**20CE32E1 –HYDROLOGY &WATER RESOURCES ENGINEERING**

**(Civil Engineering)**

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| **Course Category** | Professional Elective | **Credits** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical** | 3-0 - 0 |
| **Prerequisite** | Fluid Mechanics | **Sessional Evaluation** | 40 |
| **Semester End Exam Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Outcomes** | CO1 | Understand the theories and principles governing the hydrologic processes. |
| CO2 | Determine the loss due to evapotranspiration and infiltration. |
| CO3 | Determine the runoff due to precipitation and develop runoff hydrographs. |
| CO4 | Assess and analyze floods and flood control measures. |
| CO5 | Determine aquifer parameters and yield of wells. |
| CO6 | Explain the basic concepts of irrigation engineering. |
| **Course Content** | **UNIT – I**  **INTRODUCTION:** Definition and scope; Hydrologic cycle; Sources of hydrological data.  **PRECIPITATION:** Forms of precipitation; Measurement of precipitation; Rain gauge network;Preparation and presentation of rainfall data; Mean precipitation of rainfall data; Depth-Area-Duration relationship; Frequency of point rainfall Maximum Intensity/Depth-Duration-Frequency relationship; Probable maximum Precipitation (PMP). | |
| **UNIT – II**  **ABSTRACTIONS FROM PRECIPITATION:** Evaporation process; Evaporimeters; Empirical evaporation equations; Analytical methods - estimation of evaporation and transpiration.  **EVAPOTRANSPIRATION:** Measurement of evapotranspiration; Evapotranspiration equations – Potential evapotranspiration and Actual evapotranspiration; Infiltration; Factors affecting infiltration; Infiltration indices.  **UNIT – III**  **RUNOFF:** Runoff characteristics; Factors affecting runoff– Catchment characteristics; Flow-duration curve; Flow-mass curve.  **HYDROGRAPHS:** Components of hydrograph; Base flow separation; unit hydrograph– Derivation of unit hydrograph–Unit hydrograph of different durations – Uses and limitations of unit hydrograph– Duration of the unit hydrograph; S-curve hydrograph; Instantaneous unit hydrograph.  **UNIT – IV**  **FLOODS:** Introduction– Rational method– Empirical formulae–Unit hydrograph method; Flood frequency studies–Gumbel’s method– Log-Pearson type III distribution; Partial duration series; Regional flood;Frequency analysis; Data for frequency studies; Design flood– Design storm– Risk, reliability and safety factor; Flood routing-channel routing; Flood control – Classification of methods for flood control or management; Flood control reservoir; Channel improvement; Floodways.  **UNIT – V**  **GROUNDWATER:** Introduction– Forms of subsurface water; Saturated formation; Aquifer properties; Geologic formations as aquifers; Equation of motion; Wells– Steady flow into a well– Open wells;Unsteady flow in a confined aquifer; Well loss– Specific capacity;Sea-water intrusion– Recharge.  **UNIT – VI**  **IRRIGATION:** Necessity and importance– Principal crops and crop seasons– Types– Methods of application– Soil-water–Plant relationship–Soil moisture constants – Consumptive use– Estimation of consumptive use– Crop water requirement– Duty and delta– Factors affecting duty– Depth and frequency of irrigation– Irrigation efficiencies– Water logging and causes– Standards of quality for irrigation water – Crop rotation. | |
| **Textbooks**  **and**  **References** | **TEXTBOOKS:**   1. K. Subramanya, *Engineering Hydrology*, Tata McGraw-Hill Education Pvt. Ltd, 5thedition, 2017. 2. P. Jayarami Reddy, *Engineering Hydrology*, Laxmi Publications Pvt. Ltd., 3rd edition, 2016. 3. P.N. Modi, *Irrigation water resources and water power engineering,* Standard Book House publication, 11th Edition, 2019.   **REFERENCES:**   1. K.N. Duggal and J.P. Soni, *Elements of water resources engineering*, New Age International Publishers, 2nd edition, 2005. 2. G.L.Asawa, *Irrigation Engineering*, NewAge International Publishers, 2nd edition, 2000. 3. S.K. Garg, *Irrigation Engineering and Hydraulic Structures,* Khanna Publishers, 36th edition, 2020. | |

**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** | **PSO1** | **PSO2** | **PSO3** |
| **CO 1** | 2 | - | - | 2 | - | - | 1 | - | - | - | - | 1 | - | - | - |
| **CO 2** | 3 | 2 | - | 1 | 1 | - | 1 | - | 1 | - | - | 1 | - | 1 | 1 |
| **CO 3** | 2 | - | - | 2 | 1 | - | 1 | - | 1 | - | - | 2 | 1 | 3 | 2 |
| **CO 4** | 2 | - | - | 1 | 1 | - | 1 | - | - | - | - | 1 | 1 | 3 | 2 |
| **CO 5** | 2 | 2 | - | 1 | - | - | 1 | - | 1 | - | - | 1 | 1 | - | 1 |
| **CO 6** | 3 | - | 1 | - | - | 2 | - | - | 1 | - | 1 | 1 | - | 1 | - |