, importing and exporting spreadsheets or CSV files in GIS environment.	2 Hours
Experiment No. 9: Production and Management of Geospatial Database **Learning Outcome:** Analysis of geospatial data with GIS, computation of length, perimeter, area and other geometrical features.	2 Hours
Experiment No. 10: Map Publishing **Learning Outcome:** Creating map layout in GIS, exporting the map to various formats, components and details of map.	2 Hours

Text Books:

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.

Reference 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 and Sons, Inc.

Websites:

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

Class: S. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Mini Project - I **Course No.:** UCEC0451	**L**	**T**	**P**	**Credits**
	---	---	02 hours per week	1

Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Sciences
- Engineering Sciences
- Mathematics
- Program Core Courses

Course Description:

The Mini Project-I laboratory is designed to help students to develop practical ability and knowledge about practical tools/ techniques in order to solve real-life problems related to the industry, academic institutions, and research. The course Mini Project is one that involves practical work for understanding and solving problems in the field of Civil and Environmental Engineering. It provides the opportunity for students to demonstrate the application of their fundamental, analytical, and research skills, and to apply their knowledge to complex and real-world problems.

Course Learning Objectives:

1. To acquire knowledge to conduct research
2. Develop an experimental set-up to solve the problem, do testing, and validation of the results

Course Outcomes:

COs	**After the completion of the course, the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Undertake research work using theoretical studies, Experimentations, and computer simulations.	Psychomotor (Readiness to Act) L2
CO.2	Establish the findings for describing the work undertaken, results, and conclusions within the specified time frame.	Psychomotor (Ability to Perform) L5

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1	2	1
CO2	1	2

Assessments:

Assessment	**Weightage (Marks)**
ISE	50

- ISE: Assessment is based on the efforts of the students for formulating the problem, developing design solutions, testing and validating the solution and presentation

Course Contents:

Students are expected to carry out independent research work on the selected topic. It is expected that the students formulate the research problem, develop/fabricate of experimental set-up (if any) and test and analysis of results thus obtained. The students are required to submit the report of mini project work and present their findings during the oral presentations.