

SEMESTER 2nd
MINOR COURSE

WMG222N: WATER MANAGEMENT (HYDROLOGY AND WATER QUALITY)
(4+2 CREDITS)

***Paper outcome:** The paper introduces students to the concept of Physicochemical and biological quality of water. The students will also be aware of different water quality standards for application of water in different sectors.*

THEORY (4 CREDITS)

Unit I: Hydrology and hydrological cycle

Concept and scope of hydrology, Hydrological cycle: Evaporation: Process, Factors effecting evaporation, Measurement of evaporation, Transpiration: process, Factors affecting transpiration, Condensation: Process and measurement, Precipitation: Process, Types and forms, Measurement and distribution.

Unit II: Runoff and ground water

Runoff cycle and its components, Factors effecting runoff, Measurement of Runoff, Stream, gauging, Stream hydrology, Hydrograph concept and its applications, Ground water movement (Darcy's Law), Permeability and hydraulic conductivity, Aquifers: Types and geology.

Unit III: Physical water quality parameters

Temperature, Colour, Taste, Odour Turbidity: Total Solids (TS), Total dissolved Solids (TDS), Total Suspended Solids (TSS), Volatile suspended solids (VSS), Volatile Dissolved Solids (VDS), Total VolatFAile Solids (TVS), pH, Conductivity, Concept of water quality index.

Unit IV: Chemical and biological water quality parameters

Major cations (Ca, Mg, Na, K), Major Anions (bicarbonates, sulphates, chlorides), Dissolved Gases in water (DO, CO₂), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), Microbial water quality-coliform bacteria, Indicator organisms.

LABORATORY COURSE (CREDITS-2)

1. Sampling methods (Grab and Composite) for physicochemical analysis of water (lake, river, groundwater, spring)
2. Measurement of precipitation and evaporation
3. Measurement of flow and discharge of stream/spring
4. Determine pH and alkalinity of water sample
5. Determine conductivity of different water samples
6. Determination of TSS and TDS of different water samples
7. Determination of hardness in different water samples
8. Determination of Chloride in water sample

SUGGESTED READINGS:

- Bansil, P.C. 2004. *Water Management in India*. Concept Publishing Company, India.
- Brebbia, C.A. 2013. *Water Resources Management VII*. WIT Press.
- CEA. 2011. *Water Resources and Power Maps of India*. Central Board of Irrigation & Power.
- Grumbine, R.E. and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science* 339: 36-37.
- Loucks, D.P., Stedinger, J.R. & Haith, D. A. 1981. *Water Resource Systems Planning and Analysis*. Englewood Cliffs, NJ, Prentice Hall.
- Mays, L.W. 2006. *Water Resources Sustainability*. The McGraw-Hill Publications.
- Schward and Zhang, 2003. *Fundamentals of Groundwater*. John Willey and Sons.
- Souvorov, A.V. 1999. *Marine Ecologonomics: The Ecology and Economics of Marine Natural Resource Management*. Elsevier Publications.
- Vickers, A. 2001. *Handbook of Water Use and Conservation*. Water Plow Press.
- Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.