**19CE3203 - IRRIGATION & HYDRAULIC STRUCTURES**

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| **Course category** | Professional Core | **Credits** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical:** | 3 - 0 - 0 |
| **Prerequisite** | Water Resources Engineering | **Sessional Evaluation :****Univ. Exam Evaluation:****Total Marks:** | 4060100 |

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| **Course Objectives** | 1. To introduce irrigation engineering, understand the concepts of duty-delta and irrigation water requirements.
2. Understand various design concepts of lined canals.
3. Understand causes and remedial measures for failure of diversion head works on permeable foundation.
4. Understand the forces acting, elementary and practical profile of storage head work.
5. To impart the knowledge on design principles of spillways and effect of TWC and JHC in energy dissipation.
6. Study the effects, causes due to water logging and remedial measures.
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| **Course Outcomes** | CO1 | Assess the water requirements to the crop for efficient irrigation method. |
| CO2 | Design lined canal according to Kennedy’s and Lacey’s theories. |
| CO3 | Design weir on permeable foundation according to Bligh’s and Khosla’s theories. |
| CO4 | Apply the basic concepts of planning and design of dams and reservoirs. |
| CO5 | Apply the basic principles of spillway design for efficient energy dissipation. |
| CO6 | Demonstrate the effects of waterlogging and suggest remedial measures. |
| **Course Content** | **UNIT – I****IRRIGATION ENGINEERING :** Benefits and ill effects of irrigation – Methods of irrigation – Quality of irrigation water – Duty and Delta – Irrigation efficiencies – Irrigation water requirements – Assessment of Irrigation water - Crop Seasons – Principle crops – Rotation of crops.**UNIT – II****CANALS:** Classification of canals – Canal alignment – Kennedy’s and Lacey’s theories – Design – Balancing depth – Effects, causes and prevention of water logging – Types of lining – Design of lined canals – Canal outlets – Falls – Cross Drainage works.**UNIT – III****DIVERSION HEAD WORKS:** Location of diversion head works – Components – Causes of failure of weirs and remedial measures – Bligh’s and Khosla’s theories of design of weirs and permeable foundation.**UNIT – IV****STORAGE HEAD WORKS:** Types of dams – Site selection and Reservoir Planning – Forces acting on and causes of failure of a gravity dam – Elementary and practical profiles – Stability analysis – Single and multiple step methods of design – Grouting – Multipurpose projects.**UNIT – V****SPILLWAYS:** Requirements, components and types of spillways – Design principles of ogee spillway – Methods of energy dissipation below spillways – effect of Tail Water Curve (TWC) and Jump Height Curve (JHC) – Scour protection below spillways Stilling basins and appurtenances – Hydraulic design of energy dissipaters.**UNIT – VI****WATER LOGGING:** Water Logging; Effects of Water logging; Causes of Water logging, Remedial Measures; Losses in Canals; Benefits of Drainage, Types of Drains, Design and Maintenance of Open Drains, Under Drains or Tile Drains, Layout of a Tile Drain System; Flow of Ground Water to Drains. |
| **Text Books and reference Books:** | **TEXT BOOKS:**1. Dr. P.N. Modi, *Irrigation water resources and water power engineering,* Standard book house, 11th edition, 2019.
2. S.K. Garg, *Water Resources Engineering Vol. II Irrigation Engineering & Hydraulic Structures,* Khanna publishers,36th edition 2020.
3. Larry W.Mays, *Water Resources Engineering*, Wiley India Private Limited, 2nd edition, 2011

**REFERENCE BOOKS:**1. B.C. Punmia, *Irrigation and Water Power Engineering*, Laxmi Publications, 17th edition, 2021.
2. G.L. Asawal, *Irrigation and Water Resources Engineering*, Newage publishers, 4th edition, 2005.
3. H.M. Raghunath, *Irrigation Engineering*, Wiley India, 8th edition, 2011
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**CO-PO Mapping:** 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

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|   | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 2 | - | 1 | 1 | - | - | - | - | - | - | - | 2 |
| **CO 2** | 3 | - | 3 | 1 | - | - | 1 | - | - | - | 1 | 1 |
| **CO 3** | 2 | - | 2 | 2 | - | - | 1 | - | - | - | - | 2 |
| **CO 4** | 2 | - | 1 | 1 | - | - | 1 | - | - | - | 1 | - |
| **CO 5** | 3 | - | 2 | - | - | - | 1 | - | - | - | 1 | 1 |
| **CO 6** | 2 | - | - | 2 | - | - | 1 | - | - | - | - | 1 |