WATER RESOURCES ENGINEERING-II

Course Code: 20CE1124

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Pre-requisites: Hydraulics and Hydraulic Machinery, Water Resources Engineering-I

Course Outcomes:

At the end of the course, the student will be able to:

- **CO1:** Analyse the stability of impervious floor on permeable foundations (L3)
- **CO2:** Design the unlined channels and explain the design principles of canal regulation Structures (L3)
- **CO3:** Explain the design principles of canal falls and cross drainage structures (L3)
- **CO4:** Determine the capacity of reservoir and compute the forces on gravity dam (L3)
- **CO5:** Estimate the seepage through earthen dams and describe about energy dissipation below spillway (L3)

UNIT-I

DIVERSION HEAD WORKS:

Types of Diversion head works-diversion and storage head works, weirs and barrages, layout of diversion head works, components. Causes and failure of hydraulic structures on permeable foundations, Bligh's creep theory, Khosla's theory, determination of uplift pressure and thickness of impervious floor using Bligh's and Khosla's theory, exit gradient, functions of upstream and downstream sheet piles.

Learning outcomes:

At the end of the unit, the student will be able to

- 1. Explain the various components of diversion head works (L2)
- 2. Explain the Bligh's and Khosla's seepage theories (L2)
- 3. Determine the uplift pressure and thickness of impervious floor using seepage theories(L3)

UNIT-II

DESIGN OF CHANNELS:

Classification of canals, design of Irrigation canals by Kennedy's and Lacey's theories, balancing depth of cutting.

CANAL REGULATION WORKS:

Canal regulation works - principles of design of distributary head regulator and cross regulator, Canal outlets - types of canal modules, proportionality, sensitivity and flexibility.

Learning outcomes:

At the end of the unit, the student will be able to

1. Design the unlined Irrigation canals by Kennedy's and Lacey's theories (L3)

2. Explain the hydraulic design principles of distributary head regulator and cross regulator (L2)

3. Explain the types of canal outlets (L2)

UNIT-III

(10 Lectures)

CANAL FALLS:

Types of falls and their location, design principles of Sarda type fall, Straight glacis fall.

(10 Lectures)

(10 Lectures)

CROSS DRAINAGE WORKS:

Cross drainage works - types, selection of site, design principles of aqueduct and syphon aqueduct.

Learning outcomes:

At the end of the unit, the student will be able to

- 1. Apply the hydraulic design principles to design the Sarda and Straight glacis falls (L3)
- 2. Describe various types of canal falls and cross drainage works (L2)
- 3. Explain the hydraulic design principles of aqueduct and syphon aqueduct (L2)

UNIT-IV

(10 Lectures)

RESERVOIRS AND DAMS:

Types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve for constant demand only, Types of dams, merits and demerits, selection of type of a dam, selection of site for a dam.

GRAVITY DAMS:

Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a low gravity dam, stability analysis, drainage galleries.

Learning outcomes:

At the end of the unit, the student will be able to

1. Describe the various types of reservoirs and dams (L2)

2. Estimate the capacity of reservoir using mass curve (L2)

3. Analyze the given dam section for its stability criteria (L3)

UNIT-V

(10 Lectures)

EARTH DAMS:

Types of Earth dams, causes of failure of earth dam, criteria for safe design of earth dam, seepage through earth dam-graphical method, measures for control of seepage.

SPILLWAYS:

Types of spillways, types of spillway gates, Methods of energy dissipation below spillway-Description only.

Learning outcomes:

At the end of the unit, the student will be able to

- 1. Explain the various causes of failures of earthen dams (L2)
- 2. Explain the various types of spillways and spillway gates (L2)
- 3. Describe the methods of energy dissipation below spillway (L2)

Text Books:

- 1. B.C. Punmia, B.B.L. Pande, Ashok K.R. Jain, Arun K.R.Jain, "Irrigation & Water Power Engineering", 16th Edition, Laxmi Publications (P) Ltd., New Delhi, 2009.
- 2. K.R. Arora, "Irrigation, Water Power and Water Resources Engineering", 3rd Edition, Standard Publishers Distributors, 2010.

References:

- 1. G.L.Asawa, "Irrigation and Water Resources Engineering", New Age International Publishers, 2005.
- Varshney R.S., "Concrete Dams", 2nd Edition, Oxford and IBH Pub. Co. in, New Delhi, 1982.
- 3. Varshney R.S, S. C. Gupta & R.L. Gupta, "Theory and Design of Hydraulic Structures", 2nd Edition, Nemchand and Brothers, 1992.
- 4. Satyanarayana Murthy C, "Water Resources Engineering", 1st Edition, New Age International Pvt. Ltd. Publishers, 1997.
- S.K. Garg, "Irrigation Engineering and Hydraulic Structures", 24th Edition, Khanna publishers, 2012.
- 6. R.K. Sharma and T.K. Sharma, "Irrigation Engineering", S. Chand Publishers, 2007.
- 7. Relevant IS codes.

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