DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Kolhapur Institute of Technology's College of Engineering Kolhapur (Empowered Autonomous)

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

Department of Civil and Environmental Engineering

Curriculum and Syllabus for

Third Year B. Tech. Civil and Environmental Engineering

(As Per NEP, 2020)

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

ABOUT THE DEPARTMENT

Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur is the only Institute in Maharashtra offering B. Tech in Civil and Environmental Engineering (04 Years Duration). Department offers M. Tech Program in Environmental Engineering (02 Years Duration) and it also has Ph.D. Research Centre in Environmental Engineering approved by Shivaji University, Kolhapur. Department is Accredited by National Board of Accreditation (NBA), New Delhi. Department of Civil and Environmental Engineering of KIT CoE, Kolhapur has been imparting education and training in all aspects of sustainable environment. The students undergo an academic program based on necessary fundamental concepts and major thrust areas of Civil Engineering and emphasizing on domains of Environmental Engineering such as, Water and Wastewater Engineering, Air and Noise Pollution Control, Solid and Hazardous Waste Management, Hydraulics, Environmental Management System, Environmental Impact Assessment and Legislation, Environment Health and Safety, Environmental Sanitation, Geospatial Technology, Renewable Energy Resources, Environmental Sustainability etc.
Department has PAN India Consultancy. Faculties and students are actively involved in several projects funded by various funding agencies and industries. The department has very good infrastructure equipped with necessary facilities and laboratories. Teaching learning process is effective by use of MOODLE and ICT based education. Student progress is monitored by effective mentoring and feedback system. Department offers B. Tech (Hons.) Civil and Environmental Engineering with Specialization in Green Technology and Sustainability Engineering, Project Based Learning, Business Club Activity, Soft Skill Development Programs, Student – Alumni Dialogues Initiatives as well as Value Added Programs. Department has a very strong alumni base spread all over the world as well as very good industry-institute connect through which training, internship and placement opportunities are provided to the students. The department has very strong student-support system.

DEPARTMENT VISION

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

DEPARTMENT MISSION

M1:	To impart essential technical knowledge, skills and Environmental ethics.
M2:	To develop professional capabilities to meet changing societal and industrial needs.
M3:	To build up base for Research and Consultancy activities.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1:	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.

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PROGRAMME OUTCOMES (PO)	
PO1:	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and engineering specialization for solution of complex problems of Civil and Environmental Engineering.
PO2:	Identify, formulate, review research literature and analyze complex Civil and Environmental Engineering problems reaching substantiated conclusions with consideration for sustainable development.
PO3:	Design creative solutions for complex Civil and Environmental Engineering problems and develop system components to meet identified needs with consideration for public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
PO4:	Conduct investigations of complex Civil and Environmental Engineering problems using research-based knowledge including design of experiments, modeling, analysis and interpretation of data to provide valid conclusions.
PO5:	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling, recognizing their limitations to solve complex Civil and Environmental Engineering problems
PO6:	Analyze and evaluate societal and environmental aspects while solving complex Civil and Environmental Engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.
PO7:	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national and international laws.
PO8:	Function effectively as an individual, and as a member or leader in multi-disciplinary teams.
PO9:	Communicate effectively and inclusively within the engineering community and society at large, through oral presentations and written reports and design documentation, considering cultural, language, and learning differences.
PO10:	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage Civil and Environmental Engineering projects in multidisciplinary environments.
PO11:	Recognize the need for and have the preparation and ability for independent and life-long learning to engage in contemporary and emerging technologies and thinking in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)	
PSO1:	Identify and analyze the pollution related problems generated due to urbanization and industrialization.
PSO2:	Interpret the data using various tools and techniques to provide effective and applicable solutions.

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As per NEP Guidelines											
Proposed Scheme of Credit Distribution											
	Year	**FY**		**SY**		**TY**		**B. Tech.**			
Sr. No.	**Curriculum Components**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Actual**	**NEP Guidelines**
1	Basic Science Courses **(BSC)**	8	8							**16**	**14-18**
2	Engineering Science courses **(ESC)**	10	3							**13**	**12-16**
3	Programme Core Courses **(PC)**		3	16	15	10	11	11		**66**	**44-56**
4	Programme Elective courses **(PEC)**					3	3	3	6	**15**	**20**
5	Multi Minor **(MM)**			2	3	3	3	3		**14**	**14**
6	Open elective **(OE)**					3	3	2		**8**	**8**
7	Vocational and Skill Enhancement course **(VSEC)**	1	3		1	1				**6**	**8**
8	Ability Enhancement Course **(AEC)**		3				1			**4**	**4**
9	Entrepreneurship /Economics/ Management courses (Mgt/Economics/Mkt/Finance) **(HSSM)**			2		2				**4**	**4**
10	Indian knowledge system **(IKS)**	2								**2**	**2**
11	Value Education course **(VEC)**			2	2					**4**	**4**
12	Research Methodology (Project) **(RM)**							4		**4**	**4**
13	Comm. Engg Project/Field Project (PBL/Seminar/Mini Project) **(CEP)**					1	1			**2**	**2**
14	Project **(PP)**								4	**4**	**4**
15	Internship/OJT (PBL/Seminar/Mini Project/Virtual Internship/Physical) **(OJT)**			1	1				6	**8**	**12**
16	Co-curricular Courses **(CC)**		1		1		1		1	**4**	**4**
		20-22	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**174**	
		21	**21**	**23**	**23**	**23**	**23**	**23**	**17**	**174**	

B. Tech. Civil and Environmental Engineering
Regulation 2024-25

SEMESTER-I

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component			
1.	BSC	UHSBS0101	Engineering Mathematics-I	3	1	-	4	4	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2.	BSC	UHSBS0108	General Physics and Optics	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3.	ESC	UHSES0109	Engineering Mechanics	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
4.	ESC	UHSES0110	Basic Mechanical Engineering	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
5.	ESC	UHSES0111	Introduction to Python Programming	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
6.	BSC	UHSBS0128	General Physics and Optics Lab	-	-	2	2	1	ISE	50	20	
7.	ESC	UHSES0129	Engineering Mechanics Lab	-	-	2	2	1	ISE	50	20	
8.	ESC	UHSES0130	Basic Mechanical Engineering Lab	-	-	2	2	1	ISE	50	20	
9.	ESC	UHSES0131	Introduction to Python programming Lab	-	-	2	2	1	ISE	50	20	
10.	VSEC	UHSVS0132	Workshop Practice Lab	-	-	2	2	1	ISE	50	20	
11.	IKS	UHSIK0136	Ecology, Energy & Environment	2	-	-	2	2	ISE	100	40	
Total:							**26**	**21**	**Total Marks: 800 Total Credit: 21**			

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SEMESTER-II

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component			
1.	BSC	UHSBS0201	Engineering Mathematics-II	3	1	-	4	4	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2.	BSC	UHSBS0212	Applied Chemistry	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3.	AEC	UHSAE0203	Communication Skills	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
4.	ESC	UHSES0213	Basic Civil Engineering	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
5.	PC	UHSPC0214	Fundamentals of Electrical Engineering	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
6.	BSC	UHSBS0233	Applied Chemistry Lab	-	-	2	2	1	ISE	50	20	
7.	AEC	UHSAE0222	Communication Skills Lab	-	-	2	2	1	ISE	50	20	
8.	ESC	UHSES0234	Basic Civil Engineering Lab	-	-	2	2	1	ISE	50	20	
9.	PC	UHSPC0235	Fundamentals of Electrical Engineering Lab	-	-	2	2	1	ISE	50	20	
10.	VSEC	UHSVS0238	Computer Aided Engineering Drawing	-	-	2	2	3	ISE1 ISE2 ESE (POE)	25 25 50	 20	40
11.	CC	UHSCC0239	Co-Curricular Course	1	-	-	-	1	ISE	100	40	
						Total:	**24**	**21**	**Total Marks: 800** **Total Credit: 21**			

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SEMESTER-III

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component			
1.	PC	UCEPC0301	Computational Methods and Numerical Analysis	3	1	-	4	4	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2.	PC	UCEPC0302	Fluid Mechanics	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3.	PC	UCEPC0303	Solid Mechanics	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
4.	PC	UCEPC0304	Surveying and Geospatial Technology	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
5.	HSSM	UCEEM0305	Engineering Management	2	-	-	2	2	ESE	50	20	20
6.	VEC	UCEVE0306	Environmental Studies	2	-	-	2	2	ISE	50	20	20
7.	PC	UCEPC0331	Fluid Mechanics Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10	
8.	PC	UCEPC0332	Strength of Materials Laboratory	-	-	2	2	1	ISE	25	10	
9.	PC	UCEPC0333	Surveying Laboratory	-	-	2	2	1	ISE ESE (POE)	50 25	20 10	
10.	OJT (CLPBL)	UCEIL0334	Building Planning and Design Laboratory	-	-	2	2	1	ISE	50	20	
11.	MM	*UCEMM0__	Multi-Disciplinary Minor	2	-	-	2	2	ESE	100	40	
						Total:	**27**	**23**	**Total Marks: 800** **Total Credit: 23**			

*UCEMM0341	Introduction to Data Science (MM-1)
*UCVMM0341	Basics of Projects and Automation (MM-1)
*UCEMM0342	Introduction to Management (MM-1)

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SEMESTER-IV

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component			
1.	PC	UCEPC0401	Building Construction Technology	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2.	PC	UCEPC0402	Environmental Hydraulics	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3.	PC	UCEPC0403	Structural Analysis	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
4.	PC	UCEPC0404	Hydrology and Water Resources Engineering	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
5.	PC	UCEPC0405	Environmental Chemistry and Microbiology	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
6.	VEC	UCEVE0406	Constitution of India	2	-	-	2	2	ISE	50	20	
7.	PC	UCEPC0431	Material Testing Laboratory	-	-	2	2	1	ISE ESE (OE)	25 25	10 10	
8.	PC	UCEPC0432	Environmental Chemistry and Microbiology Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10	
9.	OJT (MPBL)	UCEIL0471	Mini Project - I	-	-	2	2	1	ISE	25	10	
10.	VSEC	UCEVS0433	Geospatial Laboratory	-	-	2	2	1	ISE	25	10	
11.	CC	UCECC0434	Co-Curricular Activities I	-	-	2	2	1	ISE	50	20	
12.	MM	*UCEMM0__	Multi-Disciplinary Minor	3	-	-	3	3	ESE	100	40	
						Total:	**28**	**23**	**Total Marks: 850** **Total Credit: 23**			

*UCEMM0441	Statistics for Data Science (MM-II)
*UCVMM0441	Instrumentation and Data Analytics (MM-II)
*UCEMM0442	Introduction to Human Resource management (MM-II)

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SEMESTER-V

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component			
1.	PC	UCEPC0501	Water Supply Engineering	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2.	PC	UCEPC0502	Transportation Engineering	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3.	PC	UCEPC0503	Air Pollution and Control	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
4.	PEC	UCEPE05**	Program Elective – I	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
5.	OE	UCEOE05**	Open Elective – I	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
6.	HSSM	UCEEM0504	Sustainability Management	2	-	-	2	2	ESE	50	20	
7.	PC	UCEPC0531	Water Treatment Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10	
8.	PC	UCEPC0532	Transportation Engineering Laboratory	-	-	2	2	1	ISE	25	10	
9.	VSEC	UCEVS0533	Environmental Monitoring Laboratory	-	-	2	2	1	ISE ESE (OE)	25 25	10 10	
10.	CEP	UCEIL0571	Mini Project – II	-	-	2	2	1	ISE	25	10	
11.	MM	*UCEMM0__	Multi-Disciplinary Minor	3	-	-	3	3	ESE	100	40	
						Total:	**27**	**23**	**Total Marks: 800** **Total Credit: 23**			

*UCEMM0541	Python for Data Science (MM-III)
*UCVMM0541	Applications of AI (MM-III)
*UCEMM0542	Introduction to Marketing Management (MM-III)

Program Electives:

PROGRAM ELECTIVE –I (PEC)								
Sr. No.	**Semester**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1.	V	UCEPE0511	Environmental Sanitation (PE-I)	3	-	-	3	3
2.	V	UCEPE0512	Renewable Energy Engineering (PE-I)	3	-	-	3	3
3.	V	UCEPE0513	Construction Practices (PE-I)	3	-	-	3	3
						Total:	**3**	**3**

Open Elective Courses:

OPEN ELECTIVE –I (OE)								
Sr. No.	**Semester**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1.	V	UCEOE0521	Water Resources Management	3	-	-	3	3
						Total:	**3**	**3**

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SEMESTER-VI

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component			
1.	PC	UCEPC0601	Wastewater Engineering	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2.	PC	UCEPC0602	Solid Waste Management	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3.	PC	UCEPC0603	Geotechnical Engineering	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
4.	PEC	UCEPE06**	Program Elective – II	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
5.	OE	UCEOE06**	Open Elective – II	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
6.	AEC	UCEAE0604	Business Communication and Value Science		-	2	2	1	ISE	50	20	
7.	PC	UCEPC0631	Wastewater Engineering Laboratory	-	-	2	2	1	ISE ESE (OE)	25 25	10 10	
8.	PC	UCEPC0632	Geotechnical Engineering Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10	
9.	PC	UCEPC0633	Programming Laboratory	-	-	2	2	1	ISE	25	10	
10.	FP	UCEIL0671	Design and Drawing of Environmental Systems	-	-	2	2	1	ISE	25	10	
11.	CC	UCECC0634	Co-Curricular Activities II	-	-	2	2	1	ISE	50	20	
12.	MM	*UCEMM0__	Multi-Disciplinary Minor	3	-	-	3	3	ESE	100	40	
						Total:	**29**	**23**	**Total Marks: 850** **Total Credit: 23**			

*UCEMM0641	Data Analytics (MM-IV)
*UCVMM0641	Digital Twin and Asset management (MM-IV)
*UCEMM0642	HR practices in the Organization (MM-IV)

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PROGRAM ELECTIVE – II (PEC)

Sr. No.	Semester	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1.	VI	UCEPE0611	Noise Pollution and Control (PE-II)	3	1	-	4	4
2.	VI	UCEPE0612	Irrigation and Hydraulic Structures (PE-II)	3	1	-	4	4
3.	VI	UCEPE0613	Design of Steel Structures (PE-II)	3	1	-	4	4
						Total:	**4**	**4**

OPEN ELECTIVE –II (OE)

Sr. No.	Semester	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1.	VI	UCEOE0621	Waste Management	3	-	-	3	3
2.	VI	UCEOE0622	Industrial Health & Safety	3	-	-	3	3
						Total:	**3**	**3**

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SEMESTER-VII

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component			
1.	PC	UCEPC0701	Design of Concrete Structures	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2.	PC	UCEPC0702	Advanced Water and Wastewater Treatment	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3.	PC	UCEPC0703	Quantity Surveying and Valuation	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
4.	PEC	UCEPE07**	Program Elective – III	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
5.	OE	UCEOE07**	Open Elective – III	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
6.	PC	UCEPC0731	Treatability Studies Laboratory	-	-	2	2	1	ISE ESE (OE)	25 25	10 10	
7.	PC	UCEPC0732	Quantity Surveying and Valuation Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10	
8.	RM (Project)	UCEIL0771	Project I	-	-	8	8	4	ISE ESE	50 50	20 20	
9.	MM	*UCEMM0__	Multi-Disciplinary Minor	3	-	-	3	3	ESE	100	40	
						Total:	**29**	**23**	**Total Marks: 800** **Total Credit: 23**			

*UCEMM0741	Mathematical Modelling and Simulation (MM-V)
*UCVMM0741	Automation in Project Implementation (MM-V)
*UCEMM0742	Introduction to Financial Management (MM-V)

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PROGRAM ELECTIVE –III (PEC)								
Sr. No.	**Semester**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1.	VII	UCEPE0711	Environment, Health, and Safety (PE-III)	3	-	-	3	3
2.	VII	UCEPE0712	Operation and Maintenance of Environmental Facilities (PE-III)	3	-	-	3	3
3.	VII	UCEPE0713	Transportation Infrastructure (PE-III)	3	-	-	3	3
						Total:	**3**	**3**

OPEN ELECTIVE-III(OE)								
Sr. No.	**Semester**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1.	VII	UCEOE0721	Environmental Policies & Laws	2	-	-	2	2
2.	VII	UCEOE0722	Environmental Impact Assessment	2	-	-	2	2
						Total:	**2**	**2**

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SEMESTER-VIII

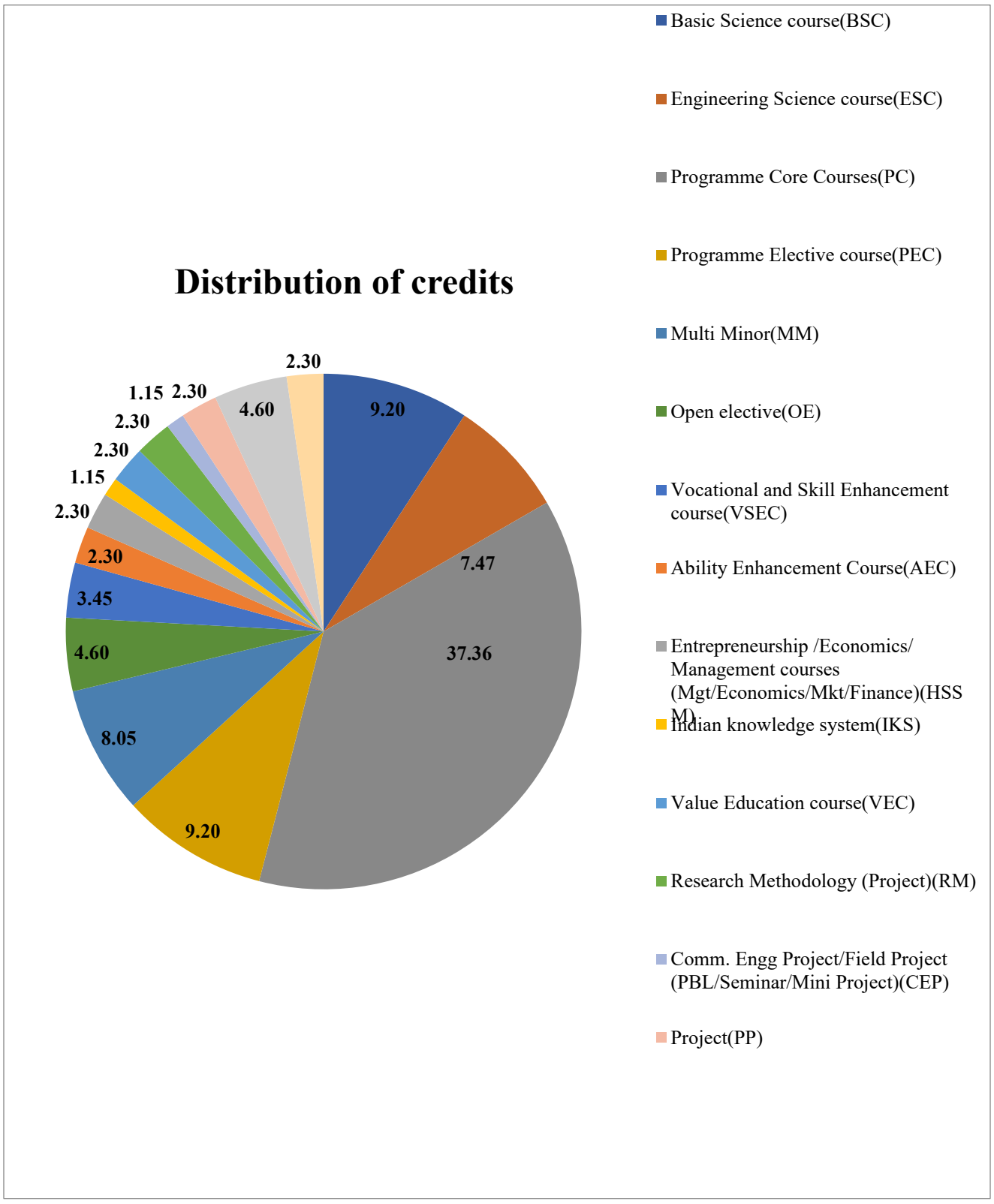
Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component			
1.	PEC	UCEPE08**	Program Elective – IV	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2.	PEC	UCEPE08**	Program Elective – V	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3.	PP	UCEIL0871	Project II	-	-	8	8	4	ISE ESE	50 50	20 20	40
4.	OJT	UCEIL0872	Internship	-	-	12	12	6	ISE I ISE II	75 75	30 30	60
5.	CC	UCECC0831	Co-Curricular Activities	-	-	2	2	1	ISE	50	20	
						Total:	**28**	**17**	**Total Marks: 500 Total Credit: 17**			

