B. Tech. Engineering				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
CE 304: Water Resources Engineering	**L**	**T**	**P**	**NIL**
	3	**0**	**2**	

Course Objective: The course aims to equip students with the knowledge and skills necessary for designing, analysing, and managing water resources efficiently while considering environmental, economic, and sustainability aspects.

S. No	Course Outcomes (CO)
CO1	Assess different methods of irrigation and drainage, and understand the fundamental concepts of river morphology.
CO2	To analyse and design the structures such as notch falls, Sharda falls, and the design of an aqueduct and a siphon aqueduct.
CO3	To analyse and design the Regulation works and Cross-Drainage structures such as dams, spillways, and weirs.
CO4	Understand the fundamentals of hydrology, including precipitation, runoff, and infiltration processes.
CO5	Evaluate groundwater flow, well hydraulics, and aquifer characteristics for sustainable water extraction.

S. No	Contents	Contact Hours
UNIT 1	**Irrigation and Drainage works:** Necessity and types of irrigation, soil moisture and crop water relations, consumptive use of water, water logging, design concepts of surface and sub-surface drainage system. **Rivers and River training works:** Rivers of different types, river behaviour, meanders, cut offs, river training works and their design. **Canal irrigation:** Types of reservoirs, reservoir yield, reservoirs losses, multi-purpose river valley projects. **T**ypes of canal, parts of canal irrigation system, assessment of water requirements, estimation of channel losses, design of lined and unlined channels, regime and semi-theoretical approaches (Kennedy's theory and Lacey's theory). Modular and non-modular outlets.	12
UNIT 2	**Regulation works and Cross-Drainage structures:** Classification of falls and their suitability, design of notch falls, Sharda falls and Montague falls, distributary head regulators and escapes. Necessity of cross-drainage structures, their types and selection, comparative merits and demerits, design of aqueduct and siphon aqueduct.	7

UNIT 3	**Diversion Head works:** Selection of site and layout, different parts of diversion head works, types of weirs and barrages, design of weirs on permeable foundation barrage by Bligh's and Khosla's methods. Silt excluders and silt ejectors. **Dams and Spillways:** Introduction, suitable sites, types of dams, forces acting on a gravity dam, stability requirements, arch dams, buttress dams, earth and rock-fill dams, design of gravity dams. Introduction, types of spillways, design of spillways, energy dissipation below spillways.	8
UNIT 4	**Hydrology**: Hydrologic cycle, rain gauge, measurement of rainfall, rainfall analysis, infiltration, runoff estimation; Stream flows and their measurement, Stage-discharge curves, Unit & Synthetic hydrographs and their applications, flood hydrograph. Peak flows estimation and flood frequency analysis. Reservoir routing and channel routing.	10
UNIT 5	**Ground water engineering: A**quifers, movement of ground water, steady and unsteady flow towards wells in confined and unconfined aquifers, well losses.	5
	Total	**42**

REFERENCES

S. No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Subramanya, K., "Engineering Hydrology", Tata McGraw-Hill Education Private Limited(ISBN 0-07-75158-4)	2015
2	Patra, K, C, "Hydrology and Water Resources Engineering", Narosa Publishing House(ISBN 0-07-06472-59-8).	2002
3	Viessman Jr., W., and Lewis, G. L. "Introduction to Hydrology", Prentice Hall of India Pvt. Ltd. (ISBN 0-07-478214-1)	2008
4	Garg, S.K, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi. (ISBN 0-07-06487-1)	2014
5	Modi P. N., "Irrigation Water Resources and Water Power Engineering", Standard Book House, Delhi. (ISBN 0-07-078546-7).	1990
6	Asawa, G. L. "Irrigation and Water Resources Engineering", New Age International Publishers. (ISBN 0-07-795568-3)	1993