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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **24WI3001** | **Duration** | **3hrs** |
| **Course Title** | **BASIC PRINCIPLES OF IWRM** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Define sustainability. | CO1 | U | 4 |
|  | b. | With the help of a sketch, explain the factors influencing sustainability. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 2. | a. | Define ‘blue water’. | CO3 | A | 4 |
|  | b. | Explain the impact of climate change on hydrology and water management. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 3. | a. | How does forest influence the hydrograph? Explain with a diagram. | CO2 | A | 8 |
|  | b. | Describe the impact of urbanization on the hydrology of a watershed. | CO2 | An | 8 |
|  |  |  |  |  |  |
| 4. | a. | What are the different types of droughts? | CO4 | R | 6 |
|  | b. | How will you mitigate droughts? | CO4 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Describe sheet and channel erosion. | CO2 | U | 8 |
|  | b. | With the help of a sketch explain aggradation and degradation in a reservoir. | CO2 | C | 8 |
|  |  |  |  |  |  |
| 6. | a. | List the techniques for artificial recharge of groundwater. | CO2 | A | 6 |
|  | b. | With the help of a sketch, highlight the septic tank used for ‘grey water’  treatment. | CO3 | E | 10 |
|  |  |  |  |  |  |
| 7. | a. | What do you understand by Virtual Water trade? | CO5 | U | 8 |
|  | b. | Explain participatory approach in watershed planning. | CO2 | A | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Write a short note on water pricing. | CO6 | E | 10 |
|  | b. | Highlight the institutional mechanism for implementing IWRM. | CO6 | C | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Explain the concepts and principles of IWRM in the context of three pillars of sustainability to assess water crisis. |
| CO2 | List the salient features of national water policy and relate the concepts of the river basin approach and watershed management towards sustainability. |
| CO3 | Identify and correlate the problems related to water & soil and their impacts on human and environment. |
| CO4 | Compare the effectiveness of traditional and modern techniques for water security, considering environment, society and economics |
| CO5 | Describe the case studies of Public-Private Partnerships (PPPs) in the context of IWRM. |
| CO6 | Articulate the role and impact of IWRM framework in SDG |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 12 | 4 | - | - | - | - | 16 |
| CO2 | - | 8 | 22 | 8 | - | 8 | 46 |
| CO3 | - | - | 4 | 12 | 10 | - | 26 |
| CO4 | 6 | - | - | - | 10 | - | 16 |
| CO5 | - | 8 | - | - | - | - | 8 |
| CO6 | - | - | - | - | 10 | 10 | 20 |
| Subtotal | 18 | 20 | 26 | 20 | 30 | 18 | **132** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **24WI3002** | **Duration** | **3hrs** |
| **Course Title** | **HYDROLOGICAL PROCESSES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | i. Describe the essential components of the hydrologic cycle using a diagram.  ii. Estimate the approximate distribution of groundwater as a percentage of the total availability of water in the planet. | CO1  CO1 | U  An | 6 2 |
|  | b. | Discuss any four applications of hydrology, indicating the factors and methodologies considered in practical application. | CO1 | Ap | 8 |
|  |  |  |  |  |  |
| 2. | a. | i. Explain the working of a float type recording rain gauge with neat sketch. Mention its advantages over non-recording types.  ii. The hourly precipitation data during a storm is as follows:   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Time (Hrs.) | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | | Precipitation (mm) | 0 | 25 | 5 | 10 | 25 | 15 | 10 | 5 | 0 |   Plot the following:   1. Hyetograph ii) Mass curve | CO2  CO2 | U  A | 4  4 |
|  | b. | 1. Draw a neat, labeled sketch illustrating the field method for measuring evaporation. 2. Write the Modified Penman Equation to measure evapotranspiration. List the significant parameters involved. | CO2  CO2 | An  U | 5  3 |
|  |  |  |  |  |  |
| 3. | a. | Explain the concept of a stage-discharge curve, describe the process of its development, and illustrate its applications in hydrology. | CO3 | An | 8 |
