

### **Course Objectives**

1. To study the paradigm shift in water management with global and national perspectives of water crisis. It also aims to understand the concepts of 'blue water', 'green water' and 'virtual water' and their roles in water management.
2. To study the sustainable water resources management and to plan and develop framework for future.
3. To study the modern principles of water management and planning.
4. To develop surface and subsurface water systems along with water balance equation.
5. To study the conventional and non-conventional techniques for water security.

### **UNIT I: Paradigm Shift in Water Management**

Global and national perspectives of water crisis, water scarcity, water functions in the life-support systems, water availability and requirements for humans and nature, concepts of 'blue water', 'green water' and 'virtual water' and their roles in water management, human-landscape interventions, and salient water management issues and challenges.-landscape interventions, and salient water management issues and challenges.

### **UNIT II: Sustainable Water Resources Management**

Concept of sustainable development, sustainability principles for water management, goals for guiding sustainable water resource management, important preconditioning in water policy approaches, framework for planning a sustainable water future.

### **UNIT III: Integrated Water Resources Management (IWRM) Approach**

IWRM Principles: Modern principles for water management and planning, definition, components, and critique of IWRM. *IWRM Implementation:* Socio-scientific, economic, political and ecological factors affecting the implementation of IWRM principles Salient examples of river basin management, lessons from best practices in river-basin management.

### **UNIT IV: Surface and Subsurface Water Systems**

Impacts of development activities on the water cycle, precipitation, evapotranspiration, infiltration, runoff, streamflow, erosion and sedimentation, types of aquifer systems and their hydraulic characteristics, environmental impacts on groundwater systems, estimation of groundwater recharge and discharge, assessment of groundwater potential, surface water-groundwater interaction, concept of sustainable groundwater development and management, water balance, balance of water resources and needs, minimum water table and minimum discharges.

## **UNIT V: Conventional and Non-conventional Techniques for Water Security**

Rainwater harvesting, groundwater mining and artificial recharge, conjunctive use of surface water and groundwater resources, long-distance water conveyance and transport, conservation of 'green water', desalination, treatment of poor-quality waters.

### **Course Outcomes:**

After studying this course, students will be able to:

1. Assess the potential of groundwater and surface water resources.
2. Address the issues related to planning and management of water resources.
3. Know how to implement IWRM in different regions.
4. Understand the legal issues of water policy.
5. Select the method for water harvesting based on the area.

### **Text Books:**

2. K. Subramanya, Engineering Hydrology, Tata McGraw Hill Publishers, New Delhi.
3. H.M. Raghunath, Ground Water, Wiley Eastern Publication, New Delhi.
4. Daniel P. Loucks and Eelco van Beek, Water Resources Systems. Planning and Management, UNESCO Publication.
5. Mollinga, P. et al, Integrated Water Resources Management, Water in South Asia Volume I, Sage Publications, 2006.
6. Singh, Chhatrapati Water Rights in India, Ed: Chhatrapati Singh. Water Law in India: The Indian Law Institute, New Delhi, 1992.
7. Dhruva Narayana, G. Sastry, V. S. Patnaik, Watershed Management, CSWCTRI, Dehradun, ICAR Publications, 1997.

### **Reference Books:**

1. Lal, Ruttan. Integrated Watershed Management in the Global Ecosystem. CRC Press, New York.
2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. 1988. John Wiley and Sons, Inc., New York.