PROGRAM ELECTIVE – IV(PEC)

Sr. No.	Semester	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1.	VIII	UCEPE0811	Advanced Construction Technology (PE-IV)	3	-	-	3	3
2.	VIII	UCEPE0812	Industrial Wastewater Treatment (PE-IV)	3	-	-	3	3
3.	VIII	UCEPE0813	Urban and Rural Planning (PE-IV)	3	-	-	3	3
4.	VIII	UCEPE0814	Environmental Impact Assessment & Legislation (PE-IV)	3	-	-	3	3
						Total:	**3**	**3**

PROGRAM ELECTIVE –V (PEC)

Sr. No.	Semester	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1.	VIII	UCEPE0815	Environmental Management System (PE-V)	3	-	-	3	3
2.	VIII	UCEPE0816	Project Management (PE-IV)	3	-	-	3	3
3.	VIII	UCEPE0817	Environmental Social Governance (PE-V)	3	-	-	3	3
4.	VIII	UCEPE0818	Hazardous Waste Management (PE-V)	3	-	-	3	3
						Total:	**3**	**3**



Pie chart showing the distribution of credits.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

MULTIDISCIPLINARY MINOR IN DATA SCIENCE (MDM-DS)								
Sr. No.	**Seme**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1.	III	UCEMM0341	Introduction to Data Science (MM-I)	2	-	-	2	2
2.	IV	UCEMM0441	Statistics for Data Science (MM-II)	3	-	-	3	3
3.	V	UCEMM0541	Python for Data Science (MM-III)	3	-	-	3	3
4.	VI	UCEMM0641	Data Analytics (MM-VI)	3	-	-	3	3
5.	VII	UCEMM0741	Mathematical Modeling & Simulation (MM-V)	3	-	-	3	3
						Total:	**14**	**14**

MULTIDISCIPLINARY MINOR in PROJECT AUTOMATION (MDM-PE)								
Sr. No.	**Sem**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1.	III	UCVMM0341	Basics of Projects and Automation (MM-I)	2	-	-	2	2
2.	IV	UCVMM0441	Instrumentation and Data Analytics (MM-II)	3	-	-	3	3
3.	V	UCVMM0541	Applications of AI (MM-III)	3	-	-	3	3
4.	VI	UCVMM0641	Digital Twin and Asset Management (MM-IV)	3	-	-	3	3
5.	VII	UCVMM0741	Automation in Project Implementation (MM-V)	3	-	-	3	3
						Total:	**14**	**14**

MULTIDISCIPLINARY MINOR In LEADERSHIP and MANAGEMENT (MDM-HRD)								
Sr. No.	**Seme**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1.	III	UCEMM0342	Introduction to Management (MM-I)	2	-	-	2	2
2.	IV	UCEMM0442	Introduction to Human Resource Management (MM-II)	3	-	-	3	3
3.	V	UCEMM0542	Introduction to Marketing Management (MM-III)	3	-	-	3	3
4.	VI	UCEMM0642	HR Practices in the Organization (MM-IV)	3	-	-	3	3
5.	VII	UCEMM0742	Introduction to Financial Management (MM-V)	3	-	-	3	3
						Total:	**14**	**14**

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

B. TECH (HONS.) IN CIVIL AND ENVIRONMENTAL ENGINEERING WITH SPECIALIZATION IN GREEN TECHNOLOGY AND SUSTAINABILITY ENGINEERING

Sr. No.	Semester	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1.	III	UCEHC0351	Environmentally Sustainable Materials	3	1	-	4	4
2.	IV	UCEHC0451	Energy Technologies and Management	3	1	-	4	4
3.	V	UCEHC0551	Faecal Sludge and Septage Management	3	1	-	4	4
4.	VI	UCEHC0651	Environmental Economics	3	1	-	4	4
5.	VII	UCEHC0751	Mini Project	-	-	4	4	2
						Total:	**20**	**18**

B. TECH (EMERGING MINOR) IN CIVIL AND ENVIRONMENTAL ENGINEERING WITH SPECIALIZATION IN SUSTAINABILITY ENGINEERING

Sr. No.	Semester	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1.	III	UCEMNC0361	Sustainable Materials	3	1	-	4	4
2.	IV	UCEMNC0461	Clean Energy Engineering	3	1	-	4	4
3.	V	UCEMNC0561	Climate Change and Sustainable Development	3	1	-	4	4
4.	VI	UCEMNC0661	Sustainable Infrastructure Engineering	3	1	-	4	4
5.	VII	UCEMNC0761	Environmental Management	2	-	-	2	2
						Total:	**18**	**18**

B. TECH (EXIT COURSES) IN CIVIL AND ENVIRONMENTAL ENGINEERING After semester IV

Sr. No.	Semester	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1.	After IV	UCEEX0491	Advance Construction Technology	3	-	-	3	3
2.	After IV	UCEEX0492	Civil Drafting	1	-	4	5	3
3.	After IV	UCEEX0493	Construction Site Supervision Training	-	-	4	4	2
						Total:		**08**

B. TECH (EXIT COURSES) IN CIVIL AND ENVIRONMENTAL ENGINEERING After semester VI

Sr. No.	Semester	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1.	After VI	UCEEX0691	Estimation & Costing	3	-	-	3	3
2.	After VI	UCEEX0692	Occupational Health & Safety	3	-		3	3
3.	After VI	UCEEX0693	Vocational Training	-	-	4	4	2
						Total:		**08**

Class: T. Y.B. Tech. Civil and Environmental Engineering **Title of the Course:** Water Supply Engineering **Course Code:** UCEPC0501	**L**	**T**	**P**	**Credits**
	03	---	---	03

Course Pre-Requisite:

Students shall have knowledge of:

- Environmental chemistry and microbiology
- Hydraulics and water resource engineering

Course Description:

This course teaches the fundamentals and design concepts of water supply systems and water treatment plants, as well as the processes involved with their operation. Topics covered include water supply systems, water quality issues, and water treatment processes and systems. After completing this course students will be able to design water collection systems and water treatment plants.

Course Learning Objectives:

1. Know sources and characteristics of raw water, quantity and quality of water for drinking purpose.
2. Understand concepts of collection and conveyance of water from source.
3. Acquire an understanding of the fundamental concepts and detailed technical knowledge of the technologies required for conventional treatment of water.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Explain the different water demands, significance of characteristics of water and drinking water quality standards.	Cognitive (Understanding) L2
CO2	Identify the requirements of water abstraction and supply of treated water.	Cognitive (Applying) L3
CO3	Explain the mechanism of different processes in water treatment.	Cognitive (Evaluation) L5
CO4	Design the water abstraction, transportation and conventional treatment units.	Cognitive (Creating) L6

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	0	1	0	0	1	0	0	0	0	0
CO2	2	0	0	0	0	0	0	0	0	0	0
CO3	0	0	0	0	0	0	0	0	0	0	0
CO4	2	0	1	2	0	0	0	0	0	0	0

COs	**PSO1**	**PSO2**
CO1	-	-
CO2	-	-
CO3	-	-
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: Quantity of water, population forecasting, rate of consumption for various purposes, factors affecting consumption, fluctuation in demand, quality of water with respect to source - surface water, ground water, treated wastewater, drinking water quality standards, physical; chemical and bacteriological characteristics of water, emerging contaminants in the water sources – natural and anthropogenic.	**07 Hrs.**
Unit 2: Intake works-types, design of rising main, location and design of jack well and pump house, economic size of rising main, objectives and necessity of treatment, study of flow sheet for different sources of water.	**07 Hrs.**
Unit 3: Aeration, two film theory of gas transfer, types of aerators, theory of coagulation and flocculation, rapid mix and slow mix units, design of flash mixer, design of mechanical flocculator, types of settling, design of sedimentation tank.	**09 Hrs.**
Unit 4: Filtration process, classification of filters, design of rapid sand filter, reuse of back wash water, introduction to multimedia filters and pressure filters, Mechanism of Disinfection, Physical & chemical disinfectants, factors affecting disinfection, Characteristics of good disinfectant, chlorination- types, break point chlorination, introduction to UV and ozone disinfection.	**09 Hrs.**
Unit 5: Water softening: Lime soda process, recarbonation, ion exchange process, Removal of colour, taste and odour, iron and manganese, fluoridation and defluoridation, treatment with respect to arsenic and uranium. Applications of IoT, SCADA, PLCs in Water Treatment Plants, Adequacy check of WTP, Retrofitting in WTPs.	**07 Hrs.**
Unit 6: House connection from mains, different valves, meters and hydrants, storage reservoirs, balancing reservoir, detection and prevention of leaks in the distribution systems, maintenance of distribution systems, design of water distribution network.	**06 Hrs.**

Textbooks:

1. Mark J. Hammer & Mark J. Hammer Jr.,Water and Waste Water Technology, Prentice Hall of India Pvt. Ltd., 1998, New Delhi.
2. Water Supply & Sanitary Engineering by by Birdie G. S., Birdie J. S., Dhanpatrai Publishing Company.

Reference Books:

1. Manual on Water Supply and Treatment (3rd ed. revised and updated) - Ministry of Urban Development, New Delhi, 1999.
   Water Quality and Treatment Handbook – American Water Works Association, McGraw - Hill Pub. 1999.
3. Fair, Geyer & Okun, Water & Waste Water Engineering, John Wiley, 1966,New York.
4. Ernest W. Steel & Terence J. Mc Ghee, Water Supply & Sewage, McGraw Hill,1990, New York.
5. Physico Chemical Processes for Water Quality Control – Walter J. Weber Jr. Wiley
6. Water Supply Engineering by Dr. B. C. Punmia, Dr. Arun Kumar Jain

Class: T. Y.B. Tech. Civil and Environmental Engineering **Title of the Course:** Transportation Engineering **Course Code:** UCEPC0502	**L**	**T**	**P**	**Credits**
	2	-	-	2

Course Pre-Requisite:

Students shall have the knowledge of:

- Engineering Mathematics
- Basic Civil Engineering
- Surveying
- Building Materials & Concrete Technology

Course Description:

This course will help the students to understand the design of Horizontal and Vertical Curves. Types and function of pavement design, stresses in highway pavement, Joints in Pavement. Also, this course will help students to analyze traffic patterns and understand the importance of different traffic management systems.

Course Learning Objectives:

- To provides basic knowledge on Urbanization and its trend. Necessity, scope and principles of town planning
- To design various geometrical parameters for road construction.
- To expose to the various aspects of planning and designing of transportation system.
- To identify the input parameters required for design of a bridge structures.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Recall about the history of highway development, classification of roads Highway Construction.	Cognitive (knowledge) L1
CO2	Design features such as Super-elevation, Sight distance section of road in Cutting and filling.	Cognitive (knowledge) L1
CO3	Understand importance of traffic management systems.	Cognitive (Understanding) L2
CO4	Design drainage systems for road infrastructure	Cognitive (Applying) L3

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	0	0	0	0	1	1	0	0	0	1
CO2	3	2	2	3	0	2	1	0	1	0	2
CO3	0	3	3	3	3	1	2	0	2	0	2
CO4	1	1	1	0	0	2	2	0	1	0	2

COs	**PSO1**	**PSO2**
CO1	2	0
CO2	2	1
CO3	3	1
CO4	2	0

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 Highway planning-Classification of roads, brief history of road development in India, present status of roads in India. NHAI, NHDP, PMGSY, MSRDC	**06 Hrs.**
Unit 2 Geometric design of highways-Terrain classification, design speed, vehicular characteristics, highway cross-section elements Sight distance: introduction to sight distance, reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance. Design of horizontal alignment: horizontal curves, design of super elevation and its provision, radius at horizontal curves, widening of pavements at horizontal curves, analysis of transition curves. Design of vertical alignment: different types of gradients, grade compensation on curves, analysis of vertical curves, summit curves, valley curves	**09 Hrs.**
Unit 3 Pavement materials- Classification of pavement (Rigid Pavement & Flexible Pavement) Stone aggregates: desirable properties, tests, requirements of aggregates for different types of pavements. Bituminous materials: types, tests on bitumen, desirable properties, selection of grade of bitumen. Bituminous mix design: principle, methods, modified binders. Introduction to alternate pavement materials (construction demolition waste, plastic etc.)	**06 Hrs.**
Unit 4 Highway Drainage: Significance and requirements, Surface drainage system Types of cross drainage Structures, their choice and location. Road Maintenance & its importance. Traffic engineering- Introduction, Traffic scenario in India, traffic characteristics: Vehicular characteristics & user characteristics, importance of traffic characteristics. Traffic Studies: - Importance, Volume study, Speed study, Spot speed study, Accident study etc. Intelligent Transport System: Necessity, importance, Advanced transport management systems, Service in ITS, Critical issues, Application in Indian Context. Accident prevention technologies used in ITS.	**9 Hrs.**

Textbooks:

1. L R Kadiyali — Highway Engineering, Khanna Publishers, New Delhi. Town and country Planning- N.K. Gandhi
2. Khanna and Justo - Highway Engineering, Nemchand & Bros., Roorkee.

References:

1. S.K. Sharma, Highway Engineering
2. Partha Chakraborty and Animesh das, Principles of Transportation Engineering, Prentice Hall,
3. IRC code.

Class: T.Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Air Pollution Control **Course Code:** UCEPC0503	**L**	**T**	**P**	**Credit**
	3	-	-	3

Course Pre-Requisite: Students shall have the knowledge of:

- Engineering Mathematics
- Engineering Physics
- Environmental chemistry
- Fluid Mechanics

Course Description

As a comprehensive course, it introduces the sources of air pollution, physical and chemical behavior of pollutants, the effects of air pollutants on human beings and the environment and dispersion in the atmosphere. Also, it covers legislation and regulation; control technologies and future trends toward preventing air pollution.

Course Objectives:

1. Gain understanding of the basic concepts of air pollution and its effects on human and ecosystem health
2. Know how to interpret meteorological data for atmospheric stability, transportation and dispersion of air pollutants
3. Get an insight into some of the most widely used commercial and freely available air quality models
4. Present detailed information about the theory and design of various equipment for controlling air pollutants.
5. Articulate current air pollution policies and measures for control.

Course Learning Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Explain current air pollution issues, classification of air pollutants and their effects on human health, welfare and the environment	Cognitive (Understanding) L2
CO2	Interpret problems related to stability of the atmosphere and dispersion of air pollutants	Cognitive (Understanding) L2
CO3	Select methods for control, and prevention of air pollution to meet stipulated standards needs using various mathematical models	Cognitive (Applying) L3
CO4	Develop a broad understanding of the strategies, regulations and policies to manage air pollution	Cognitive (Analyzing) L4

CO-PO Mapping:

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

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

Assessments:

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End

Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

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

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three Units)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three Units) covered after MSE.

Course Contents:

Unit 1: Introduction to Air pollution Current scenario of air pollution at national and global scales, Sources of air pollution, Classification of air pollutants, Impacts of air pollution, Criteria air pollutants and their effects, Ambient air quality standards	**05 Hrs.**
Unit 2: Meteorology and Air Pollution Structure and composition of atmosphere, Meteorology- climate and weather, Role of meteorological parameters in dispersion of air pollutants, Wind circulation, Wind speed and direction, Wind rose diagram, Lapse rates, Stability of atmosphere, Inversion and its types, Plume behavior, Maximum Mixing Depth, Cyclones and anticyclones, Precipitation & its types	**07 Hrs.**
Unit 3: Dispersion of Air Pollutants Air quality dispersion models, Gaussian dispersion model for point sources and line sources, applications and limitations of Gaussian model, plume rise- causes and significance, Formulas for estimation of Plume Rise, Plume down wash, Stability classes, Box model, Street canyon model, Introduction to AERMOD and other software	**10 Hrs.**
Unit 4: Air Quality management Control of air pollution from stationary and mobile sources, measures for effective control of air pollution in India, Alternative fuels, Air quality index, National Air quality Monitoring Program, Legislative measures, international treaties for control and mitigation of air pollution	**06 Hrs**.
Unit 5: Control of Particulate Matter Sources of Suspended Particulate Matter, Particulate removal mechanisms, study of working principle and design, removal efficiency (block flow and mixed flow) of Control Equipment for Particulate Matter: Settling chamber, Cyclone separator, Fabric filter, Electrostatic precipitator, Wet collectors – spray towers, cyclonic scrubbers, Venture scrubber	**10Hrs.**
Unit 6: Control of Gaseous pollutants Sources and types of gaseous pollutants, Mechanisms for removal, Various techniques for control of gaseous pollutants - Principles suitability of absorption and adsorption, combustion/ incineration of gaseous pollutants, use of after burners, catalytic combustion, surface and direct condensation of air pollutants, Indoor air quality control in industries and buildings.	**07 Hrs.**

Textbooks:

1. K. Wark, C.F. Warner & W.T. Davis Air Pollution Control: its Origin and Control, Addision-Wesley, (1998).
2. Stern A.C., “Air Pollution Vol. I and II”, Allied Publishers Limited, 1st Edition, 1994.
3. Nevers N., "Air Pollution control Engineering" McGraw-Hill, New York, 2nd edition, 1995

References:

1. Martin Crawford, “Air Pollution and Control”, Tata McGraw Hill Publication, 1st Edition, 1976.
2. Air Pollution and Control Technologies by Anjaneyulu, D”, Allied Publishers, Mumbai, 2002
3. Environmental Pollution Control Engineering by Rao, C.S., Wiley Eastern Ltd., New Delhi, 1996
4. Industrial Air Pollution Control Systems by W.L.Heumann, McGraw-Hill, New York, 1997
5. Environmental Engineering by Peavy S.W., Rowe D.R. and Tchobanoglous G, McGraw Hill, New Delhi, 1985
6. Environmental Engineering Vol. II by Garg, S.K, Khanna Publishers, New Delhi

7. Fundamentals of Air Pollution by Richard W.Boubel, D.L.Fox, D.B.Turner& A.C.Stern, Reed Elsevier India Pvt. Ltd., New Delhi,

Class: T.Y.B.Tech Civil and Environmental Engineering **Title of the Course:** Environmental Sanitation (PE-I) **Course Code:** UCEPE0511	**L**	**T**	**P**	**Credits**
	3	-	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Environmental Studies
- Environmental Chemistry and Microbiology

Course Description:

The course covers vital aspects of ecology, ecosystem, interactions, factors influencing and effect of human activities, Role and functions of local to global agencies in sanitation, Bylaws and sanitation requirements of public places, control of communicable disease, vital statistics, Concept of healthful housing, Government policies and initiatives for urban and rural sanitation.

