CLXXX: SMART WATER MANGEMENT SYSTEM

B. TECH 7th SEMESTER (CIVIL ENGINEERING)

SMART CITIES SPECIALIZATION COURSE

Credits and Hours:

Teaching Scheme	Theory	Tutorial	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Smart Water Management System	06
2	Environmental & Asset Monitoring: Leak Detection, Water Quality Monitoring, Flood Monitoring, Asset Monitoring	14
3	Smart Applications in the Water Sector	10
4	Water Sensitive Urban Design and Planning (WSUDP)	10
5	Smart Rainwater Management	14
6	Smart Water Management using IoT	06

Total Hours (Theory): 60
Total Hours (Lab): 30
Total Hours: 90

B. Detailed Syllabus:

1	**Introduction to Smart Water Management System**	**06 Hours**	**10%**
1.1	Current State of the Water Industry Across the Globe		
1.2	Need of smart technology in water management system, ,		
1.3	Introduction to smart water management system		
1.4	Components of smart water management: Water distribution management, Strom Water Management		
2	**Environmental & Asset Monitoring**	**14 Hours**	**23%**
2.1	Leak Detection: Leak detection and location methods, Basic mechanisms of bursts and leakage, Laying leak-free new		

	networks, Water accounting and quantification, Leakage innovation heat mapping		
2.2	Water Quality Monitoring: Water quality systems – drinking water, Water quality sensors, Water quality and distribution system optimization, Using turbidity to control PRV's		
2.3	Flood Monitoring: Flood measurements, Fleet monitoring, Manhole covers		
2.4	Asset Monitoring: Smart Water Metering, Tool and Techniques		
3	**Smart Applications in the Water Sector**	**10 Hours**	**17%**
3.1	Technology for Smart Water Management		
3.2	Digital output instruments (meters and sensors)		
3.3	Supervisory control and data acquisition (SCADA) systems		
3.4	Geographic information system (GIS)		
4	**Water Sensitive Urban Design and Planning (WSUDP)**	**10 Hours**	**17%**
4.1	Concept of Water Sensitive Urban Design and Planning, essential elements of WSUDP, essential elements of WSUDP		
4.2	SUDS, RWH(Rain water Harvesting) and local reuse of treated wastewater		
4.3	planning and designing of water sensitive structures, their techno-economic feasibility, operation and maintenance measures etc.		
4.4	Case study: Managing the water distribution network with a Smart Water Grid in Singapore		
5	**Smart Rainwater Management**	**14 Hours**	**23%**
5.1	Introduction, Rainwater harvesting, History		
5.2	Methods of rainwater harvesting		
5.3	Traditional methods of rainwater harvesting in India		
5.4	Rain centre Advantages, Disadvantages		
6	**Smart Water Management using IoT**	**06 Hours**	**10%**
6.1	Introduction to IOT and Terminologies		
6.2	LPWAN Technologies for Industrial IOT, Advantages and limitations of different technologies		
6.3	Different Applications / Case Studies of IOT for water applications in Singapore		

C. Course Outcomes (COs):

On the successful completion of this course, the students will be able to:

CO1 Have in-depth understanding of the state of art, challenges and opportunities of smart water systems

CO2 Use data driven approaches and probabilistic optimization tools to solve relevant problems in water management in the context of smart water systems

CO3 develop a systems viewpoint to smart water and its link to emerging AI technologies and enhance their ability to critically evaluate problems and solutions in the context of smart water systems

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	-	-	2	1	-	-	-	-	1	1	1	1
CO2	2	2	2	2	2	3	3	1	2	-	-	1	2	2	2
CO3	-	-	-	-	3	3	2	1	2	-	-	1	1	1	1

D. Recommended Study Material:

References:

- Harrison, Roy M., Sustainable Water. United Kingdom: Royal Society of Chemistry, 2011.
- Lloyd Owen, David A., Smart Water Technologies and Techniques: Data Capture and Analysis for Sustainable Water Management. Germany: Wiley, 2018.
- Panagiotis Tsakalides, Athanasia Panousopoulou, Grigorios Tsagkatakis., Smart Water Grids, CRC press, Taylor & Francis Group, 2018

Web Materials:

- https://development.asia/explainer/what-smart-water-management
- https://www.waterworld.com/international/wastewater/article/16190746/smart-water-a-key-building-block-of-the-smart-city-of-the-future
- https://www.cseindia.org/training-programme-on-water-sensitive-urban-design-and-planning-at-building-and-neighborhood-scale-9461
- https://www.mdpi.com/2073-4441/12/1/58/htm

- https://www.gsma.com/iot/wp-content/uploads/2016/11/Smart-water-management-guide-digital.pdf
- https://www.cseindia.org/training-programme-on-water-sensitive-urban-design-and-planning-at-building-and-neighborhood-scale-9461
- https://smartwaterjournal.springeropen.com/articles/10.1186/s40713-016-0004-4
- https://theconstructor.org/water-resources/methods-rainwater-harvesting/5420/
- https://www.swa.org.sg/smart-water-management-using-iot-and-ai/