|  | b. | Five velocity measurements are taken across the stream with the values  given below: Calculate the discharge   |  |  |  |  | | --- | --- | --- | --- | | Measurement  No. | Distance from  Initial point (m) | Depth (m) | Mean  Velocity (m/s) | | 1 | 0 | 0.5 | 1.0 | | 2 | 3 | 1.0 | 1.4 | | 3 | 6 | 1.5 | 2.0 | | 4 | 9 | 1.8 | 1.5 | | 5 | 12 | 1.0 | 0.8 | | CO3 | Ap | 8 |
|  |  |  |  |  |  |
| 4. | a. | 1. What is Darcy’s law? Explain its significance in groundwater movement and mention its limitations. 2. Briefly describe how water is stored in a groundwater reservoir, including the various zones highlighting the importance of the zone of saturation. | CO4  CO4 | Ap  U | 4  4 |
|  | b. | A well with a 0.5 m diameter penetrates 33 m below the static water table. After a prolonged period of pumping at 80 m³/hr, the drawdown at 18 m and 45 m from the pumped well were observed to be 1.8 m and 1.1 m, respectively. a) Calculate the transmissibility of the aquifer. b) Estimate the approximate drawdown in the pumped well. c) Determine the radius of influence of the pumping well. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | 1. List the forms of precipitation in the hydrological cycle. Explain the any two types of precipitation with a neat sketch. 2. Differentiate between specific yield and specific retention and describe their relationship with porosity. | CO2  CO4 | U  Ap | 4  4 |
|  | b. | i. A 30 cm diameter well completely penetrates an unconfined aquifer with a saturated depth of 40 m. After steady-state pumping at 1500 lpm for an extended period, the drawdown at two observation wells located 25 m and 75 m from the pumping well were 3.5 m and 2.0 m, respectively. a) Determine the transmissibility of the aquifer. b) Calculate the drawdown at the pumping well.  ii. Explain the procedure for estimation of aquifer parameters using the Theis method. | CO5  CO5 | Ap  U | 4  4 |
|  |  |  |  |  |  |
| 6. | a. | Derive the equations for steady state flow in confined and unconfined aquifers with a neat, labelled sketch. | CO4 | Ap | 6 |
|  | b. | i. Explain how the different land uses affect the surface flow in a basin.  ii. The total rainfall is 5.5 cm. in 70 minutes in a basin area of 380 sq.km. If one-third of the rainfall received is intercepted and infiltrated, how much volume is available as surface flow? | CO3  CO3 | An  Ap | 4  6 |
|  |  |  |  |  |  |
| 7. | a. | Classify different types of aquifers and their significant role in groundwater storage and movement. | CO4 | U | 8 |
|  | b. | Explain three methods of determination of the mean precipitation over a given catchment area with a neat sketch and equation. | CO2 | Ap | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | How the draw down and radius of influence are related during discharge under steady state flow conditions? (Represent it with a neat sketch). | CO5 | Ap | 4 |
|  | b. | Explain the different computational models used in hydrology and outline their benefits. List the classification of models based on the purpose or applications. Name three widely used hydrologic models. | CO6 | U | 16 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Elaborate the role and significance of processes in hydrological cycle for estimation of water budget. |
| CO2 | Analyze the precipitation data and estimate the losses due to evaporation and evapotranspiration. |
| CO3 | Articulate the measurement techniques of streamflow and predict the peak & design flow using hydrographs. |
| CO4 | Explain the physical properties of confined and unconfined aquifers in the groundwater system. |
| CO5 | Estimate the aquifer parameters using pumping test results and analyse draw down in the wells. |
| CO6 | Describe the concepts and applications of hydrological models in water resources planning and management. |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 6 | 8 | 2 |  |  | 16 |
| CO2 |  | 11 | 12 | 5 |  |  | 28 |
| CO3 |  |  | 14 | 12 |  |  | 26 |
| CO4 |  | 12 | 14 | - |  |  | 26 |
| CO5 |  | 4 | 8 | 8 |  |  | 20 |
| CO6 |  | 16 |  |  |  |  | 16 |
|  | | | | | | | **132** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **24WI3003** | **Duration** | **3hrs** |