Course Learning Objectives:

- To understand ecology, ecosystem, ecological interactions and effects of human activities.
- To study health education and sanitation requirements of public places
- To understand the role of environmental engineers in control of epidemics, milk and food sanitation as well as use of vital statistics.
- To study requirements and principles of healthful housing and aspects of sanitation and its policies.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Explain components of ecosystem, environmental cycles, human activities and factors causing imbalance as well as importance of aquatic ecosystem.	Cognitive (Understanding) L2
CO2	Summarize sanitation requirement of public places, measures for control of an epidemic and importance of vital statistics	Cognitive (Understanding) L2
CO3	Identify housing standards, requirements of healthful and safe housing, provisions for milk and food sanitation	Cognitive (Applying) L3
CO4	Distinguish the significance of sanitation, sanitation policies and sanitation tools.	Cognitive (Analysing) L4

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	0	0	0	0	2	0	0	0	0
CO2	0	0	1	0	0	2	0	3	0	0	0
CO3	0	0	0	1	0	2	0	0	0	0	0
CO4	0	0	0	1	0	0	1	0	0	0	0

COs	**PSO1**	**PSO2**
CO1	1	0
CO2	1	0
CO3	0	0
CO4	0	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: Basics of sanitation Community and sanitary latrines, Importance of wastewater collection treatment and disposal of wastewater, Compact and simple wastewater treatment units in rural areas: septic tanks, soak pit, low cost excreta disposal systems. **Sanitation tools**: Shit Flow Diagram (SFD): Concept, Applications, Citywide Inclusive Sanitation	**07 Hrs.**
Unit 2: Introduction to Ecology and Ecosystems. **Bio-geochemical cycles:** Sulfur, Carbon, Nitrogen, Phosphorus cycles etc. **Population Ecology**: Characteristics of population, Population age distribution and growth forms, limiting factors, Liebig's law, Interactions such as competition, coexistence, pray predator among different species, **Introduction to Ecosystems:** Definition, Types, Necessity, Conservation of aquatic ecosystems - National plan for conservation of aquatic ecosystem: classification, Importance, benefits and conservation of natural wetlands, Eutrophication of wetlands and ponds, National plans for conservation: RAMSAR convention, *National River Conservation Directorate*	**08 Hrs.**
Unit 3: Health Education and its Importance **Environmental health planning**: Need and process. Hygiene: Concept, Meaning, Principles and Importance, Types of Hygiene, Sustainable Development Goals (SDG) pertaining to Environmental Issues. **Sanitation of Public places:** Building byelaws for sanitation requirements of public places with case studies, sanitation efforts to be taken during large gatherings and disasters	**07 Hrs.**
Unit 4: Communicable Diseases and Health: **Diseases**: Transmission of diseases, Diseases transmitted through air, water, food, contacts, control measures of diseases and preventive measures, Environmental control of insect vector, rodents etc. Epidemics **Public Health**: Health Status and Health Problems in India, Communicable, Non-communicable Diseases and Lifestyle Illnesses, Emerging Concerns related to Public Health. **Vital Statistics**: Uses and sources of vital statistics, birth and death certification, indicators of community health, morbidity and mortality rates, causes and factors affecting morbidity, infant mortality rates.	**08 Hrs.**
Unit 5: Food Sanitation and Housing **Milk and Food Sanitation:** Necessity, Milk and food as vehicles of infection, Essential of milk sanitation **Methods of Sanitation**: Pasteurization, Food sanitation and preservation methods. **Housing:** Concept of healthful housing, Causes of slum development, Criteria for good housing, Housing standards with respect to space, light, ventilation and safety.	**07 Hrs.**
Unit 6: Sanitation policies Environmental health services, international efforts, role of industry, Law and human welfare, Organization and Administration of Health Care from Centre to the Village Level, Integrated approach to health and sanitation, Public health activities of World Health Organization (WHO). **Water, Sanitation and Hygiene (WASH):** Concept, Meaning, Principles, and Practices, Policies and Programmes related to WASH	**08 Hrs.**

Governmental Policies and Programmes *- Central Rural Sanitation Programme (CRSP) 1986, Total Sanitation Campaign (TSC) Programme 1999, Nirmal Bharat Abhiyan 2012; Swachh Bharat Mission 2014 and Role of Local Bodies, Accelerated Rural Water Supply Programme (ARWSP), the Sector Reforms Project, Swajal Dhara and the National Rural Drinking Water Programme (NRDWP)*	

Textbooks:

1. Odum, E.p., Brrett, G. W. (2005). Fundamentals of ecology. Thomson Brooks/Cole.
2. Ehlers, V.M., Steel, E. W. (1965). Municipal and Rural Sanitation 6th edition. McGraw hill.
3. Salvato, J.A. (1992). Environmental Engineering and Sanitation. Wiley.

Reference Books:

1. Dash, M.C., Dash, S. p. (1993). Fundamentals of ecology. McGraw hill.
2. Park, K. (2015). Park's textbook of preventive and social medicine 23rd edition. Bhanot publishers.

Class: T. Y. B. Tech Civil and Environmental Engineering **Course Name:** Renewable Energy Engineering (PE-I) **Course Code:** UCEPE0512	**L**	**T**	**P**	**Credits**
	3	-	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Engineering Physics and Chemistry

Course Description:

The course emphasizes studying energy demand, energy crisis, types and potential of renewable energy sources, concepts and technology to harness renewable/clean energy, applications and limitations of renewable energy.

Course Learning Objectives:

- To study energy needs, demand and various renewable alternatives.
- To understand the potential of renewable energy resources.
- To study technologies to harness energy.
- To understand management of energy resources.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Compare conventional and renewable energy resources	Cognitive (Understanding) L2
CO2	Identify scope and potential of renewable energy.	Cognitive (Understanding) L2
CO3	Select suitable renewable energy resource	Cognitive (Applying) L3
CO4	Utilize energy management principles and strategies.	Cognitive (Applying) L3

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1	1	-
CO2	2	-
CO3	-	-
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: **Introduction:** Types and Forms of Energy, Energy chains, Energy demand, Energy crisis Causes. Classification of energy sources, Global and Indian energy scenario, Impact of present Energy practices and rise in usage on Environment, Renewable energy resources, types and potential, Merits and obstacles in Renewable Energy.	**07 Hrs.**
Unit 2: **Solar Energy:** Introduction, utilization methods, merits and demerits of solar energy utilization, potential of solar energy, solar radiation data for India, solar thermal collectors, concentrators and reflectors, collector efficiency, applications of solar energy, solar cooker, solar water heating, solar dryer, solar distillation, solar photovoltaic systems, solar pond. **Nuclear Energy:** Introduction, utilization methods, merits and demerits of nuclear energy utilization, potential of nuclear energy, general introduction of nuclear power plant.	**08 Hrs.**
Unit 3: **Hydro Energy:** Introduction, India's Hydro reserves, merits and limitations, low head, medium head, high head schemes, hydro turbines, economics. **Geothermal Energy:** Introduction, types of geothermal resources, potential of geothermal resources in India and world, Environmental problems in utilization of geothermal resources.	**07 Hrs.**
Unit 4: **Wind Energy:** Introduction, potential and scope, classification and types of wind machines, application of wind energy, merits and limitations of wind energy. Site selection for wind farm, wind map of India, wind energy station in India **Tidal Energy:** Tides, tidal range, tidal power, suitably sites and prospects. Types of tidal power plants, single basin, modulated single basin and double basin schemes, main equipment, energy storage.	**08 Hrs.**
Unit 5: **Ocean thermal energy conversion:** Introduction, principle of OTEC, open cycle and closed cycle OTEC schemes, potential and prospects in India **Wave Energy:** Introduction, power of wave, wave data collection, wave machines (wave energy converters), forces on wave machines and associated structures, merits and demerits of wave energy	**07 Hrs.**
Unit 6: **Biomass Energy Resources:** Biomass energy, biomass energy from cultivated crops and from waste organic matter, biomass conversion processes, incineration and thermos-chemical, biochemical conversion of biomass, energy from plants / projects. concept of energy from specific type of waste materials. **Energy Management and planning:** Energy management principles, Energy and pollution trade off, objectives of energy management, energy strategy and energy planning, Energy audit.	**08 Hrs.**
Textbooks: 1. Renewable Energy Resources By John Twidell, Taylor and Fransis (2021) 2. Environmental studies: Benny Joseph 3. Environmental Biology: K. C. Agarwal 4. Environmental Encyclopaedia: Cunningham, W. P. Cooper, T. H. Hepworth (Jaico Pub.) 5. Energy and Ecology: David M. Gates (Sinaur Associates)	
Reference Books: 1. Non-Conventional Energy Sources: G. D. Rai 2. Power Technologies: Stephenson 3. Energy Technology: S. Rao and B. B. Parulekar	

Class: T. Y. B. Tech Environmental Engineering **Title of the Course:** Construction Practices (PE-I) **Course No.:** UCEPE0513	**L**	**T**	**P**	**Credit**
	3	-	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Civil Engineering
- Building Materials
- Concrete Technology

Course Description:

The course comprises engineering practices involved on construction sites
The course includes details of steps involved in various construction work
The course also deals with application of advance technologies involved in construction work

Course Learning Objectives:

- Aware the student with a wide range of construction practices involved in construction project
- Aware the student about technical aspects of various construction activities.
- Aware the student about methods of construction and quality required for construction works.
- To develop a practical approach for monitoring various construction activity.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Illustrate types of buildings & agencies involved in construction project	Understanding (L2)
CO2	Demonstrate procedures involved in construction project.	Understanding (L2)
CO3	Analyze various construction techniques used for earth work.	Analyzing (L4)
CO4	List safety measures according to construction activities.	Understanding (L2)

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	0	0	1	1	0	2	1	0	0	3	0
CO2	0	0	1	1	1	0	0	0	2	1	0
CO3	0	0	2	1	1	0	0	0	0	0	2
CO4	0	0	1	1	0	2	3	0	1	2	1

COs	**PSO1**	**PSO2**
CO1	0	1
CO2	0	1
CO3	0	1
CO4	2	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 Introduction, Types of buildings based upon occupancy. Sequence of activities in a building project, Functions and role of various agencies: Owner, Architect, Civil Engineer, Structural Engineer, and Contractor.	**06 Hrs.**
Unit 2: Temporary Structure (A)Purpose, scaffolding and shuttering. Scaffolding: Types of scaffolding (Single, Double, Cantilever etc.) & Their applications, Material used for scaffolding, procedure of erection of scaffolding, safety measure & precautions (B)Shuttering: Types of shuttering (steel, wooden, Aluminum), procedure of erection of shuttering, safety measure & precautions	**06 Hrs.**
Unit :3 Excavation work (A) Mechanical v/s manual construction, Excavation in Earth: Earth moving equipment-Tractors, Bulldozers, Scrappers, Power shovel, Hoes Types. (B) Drag line, Clamshell, Trenchers, Compactors, Tippers, Cranes (C) Quantity evolution of any equipment	**08 Hrs.**
Unit :4 Excavation in hard rock (A) Excavation in hard rock: Rippers, Jack Hammers, Drills, Compressors and Pneumatic Equipment. (B) Blasting Explosives, Detonators, Fuses, Drainage in excavation –Necessity and Methods of Dewatering.	**08 Hrs.**
Unit 5: Advance construction technology (A) Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – cooling towers, silos, chimney, Concept of advanced construction technologies. (B) Erection techniques of tall structures – erection of articulated structures – aerial transporting, handling, erecting light weight components on tall structures – Large span structures – In-situ pre-stressing in high rise structures. (C)Rapid construction techniques, 3D concrete printing,	**08 Hrs.**
Unit 6: Unit 6: Construction Safety (A)Safety in various construction operations- Excavation- under- water works- underpinning & shoring Ladders & Scaffolds- Tunneling- Blasting- Demolition- Pneumatic casinos- confined Space Temporary Structures. Indian Standards on construction safety National Building Code Provisions on construction safety. (B) Safety in material handling and equipment's-Safety in storage & stacking of Construction materials	**06 Hrs.**

Textbooks:

1. Building Construction – B.C.Punmia (Laxmi Publications)
2. Basic Civil Engineering – G. K. Hiraskar (DhanpatRai Publications)
3. Construction Technology (Volume 1 to 4) – R. Chudley (ELBS)
4. A Text Book of Building Construction – Arora&Bindra (DhanpatRai Publications)
5. A Text Book of Building Construction – Dr. S. K. Sharma, S. Chand Publications

References:

1. P. Kumar Mehta, "Microstructure and properties of concrete", Prentice Hall. Tata McGraw Hill
2. Jain V.K. "Fire safety in Buildings" new Age International Publisher
3. Barrid, "Building Construction" Tata McGraw Hill, New Delhi
4. Heavy Construction – Planning, Equipment and Methods, Singh. J, Third Edition, CRC Press, 2009.
5. Construction Technology for Tall Buildings, Michael Chew Yit Lin, Singapore University Press, Singapore, 2001.
6. Callender," Times Savers Standards of Architectural Design Data", Tata McGraw Hill

Class: T. Y. B. Tech Environmental Engineering **Title of the Course:** Sustainability Management **Course No.:** UCEEM0504	**L**	**T**	**P**	**Credit**
	2	-	-	2

Course Pre-Requisite:

Students shall have the knowledge of:

Basic understanding of environmental systems, pollution control, and resource management.

Knowledge of ecological principles, ecosystems, and biodiversity.

Proficiency in basic mathematical and statistical tools.

Course Description:

This course introduces students to the principles and practices of sustainability management, focusing on integrating environmental, social, and economic considerations into decision-making processes. Students will learn to apply sustainability frameworks, tools, and strategies to address complex environmental challenges in engineering contexts.

Course Learning Objectives:

Explain core sustainability concepts and global challenges.

Apply LCA and foot printing tools to assess environmental impacts.

Integrate sustainability into business models and stakeholder strategies.

Evaluate emerging technologies and policies for sustainable solutions.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Explain foundational knowledge of sustainability principles and frameworks.	L2 Understand
CO2	Develop skills to quantify and mitigate environmental impacts using analytical tools.	L3 Apply
CO3	Plan strategies for organizational sustainability and reporting.	L3 Apply
CO4	Examine innovations and policies driving future sustainability.	L4 Analyse

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1	2	
CO2	1	
CO3		2
CO4		1

Assessments:

Assessment	**Weightage (Marks)**
ESE	50

ESE: Assessment is based on 100% course content.

Course Contents:

Unit 1: Introduction to Sustainability Management **Concept and History of Sustainability**: Definition of sustainability, Historical evolution of sustainability concepts, Key milestones in sustainability (e.g., Brundtland Report, Earth Summit)	**07 Hrs.**

Global Sustainability Challenges: Climate change and its impacts, Resource depletion (water, energy, minerals), Pollution and waste management issues, Biodiversity loss and ecosystem degradation, Sustainable Development Goals (SDGs),	
Unit 2: Sustainability Assessment Tools and Techniques **Life Cycle Assessment (LCA):** Principles and phases of LCA (goal definition, inventory analysis, impact assessment, interpretation), Applications of LCA in engineering projects, Case studies of LCA in product and process design **Carbon and Water Foot printing:** Methods for calculating carbon and water footprints, Tools and software for footprint analysis, Strategies for reducing footprints in engineering systems	**07 Hrs.**
Unit 3: Integrating Sustainability into Organizational and Project Management **Sustainable Business Models and CSR:** Concepts of corporate social responsibility (CSR), Sustainable business models (e.g., green supply chain, eco-design), Role of innovation in sustainability **Stakeholder Engagement and Communication:** Identifying and engaging stakeholders, Strategies for effective communication of sustainability initiatives, Building partnerships for sustainability	**07 Hrs.**
Unit 4 : Emerging Trends and Innovations in Sustainability Management **Digital Sustainability and Smart Technologies:** Role of IoT (Internet of Things) and AI (Artificial Intelligence) in sustainability monitoring and management, Smart grids, smart cities, and their contribution to sustainability, big data analytics for sustainability decision-making. **Green Technologies and Innovations:** Advances in renewable energy technologies (e.g., hydrogen energy, offshore wind, energy storage), Green building technologies and sustainable construction practices, Innovations in waste-to-energy and bio-based materials.	**07 Hrs.**

Textbooks:

1. *"Sustainability Management: A Strategy-Oriented Approach"*
   By Akhilesh Kumar and K. Ganesh
2. *"Sustainability Principles and Practice"*
   By Margaret Robertson

References:

1. "Handbook of Sustainability Management"
   By Christian N. Madu and Chu-Hua Kuei
2. "Environmental Economics and Sustainability"
   By Mohan Munasinghe

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Water Treatment Laboratory **Course Code:** UCEPC0531	**L**	**T**	**P**	**Credits**
	-	-	2	1

Course Pre-Requisite:

Students shall have the knowledge of:

- Water Quality Parameters

Course Description:

The course explores the knowledge and principles of determination of different water quality parameters. It also enables to understand the relationships between different parameters and its effect in water treatment and water quality.

Course Learning Objectives:

- To understand the knowledge and principles of determination of different water quality parameters
- To understand the basics of water treatment processes

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Interpret the quality of water after treatment.	Cognitive (Understanding) L2
CO2	Demonstrate the treatment process of water.	Psychomotor (Understanding)L2

CO – PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	0	1	0	0	1	0	0	0	0	0
CO2	2	0	0	0	0	0	0	0	0	0	0

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

Assessments:

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

ISE: Based on practical performance / Quiz/ Mini- Project assigned / Presentation/ Group Discussion / Internal Oral etc.

ESE (POE): Based on the Practical Oral Examination.

Course Contents:

Experiment No. 1: Aeration **Learning Outcome:** To determine the increase in Dissolved Oxygen Concentration with aeration process.	**02 Hrs.**
Experiment No. 2: Sedimentation **Learning Outcome:** To perform the Settling Column Analysis for determination of detention time for an expected removal of Suspended Solids.	**04 Hrs.**
Experiment No. 3: Coagulation and Flocculation **Learning Outcome:** To determine the optimum dose of coagulant for given water by a Jar Test.	**02 Hrs.**

Experiment No. 4: Preparation of Filter Sand **Learning Outcome:** To prepare the filter sand with respect to specifications for a Rapid Sand Filter.	**02 Hrs.**
Experiment No. 5: Acid Solubility Test **Learning Outcome:** To determine the solubility percentage of sand by Acid Solubility Test.	**02 Hrs.**
Experiment No. 6: Loss on Ignition Test **Learning Outcome:** To determine the percentage loss on ignition of sand by Loss on Ignition Test.	**02 Hrs.**
Experiment No. 7: Filtration **Learning Outcome:** To determine the removal of turbidity from water after filtration.	**04 Hrs.**
Experiment No. 8: Hardness Removal **Learning Outcome:** To determine the removal of Hardness by Boiling, Lime Soda Process and Ion Exchange Process.	**04 Hrs.**
Experiment No. 9: Chlorination **Learning Outcome:** To determine Break Point Chlorine dose for given water sample.	**04 Hrs.**
Experiment No. 10: UV Disinfection **Learning Outcome:** To determine the reduction in MPN for a given water after UV disinfection process.	**04 Hrs.**

Textbooks:

1. Chemistry for Environmental Engineering and Science by Sawyer, McCarty and Parkin

References:

1. Standard Methods for examination of Water and Wastewater
2. Manual on Water Supply and Treatment (3rdedrevisedandupdated)-Ministry of Urban Development, New Delhi, 1999.

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Transportation Engineering Laboratory **Course No.:** UCEPC0532	**L**	**T**	**P**	**Credits**
	-	-	2	1

Course Pre-Requisite:

Students shall have the knowledge of:

- Engineering Mathematics
- Basic Civil Engineering
- Building Materials and Concrete Technology

Course Description:

The course helps to develop laboratory skills as well as enhances methodical abilities by performing experiments relating to transportation engineering. Experiments will help the students to understand types of Bituminous materials and selection of grade of bituminous and aggregates, for different types of pavements.

