WATER RESOURCES ENGINEERING – I

Lectures / Tutorials   : 4 / 1 Periods/Week

Semester End Exam. : 3 Hours

Sessional marks: 40

Semester End Exam. marks: 60

Credits : 4

Course Objectives:

- To study hydrologic cycle, measure precipitation and compute average rainfall over a basin
- To study evaporation and infiltration and to determine infiltration indices and to compute runoff from a basin.
- To introduce concept of Unit Hydrograph and to construct Unit Hydrograph and S-curve and to discuss their applications.
- To study well hydraulics and to discuss Dupit's theory for steady radial flow into a well and to determine yield from open well by constant pumping and recuperation tests.
- To introduce scope, benefits and ill-effects of irrigation and to study various types and methods of irrigation.
- To discuss duty, delta and their relation, consumptive use and frequency and depth of application of irrigation water.
- To discuss Kennedy's silt theory and Lacey's regime theory and the comparison of the two theories and to discuss the design aspects of channels based on these two theories.
- To discuss the causes and remedial measures of water logging and to design lined canals.
- To study component parts of diversion head works and their functions and to discuss Bligh's creep theory and Khosla's theory and their applications in the design of weirs on permeable foundations.

Course Outcomes:

- At the end of the course the student will be able to:
- compute average rainfall over a basin and to distinguish between recording and non-recording rain gauges.
- determine the infiltration indices and run off from a basin.
- construct unit hydrograph and S-curves and determine the peak flood discharge.
- determine the discharge from tube wells and open wells.
- estimate consumptive use and determine the depth and frequency of irrigation water required for the given crop.
- ascertain the discharge required in the irrigation canal.
- design unlined canals by using Kennedy's and Lacey's theories and able to distinguish between these two theories.
- use Garrot's diagrams and Lacey's diagrams for design of unlined canals.
- suggest suitable methods to control water logging of irrigation lands.
- design lined irrigation canals for varying discharges.
- design weirs on permeable foundations based on Bligh's creep and Khosla's theory

UNIT – I

Hydrology

Hydrologic cycle; Precipitation types; Rain gauges; Computation of average rain fall over a basin; Abstraction from rainfall; evaporation, factors affecting evaporation, measurement of evaporation;

Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices; Run off; Factors affecting run off; Computation of run-off; Design flood, Estimation of maximum rate of run-off.

Hydrographs

Hydrograph analysis; Unit hydrograph; Construction of UH for an isolated storm, Application of UH to the construction of a flood hydrograph resulting from rainfall of unit duration; Construction of unit hydrograph of different unit duration from a unit hydrograph of some given unit duration by superposition method and S-curve method.

UNIT – II

Ground Water – Well Irrigation

Introduction; Aquifer; Aquiclude; Aquifuge; Specific yield; Specific retention; Divisions of sub–surface water; Water table; Types of aquifers; Well hydraulics- Steady radial flow to a well–Dupuit's theory for confined and unconfined aquifers; Tube wells - Open wells; Yield of an open well–Constant level pumping test and Recuperation test.

Introduction to Irrigation

Definition; Necessity; Scope of irrigation science; Benefits of irrigation; Ill-effects of irrigation; Types of irrigation.

Methods of Irrigation

Methods of applying water to crops; Uncontrolled or wild flooding; Free flooding; Contour laterals; Border strip method; Check flooding; Basin flooding; Zigzag method; Furrow method; Contour Farming; Sub-surface irrigation; Sprinkler irrigation; Drip irrigation.

UNIT – III

Water Requirement of Crops

Functions of irrigation water; Classes and availability of soil water; Saturation capacity; Field capacity; Wilting point; Available moisture and readily available moisture; Moisture equivalent; Soil – moisture deficiency; Limiting soil moisture conditions; Depth and frequency of irrigation; Duty and Delta; Base period; Relation between Duty and Delta; Factors affecting duty; Methods of improving duty; Gross command area; Culturable command area; Culturable cultivated and uncultivated area; Kor depth and Kor period; Consumptive use of water ; Irrigation efficiencies – Water conveyance efficiency, Water application efficiency, Water distribution efficiency and Consumptive use efficiency; Determination of irrigation requirements of crops; crop rotation, Assessment of Irrigation water.

Irrigation Channels – Silt Theories and Design Procedure

Classification; Canal alignment; Inundation canals; Cross–section of an irrigation channel; Balancing depth; Borrow pit; Spoil bank; Land width; Silt theories–Kennedy's theory, Kennedy's method of channel design; Drawbacks in Kennedy's theory; Lacey's regime theory; Lacey's theory applied to channel design; Defects in Lacey's theory; Comparison of Kennedy's and Lacey's theory.

UNIT – IV

Water Logging and Canal Lining

Water logging; Effects of water logging; Causes of water logging; Remedial measures; Saline and alkaline soils and their reclamation; Losses in canal; Lining of irrigation channels –

necessity, advantages and disadvantages; Types of lining; Design of lined canal.

Diversion Head Works

Component parts of a Diversion Head work; Weirs and barrages- Types of weirs; Causes of failure of weirs and their remedies; Design of weirs on permeable foundations – Bligh's creep theory, Silt control at head works.

NOTE

Two questions of 12 marks each will be given from each unit out of which one is to be answered. Twelve questions of one mark each will be given from entire syllabus which is a compulsory question.

TEXT BOOKS

1. Irrigation and water power Engineering by B.C. Punmia and Pande B.B. Lal; 16th Edition,Laxmi Publications Pvt. Ltd., New Delhi.
2. Irrigation Engineering and Hydraulic structures by S. K. Garg; Khanna Publishers, Delhi,2011.

REFERENCE BOOKS

1. Irrigation, Water Resources and Water Power Engineering by P.N. Modi, 7th Edition, Standard Book House, 2008.
2. Irrigation, water power and water resources Engineering by K R Arora, Standard Publishers, 2010.
3. Engineering Hydrology by K. Subramanya, 3rd Edition, Tata McGraw-Hills
4. Engineering Hydrology by P. Jayarami Reddy, Laxmi Publications
5. Applied Hydrology by Ven Te Chow, Maidenment and Mays, Mc Graw Hill Publications.

WEBREFERENCES:

www.nptel.iitm.ac.in
www.sprinkerlink.org for e-journals.