	National Institute of Technology Meghalaya An Institute of National Importance		CURRICULUM
Programme	**Bachelor of Technology in Civil Engineering**	Year of Regulation	**2019-20**
Department	**Civil Engineering**	Semester	**V**

Course Code	Course Name	Pre requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
CE 311	**Environmental Engineering – II**	**Nil**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives		Course Outcomes		
	I. To analyze the Waste water sources and waste water characteristics and to develop various waste water treatment process.		CO1	Able to gain an experience in the implementation of environmental Engineering on engineering concepts which are applied in field.
	II. To train the students on developing practical, efficient and cost effective solutions on problems and challenges on environmental sciences and engineering.		CO2	Able to get a diverse knowledge of environmental engineering practices applied to real life problems.
	III. To give an experience in the implementation of engineering concepts which are applied in field of waste Water treatment process.		CO3	Able to learn to understand the theoretical and practical aspects of environmental engineering along with the design and management applications.
	IV. To present the foundations of many basic Engineering tools and concepts related Environmental Engineering.		CO4	Able to identify environmental problems and solutions.
			CO5	Able to designing various physico-chemical unit processes and operations to achieve the desired water quality in water and wastewater systems.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0
2	CO2	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0
3	CO3	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0
4	CO4	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0
5	CO5	3	0	1	0	0	0	0	0	0	0	0	0	0	3	0

SYLLABUS

No.	Content	Hours	COs
I	**Sanitary Engineering** Definition of sullage, sewage, sewerage, sewer, refuge, garbage, sewage treatment/Disposal system and waste water management.	**04**	**CO1, CO2, CO3**
II	**Sewage Systems, Collection and Conveyance** Strength of Sewage, Sampling of Sewage to analyze for Physical, Chemical and Biological Parameters; Decomposition of sewage, comparison, Design of Sewer; Domestic and industrial sewage, volume of domestic sewage, variability of flow, limiting velocities-Self cleansing and Maximum velocities of sewer; Types of Sewers.	**06**	**CO3**
III	**Waste Water Flow** Estimation of Dry Weather Flow and Storm Water, Variation of flow, Estimation of design discharge.	**04**	**CO3**
IV	**Waste Water Characteristics** Physical, chemical, and Biological characteristics of sewage and wastewater, effluent standards	**04**	**CO4**
V	**Waste Water Disposal and Treatment** Treatment Methods – Principles; Dilution, self-purification, Flow diagram of conventional sewage treatment plant, Primary treatment – screens, Grit Chambers, detritus tank, skimming tank, Type – III and Type – IV settling, Design of secondary sedimentation tank. Secondary treatment – Trickling fitters, Biological contractor, Activated sludge process, Sequencing Batch Reactor (SBR); Membrane Bioreactor (UASB); Waste Stabilization Ponds; oxidation pond and ditches, aerated lagoon; Tertiary Treatment of Sewage; Decentralised Sewage Treatment & Reuse.	**10**	**CO5**
VI	**Treatment and Disposal of Sludge** Sludge characterization; Thickening; Design of gravity thickener; Aerobic and anaerobic digestion; Standard rate and High rate digester design; Biogas recovery; Sludge Conditioning and Dewatering; Sludge drying beds; Standards for Disposal Methods; dilution; Mass balance principle; Self purification of river; Oxygen sag curve.	**08**	**CO5**
	Total Hours	**36**	

Essential Readings

1. Environmental Engineering, Peavy H. S., Rowe D. R. and George Tchobanoglous, McGraw-Hill International.
2. Water Supply and Sewerage, McGhee T. J ., McGraw-Hill Inc.,
3. Garg, S.K., "Environmental Engineering", Vol. 1 & II Khanna Publishers, New Delhi, 2005.

Supplementary Readings

1. Introduction to Environmental Engineering, Davis M. L and Cornwell D. A McGraw-Hill, Inc.
2. Wastewater Engineering- Treatment and Reuse, Metcalf & Eddy (Revised by G. Tchobanoglous, F. L. Burton and H. D. Stensel), Tata McGraw Hill.
3. Chemistry for Environmental Engineers, Sawyer C. N., McCarty P. L and Parkin G. F., McGraw- Hill.
4. APHA, Standard Methods Examination of Water and Wastewater, American Public Health Association, Washington DC, 1995.
5. Manual for water supply and treatment, Central Public Health & Environmental Engineering Organization, Ministry of Housing and Urban Development, Govt. of India, 1999.