Course Learning Objectives:

- TointroducethestudentstolaboratorymethodsforperformingexperimentinTransportation engineering
- To provide clear understanding on conducting various types of different test on aggregates and bituminous materials.
- To highlight importance of IRC requirements Tor elate laboratory results to field conditions.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Taxonomy Descriptor**
CO1	Compare the properties of aggregates& bitumen to IRC recommendations	Cognitive (Understanding) L2
CO2	Interpret traffic volume & speed data.	Cognitive (Understanding) L2

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	1	1	2	0	1	1	0	0	0	1
CO2	1	2	2	2	2	2	1	0	0	2	2

COs	**PSO1**	**PSO2**
CO1	0	1
CO2	3	0

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: Aggregate Impact Value Experiment **Learning Outcome:** Determine the Impact value of aggregate & understand its practical significance.	**02 Hrs.**
Experiment No.2: Los Angles Abrasion Test Experiment **Learning Outcome:** Determination of Abrasion value of aggregates for road construction.	**04 Hrs.**
Experiment No.3: Crushing test of aggregate Experiment **Learning Outcome:** Determination of Crushing strength of aggregates	**02 Hrs.**
Experiment No. 4: Bitumen Penetration Experiment	**02 Hrs.**

Learning Outcome: Determination of penetration value of bitumen	
Experiment No.5: Softening Point Experiment. **Learning Outcome:** Determination of Softening Point of bitumen	**02 Hrs.**
Experiment No.6: Flash Point and Fire Point Test Experiment. **Learning Outcome:** Determination of Flash Point and Fire Point of bitumen	**02 Hrs.**
Experiment No.7: Ductility test Experiment. **Learning Outcome:** To Determine ductility of bitumen.	**04 Hrs.**
Experiment No.8: Viscosity of bitumen Experiment **Learning Outcome:** To Determine Viscosity of bitumen	**02 Hrs.**
Experiment No.9: Traffic Volume Study **Learning Outcome:** To conduct a traffic volume study and to determine different volume statistics for a particular road section.	**04 Hrs.**
Experiment No.10: Spot Speed Studies **Learning Outcome:** To conduct a spot speed study, develop a cumulative frequency speed distribution curve and calculate various statistical measures.	**04 Hrs.**
ExperimentNo.11: Report writing on high performance materials used in road construction **Learning Outcome:** To prepare report on advance pavement material to understand necessity & application of high-performance materials in road construction sector.	**02 Hrs.**

Textbooks

1. L R Kandivali— Highway Engineering, Khanna Publishers, New Delhi. Town and country Planning- N.K. Gandhi
2. Khanna and Justo - Highway Engineering, Nandchand & Bros., Roorkee.
3. IRC code

Reference Books

1. S.K. Sharma, Highway Engineering
2. Partha Chakraborty and Animesh das, Principles of Transportation Engineering, Prentice Hall,
3. IRC code.

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course**: Environmental Monitoring Laboratory **Course Code:** UCEVS0533	**L**	**T**	**P**	**Credit**
	-	-	2	1

Course Pre-Requisite:

Students shall have the knowledge of:

- Environmental Chemistry and microbiology

Course Description:

This laboratory course is designed to provide hands-on experience in monitoring and analyzing various environmental parameters. Students will learn to measure ambient air temperature, relative humidity, wind speed, air pollutants (RSPM, SOx, NOx), stack emissions, noise levels, and solid waste characteristics (composition, bulk density, moisture content, and calorific value). The course emphasizes standard sampling techniques, instrumentation, data interpretation, and compliance with environmental regulations.

Course Outcomes:

COs	**After the completion of the course the students will be ableto**	**Bloom's Cognitive Descriptor**
CO1	Design and conduct experiments with respect to air quality monitoring including noise pollution.	Design L5
CO2	Analyze environmental data for solid waste management strategies.	Analyzing L4

CO-PO & PSO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	-	-	3	-	3	-	-	-	-	-
CO2	3	-	-	3	-	3	-	-	-	-	-

COs	PSO1	PSO2
CO1	3	1
CO2	3	1

Assessments:

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

ISE: Based on practical performance / Quiz/ Mini- Project assigned / Presentation/ Group Discussion / Internal Oral etc.

ESE (OE): Based on the Oral Examination.

Course Contents:

Experiment No. 1: To Measure ambient air temperature **Learning Outcome:** Students will be monitor ambient air temperature for studyand research purposes.	**02 Hrs.**
Experiment No.2: To Measure relative humidity and dew point temperature of ambient air **Learning Outcome:** Students will be able to measure relative humidity and dew point temperature for studyand research purposes.	**02 Hrs.**
Experiment No.3: To measure wind speed and direction for preparation of wind rose diagram **Learning Outcome**: Students will be able to interpret and develop wind rose diagrams for study and research purposes	**02 Hrs.**

Experiment No. 4: : determine the concentration of RSPM, SOX and NOx in ambient air **Learning Outcome:** Students will be able to monitor ambient air quality with respect to RSPM, Sox and NOx for study and research purposes	**02 Hrs.**
Experiment No. 5 To study the sampling procedure of Stack gas MonitoringKIT **Learning Outcome:** Students will be able to explain the significance and procedure ofstack gas monitoring	**02 Hrs.**
Experiment No. 6: To measure noise levels in various zones of Kolhapur city **Learning Outcome:** Students will be able to check compliance with stipulated noise standards as per Noise (Control and Regulation) Rules, 2000 Students	**06 Hrs.**
Experiment No. 7: To collect solid waste samples by following proper sampling techniques and to determine various components of Municipal Solid Waste. **Learning Outcome:** Students will be able to collect solid waste samples by following standard procedure and will be able to determine various components present in it.	**04 Hrs.**
Experiment No. 8: To determine the bulk density of Municipal Solid Waste **Learning Outcome:** Students will be able to measure density of collected solid waste samples.	**02 Hrs.**
Experiment No. 9: To determine the moisture percent of the waste samples **Learning Outcome:** Students will be able to know the percent of moisture content present in solid waste samples.	**02 Hrs.**
Experiment No. 10: To determine Calorific Value of Municipal Solid Waste by using Bomb Calorimeter. **Learning Outcome:** Students will do practical use of Bomb Calorimeter to find out calorific value of solid waste samples.	**04 Hrs.**

Textbooks:

- Chemistry for Environmental Engineering and Science by Sawyer, McCarty and Parkin

References:

1. Guidelines for Ambient Air Quality Monitoring-Central Pollution Control Board, (2003).
2. Air Pollution Sampling and Analysis (Laboratory Manual)- Dr. Sharad Ghokale,IIT Guwahati
3. Laboratory Manual for Air Quality Sampling and Analysis, IIT Delhi

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Mini Project- II **Course Code:** UCEIL0571	**L**	**T**	**P**	**Credits**
	-	-	2	1

Course Pre-Requisite:

Students shall have the knowledge of:

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

Course Description:

The Mini Project-II laboratory is designed to help students develop practical ability and knowledge about practical tools/ techniques to solve real-life problems related to the Civil and Environmental problems. The students will identify and work towards solving problems related to major attributes of Civil Engineering as well as Environmental Engineering. Also, the course intends to improve communication skills of students through technical report writing and presentations.

Course Learning Objectives:

- To apply basic engineering fundamentals and attempt to find solutions to the problems.
- To develop communication skills and improve teamwork amongst group members and inculcate the process of self-learning and research.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Taxonomy Descriptor**
CO1	Carry out research work using fundamental concepts, Experimental analysis and/or computer simulations.	Psychomotor (Readiness to Act) L2
CO2	Conclude the findings based on the work undertaken and results obtained within the specified time frame.	Psychomotor (Ability to Perform) L5

CO-PO Mapping:

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

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

Assessments:

Assessment	**Weightage (Marks)**
ISE	25

ISE: Assessment is based on at least two group presentations showcasing the efforts of the mini project group for formulating the problem, developing/designing the solutions, testing and validating the solution, with submission of project report.

Course Contents:

"Introduction to Research Methodology" will be covered In first 2 sessions and then the students in a group of 4 to 5 will work on a topic approved by the assigned faculty member and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews.	**02 Hrs/ week**

Class: T. Y. B. Tech Civil and Environmental Engineering (Multidisciplinary Minor In Data Science (MDM-DS)) **Title of the Course:** Python for Data Science. (MM-III) **Course No.:** UCEMM0541	**L**	**T**	**P**	**Credits**
	03	---	---	03

Course Pre-Requisite:

Students shall have knowledge of:

- Basic Knowledge of Python Programming.

Course Description:

This course is intended to understand the basic concepts related to python for data science involved by data manipulation, cleaning, preparation, and visualization.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Identify the need for data science and solve basic problems using Python built-in data types and their methods.	Understanding (L2)
CO.2	Identify efficient storage and data operations using NumPy arrays	Apply (L3)
CO.3	Apply powerful data manipulations, data pre-processing and visualization using Pandas.	Apply (L3)
CO.4	Design an application with user-defined modules and packages.	Create (L6)

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO.1	0	0	0	0	3	0	0	0	0	0	1
CO.2	0	0	0	0	3	0	0	0	0	0	1
CO.3	0	0	0	0	3	0	0	0	0	0	1
CO.4	0	0	0	0	3	0	0	0	0	0	1

COs	**PSO1**	**PSO2**
CO.1	0	0
CO.2	0	0
CO.3	0	0
CO.4	0	0

Assessments:

Assessment	**Weightage (Marks)**
ESE	100

- **ESE:** Assessment is based on 100% course content.

Course Contents:

Unit 1: **Background & Introduction** Python for Data Analysis, essential python libraries, Installation and setup of different operating systems, important development environments (IDEs) and text editors, brief background of python, decision structures and Boolean logic, looping, built-in data types, and functions.	08 Hrs.
Unit 2: Files, Input-Output, Errors, and Exceptions: File objects, file built-in functions, file built-in methods, file built-in attributes, standard files, command-line arguments, file system, file execution, exception in python, detecting and handling exceptions, standard.	08 Hrs.
Unit 3: Introduction to Numpy: NumPy basics: arrays and vectorized computation- the NumPy ndarray, creating ndarrays, data types for ndarrays, arithmetic with NumPy arrays, basic indexing and slicing, boolean indexing, transposing arrays and swapping axes, universal functions: fast element-wise array functions, mathematical and statistical methods, Sorting, unique and other set logic	08 Hrs.

Unit 4: Data Manipulation with Pandas: Introduction to pandas data structures: series, data frame, essential functionality- dropping entries, indexing, selection, and filtering, function application and mapping, sorting and ranking, summarizing and computing descriptive statistics, Unique values value counts, and membership, reading and writing data in text format.	08 Hrs.
Unit 5: Data Cleaning and Preparation: Handling missing data-filtering out missing data, filling in missing data, data transformation-removing duplicates, transforming data using a function or mapping, replacing values, detecting and filtering outliers, string manipulation, vectorized string functions in pandas.	07 Hrs.
Unit 6: Plotting and Visualization: Matplotlib and libraries, figures and subplots, colors, markers and line styles, ticks, labels, and legends, Annotations and drawing on a subplot, saving plots to file, plotting with pandas-line plot, bar plot, histogram and density plots, scatter and point plots.	06 Hrs.

REFERENCE BOOKS:

1.Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018

2. WesLey J. Chun, "Core Python Programming", Second Edition, Pearson Education, 2010.

3. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly 2017.

Class: T.Y. B. Tech Civil and Environmental Engineering (Multidisciplinary Minor in Leadership and Management (MDM-HRD)) **Title of the Course:** Introduction to marketing management **Course No.:** UCEMM0542	**L**	**T**	**P**	**Credits**
	3	-	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Engineering Management
- Basics of Human Resource Management

Course Description:

This course provides a comprehensive introduction to the fundamental principles of marketing. It examines consumer behavior, analyzing the factors affecting purchasing decisions across general, industrial, and online consumers. The course also explores the new product development process and its strategic implications. students will gain insights into pricing strategies, distribution channels, and promotional techniques. The course covers pricing objectives and methods, the selection of distribution channels, and the components of the promotion mix, including advertising and other promotional strategies.

Course Learning Objectives:

- To understand the nature and significance of the Marketing Function and the Marketing management process.
- To gain knowledge about the key aspects of the Buying Behavior of consumers and develop an understanding of the STP Process.
- To explain the factors affecting various product, pricing, channel management and Marketing communication decisions.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Identify the marketing functions, environment and segmentation for effective positioning of the products.	Understanding (L2)
CO2	Assess the factors influencing consumer behavior and apply recent marketing trends in business.	Understanding (L2)
CO3	Develop new products and services that are consistent with evolving marketing needs.	Apply (L3)
CO4	Formulate effective pricing policy, select an appropriate channel of distribution and Promotion mix	Analyse (L4)

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	0	0	0	0	0	0	0	0	0	3	1
CO2	0	0	0	0	0	0	0	0	0	3	1
CO3	0	0	0	0	0	0	0	0	0	3	2
CO4	0	0	0	0	0	0	0	0	0	3	1

COs	**PSO1**	**PSO2**
CO1	0	0
CO2	0	0
CO3	0	0
CO4	0	0

Assessments:

Assessment	**Weightage (Marks)**
ESE	100

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 Nature, Scope and Importance of Marketing – Functions – Marketing Environment- Factors Influencing Marketing Environment – Market Segmentation – Need and basis of Market Segmentation Targeting and Positioning. Selling Vs. Marketing.	**07 Hrs.**
Unit 2: Consumer Behaviour Factors Influencing Consumer Behaviour - General Consumers, Industrial Consumers, Online Consumers - Recent Concepts in Marketing – Green Marketing, Digital Marketing, Relationship Marketing.	**08 Hrs.**
Unit 3: Product Product –Definition – Levels of Product - Classification of Products – Product Mix: Levels, Hierarchy, Classifications, Mix. Product Lifecycle: The Concept and its Strategic Implications, Significance of Branding, New Product Development Process.	**08 Hrs.**
Unit 4: Pricing Price Decisions - Pricing objectives - Pricing policies and constraints - Different pricing method - New product pricing, Product Mix pricing strategies and Price adjustment strategy.	**07 Hrs.**
Unit 5: Promotion Promotion Decision - Promotion mix - Advertising Decision, Advertising objectives - Advertising and Sales Promotion – Developing Advertising Programmed – Role of Media in Advertising - Advertisement effectiveness - - Sales force Decision	**07 Hrs.**
Unit 6: Distribution Channel Channel Decision - Nature of Marketing Channels –. Types of Channel flows - Channel functions - Functions of Distribution Channel – Structure and Design of Marketing Channels -Channel co-operation, conflict and competition – Retailers and wholesalers.	**08 Hrs.**
Recommended Books: 1. Dr. C B Gupta, Dr. N. Rajan Nair, Marketing Management - Sultan Chand & Sons, New Delhi. 2. Philip Kotler, Marketing Management - Prentice Hall of India Pvt Ltd., New Delhi.	
References: 1. R.S.N.Pillai & Bagavathi, Marketing Management, S. Chand Publishing. 2. RajanSexna, Marketing Management, MC Graw Hill Education. 3. Ramaswamy,V.S.,Namakumari,S- Marketing Management: Global Perspective, Sage Publications India Private Ltd, New Delhi. 4. Philip Kotler, HermawanKartajaya, Iwan Setiawan, Marketing 4.0- John Wiley & Sons, Inc., USA. WEB	

Title of the Course:	**APPLICATIONS OF AI (MDM)**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVMM0541**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Basics of Projects and Automation, Instrumentation and Data Analytics

Course Description:

This course is designed to understand applications of Artificial Intelligence for construction projects as a primary requirement to facilitate decision making for controlling cost overruns and delays

Course Learning Objectives:

The objective of learning this course is to identify possible scenarios in construction projects from concept to operation phase which need assistance from AI for making efficient decision making.

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Recognize the significance of Applications of AI for construction projects	01	Knowledge
CO2	Acquire skills to use AI for construction projects to control cost overruns and delays	03	Apply

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	1	0	2

Assessments:

Teacher Assessment:

- ESE: End Semester Examination is based on 100% course content It may include Multi choice questions

Course Contents:

Unit: 1	**CO: 1**	
Brief review of history of AI & related fields, Introduction to Artificial Neural Networks, Introduction to fuzzy systems, Introduction to predictive analytics, Introduction to machine Learning (ML)		**07 Hrs.**

Unit: 2	**CO: 1**	
Fundamentals of Genetic Algorithm. Genetic algorithm in Civil engineering, Adoption of AI in different fields of Civil Engineering, Challenges of Adoption of AI in Civil Engineering, Different models of AI		**06 Hrs.**
Unit: 3	**CO: 2**	
Structural Analysis and Design Optimization, Application of AI in Structural Analysis, Case Studies: Predictive Maintenance and Optimal Design Solutions, Structural health monitoring with AI techniques, Case studies: predictive modeling for structural integrity assessment		**10 Hrs.**
Unit: 4	**CO: 2**	
AI and ML in Construction Management, Introduction to construction management, Schedule optimization using ML algorithms, Resource allocation and risk management with AI, Predictive analytics for infrastructure maintenance, Case studies: AI-driven construction project management systems		**10 Hrs.**
Unit: 5	**CO: 2**	
Infrastructure Monitoring and Management, Introduction to infrastructure monitoring, IoT and sensor data integration with ML, Implementation of AI and ML algorithms using Python		**06 Hrs.**
Unit: 6	**CO: 2**	
Integrating AI in design phase, AI applied to BIM, AI applied to sustainable design, AI applied to cost estimation, Ethical considerations in AI and ML applications		**06 Hrs.**

References Books:

1. Kishan Mehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, Penram International
2. Machine Learning with Python for Everyone, Mark Fenner, Pearson
3. Neural Networks, Fuzzy Logic, and Genetic Algorithms : Synthesis and Applications By S. Rajshekharan, G. A. Vijayalakshmi Pai, PHI
4. Andries P. Engelbrecht, Computational Intelligence - An Introduction, Wiley Publication

Program: B. Tech (Hons.) in Civil and Environmental Engineering with Specialization in Green Technology and Sustainability Engineering **Class:** T. Y. B. Tech **Title of the Course:** Fecal Sludge and Septage Management **Course No.:** UCEHN0551	**L**	**T**	**P**	**Credit**
	03 hours per week	01 hour per week	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Subject "Environmental Chemistry and Microbiology"
- Subject "Water resources engineering"
- Subject "Hydraulics"

Course Description: This course aims to build students' capacity to plan, design, and implement non-sewered decentralized sanitation solutions with a specific focus on feacal sludge and septage management (FSSM). Decentralized faecal septage treatment plants (FSTP) are emerging as solutions to the challenge of addressing safe treatment and disposal of septage.

Course Learning Objectives:

1. Understand the Need for fecal sludge and septage management.
2. Analyze various government policies and rules related to fecal sludge and septage management and the existing Situation and Challenges in fecal sludge and septage management.
3. Recommend on-site or integrated fecal sludge and septage treatment technologies.
4. Develop the planning strategies for suggested fecal sludge and septage treatment technologies

Course Outcomes:

COs	**After the completion of the course, the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Understand the Need for fecal sludge and septage management.	Cognitive (Understanding) L2
CO.2	Analyze various government policies and rules related to fecal sludge and septage management and the existing Situation and Challenges in fecal sludge and septage management.	Cognitive (Analysing) L4
CO.3	Recommend on-site or integrated fecal sludge and septage treatment technologies.	Cognitive (Evaluating) L5
CO.4	Develop the planning strategies for suggested fecal sludge and septage treatment technologies	Cognitive (Applying) L3

CO-PO Mapping:

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

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

Assessments:

Assessment	**Weightage (Marks)**
ESE	100

- **ESE:** Assessment is based on end semester examination with 100% course content.

