Course Code	18CEO405T	Course Name	WATER POLLUTION AND ITS MANAGEMENT	Course Category	O	Open Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1:	Understand insights to the source and type of water pollution	
CLR-2:	Realise the charecteristics of domestic and industrial water pollution	
CLR-3:	Know resource recovered from the wastewater and the concept of treating polluted water	
CLR-4:	Explore the various methods to control the water pollution and regulatory bodies	
CLR-5:	Comprehend sustainable practices for effective water management.	

Course Outcomes (CO):	At the end of this course, learners will be able to:	Level of Thinking (Bloom)	Program Outcomes (PO)													
			1	2	3	4	5	6	7	8	9	10	11	12		
			Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO -1	PSO -2	PSO - 3
CO-1:	Identify the various sources of water pollution	5	3	-	-	-	-	-	3	-	-	-	-	2	3	-	-
CO-2:	Recognise various charecteristics present in polluted water.	5	3	-	-	-	-	-	3	-	-	-	-	2	3	-	-
CO-3:	Apply the concept of resource recovered from the polluted water and able to understand the treatment of polluted water	5	3	-	-	-	-	-	3	-	-	-	-	2	3	-	-
CO-4:	Intrepret Water Act 1974 and regulatory bodies to control Water Pollution	5	3	-	-	-	-	-	3	-	-	-	-	2	3	-	-
CO-5:	Analyze the environmental impacts of water pollution	5	3	-	-	-	-	-	3	-	-	-	-	2	3	-	-

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Introduction to water pollution.	Charecteristics of water and wastewater.	Mitigation measures for water pollution contamination due to industries.	Water pollution regulations	Sustainable water managment techniques
	SLO-2	Sources and types of water pollution.	Physical characteristics-Colour, odour, turbidity, temperature, specific conductivity	Treatment of industrial wastewater	Administrative regulation under recent legislations in water pollution control.	Rain water harvesting.
S-2	SLO-1	Point source pollution and non point source pollution.	Chemical charactericticts- Organic and inorganic.	Guidelines and protocol for treating industrial wastewater.	Water (prevention & control of pollution) Act 1974.	Classification of rainwater harvesting
	SLO-2	Types of pollutants.	Biological charecteristics and its significance.	Pollution characteristiscs of certain typical industries.	Water (prevention & control of pollution) Rules 1975-water (prevention & control of pollution) Cess Act 1977.	Microlevel harvesting, macrolevel harvesting and other methods
S-3	SLO-1	Adverse effects of pollutnats.	Analysis of water pollution and their testing procedures.	Thermal pollution and its adverse effects.	Role of pollution control board.	Roof top harvesting and their benefits
	SLO-2	Principles of pollution assessment.	Water quality standards-BIS	Role of regulatory bodies in protection of water bodies-Control measures.	Powers given to boards	Role of regulatory bodies
S-4	SLO-1	Terms and definitions in wastewater.	Discharge of effluent and their standards	Discharge standards for rivers and streams	Irrigational approach in waste conservation	Role of local bodies-TWAD board-CMWSSB.
	SLO-2	Transport of pollutants.	Water borne diseases.	Self purification of streams.	Legal action against defualters.	Case studies related to effective water management.
S-5	SLO-1	Causes of water pollution.	Impact of water related issues on animals.	Role of stakeholders.	Managmentstratergy used for water conservation	Water crisis and their effects
	SLO-2	Hydraulic flow of water pollution.	Ground water quality.	Water quality monitoring and its purpose	Industrial approach in water conservation	Problems faced in water crisis
S-6	SLO-1	Sampling procedure.	Impact on effluent in ground water quality.	Monitoring activities and its stratregy	Awarness of domestic usage for conservation of water	Zero water day - awareness
	SLO-2	Methods of sampling and storage	Effects of ground water pollution	Types of monitoring	Groundwater management.	Awarnessprogramme for water management and its sustainable development

S-7	SLO-1	*Effects of water pollution*	*Sampling methods of ground water pollution*	*Steps involved in water quality monitoring*	*Public participation in water managment*	*Importance of world water day and world environment day.*
	SLO-2	*Eutrophication and their process*	*Legal regulatory aspects of ground water contamination*	*Parameters and frequency of monitoring*	*Environmental indicies and its types*	*Vulnerability of improper water management*
S-8	SLO-1	*Public awarness and practices in water pollution.*	*Industrial partcipation with regulatory boards.*	*Graphical reperesentation of water quality*	*Water quality index and its types*	*Case study on adverse effects of watercrisis*
	SLO-2	*Industries and their role in water pollution*	*Water used in different industries*	*Softwares used in water quality modelling.*	*Assesment of water quality index*	*Sustainable development*
S-9	SLO-1	*Tutorials 1: Identify the various source of water pollution*	*Tutorials 3: Analyse the sample of polluted water.*	*Tutorials 5: Mention the various mitigation measures in industries*	*Tutorials 7: Case study on industrial pollution in water bodies*	*Tutorials 9: Compare potential rain water harvesting method*
	SLO-2	*Tutorials 2: NGO participation in creating awarness of water pollution*	*Tutorials 4: Compare the various industrial effluent discharge standards*	*Tutorials 6: Case study of water contamiation and its mitigation*	*Tutorials 8: Identify effective water management technique.*	*Tutorials10: Effective water management practices.*

Learning Resources

1. *Fair.G.M, "Water and Waste water engineering Vol.I& II" .John Wiley and sons, Newyork. 2010.*
2. *Metcalf & Eddy, "Wastewater engineering, Treatment and Reuse", Tata MacGrawhill publications, 2008.*
3. CPHEEO, ""Manual on Sewerage & Sewage Treatment", Ministry of Housing and Urban Affairs,Government of India, New Delhi, 2009.
4. P. K. Goel, Water Pollution: Causes, effects and Control. New Age International, 2006.
5. *NPTEL Course: Water, Society and Sustainability.* -https://onlinecourses-archive.nptel.ac.in/noc18_hs36
6. *NPTEL Course: Wastewater Treatment & Recycling. https://onlinecourses-archive.nptel.ac.in/noc18_ce26*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate	20%	-	20%	-	20%	-	20%	-	20%	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.

Course Designers

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