Course Contents:

Unit 1: Urban Sanitation

Urbanization, Urbanisation trends and estimates in major regions of the world, Urban Sanitation in India, The Challenge of Water Supply and Sanitation in the Context of Urbanisation, introduction to fecal sludge and septage, Need for fecal sludge and septage management (FSSM), characterization and quantification of fecal sludge and septage.	**06 Hrs.**
Unit 2: History of Sanitation Efforts and the Shifting Paradigm towards FSSM Jawaharlal Nehru National Urban Renewal Mission (JNNURM), National Urban Sanitation Policy (NUSP), Swachh Bharat Mission (Urban), National Policy on Faecal Sludge and Septage Management (FSSM), Jal Jeevan Mission-Urban (JJM-U) Mission, The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) mission.	**07 Hrs.**
Unit 3: Existing Situation and Challenges in FSSM Sanitation service chain, sanitation value chain (User Interface, Collection/Storage/ Treatment, Emptying and Conveyance), Gender, Caste, and Class Dimensions of Urban Sanitation, FSSM Enabling Compliance for Ending Manual Scavenging	**08 Hrs.**
Unit 4: On-site treatment Technology options for FSSM Different on-site containment systems--Twin pit for pour flush toilet, Septic Tank, Anaerobic Baffled Reactor, Anaerobic up-flow filter, different conveyance methods or techniques of Faecal Sludge and Septage- Human-powered Emptying, Motorized Emptying, and Transport, Transfer Stations	**07 Hrs.**
Unit 5: Integrated Faecal Sludge and Septage Management (IFSM) Treatment Chain of Integrated Faecal Sludge and Septage Management (IFSM), Criteria for selection of treatment options, Treatment methods--Co-treatment of FS in STP, Deep Row Entrenchment, Anaerobic Digestion, Imhoff Tanks, Planted and unplanted sludge drying beds, Sludge incineration, Thermal Drying, and Pelletising.	**06 Hrs.**
Unit 6: Planning of FSSM factors and decisions guiding the planning of septage (generation and its conveyance and treatment) management, Assessment of Financing Requirement Across the FSSM Value Chain, Potential Sources of Financing for Capex and Opex, Some case studies on FSSM from India and abroad.	**06 Hrs.**
Textbooks: 1. Integrated Faecal Sludge and Septage Management modules (2019) by National Institute of Urban Affairs, New Delhi India.	
Reference Book: 1. Faecal Sludge and Septage Treatment A guide for low- and middle-income countries (2018) by Kevin Tayler, Practical Action Publishing Ltd Rugby, Warwickshire, UK.	

Class: T. Y. B. Tech (Emerging Minor) In Civil and Environmental Engineering with Specialization in Sustainability Engineering **Title of the Course:** Climate Change and Sustainable Development **Course No.:** UCEMNC0561	**L**	**T**	**P**	**Credit**
	03 hours per week	01 hour per week	-	4

Course Pre-Requisite:

- Environmental Science
- Basic Knowledge of Ecology
- Environmental Chemistry and Microbiology

Course Description:

This course explores the scientific, social, and economic dimensions of climate change and its intersection with sustainable development. Students will analyse mitigation and adaptation strategies, policy frameworks, and global initiatives like the Paris Agreement. The course emphasizes practical solutions for low-carbon development and resilience planning.

Course Learning Objectives:

5. Explain the scientific basis of climate change, including greenhouse gas dynamics and global warming projections.
6. Evaluate the impacts of climate change on ecosystems, economies, and vulnerable communities.
7. Design mitigation and adaptation strategies aligned with SDGs (e.g., SDG 13: Climate Action).
8. Critique international climate policies (e.g., Paris Agreement, NDCs) and their implementation challenges.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Describe climate science fundamentals and key drivers of global warming.	Cognitive (Understanding) L2
CO.2	Assess climate risks (e.g., sea-level rise, extreme weather) using case studies.	Cognitive (Analyzing) L4
CO.3	Propose sustainable solutions (renewable energy, carbon sequestration).	Cognitive (Applying) L3
CO.4	Analyse climate justice issues and policy gaps in Global North vs. South.	Cognitive (Evaluating) L5

CO-PO Mapping:

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

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

Assessments:

Assessment	Weightage (Marks)
ESE	100

- **ESE:** Assessment is based on 100% course content.

Course Contents:

Unit 1: Introduction to Climate Change Understanding climate change: Definition and scope, Climate change science: Greenhouse gases, carbon cycle, and radiative forcing, Natural vs. anthropogenic causes of climate change, Climate feedback mechanisms and tipping points.	**08 hours**
Unit 2: Impacts of Climate Change Environmental impacts: Rising temperatures, melting ice caps, sea-level rise, Effects on biodiversity and ecosystems, Social and economic consequences: Food security, water scarcity, health risks, Climate change and extreme weather events, case studies, physical climate risk assessment.	**07 hours**
Unit 3: Climate Change Mitigation Reducing greenhouse gas emissions: Energy efficiency, renewable energy, Carbon sequestration and carbon capture technologies, Role of industries and businesses in climate action, Circular economy and sustainable production, case studies.	**08 hours**
Unit 4: Climate Change Adaptation Need for adaptation: Risk assessment and vulnerability analysis, Adaptation strategies in agriculture, water resources, and infrastructure, Community-based adaptation and climate-resilient planning, Role of technology and innovation in adaptation	**07 hours**
Unit 5: Sustainable Development and Climate Change Concept and principles of sustainable development, Linkages between climate change and sustainability, UN Sustainable Development Goals (SDGs) and climate action, Sustainable cities, green transportation, and resource management, case studies.	**08 hours**
Unit 6: Climate Policies and Global Initiatives International climate agreements: UNFCCC, Kyoto Protocol, Paris Agreement, National and regional climate policies and action plans, Role of government, NGOs, and civil society in climate governance, Carbon markets and climate finance	**07 hours**

Textbooks:

1. Climate Change: A Very Short Introduction – Mark Maslin
2. Sustainability: A Comprehensive Foundation – Tom Theis, Jonathan Tomkin

References:

1. IPCC Climate Change Assessment Reports
2. The Economics of Climate Change – Nicholas Stern
3. Sustainable Development: Concepts and Practices – John Blewitt

Class: T. Y. B. Tech Environmental Engineering **Title of the Course:** Wastewater Engineering **Course Code:** UCEPC0601	**L**	**T**	**P**	**Credit**
	3	-	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Environmental chemistry and microbiology
- Hydraulics and water supply engineering

Course Description:

The course reviews the collection and conventional treatment of municipal wastewater. Students design sewers and sewage pumping station. Students learn primary and secondary/biological treatment principles and processes. Management of sludge and disinfection of municipal effluents are also covered. This course prepares students for advanced wastewater treatment processes, including industrial wastewater, in further treatment courses.

Course Learning Objectives:

- To deliver knowledge of sources and flowrates of wastewater and characteristics of Municipal wastewater.
- To impart necessary skills for the design and operation of wastewater treatment plants.
- To introduce new developments in the field of wastewater treatment.
- To prepare students for higher studies and research in the field of wastewater treatment technology.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Explain characteristics of domestic wastewater and domestic wastewater treatment technologies	Cognitive (Understanding) L2
CO2	Apply the concepts of wastewater treatment	Cognitive (Applying) L3
CO3	Evaluate the processes used for wastewater treatment	Cognitive (Applying) L4
CO4	Design domestic wastewater treatment units.	Cognitive (Creating) L6

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	0	0	0	0	1	0	0	0	0	1
CO2	2	1	0	1	1	1	0	0	0	0	1
CO3	0	2	0	2	1	1	0	0	0	0	0
CO4	1	1	2	1	1	1	0	0	0	0	1

COs	**PSO1**	**PSO2**
CO1	1	0
CO2	1	1
CO3	1	2
CO4	1	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: **Introduction, Quantity & Characteristics of Wastewater:** Components of Wastewater Flows, Wastewater Sources & Flow rate, Variations in Flow rates & Strength, sampling and significance of wastewater analysis, physical, chemical and biological characteristics of domestic wastewater, Sewer appurtenances, Sewage Pumping, Location, Capacity, Pumping Station Design. **Self-Purification of water bodies:** DO Sag Curve, Streeter Phelp's Model, Stream Classification, Effluent Standards for Discharge into Surface Water & on Land.	**08 Hrs.**
Unit 2: **Primary Treatment of Wastewater:** Physical Unit Operations- Screening, Grit Removal, Oil & Grease Removal, Primary Sedimentation	**08 Hrs.**
Unit 3: **Secondary Treatment of Wastewater:** Fundamentals of Biological Treatment, Microbial Metabolism, Bacterial Growth, Suspended & Attached Growth Processes, Activated Sludge Process & its Modifications, Trickling Filters, Secondary Clarification, Aerated Lagoons, Oxidation Ditch, WSP	**07 Hrs.**
Unit 4: **Anaerobic Treatment of Wastewater:** Anaerobic Suspended & Attached Growth Processes, Factors affecting Anaerobic Processes, Anaerobic Lagoons, UASB, Septic Tank, Anaerobic Baffled Reactor	**07 Hrs.**
Unit 5: **Sludge Treatment:** Solid Sources, Characteristics & Quantities, classes of sludge and its treatment as per latest norms, Sludge Pumping, Introduction to mass balance approach, Treatment- Thickening, Stabilization, Design of Sludge Digester, Conditioning, Dewatering, Drying, Ultimate Disposal of Sludge Solids	**08 Hrs.**
Unit 6: **Decentralized wastewater treatment and Disposal of Wastewater:** Concept of decentralized wastewater treatment systems, (MBR, MBBR, DEWATS, Package Treatment Plants) Need of Disinfection, Introduction to tertiary treatment.	**07 Hrs.**

Textbooks:

1. Modi, P. N., "Wastewater Engineering," Standard Book House, 1st edition, 2001.
2. Manual on sewerage and sewage Treatment- Ministry of Urban Development, New Delhi (CPHEEO)
3. Environmental Engineering – 2, Wastewater Engineering, B. C. Punmia, Arun K. Jain and Ashok K. Jain, Laxmi Publications Pvt. Ltd., New Delhi.
4. Sewage Disposal and Air Pollution Engineering, S. K. Garg, Khanna Publishers.

References:

1. Metcalf & Eddy, Waste Water Engg. Treatment & Disposal, Tata McGraw Hill (2nd Edition)
2. Peavey, H. S. Rowe, D.R., and Tchobanoglous, Environmental Engineering, McGraw-Hill Book Company.
3. Hammer M.J. Water and Waste water Technology, Prentice-Hall of India P.Ltd.

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Solid Waste Management **Course Code:** UCEPC0602	**L**	**T**	**P**	**Credit**
	2	-	-	2

Course Pre-Requisite:

Students shall have the knowledge of

- Environmental Chemistry and microbiology
- Fluid Mechanics (for landfill leachate management)
- Engineering Mathematics

Course Description:

Solid waste management (SWM) is a critical challenge in urban and rural environments due to increasing waste complexity, population growth, and environmental regulations. This course covers modern SWM strategies, from waste generation to disposal, emphasizing sustainability, circular economy principles, and smart technologies. Students will explore functional elements (collection, processing, recycling, and disposal), legal frameworks, and innovative solutions like zero-waste initiatives.

Course Learning Objectives:

- Classify solid waste based on physical state, sources, and properties, and analyze factors affecting waste generation rates, including health impacts and policy tools like EPR and carbon credits
- Design efficient waste collection systems by evaluating routing mechanisms, transfer stations, and characterization methods (physical, chemical, biological) for Municipal Solid Waste.
- Compare and select appropriate waste processing techniques (biological, thermal, recycling) to achieve waste minimization and energy recovery, adhering to the waste hierarchy.
- Evaluate landfill technologies and global/Indian legal frameworks to propose compliant and sustainable disposal solutions

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Illustrate foundational knowledge of waste classification, generation trends, and circular economic strategies to address environmental and health impacts.	Cognitive (Understanding) L2
CO2	Develop skills in waste collection system design, optimization, and characterization to improve operational efficiency.	Cognitive (Applying) L3
CO3	List advanced waste treatment technologies to promote resource recovery and sustainability	Cognitive (Applying) L4
CO4	Examine disposal methods and legal frameworks to ensure regulatory compliance and innovation in waste management.	Cognitive (Applying) L4

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1	2	-
CO2	-	2
CO3	2	-
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: Waste types and Classification: Definition of solid waste, classification of solid waste based on physical state, sources of solid waste generation and properties. Solid waste generation rates, techniques to estimate waste generation rates. Factors affecting waste generation, health effects due to improper management of wastes, EPR (Extended Producer Responsibility), Circular economy and zero-waste strategies and carbon credit mechanisms.	**06 Hrs.**
Unit 2: Waste Collection and Characterization: Concept, components of waste collection system, types of vehicles used in waste collection, collection frequency and routing mechanism involved in waste collection, Route optimization, Concept and types of transfer station, advancements in waste segregation. **Characterization of Solid waste:** Concept, methods (physical, chemical and biological), characteristics of Municipal Solid Waste in India, Study of waste composition.	**06 Hrs.**
Unit 3: Waste Processing and treatment Size and Volume reduction of waste, Waste minimization, hierarchy of waste management **Biological Treatment of Solid Waste**: Composting, Vermicomposting, Decentralized composting solutions for urban areas, Biogas production from solid waste (Anaerobic Digestion) **Thermal Treatment of Solid Waste:** Incineration technology, Pyrolysis and Gasification of solid waste, Waste-to-energy (WtE) technologies: Plasma gasification, RDF plants. **Recycling of Solid Waste:** Types of recycling, steps involved in recycling of different items, Chemical recycling of plastics and e-waste.	**10 Hrs.**
Unit 4: Solid waste disposal and legal frameworks **Solid Waste Disposal:** Sanitary Landfills, leachate characteristics, Landfill leachate and gas management, Landfill mining and bioreactor landfills. **Legal Framework in Solid Waste Management:** Solid waste management Rules 2016, E-waste management Rules2016, Plastic waste management Rules 2016, Clean India Mission, Global policies: EU Green Deal, Clean India Mission 2.0.	**08 Hrs.**

Textbooks:
Handbook of Solid Waste Management- Frank Kreith
Solid Waste Management - Jagbir Singh and AL Ramanathan
Solid Waste Management- Velma I. Grover and B. K. Guha

References:

1. Integrated Solid Waste Management - Tchobanoglous
2. Handbook and Solid Waste Disposal – George Tchobanoglous and Frank Kreith
3. Solid and Hazardous Waste Management- M. N. Rao
4. CPHEEO Manual on Solid Waste Vol. I,II
5. Swayam-NPTEL platform

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Geotechnical Engineering **Course Code:** UCEPC0603	**L**	**T**	**P**	**Credits**
	3 hours per week	-	-	3

Course Pre-Requisite:

Students shall have knowledge of:

- Algebra and Engineering Mathematics
- Engineering Physics and Chemistry
- Engineering Mechanics
- Fluid Mechanics

Course Description:

The course imparts fundamental knowledge of geotechnical properties and their significance in Civil and Environmental Engineering. The subject covers interpretation of index and engineering properties, their field relevance as well as estimation of stress, development of earth pressure, analysis of stability of earth work. The basics and concepts of foundation design and settlement analysis are also dealt.

Course Learning Objectives:

- To study various soil properties and its methods of determination.
- To understand applications of soil properties in Civil and Environmental Engineering
- To study parameters of soil for strength and stability.
- To understand concepts of earth retaining structures.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Explain soil properties and methods for its determination	Cognitive (Understanding) L2
CO2	Utilize soil properties for predicting soil performance.	Cognitive (Applying) L3
CO3	Analyze shear strength, earth pressure and slope stability.	Cognitive (Applying) L4
CO4	Assess suitability of earth retaining Structures.	Cognitive (Evaluating) L5

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2	1	2	0	0	0	0	0	0	0
CO2	3	2	0	1	0	0	0	0	0	0	0
CO3	0	2	1	2	0	0	0	0	0	0	1
CO4	1	1	2	2	0	1	0	0	0	0	0

COs	**PSO1**	**PSO2**
CO1	1	0
CO2	1	0
CO3	0	0
CO4	0	0

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: Properties of Soil: Introduction to Geotechnology and its application areas, Formation of soil, Soil as three phase system, Weight- Volume relationships, Index & Engineering properties of soil, Determination of index properties and its significance, Soil classification and Soil structure.	04 Hrs.
Unit 2: Soil hydraulics: Modes of occurrence of water in soil, Darcy 's law & its validity, Coefficient of permeability & its determination methods, Factors affecting permeability, Permeability of layered soils. Seepage analysis: Quick sand condition, Uplift pressure, exit gradient, failure due to piping, Flow net - properties and applications, Concept of effective, neutral & total stress in soil mass.	08 Hrs.
Unit 3: Compaction & Consolidation: Compaction: Theory, Methods of compaction, Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment's and methods, Field control of compaction, Factors affecting compaction, Consolidation: Consolidation process - Spring analogy, e- log P curve, Terzaghi 's theory of one-dimensional consolidation, Type of settlement, rate and time of settlement.	06 Hrs.
Unit 4: Shear Strength and its measurement: Concept of shear, Principal plane and stresses, Mohr - Coulomb 's theory and failure envelope of types of soil, Total stress approach and effective stress approach, Types of shear test – Direct (box) shear test, Triaxial compression test, Unconfined compression test. Drainage conditions: Unconsolidated–Undrained(U-U), Consolidated -Undrained (C-U) and Consolidated –Drained (C-D)	06 Hrs.
Unit 5: Earth Pressure: Concept, earth pressure at rest, active and passive condition, Rankine's and Coulomb's theory of earth pressure, Estimation of earth pressure in different conditions. Concept of slope stability: Slope classification, slope failure modes, Infinite, Finite slope and analysis of stability, Taylor's stability number, slope protection measures	06 Hrs.
Unit 6: Earth Retaining Structures: Gravity Retaining Walls, Sheet Pile Walls, Cantilever Walls, Anchored Earth Structures, Embankment Slopes, Soil Nail Wall, Gabion Structure, Reinforcement Techniques **Ground Improvement** Stone columns, Vibro flotation, Preloading technique. Use of Geo-synthetics and geotextiles, Electrokinetic treatment, Jet Grouting, Chemical grouting.RE structure, modern consolidation technique.	06 Hrs.

TEXT BOOKS:

1. Text book of soil mechanics in theory and practice‖ by Dr. Alam Singh (Asian Publishing House, Bombay)
2. Soil mechanics and Foundation engineering‖ by V. N. S. Murthy. (U. B. S. Publishers and distributors New Delhi

REFERENCE BOOKS:

1 Soil mechanics and Foundation engineering‖ by B. S. Punmia. (A Saurabh and Company Pvt. Ltd., Madras)
2 Geotechnical Engineering‖ by P. Purushottam Raj. (Tata Mcgraw Hill Company Ltd. New Delhi)
3 Soil mechanics‖ by Terzaghi and Peak. (John Willey and Sons, New- York)

4 Soil Testing by T.W. Lambe. (Willey Eastern Ltd., New Delhi) 5 Geotechnical Engineering by Venkatramiah
Unit wise Measurable Students Learning Objectives and Outcomes: Unit Student Learning outcome **Unit 1**: Derive functional relationships, determine soil properties and understand soil classification and structure. **Unit 2:** Analyze flow problem through soil and estimate seepage and stresses developed in soil. **Unit 3:** Establish criteria for field compaction and suitability of compaction equipment's. Estimate consolidation of soil layer, thereby probable foundation settlement **Unit 4:** Select suitable laboratory method for shear stress parameter determination and interpret soil strength. **Unit 5:** Apply theories and calculate magnitude of earth pressure as well as its point of application. Analyze slope stability and design a stable slope. **Unit 6:** Evaluate bearing capacity of soil, predict probable settlement and propose suitable foundation type

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Noise Pollution and Control (PE-II) **Course Code:** UCEPE0611	**L**	**T**	**P**	**Credits**
	3	1	-	4

Course Pre-Requisite:

Students shall have the knowledge of:

- Knowledge of engineering mathematics and physics

Course Description:

This course is intended to make students aware of the sources of noise, measurement. Various effects, health monitoring with respect to noise, legal provisions as well as various engineering measures for control of noise.

Course Learning Objectives:

- Study the sources and effects of noise.
- Learn measurement and propagation of noise.
- Study the various techniques for controlling noise in community and industries.
- Understand the legal provisions for control of noise.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Explain propagation and various effects of noise	Cognitive (Understanding) L2
CO2	Develop various indices for noise based on noise monitoring data	Cognitive (Applying) L3
CO3	Select various control measures for noise in industries and community	Cognitive (Applying) L3
CO4	Compare the measured noise levels to legal compliance	Cognitive (Analysing) L4

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1	1	-
CO2	-	2
CO3	2	2
CO4	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 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: Sound Transmission and measurement Sound- characteristics, Sound transmission and Characteristics of sound wave, Measurement of sound with respect to sound pressure, Sound power and sound intensity, Units of measurement, Sound Level Meter, Factors influencing sound transmission in outdoor atmosphere	**07 Hrs.**
Unit 2: Legal Provision for Control of noise Legal provisions for control of noise under Noise Pollution (Regulation and Control) Rules, 2000 and its amendments, Local Bye-laws regarding noise pollution control, Case studies in India and abroad	**07 Hrs.**
Unit 3: Sources and effects of Noise Definition of noise, Sound Vs. Noise, Sources of noise and classification, Infrasonic and ultrasonic sound, Threshold of hearing, Threshold of pain, Anatomy of human ear and mechanism of hearing, Effects of noise - effects on human health, auditory effects, physiological and psychological effects, effects on animals, effects on wild life, effects on plants, effects on structures	**08 Hrs.**
Unit 4: Community noise Sources and characteristics of community noise, nuisance of noise in India, Common noise levels, Measurement of community noise, Equivalent noise, Average Day and Night noise, Noise Pollution Levels, Noise Percentile	**07 Hrs.**
Unit 5: Industrial noise Types, sources and characteristics of industrial noise, Noise levels generated in various industrial operations, Measurement of industrial noise, OSHA exposure standards, Exposure measurement, Use of Dose meter, Health Monitoring, Procedure of Audiometric testing, Interpretation of Noise Induced Hearing Loss from audiogram	**08 Hrs.**
Unit 6: Control of noise Engineering control of noise, noise reduction at source, acoustical absorbing devices, Enclosure, Noise barriers (residential and industrial), Various types of mufflers, Reduction at receiving end, Active Noise Reduction, Administrative control of noise, Personal Protective Equipment's for noise, Strategy for control of noise, Control of community noise, Frequency analyser and octave band analysis, Noise mapping and its applications.	**08 Hrs.**

Textbooks:

1. Noise Pollution and Control Strategy by S.P. Singhal, Narosa Publishing House, 2005.
2. Noise Pollution by S. K. Agrawal- APH Publishing corporation, New Delhi. 2009.
3. Environmental Noise Pollution by Enda Murphy and Eoin A. King, Science Direct 2014.

Reference Books:

1. Handbook of Environmental management and technology by Gwendolyn Holmes, Ben Ramnasiue Singh and Louis Theodore (A Wiley – Enter science publication)
2. Standard Hand book of Environmental Engineering by Robert A. Corbett (McGraw Hill Inc.)
3. Industrial Pollution by N. Irving Sax (Van Nostrand Reinhold Company)
4. Environmental Engineering by G.N.Pandey and G.C. Carney (Tata McGraw Hill)
5. Some thought on Environmental and law by C.S. Mehta (RBSA Publisher)
6. IS code for practice for noise reduction in industrial buildings IS: 3483, 1965
7. Soil and Noise pollution: Dr B.K.Sharma and Dr. H.Kaur, Goel Publishing House, Krishana Prakashan mandir, Meerut

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Irrigation and Hydraulic Structures (PE-II) **Course Code:** UCEPE0612	**L**	**T**	**P**	**Credits**
	3	1	-	4

Course Pre-Requisite:

Students shall have knowledge of:

- Water Resources Engineering
- Fluid Mechanics
- Hydraulics

Course Description:

This course emphasizes on the various Hydraulic Structures used in Irrigation and allied sector. Different Hydraulic Structures like Dams, Spillways, Diversion Headworks, Canals and components of Hydroelectric System are covered in this course. It encompasses the necessity, components and requirements of these Hydraulic Structures.

Course Learning Objectives:

During this course students will

- Know necessity and importance of various Hydraulic Structures in irrigation.
- Understand the components, types and requirements of the Hydraulic Structures.
- Acquire knowledge about the theories related to design of the different Hydraulic Structures.

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Descriptor**
CO1	Illustrate the requirements of reservoirs.	Cognitive (Understanding) L2
CO2	Summarize the different types and components of dams, spillways and hydroelectric system.	Cognitive (Understanding) L2
CO3	Explain the requirements and working of diversion headworks, canals and river training works.	Cognitive (Understanding) L4
CO4	Analyze the theories and design criteria for water retaining structures and its components.	Cognitive (Analyzing) L4

CO-PO Mapping:

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

CO	**PSO1**	**PSO2**
CO1	3	0
CO2	0	1
CO3	0	0
CO4	0	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 Introduction: Water retaining structures, Classification of reservoirs, Investigations for reservoir planning, Site selection for reservoirs, Zones of storage in a reservoir, Reservoir capacity from mass inflow curve, Reservoir sedimentation, Calculation of life of reservoir.	**07 Hrs.**
Unit 2 Dams: Classification of dams, Gravity dams, Forces acting on a gravity dam, Elemental and practical profile of a gravity dam, Limiting height of a gravity dam, Design of gravity dams and stability analysis, Galleries and joints. Earthen dams-Types, Criteria for design of earthen dams, Details of section and Phreatic lines in earthen dam, Seepage analysis and control measures, Stability Analysis	**08 Hrs.**
Unit 3 Spillways: Need of spillways, Components of spillways , Types of spillways, Ogee spillway - cavitations on spillway design features of ogee spillway Chute spillway design principle Energy dissipation design of different types of stilling basins Spillway crest gates	**07 Hrs.**
Unit 4 Diversion Headworks: Introduction, Component parts of diversion headworks, Location of head works, Khosla's Theory, Bligh's Creep Theory, Lane's weighted creep theory, Design of concrete slope weir, Design of Check dams	**08 Hrs.**
Unit 5 Canals: Need of canals, Losses in canals, Lining of canals, Types of lining, Design of lined canals, Canal outlets, Canal regulation works - necessity and location, Development of falls, Classification of falls, Cross drainage works, Types and selection criteria.	**07Hrs.**
Unit 6 River Engineering and Water Power Engineering: River Engineering, Classification of rivers, Meandering of rivers, Causes and controls for meandering, River training works: classification and types, Interlinking of rivers, Necessity of water power, Types of water power development, Principle components of hydro-electric system.	**08Hrs.**

Textbooks:

1. Punmia, Irrigation and water power engineering, 1986. Standard Publications, New Delhi.
2. S.K.Garg, Irrigation Engg.
3. P.N.Modi. Irrigation and water power engineering
4. SatyanarayanMurty, Water resources Engg_, New age international private Ltd.
5. Dr. M. M. Mujumdar and Akshay R. Thorvat: Water Resources Engineering – I, Electrotech Publications.

References:

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

Class: T. Y. B. Tech. Civil and Environmental Engineering **Title of the Course:** Design of Steel Structures (PE-II) **Course Code:** UCEPE0613	**L**	**T**	**P**	**Credits**
	3	1	-	4

Course Pre-Requisite:

Students shall have knowledge of:

- Algebra and Engineering Mathematics
- Engineering Mechanics
- Solid Mechanics
- Structural Analysis

Course Description:

A Civil-Environmental Engineer needs to understand the design of various structural members such as beams, columns, treatment plants, and storage tanks as well as apply checks for safety and serviceability. Number of problems with the design of different steel member gives idea about designing process. This course acts as a prerequisite for the advanced design of steel structures.

Course Learning Objectives:

- To study concepts and design philosophies of Design of Steel Structures
- To understand analysis and design of members of steel structure
- To know various checks of steel structures for safety and stability
- To impart basic knowledge about the design of various steel structures.

Course Outcomes:

CO	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Classify the loads on various members of steel structures and with reference to IS Code	Cognitive (Understanding) L2
CO2	Choose suitable connections of various structural members in steel structure.	Cognitive (Applying) L3
CO3	Assess the strength of various steel sections as per IS Code.	Cognitive (Evaluate) L5
CO4	Design specific structural element /component of steel structure subjected to specific force.	Cognitive (Creating) L6

CO-PO Mapping:

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

CO	**PSO1**	**PSO2**
CO1	-	-
CO2	-	2
CO3	-	2
CO4	-	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 **Introduction to steel structures:** Types of steel structures, Advantages and disadvantages of steel structures, Design Philosophies, elastic and plastic properties of sections, shape factor, grades of structural steel, various rolled steel sections, Types of loads and load combinations, partial safety factors for load and materials. stress distribution under tension, compression, bending and shear Types of bolts and welds, analysis and Design of axially and eccentrically loaded bolted and welded connections (subjected to bending and torsion).	**08 Hrs.**
Unit: 2 **Tension Members:** Types of sections for tension members, IS code- IS800: 2007 provisions, Gross and Net area, modes of failures Analysis and Design of axially loaded tension members, shear lag effect and design.	**07 Hrs.**
Unit: 3 **Compression Members as Struts:** Types of sections for compression members, IS code- IS800: 2007 provisions, section classifications, effective length, slenderness ratio, Design of axially loaded compression members simple sections, single angle and double angle strut, built-up sections, design of lacings and battens.	**08 Hrs.**
Unit 4: **Columns:** IS code- IS800: 2007 provisions, Design of columns subjected to axial and eccentric loading, design of lacing, battening system, column splices. **Column Bases**: IS code- IS800: 2007 provisions, Design of slab bases and gusseted base subjected to axial and eccentric load and design of concrete pedestal (dimensions only).	**08 Hrs.**
Unit 5: **Beams:** Flexural members –Types of sections, effective length, design of laterally restrained and unrestrained beams, rolled sections, built-up beams/compound beams, IS code- IS800: 2007 provisions, Design for strength and serviceability, web buckling, web crippling, curtailment of flange plates.	**08 Hrs.**
Unit 6: **Gantry girder:** Forces acting on gantry girder, commonly used sections, IS code- IS800: 2007 provisions, design of gantry girder and connection.	**06 Hrs.**

Recommended Textbooks:

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

References Books:

1. IS: 800 – 2007, IS: 875 (part I, II and III), SP6 (1) and SP 6 (6), IS: 816, IS: 808.
2. LRFD Steel Design: William T. Segui, PWS Publishing
3. Design of Steel Structures: Edwin H. Gaylord, Charles N. Gaylord James, Stallmeyer, Mc-Graw-Hill
4. Design of Steel Structures: Mac. Ginely T.
5. Design of Steel Structures: Dayaratnam, Wheeler Publications, New Delhi.
6. Design of Steel Structures: Punmia, A. K. Jain and Arun Kumar Jain, Laxmi Publication
7. Design of Steel Structures: Kazimi S. M. and Jindal R. S., Prentice Hall India.

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

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Business Communication and Value Science (Practical) **Course Code:** UCEAE0604	**L**	**T**	**P**	**Credits**
	-	-	2	1

Course Pre-Requisite:

Students shall have knowledge of:

- Basics of Communication Skills
- LSRW Skills
- Grammar

Course Description:

This course will help students to develop their personality by learning professional skills including soft skills, presentation skills, understanding emotional intelligence, hone motivation, enhance leadership to raise their employability quotient.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Analyze personal strengths and areas for development	Cognitive (Applying) L4
CO2	Understand the importance of life skills for holistic personality development	Cognitive (Understanding) L2
CO3	Develop employability skills through various essential employability criteria	Cognitive (Evaluating) L5
CO4	Apply public speaking in real life scenarios	Cognitive (Applying) L3
CO5	Understand the implications of cross-cultural communication	Cognitive (Understanding) L2

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	-	-	-	-	-	-	2	2	2	-	2
CO2	-	-	-	-	-	-	3	1	1	-	2
CO3	-	-	-	-	-	-	2	1	1	-	2
CO4	-	-	-	-	-	-	2	3	3	-	2
CO5	-	-	-	-	-	-	2	1	3	-	2

COs	**PSO1**	**PSO2**
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-

Assessments:

Assessment	**Weightage (Marks)**
ISE	50

ISE-1: ISE is based on practical performance/ Quiz/ Presentation/ Group Discussion/Interview/Assignments/Demonstration, etc.

Course Contents:	
Self-awareness: Identifying self, personality traits, qualities, strengths and weaknesses. Create your SWOT, SWOT vs. TOWS, The balancing act- Ted talk on biomimicry. SWOT along with various aspects of self to fit the challenging professional world.	**02 Hrs.**
Soft skills and ethics: Introduction, importance of soft skills. Checklist on Soft Skills, Action Plan for improvement. Participants will read a case study and list down the soft skills.	**02 Hrs.**
Assertive communication and Positive Attitude: Positive and assertive communication with self and others to overcome challenges and build up mutual relationship and rapport. • Checklist on Positive self-talk, Positive Attitude and Self-Esteem, Goal setting, right attitude •Assertiveness Self-assessment Test: https://www.psychologytoday.com/intl/tests/personality/assertiveness-test	**04 Hrs.**
Employability quotient 1: Employment Correspondence- Participants are trained to draft Resume, CV and Application Letter in an ideal format to foster better employability**.** E-mail etiquettes.	**04 Hrs.**
Employability quotient 2: **Employment skills**- Open discussion on the topic, "Employers' expectations and the need for new skillset for the changing workforce trends." The focus is on raising learning and adaptability through employment perspective. A detailed checklist is provided to the participants to macth their skills and employer's expectations.	**04 Hrs.**
Employability quotient 3: **Group Dynamics:** Participants will be engaged in Group discussion activity to harness effective Communication skills, self-confidence, assertive self-expression, teamwork and constructive exchange of ideas and thoughts.	**02 Hrs.**
Employability quotient 4: **Interview Skills and Techniques:** Participants will face mock interview rounds followed by discussion on interview etiquettes.	**02 Hrs.**
Presentations techniques: Participants will prepare and deliver a short presentation on various soft skills or non-verbal communication. The focus is on body language, voice modulation, engagement with audience.	**02 Hrs.**
Emotional intelligence: Strategies to hone EI. A short video/movie clip showing manifestations of EI. Extemporaneous speeches on topics related to workplace scenarios followed by peer feedback.	**02 Hrs.**
Motivation and leadership: Participants are given few Case studies/ video samples to understand motivation. Participants will talk about their favorite leader and motivation throughout their life.	**02 Hrs.**
Cross- cultural communication: Techniques to facilitate cross-cultural communication. Participants will be provided a set of case scenarios to analyze cross-cultural communication. Participants will attempt a quiz based on different cultures.	**02 Hrs.**
Storytelling for business: Participants create and present a story and learn to connect with an audience and convey complex ideas through storytelling**.**	**02 Hrs.**

Textbooks:

1. Assertiveness Step by Step: Dr Windy Dryden & Daniel Constantinou, London: Sheldon, Pg 23-34
2. Emotional Intelligence, Why it can matter more than IQ: Daniel Goleman, Bloomsbury Publishing
3. Leadership: Theory and Practice: Peter G. Northouse, Sage, 2021
4. A Theory of Human Motivation: Abraham H. Maslow, 1943
5. Communication Skills: Meenakshi Raman & Sangeeta Sharma, Oxford University Press, 2013

Online resources:

1. Ted Talk: How to Speak So That Others Want to Listen https://www.youtube.com/watch?v=eIho2S0ZahI1
2. TEDx talk by Adam Galinsky: How to speak up for yourself- https://www.ted.com/talks/adam_galinsky_how_to_speak_up_for_yourself?language=en
3. https://www.youtube.com/watch?v=FFjGGZecO04
4. https://news.stanford.edu/2005/06/14/jobs-061505/ (Steve Jobs: Connecting the dots)

Class: T.Y. B. Tech (Civil & Environmental Engineering) **Title of the Course:** Wastewater Engineering Laboratory **Course Code:** UCEPC0631	**L**	**T**	**P**	**Credit**
	-	-	2	1

Course Pre-Requisite:

Students shall have the knowledge of:

- Environmental Chemistry
- Wastewater treatment

Course Description:

The course explores the application of environmental chemistry to measure the physical, chemical, and biological parameters of wastewater. The course includes laboratory methods and interpretation of results concerning environmental engineering applications.

Course Objectives:

- To provide hands-on practice for analyzing the quality of wastewater.
- To use basic design considerations for sewerage network.

Course Learning Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Make use of physical, chemical and biological methods for wastewater quality analysis.	Cognitive (Applying) L3
CO2	Analyze and apply the experimental results.	Cognitive (Analyzing) L4

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	0	0	3	2	2	0	0	0	0	2
CO2	2	1	0	3	2	2	0	0	0	0	2

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

Assessments:

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

ISE: Based on practical performed/ results analyzed / designs of treatment unit/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE (OE): Assessment is based on oral examination.

Course Contents:

Experiment No. 1: Analysis of domestic wastewater for volatile and fixed solids**.** **Learning Outcome:** To determine volatile and fixed solids and relation between them from domestic wastewater.	**04 Hrs.**
Experiment No. 2: Analysis of domestic wastewater for BOD**.** **Learning Outcome:** To determine BOD of domestic wastewater.	**06 Hrs.**
Experiment No. 3: Analysis of domestic wastewater for COD **Learning Outcome:** To determine COD of domestic wastewater	**04 Hrs.**
Experiment No. 4: Analysis of domestic wastewater for Oil & Grease	**02 Hrs.**

Learning Outcome: To determine Oil & Grease from domestic wastewater	
Experiment No. 5: Analysis of domestic wastewater for sulphates **Learning Outcome:** Determination of sulphates from domestic wastewater	**02 Hrs.**
Experiment No. 6: Analysis of domestic wastewater for Phosphorous **Learning Outcome:** Determination of Orthophosphates from domestic wastewater	**04 Hrs.**
Experiment No. 7: Analysis of domestic wastewater for TKN **Learning Outcome:** Determination of TKN from domestic wastewater	**04 Hrs.**
Experiment No. 8: Analysis of sludge **Learning Outcome:** Determination of characteristics of sludge such as pH, moisture content, volatile solids	**04 Hrs.**

References:

1. Chemistry for Environmental Engineering and Science, Clair N Sawyer, Perry L. McCarty, Gene F. Parkin
2. *Standard Methods for the Examination of Water and Wastewater* by American Public Health Association, American Water Works Association, Water Environment Federation (2005)
3. IS 3025: Methods of sampling and test (physical and chemical) for water and wastewater
4. Manual on sewerage and sewage Treatment- Ministry of Urban Development, New Delhi (CPHEEO)

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Geotechnical Engineering Laboratory **Course Code:** UCEPC0632	**L**	**T**	**P**	**Credit**
	-	-	2	1

Course Pre-Requisite:

Students shall have the knowledge of:

- Algebra and Engineering Mathematics
- Engineering Physics and Chemistry
- Engineering Mechanics
- Fluid Mechanics

Course Description:

The course helps to develop laboratory skills as well as enhances analytical abilities by performing experiments pertaining to Geotechnical Engineering. The laboratory performance and work helps to use theoretical concepts in practice, refer standard procedures and IS codes, measure parameters, make interpretations/ judgments and draw valid conclusions by using geotechnical engineering knowledge.

Course Learning Objectives:

- To introduce the students to laboratory methods for performing experiments in Geotechnical Engineering.
- To interpret observations/readings and draw conclusions.
- To relate laboratory results to field conditions.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Explain laboratory methods to determine Index and Engineering properties of soil.	Cognitive (Understanding) L2
CO2	Examine soil for its suitability as construction material.	Cognitive (Analyzing) L4

CO-PO Mapping:

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

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

Assessments:

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

ISE: Based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ GroupDiscussion/ Internal oral etc. **ESE (OE):** Assessment is based on practical oral examination.	
Course Contents:	
Experiment No. 1: Specific gravity determination **Learning Outcome:** Interpretation of specific gravity value of given soil and using it for classification of soil.	**04 Hrs.**
Experiment No. 2: Water content determination **Learning Outcome:** Determination of natural moisture content and evaluating status of soil.	**04 Hrs.**
Experiment No. 3: Grain size analysis **Learning Outcome:** Determination of gradation of soil and its classification	**04 Hrs.**
Experiment No. 4: Consistency Limits of soil **Learning Outcome:** Values of consistency limits help to comment on field behaviour of soil and its classification.	**02 Hrs.**
Experiment No. 5: Field density determination. **Learning Outcome:** Field density values help to estimate soil performance and strength.	**04 Hrs.**
Experiment No. 6: Standard proctor compaction test. **Learning Outcome:** Important parameters for earth work design and construction are determined for field compaction.	**04 Hrs.**
Experiment No. 7: To Determine Coefficient of Permeability. **Learning Outcome:** To Determine Coefficient of Permeability of The Given Soil Sample by Permeability Test.	**04 Hrs.**
Experiment No. 7: To Determine shear strength of soil. **Learning Outcome:** To Determine shear strength of soil	**04 Hrs.**

Textbooks

1. Text book of soil mechanics in theory and practice‖ by Dr. Alam Singh (Asian PublishingHouse, Bombay)
2. Soil mechanics and Foundation engineering‖ by V.N.S.Murthy.(U.B.S. Publishers anddistributors, Delhi
3. Soil mechanics and Foundation engineering‖ by B. S. Punmia. (A Saurabh and Company P.Ltd., Madras)

Reference Books

1. Geotechnical Engineering‖ by P. Purushottam Raj. (Tata Mcgraw Hill Company Ltd. NewDelhi)
2. Soil mechanics‖ by Terzaghi and Peak. (John Willey and Sons, New- York)
3. Soil Testing by T.W. Lambe. (Willey Eastern Ltd., New Delhi)
4. Geotechnical Engineering by Venkatramiah

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Programming Laboratory **Course No.:** UCEPC0633	**L**	**T**	**P**	**Credits**
	-	-	2	1

Course Pre-Requisite:

Students shall have the knowledge of:

- Introduction to Programming

Course Description:

This course introduces programming and the Python language. Students are introduced to core programming concepts like data structures, conditionals, loops, variables, and functions. This course includes an overview of the various tools available for writing and running Python and gets students coding quickly.

Course Learning Objectives:

- Understand and apply core programming concepts like data structures, conditionals, loops, variables, and functions
- Design and write fully functional Python programs using commonly used data structures, custom functions, and reading and writing to files.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Taxonomy Descriptor**
CO1	To List different programming concepts in python used for problem solving.	Cognitive (Understanding) L2
CO2	Develop an efficient solution to problems by selecting proper looping and repletion structure.	Cognitive (Applying) L3

CO-PO Mapping:

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

COs	**PSO1**	**PSO2**
CO1	1	-
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: Introduction to Python Programming and configuration of Python Development Environment	**04 Hrs.**
Experiment No. 2: Experiment to demonstrate the use of variables and Input Output operations	**02 Hrs.**
Experiment No. 3: Experiment to demonstrate conditional structures.	**02 Hrs.**
Experiment No. 4: Experiment to demonstrate use of repetition structures in python	**04 Hrs.**
Experiment No. 5: Experiment using functions and function calls and use of build in functions	**04 Hrs.**

Experiment No. 6: Experiment based on List and Tuples and operations on them	**02 Hrs.**
Experiment No. 7: Use of String and operations on Strings	**02 Hrs.**
Experiment No. 8: Implementation of Exception Handling	**02 Hrs.**
Experiment No. 9: Program on file handling	**02 Hrs.**
Experiment No. 10: Introduction to Object Oriented Programming in Python	**02 Hrs.**
Experiment No. 11: Built in Modules and implementation of user defined modules.	**02 Hrs.**
Experiment No. 12: Introduction to GUI based programming	**02 Hrs.**

Textbooks

1. Al Sweigart, "Automate the Boring Stuff with Python", William Pollock, 2015, ISBN: 978-1593275990.

Reference Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.
2. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176.
5. ReemaThareja, "Python Programming using problem solving approach", Oxford University press, 2017. ISBN-13: 978-0199480173
6. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1 st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Design and Drawing of Environmental Systems Laboratory **Course Code:** UCEIL0671	**L**	**T**	**P**	**Credit**
	-	-	2	1

Course Pre-Requisite:
Students shall have the knowledge of:
Engineering Drawing
Water Supply Engineering
Basics of Wastewater Engineering

Course Description:
This course includes study of water and wastewater treatment flow hydraulics. Also detailed and thorough knowledge of design and the detailed drawing of different water and wastewater treatment units. Also it covers design of storage reservoirs, water distribution network and sewerage systems.

Course Objectives:
Understand water and wastewater treatment facilities and their flow hydraulics
Learn detailed drawing of water and wastewater treatment units, storage reservoirs, distribution and sewerage systems

Course Learning Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	**Make use of** AutoCAD for drawing of treatment units of water and wastewater	Cognitive (Applying) L3
CO2	**Design** and draw treatment units for water and wastewater, service reservoir and sewer appurtenances.	Cognitive (Create) L6

CO-PO Mapping:

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

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

Assessments:

Assessment	**Weightage (Marks)**
ISE	50

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

Course Contents:

Experiment No. 1: Flow sheet of conventional water and wastewater treatment plant **Learning Outcomes:** To draw flow diagram of water and wastewater treatment and understand the function of each treatment unit.	**02 Hrs.**
Experiment No. 2: Design and detailed drawing of Intake well, gravity main, Pump and Rising Main **Learning Outcomes:** To design and draw in detail Intake well, gravity main, Pump and Rising Main	**04 Hrs.**
Experiment No. 3: Design and drawing of Cascade aerator, Parshall Flume and Flash Mixer	**02 Hrs.**

Learning Outcomes: To design and draw Cascade aerator, Parshall Flume and Flash Mixer	
Experiment No. 4: Design and drawing of Clarifier, Clariflocculator **Learning Outcomes:** To design and draw Clarifier, Clariflocculator	**02 Hrs.**
Experiment No. 5: Design and drawing of Rapid Sand Filter, Service Reservoir **Learning Outcomes:** To design and draw Rapid Sand Filter, Service Reservoir	**04 Hrs.**
Experiment No. 6: Design and drawing of Screen chamber and Detritus Pit **Learning Outcomes:** To design and draw Screen Chamber and Detritus Pit	**02 Hrs.**
Experiment No. 7: Design and drawing of Sewer pipe **Learning Outcomes:** To design Sewer pipe and draw the Sewer Profile	**04 Hrs.**
Experiment No. 8: Hydraulic flow diagram of conventional water and wastewater treatment plant using AutoCAD **Learning Outcomes:** To draw hydraulic flow diagram of conventional water and wastewater treatment plant using AutoCAD	**02 Hrs.**
Experiment No. 9: Water treatment units (any two) using AutoCAD **Learning Outcomes:** To draw water treatment units using AutoCAD	**04 Hrs.**

References:

Manual on Water Supply and Treatment (3rd Ed) – Ministry of Urban Development, New Delhi, 1991.
Manual on Sewerage and Sewage Treatment (2nd Ed) – Ministry of Urban Development, New Delhi, 1993.
Manual on Sewerage and Sewage Treatment (Final Draft) – Ministry of Urban Development, New Delhi, 2012

Class: T. Y. B. Tech Civil and Environmental Engineering **Title of the Course:** Co -Curricular Activities-II **Course Code**: UCECC0634	**L**	**T**	**P**	**Credits**
	-	-	2	1

Course Pre-Requisite:

None: This course is open to all second-year engineering students interested in enhancing their personal and professional development through co-curricular activities.

Course Description:

Co-Curricular activities are an integral part of curriculum which provides educational activities to the students and thereby helps in broadening their experiences. Co-Curricular activities can be defined as the activities that enhance and enrich the regular curriculum during the normal college hours. All Co-Curricular activities are organized with specific purposes which may be according to the nature and form of activities. This course introduces students to a variety of co-curricular activities aimed at enhancing their professional and personal development within the field of engineering and technology. Through practical projects, competitions, workshops, and community engagement, students will develop teamwork, leadership, communication, and technical skills are essential for success in their careers.

Course Learning Objectives (CLOs):

- To encourage students to showcase their intellectual and independent thinking skills.
- To imbibe a sense of confidence and managerial capabilities among students.
- To promote the ability to work in a team, organize and analyze available resources.
- To build responsiveness among students about social and cultural responsibilities.

Course Outcomes (COs):

At the end of the course students will be able to:

CO1	Demonstrate the ability to critically analyze information and apply independent judgment in decision-making within the context of the activity.
CO2	Apply principles of management and organizational skills to plan, coordinate, and execute tasks related to the co-curricular activity.
CO3	Collaborate effectively with peers to achieve common goals and objectives within the co-curricular activity.
CO4	Reflect on their roles and responsibilities as members of a diverse community, fostering empathy and inclusivity.

Assessments:

Assessment	**Weightage (Marks)**
ISE	50

ISE: Assessment is based on the student's participation in various Co-Curricular Activities and Guidelines given in "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document.

Course Guidelines:

Students are entitled to gain academic knowledge in this fast-paced environment, but it is also necessary for them to develop their personalities in both internal and external situations.

Co-curricular activities help students grow and develop their personalities. These activities contribute to a student's total personality development.

Not every student is intellectually inclined. Similarly, not all pupils are interested in co-curricular activities. Therefore, there is a need to provide a solid balance of co-curricular and extra-curricular activities in order to achieve the course learning objectives.

It primarily refers to intellectual, physical, emotional, and social growth that can be attained by a careful mix of academic, co-curricular, and extra-curricular activities.

So, keeping the course learning objectives the "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document is proposed.

Student participation is assessed and reflected in the final activity performance report in order to get most students involved in extra-curricular activities (Group A) and co-curricular activities (Group B) as shown in Table 1 in the Policy Document.
All undergraduate students must choose at least ONE activity/event from each group i.e. (Group A and B).
Students shall choose one activity/ event from Group A and One from Group B that take place on- campus or off-campus.
Freedom shall be given to the students to take part in more than one activity under the group.
Students are expected to actively participate in activities, participate in contests, and earn grade points. One student in each group must earn up to 50 grades in one semester so that they can achieve up to 100 grades in one year.
Grades for each semester are awarded based on the points achieved by the student, as shown in Table 2 in the Policy Document.

Course Structure: ***(Refer Rules for Assigning Activity Points: Activity – Event Grade Point Scheme)***

Sr. No.	**Initiatives**	**Criteria, Activities and Assignments**
1	Introduction to Co-Curricular Activities	Orientation, Induction, Course Overview
2	National Initiatives Participation	Participation, Achievement Levels and Assigned Activity Points in NCC, NSS, Unnat Bharat/ Unnat Maharashtra Abhiyan, Ek Bharat Shreshtha Bharat (EBSB)
3	Sports and Games Participation	Participation, Achievement Levels and Assigned Activity Points in Sports and Games
4	Cultural Activities Participation	Participation, Achievement Levels and Assigned Activity Points in Music, Performing Arts, Literary Arts
5	Professional Self Initiatives	Participation, Achievement Levels and Assigned Activity Points in Technical Events/Quiz/Paper Contest/Project Contest / Model Making etc. MOOC/ NPTEL/ SWAYAM/ Coursera etc. Competitions/ Events Conducted by Professional Societies (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.) Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at IITs/ NITs/ Reputed Institutes/ Universities Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at KITCoEK Paper Presentation in National/ International Conference of High Repute Poster Presentation in National/ International Conference of High Repute Paper Publication in National/ International Journal of High Repute Industrial Training/ Internship (at least for 04 Weeks) Participation in Institute Level Student Clubs
6	Entrepreneurship and Innovation	Participation, Achievement Levels and Assigned Activity Points in Prototype Developed and Tested Awards for Products Developed Innovative Technologies Developed and Used by Industries Got Funding from Government/ Industry for Innovative Ideas

		Patent-Filed/ Published/ Approved/ Licensed Social Innovations
7	Leadership & Management of Clubs/ Activities	Participation, Achievement Levels and Assigned Activity Points in Elected Student Representative of Student Council (University Representative, General Secretary, Cultural, Sports, NSS Secretary, Ladies Representative, Academic Toppers, Invitee Members) Office Bearer of Professional Society Chapter (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.) Office Bearer of Institute Level Student Club (Developer Student Club, Gaganvedhi, Walk With World, Team Mavericks, Cultural Club, Aura, Amateur Write Club, Rotaract Club of KIT Sunshine, Women Development and Gender Equality Cell, Shourya, Lead India etc.) Office Bearer of Departmental Student Association Office Bearer of ECell, Digital Content Lab etc. Student Ambassador for Mayura AICTE IDEA Lab/ NIDHI iTBI etc. Editorial Board Member of Annual Magazine Editorial Board Member of E-Newsletter Member of Governance Committee/ Statutory Committee
8	Culminating Event and Reflection	Final Presentations, Course Reflection, Documentation, Assessment and Evaluation

Participation Levels:

Level: I	College Level Events
Level: II	District/ Central/ Zonal Level Events
Level: III	State Level Events
Level: IV	National Level Events
Level: V	International Level Events

Approval Documents:

Certificate
Letter from Authorities
Appreciation recognition letter
Documentary evidence
Legal Proof

Grading Scheme:

Grade Range	Grade	Academic Performance
90-100	O	Outstanding
71 to 90	A+	Excellent
68-71	A	Very Good
65-68	B+	Good
60-65	B	Average
55-60	C	Below Average
50-55	D	Marginal
< 50	F1	Fail due to Poor Performance

Class: T. Y. B. Tech Civil and Environmental Engineering (Multidisciplinary Minor in Data Science (MDM-DS)) **Title of the Course:** Data Analytics (MM-VI) **Course No.:** UCEMM0641	**L**	**T**	**P**	**Credits**
	3	-	-	3

Course Pre-Requisite:

Students shall have knowledge of:

- Basic Knowledge of Python Programming.
- Basic knowledge of Data Science.
- Basic Knowledge of software's related to Civil and Environmental Engineering like GIS, QGIS

Course Description:

This course is intended to understand the basic concepts related to Data Analytics by data Processing, Tools in Data Analytics, Decision Making, and Case Studies.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Understand fundamental concepts of data analytics and its applications in Civil and Environmental Engineering include data processing techniques, data cleaning methods, and exploratory data analysis (EDA).	Cognitive (Understanding) L2
CO2	Demonstrate knowledge of various data analytics tools such as Excel, SQL, Tableau, Power BI, and GIS-based software.	Cognitive (Understanding) L2
CO3	Analyze time-series and geospatial data for engineering applications such as hydrology, traffic flow and environmental monitoring for decision-making techniques in real-world Civil and Environmental Engineering case studies.	Cognitive (Analyzing) L4
CO4	Discuss ethical considerations, challenges, and future trends in data analytics for sustainable development.	Cognitive (Create) L6

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	0	1	0	1	3	0	0	0	1	0	1
CO2	0	1	0	1	3	0	0	0	1	0	1
CO3	0	1	0	1	3	0	0	0	1	0	1
CO4	0	1	1	1	3	0	0	0	1	0	1

COs	**PSO1**	**PSO2**
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-

Assessments:

Assessment	**Weightage (Marks)**
ESE	100

ESE: Assessment is based on 100% course content.

Course Contents:

Unit 1: **Introduction to Data Analytics**: Definition, importance, and applications in Civil & Environmental Engineering. Difference between Data Science, Data Analytics, and Business Intelligence. Types of data: structured, unstructured, time-series, geospatial. Data collection methods: IoT, sensors, surveys, GIS.	**08 Hrs.**
Unit 2: Data Processing and Exploration: Data preprocessing steps: cleaning, transformation, handling missing values. Exploratory Data	**08 Hrs.**

Analysis (EDA) concepts. Descriptive statistics: mean, median, mode, standard deviation. Introduction to correlation and regression analysis. Tools: Microsoft Excel, SQL, Python (Pandas, NumPy)	
Unit 3: Tools and Technologies in Data Analytics: Overview of data analytics tools used in Civil & Environmental Engineering. Introduction to spreadsheet-based analytics (Microsoft Excel, Google Sheets).SQL for data storage, retrieval, and querying. Business Intelligence (BI) tools: Tableau, Power BI.GIS-based tools for spatial data analysis: QGIS, ArcGIS.Cloud platforms for data analytics: Google Cloud, AWS	**08 Hrs.**
Unit 4: Time Series and Spatial Data Analysis: Basics of time series analysis: trend, seasonality, forecasting. Applications: rainfall prediction, traffic flow analysis, environmental monitoring. Introduction to geospatial analytics and GIS-based data processing. Tools: QGIS, ArcGIS, Python (Geo Pandas, Folium)	**08 Hrs.**
Unit 5: Data-Driven Decision Making: Trees and clustering (K-Means, hierarchical clustering). Risk assessment and uncertainty analysis. Applications in construction management, disaster prediction, water resource management. Tools: Microsoft Excel, Power BI, Tableau.	**06 Hrs.**
Unit 6: Applications and Case Studies: Real-world applications in Civil and Environmental Engineering. Data-driven urban planning and infrastructure maintenance. Smart cities, sustainable development, and climate change analytics. Ethical considerations and challenges in data analytics Tools: Various tools based on case study requirements.	**07 Hrs.**

REFERENCE BOOKS:

1. Foster Provost, Tom Fawcett, “Data Analytics Fundamentals: O’Reilly Media ,2013.
2. Anil Maheshwari, “Data Analytics Made Accessible”, Amazon Kindle Direct Publishing 2017.
3. James B. Pick “GIS and Spatial Data Analysis: Methods and Applications” CRC Press 202.
4. Robert H. Shumway, David S. Stoffer “Time Series Analysis and Its Applications: With R Examples” Springer 2017.

Class: T.Y. B. Tech Civil and Environmental Engineering (Multidisciplinary Minor in Leadership and Management (MDM-HRD)) **Title of the Course:** HR practices in the Organization **Course Code:** UCEMM0642	**L**	**T**	**P**	**Credits**
	3	-	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Engineering Management
- Basics of Human Resource Management

Course Description:

This course provides a comprehensive overview of modern Human Resource (HR) practices, emphasizing their strategic role in business success. Students will explore key HR functions, including talent acquisition, workforce planning, performance management, compensation strategies, learning and development, and employee relations. The course highlights the use of data-driven decision-making, HR technology, and ethical considerations in HR practices. Emerging trends such as AI-driven hiring, remote work models, and HR's role in organizational change are also covered. Through case studies and practical applications, students will gain the skills necessary to implement effective HR strategies in dynamic business environments.

Course Learning Objectives:

- Analyze and apply modern HR practices by evaluating the strategic role of HR in business, ethical considerations, and data-driven decision-making to enhance organizational effectiveness.
- Design effective talent acquisition and workforce planning strategies by implementing job analysis techniques, recruitment methods, AI-driven selection processes, and employer branding to attract and retain top talent.
- Develop and implement performance management and compensation frameworks by utilizing key appraisal methods, performance metrics (KPIs, OKRs), and reward strategies to drive employee engagement and organizational growth.
- Evaluate emerging trends in HR practices by assessing the impact of HR technology, AI automation, and remote work models on the future of workforce management and organizational success.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO1	Understand HR practices and the strategic role of HR in decision making process.	Cognitive (Understanding) L2
CO2	Interpret job analysis techniques, modern recruitment methods, AI-driven selection processes, and performance appraisal frameworks for an organization	Cognitive (Understanding) L2
CO3	Develop effective learning, career development, and employee engagement strategies	Cognitive (Applying) L3
CO4	Analyze emerging HR technologies and trends	Cognitive (Analyzing) L4

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	0	0	0	0	0	0	0	0	0	2	1
CO2	0	0	0	0	0	0	0	0	0	2	1
CO3	0	0	0	0	0	0	0	0	0	3	1
CO4	0	0	0	0	0	0	0	0	0	2	1

COs	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
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: Introduction to HR Practices: Traditional vs. Modern HR Practices, Role of HR in Business Strategy, Importance and Development, Role of Data in HR Decision-Making, Ethical and Legal Considerations in HR Practices.	**04 Hrs.**
Unit 2: Talent Acquisition and Workforce Planning: Job Analysis and Job Design: Techniques and Importance, Recruitment Strategies: Internal vs. External, Digital Hiring, Selection Process: Psychometric Testing, AI in Selection, Employer Branding & Employee Value Proposition (EVP), Onboarding and Induction Best Practices	**08 Hrs.**
Unit 3: Performance Management and Compensation: Performance Appraisal Methods: 360-Degree Feedback, MBO (Management by Objectives), Key Performance Indicators (KPIs) and Key Performance Indicators (KPIs), Objectives & Key Results (OKRs), Reward and Recognition Programs, Compensation Strategies: Pay-for-Performance, Equity Plans, Employee Motivation and Engagement Models	**08 Hrs.**
Unit 4: Learning & Development (L&D) and Career Growth: Training Need Analysis (TNA) and Methods of Training, E-learning and Digital Learning Platforms, Leadership Development Programs, Succession Planning and Career Pathing, Competency Mapping and Skill Gap Analysis	**06 Hrs.**
Unit 5: Employee Relations and Workplace Culture: Workplace Diversity and Inclusion, Conflict Resolution and Grievance Handling, Employee Engagement Initiatives, HR Policies for Work-Life Balance and Well-Being, Ethics in HR and Corporate Social Responsibility (CSR)	**07 Hrs.**
Unit 6: Emerging Trends in HR Practices: HR Technology and HRIS (Human Resource Information System), Use of AI and Automation in HR, HR in Mergers and Acquisitions (M&A), Future of Work: Remote Work and Hybrid Models	**07 Hrs.**

Recommended Books:

1. **K. Aswathappa** – Human Resource Management
2. **Gary Dessler** – Human Resource Management
3. **V.S.P. Rao** – Human Resource Management
4. **Subba Rao P.** – Essentials of Human Resource Management.

References:

1. **Michael Armstrong** – A Handbook of Human Resource Management Practice

Title of the Course:	**DIGITAL TWIN AND ASSET MANAGEMENT**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVMM0641**	**3**	**-**	**-**	**3**

Course Pre-Requisite:

Basics of Projects and Automation, Instrumentation and Data Analytics, AI Applications

Course Description:

This course is designed to develop understanding about use of digital twin concept for management of various project asset in various phases of projects

Course Learning Objectives:

The objective of learning this course is to apply digital twin interventions in construction projects in its life cycle stages

Course Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Recognize the significance of Digital Twins for its use in asset management	01	Knowledge
CO2	Apply Engineering skills to use digital twin platform as a decision-making tool	03	Apply

CO-PO Mapping:

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

CO	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	1	0	2

Assessments:

Teacher Assessment:

- ESE: End Semester Examination is based on 100% course content It may include Multi choice questions

Assessment	Marks
ISE	25

Course Contents:

Unit: 1	**CO: 1**	
Definition, concepts, and evolution of Digital Twin, Difference between Digital Model, Digital Shadow, and Digital Twin., Levels of Digital Twin Maturity., Role of Digital Twin in Civil Engineering and Project Automation., Key components: Data, Simulation, Connectivity, and AI., Case studies in the construction and infrastructure sector.		**06 Hrs.**

Unit: 2	**CO: 1**	
Definition and importance of asset management., Lifecycle of civil engineering assets., Traditional vs. digital asset management., Asset Information Management (AIM) frameworks., Standards and guidelines: ISO 55000 series for asset management., Challenges in civil asset management.		**06 Hrs.**
Unit: 3	**CO: 2**	
Sensors, IoT, and data acquisition for asset monitoring, real-time data processing and cloud computing., Digital Twin-enabled condition monitoring of structures. AI, Machine Learning, and Predictive Analytics in Asset Management, Role of Big Data and Data Lakes in Digital Twins., Software platforms and tools (e.g., Autodesk Tandem, Siemens Mind Sphere, Bentley iTwin).		**10 Hrs.**
Unit: 4	**CO: 2**	
Integration of Digital Twin with BIM and GIS., BIM for asset lifecycle management., GIS for geospatial asset monitoring and management., Common Data Environments (CDE) and data interoperability., BIM-GIS-Digital Twin fusion for smart infrastructure., Case studies: BIM and GIS-enabled asset management.		**10 Hrs.**
Unit: 5	**CO: 2**	
Concept of predictive maintenance in civil structures., Digital Twin-driven Structural Health Monitoring (SHM)., Condition-based monitoring (CBM) using IoT sensors. Performance assessment and anomaly detection techniques. AI-powered maintenance planning and optimization. Case studies on predictive maintenance in bridges, roads, and buildings		**07 Hrs.**
Unit: 6	**CO: 2**	
Digital Twin applications in highways, railways, airports, and water management. Cyber-physical systems and their role in Digital Twin. Challenges in implementation: Data security, interoperability, and cost. Future trends		**06 Hrs.**

References Books:

1. Digital Twin and Smart Infrastructure, Author: Raj M. and M. Usman, Publisher: CRC Press
2. Digital Twin Technologies and Smart Cities, Author: F. J. G. Silva, L. G. Ferreira, and M. C. Azevedo, Publisher: Springer
3. Asset Management for Infrastructure Systems: Energy and Water, Author: Gerd Balzer, Publisher: Springer
4. Internet of Things and Digital Twin Technologies for Smart Cities, Author: Emmanuel Udoh, Publisher: IGI Global

Program: B. Tech (Hons.) in Civil and Environmental Engineering with Specialization in Green Technology and Sustainability Engineering **Class:** T. Y. B. Tech **Title of the Course:** Environmental Economics **Course No.:** UCEHN0651	**L**	**T**	**P**	**Credit**
	03 hours per week	01 hour per week	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Subject "Environmentally sustainable materials"
- Engineering Management
- Engineering Mathamatics

Course Description:

This course aims to provide a comprehensive introduction to the economic analysis of issues arising from interactions between the natural environment and the human economy. It focuses on ecosystem services and discusses the challenges arising due to externalities, public good character, and non-tradability of such services. It focuses on the nature of market failure along with issues for social welfare.

Course Learning Objectives:

1. To understand the basic principles of environmental hydraulics for the analysis and design of water and sewerage systems.
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 the 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 environmental issues in relation to the theory of public goods and welfare	Cognitive (Understanding) L2
CO.2	Identify the true value of environmental goods and services and growth-related issues	Cognitive (Applying) L3
CO.3	Examine the cost-benefit analysis and risk associated with environmental degradation	Cognitive (Analysing) L4
CO.4	Determine the lifecycle analysis of goods and services.	Cognitive (Evaluating) L5

CO-PO Mapping:

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

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

Assessments:

Assessment	**Weightage (Marks)**
ESE	100

- **ESE:** Assessment is based on end semester examination with 100% course content.

Course Contents:	
Unit 1: Overview of Environmental Economics Introduction, Nature-environment interaction, Material balance approach, Economic perspective of the environment.	**06 Hrs.**
Unit 2: Environmental Valuation Practical valuation techniques, Valuation of environmental goods and services, analytical approaches for pollution control policies.	**07 Hrs.**
Unit 3: Methods of Valuation Hedonic estimation technique, travel cost method, contingent valuation, total valuation (use-value and non-use-value).	**08 Hrs.**
Unit 4: Growth and General Economic Aspects of Growth Exponential growth, Meadow's study on limitation of growth, limits on growth, population growth (regional world model).	**07 Hrs.**
Unit 5: Cost-Benefit Analysis Introduction, cost of environmental burdens, stress on the environment, risk assessment, goals and objectives of risk assessment, and risk management.	**06 Hrs.**
Unit 6: Life Cycle Analysis Introduction, general aspects of life cycle analysis, methods of life cycle analysis,	**06 Hrs.**
Textbooks: 1. "Environmental Economics" by Madhu Raj , Ivy publication house, Delhi	
Reference Book: 2. "Handbook Of Environmental Economics", by KARL-GÖRAN MÄLER and JEFFREY R. VINCENT, (2003), Elsevier publication.	

Class: T. Y. B. Tech (Emerging Minor) In Civil and Environmental Engineering with Specialization in Sustainability Engineering **Title of the Course:** Sustainable Infrastructure **Course No.:** UCEMNC0661	**L**	**T**	**P**	**Credit**
	03 hours per week	01 hour per week	-	4

Course Pre-Requisite:

- Basics of Civil and Environmental Engineering
- Fundamentals of Sustainability and Green Technologies
- Principles of Infrastructure Planning

Course Description:

This course provides an in-depth understanding of sustainable infrastructure design, development, and management. It focuses on integrating environmental, social, and economic sustainability principles in urban and rural infrastructure projects. The course covers green building technologies, sustainable transportation, water and energy-efficient systems, and resilient infrastructure planning.

Course Learning Objectives:

6. To introduce the concept of sustainable infrastructure and its significance.
7. To study various sustainability approaches in infrastructure development.
8. To analyze the environmental and social impacts of infrastructure projects.
9. To explore innovative solutions for resource-efficient and climate-resilient infrastructure.
10. To evaluate policies and standards for sustainable infrastructure development.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Explain the principles of sustainable infrastructure and its key components.	Cognitive (Understanding) L2
CO.2	Evaluate sustainable building materials, technologies, and practices.	Cognitive (Evaluating) L5
CO.3	Apply sustainability principles in transportation, water, and energy infrastructure.	Cognitive (Applying) L3
CO.4	Assess policies, frameworks, and global initiatives for sustainable infrastructure.	Cognitive (Evaluating) L5

CO-PO Mapping:

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

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

Assessments:

Assessment	**Weightage (Marks)**
ESE	100

- **ESE:** Assessment is based on 100% course content.

Course Contents:

Unit 1: Introduction to Sustainable Infrastructure Definition, need, and significance of sustainable infrastructure, Principles of sustainability in infrastructure planning and design, Environmental, economic, and social dimensions of sustainability, Life cycle assessment of infrastructure projects.	**08 hours**
Unit 2: Sustainable Building and Construction Green building concepts and certification systems (LEED, GRIHA, BREEAM), Energy-efficient building materials and construction techniques, Smart buildings and net-zero energy buildings, Role of automation and IoT in sustainable buildings.	**07 hours**
Unit 3: Sustainable Transportation Systems Concepts of green and smart transportation, public transport planning and non-motorized transport systems, Electric vehicles and alternative fuels, Sustainable urban mobility planning.	**08 hours**
Unit 4: Water and Waste Management in Infrastructure Water-sensitive urban design and integrated water resource management, Sustainable stormwater management (rainwater harvesting, permeable pavements), Waste reduction strategies in infrastructure development, Circular economy in construction and demolition waste management	**07 hours**
Unit 5: Energy and Climate-Resilient Infrastructure Renewable energy integration in infrastructure projects, Decentralized energy systems and microgrids, Climate adaptation strategies for infrastructure resilience, Disaster-resistant infrastructure design.	**08 hours**
Unit 6: Policies and Global Practices in Sustainable Infrastructure International frameworks: UN-Habitat, SDGs, and climate agreements, National policies and strategies for sustainable infrastructure development, Role of government, private sector, and civil society in sustainable infrastructure, Case studies of successful sustainable infrastructure projects.	**07 hours**

Textbooks:

4. Sustainable Infrastructure: Principles into Practice – Richard Rogers
5. Infrastructure Sustainability and Design – Spiro Pollalis

References:

1. Green Infrastructure: Principles and Practices – Mark Benedict, Edward McMahon
2. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia – Anthony Townsend
3. Infrastructure Resilience and Environmental Sustainability – Annaka Peirce

Class: T.Y.B. Tech. Civil and Environmental Engineering	**L**	**T**	**P**	**Credits**
Title of the Course: Estimation & Costing **(EXIT COURSE)** **Course Code:** UCEEX0691	3	---	---	03

Course Pre-Requisite:

Students shall have the knowledge of

- Basic Civil Engineering
- Construction Technology
- Building Planning and Drawing

Course Description:

This course is designed for B. Tech Civil and Environmental Engineering students who have completed their third year and are considering exiting the program. It provides students with fundamental concepts and methodologies related to estimation, costing, and valuation in civil and environmental engineering projects. It focuses on the preparation of quantity estimates, cost analysis, rate analysis, and valuation techniques necessary for project planning and execution. The course also introduces students to modern software tools used for estimation and budgeting.

Course Learning Objectives:

1. To equip students with the knowledge and skills required for preparing cost estimates, quantity surveying, and rate analysis for civil engineering projects.
2. To develop student's ability to apply cost estimation principles, valuation techniques, and budgeting strategies in project planning and management.

Assessments:

Assessment	**Weightage (Marks)**
ISE	50

ISE: ISE is based on four different tools like assignment/declared test/quiz/seminar/Group Discussions etc.

Course Contents:	
Introduction to Estimation and Costing - Importance of estimation and costing in construction projects - Types of estimates - Units of measurement and standard specifications **Quantity Estimation of Civil Works** - Methods of taking out quantities (centre line method, long & short wall method) - Estimation of buildings, roads, and other infrastructure - Bar bending schedule **Rate Analysis and Costing** - Purpose and importance of rate analysis - Factors affecting cost of materials, labour, and machinery **Contracts and Tendering** - Types of contracts and their suitability - Contract documents and legal aspects - Tendering procedures and bid evaluation **Valuation and Depreciation** - Purpose of valuation and valuation methods - Factors affecting valuation of buildings and land - Depreciation and its types	**45 Hours**

Textbooks and References:

1. B.N. Dutta, *Estimating and Costing in Civil Engineering*, UBS Publishers.
2. M. Chakraborti, *Estimating, Costing, Specification & Valuation in Civil Engineering*, Laxmi Publications.
3. D. Datta, *Valuation of Real Properties*, Eastern Law House.
4. IS 1200 – *Methods of Measurement of Building and Civil Engineering Works*, Bureau of Indian Standards.
5. PWD and CPWD Schedule of Rates and Analysis of Rates.

Class: T.Y. B. Tech. Civil and Environmental Engineering	**L**	**T**	**P**	**Credits**
Title of the Course: Occupational Health & Safety **(EXIT COURSE)** **Course No.:** UCEEX0692	3	-	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Engineering Science
- Construction Technology & Management
- Engineering Management

Course Description:

This course is designed for B. Tech Civil and Environmental Engineering students who have completed their third year and are considering exiting the program. This course provides students with fundamental knowledge of occupational health and safety (OHS) principles, regulations, and best practices in the civil and environmental engineering sectors. It will equip students with skills to identify workplace hazards, assess risks, and implement safety measures to ensure a secure working environment.

Course Learning Objectives:

1. To provide students with a comprehensive understanding of occupational health and safety principles, enabling them to identify workplace hazards, assess risks, and ensure compliance with safety regulations in civil and environmental engineering sectors.
2. To develop student's skills in implementing safety management systems, conducting audits, and formulating emergency response plans and nurturing safety culture in engineering workplaces.

Assessments:

Assessment	Weightage (Marks)
ISE	50

ISE: ISE is based on four different tools like assignment/declared test/quiz/seminar/Group Discussions etc.

Course Contents: **45 Hrs.**

Introduction to Occupational Health & Safety

Definition and importance, Historical evolution, Roles and responsibilities of stakeholders

Workplace Hazards and Risk Assessment

Types of workplace hazards (physical, chemical, biological, ergonomic, and psychosocial) Hazard identification techniques, Risk assessment methodologies, Control measures (elimination, substitution, engineering controls, administrative controls, PPE)

Safety Regulations and Standards

National OHS laws and regulations (Factories Act, BOCW Act, OSHA, etc.), International standards: ISO 45001, International Labor Organization (ILO) conventions
Compliance and legal responsibilities

Construction Safety & Environmental Health

Safety in excavation, scaffolding, and confined spaces, Handling hazardous materials and waste management, Noise, vibration, and air quality considerations.

Safety Management Systems and Audit

Key components of safety management systems (SMS), Safety training and employee involvement, Accident investigation and reporting, Safety audits and inspections.

Emergency Preparedness and Response

Fire prevention and firefighting measures, First aid and medical emergency response, Disaster preparedness and risk mitigation

Behavioral Safety and Safety Culture Human factors in safety, Safety leadership and motivation	

Textbooks and References:

1. Goetsch, D. L. (2019). Occupational Safety and Health for Technologists, Engineers, and Managers. Pearson.
2. Reese, C. D. (2018). Occupational Health and Safety Management: A Practical Approach. CRC Press.
3. Government of India (Factories Act, BOCW Act, OSHA Guidelines, etc.).
4. ISO 45001:2018 Occupational Health and Safety Management Systems.
5. ILO Guidelines on Occupational Safety and Health Management Systems

Class: T.Y.B. Tech. Civil and Environmental Engineering **Title of the Course:** Vocational Training **(EXIT COURSE)** **Course Code:** UCEEX0693	**L**	**T**	**P**	**Credits**
	-	-	4	2

Course Pre-Requisite:

Students shall have the knowledge of:

- Use of tools and applications in various domains of Civil and Environmental Engineering
- Environmental Protection and Pollution Prevention Measures, Environmental Management

Course Description:

The Internship/Training Lab course is designed for B. Tech Civil and Environmental Engineering students who have completed their third year and are considering exiting the program. This course provides practical, hands-on experience in a professional Civil and environmental engineering setting, allowing students to apply their academic knowledge to real-world projects. Through this internship or training experience, students will gain valuable industry exposure, develop technical and professional skills and enhance their understanding of environmental engineering practices.

Course Learning Objectives:

1. To gain practical experience in the field of Civil and Environmental Engineering.
2. To apply theoretical knowledge to real-world Civil and Environmental Engineering projects.
3. To reflect on personal and professional growth through the internship or training experience.

Assessments:

Assessment	**Weightage (Marks)**
ISE	50

ISE: ISE is based on four different tools like assignment/declared test/quiz/seminar/Group Discussions etc.

Course Contents:	
• Participation in day-to-day operations and projects at the host organization. • Application of Civil and Environmental Engineering principles to practical tasks. • Data collection, analysis and reporting on Civil and Environmental projects. • Development of technical and professional skills through hands-on experience. • Preparation of a comprehensive internship report documenting experiences and learning outcomes.	**60 Hours**