| **Course Title** | **WASTEWATER MANAGEMENT** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Describe the various types of grit chambers used for wastewater treatment. | CO2 | U | 8 |
|  | b. | Design a screen chamber for a treatment plant with an average domestic wastewater flow of 5 MLD, considering suitable design criteria and a peak factor of 2. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | Discuss the importance of settling velocity and surface overflow rate in the sizing of treatment units. Provide relevant examples to illustrate how these parameters are used to determine the dimensions of treatment units. | CO2 | U | 7 |
|  | b. | 1. For a clarifier with a 20 m diameter and a wastewater flow rate of 10 MLD, calculate the detention time and surface loading rate, assuming a wastewater depth of 2.5 m. 2. Briefly explain the significance of asset management in wastewater treatment plant | CO2  CO6 | A  A | 5  4 |
|  |  |  |  |  |  |
| 3. | a. | Classify trickling filters based on organic or hydraulic loading and number of units. | CO3 | An | 8 |
|  | b. | Differentiate between attached growth and suspended growth systems in the biological treatment of wastewater. Explain one method from each system. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 4. | a. | Explain the symbiotic relationship between bacteria and algae in waste stabilization ponds, using a neat sketch. List the types of ponds used in wastewater treatment, detailing their function, dimensions, and suitability. | CO5 | A | 8 |
|  | b. | 1. Calculate the F/M (Food to Microorganism) ratio for wastewater with a BOD₅ concentration of 200 mg/L treated in a tank with a 6-hour Hydraulic Retention Time (HRT) and 4000 mg/L of mixed liquor suspended solids. 2. Illustrate and explain the various phases of the microbial life cycle. | CO3  CO3 | A  U | 3  5 |
|  |  |  |  |  |  |
| 5. | a. | Differentiate between in-situ and ex-situ bioremediation methods used in wastewater treatment. Explain any two methods in detail, including neat sketches. | CO5 | An | 5 |
|  | b. | 1. Given that the BOD₅ of a sample at 20°C is 250 mg/L, determine the ultimate BOD, assuming a reaction constant k = 0.23/day at 20°C. 2. Provide a classification of trickling filters and explain the differences between low-rate and high-rate trickling filters, as well as single-stage and two-stage trickling filters. | CO3  CO3 | A  An | 3  8 |
|  |  |  |  |  |  |
| 6. | a. | Classify the types of membrane technologies used in wastewater treatment based on their functions and specific applications. | CO4 | An | 8 |
|  | b. | 1. How adsorption principal aids in the removal of suspended solids in wastewater treatment? Explain. 2. Compare and contrast electrocoagulation and chemical coagulation in the context of removal mechanism and operational parameters. | CO4  CO4 | A  An | 3  5 |
|  |  |  |  |  |  |
| 7. | a. | Explain three types of constructed wetlands with a neat sketch. List the design parameters. | CO5 | An | 8 |
|  | b. | A community discharges 20 MLD of wastewater. Draw a conventional flow diagram for the treatment of this wastewater and discuss the design principles on which the proposed unit operations/treatment units are based? | CO1 | A | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Explain the significant role that IoT and AI play in the real-time monitoring and control of wastewater treatment unit operations, focusing on how they enhance process efficiency, improve predictive maintenance, and optimize resource usage. | CO6 | E | 10 |
|  | b. | 1. Explain why wastewater flow rates fluctuate and describe how these variations manifest in an urban community. 2. If the annual water consumption of a town with a population of 40,000 is 4000 ML, calculate the per capita daily water supply rate and the total quantity of wastewater generated. | CO1  CO1 | An  A | 8  2 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Estimate the quantity of wastewater generation and assess its physio-chemical and biological characteristics. |
| CO2 | Describe the removal mechanism of settleable and floatable solids in primary unit operations based on the design parameters |
| CO3 | Apply the concepts of biodegradation and kinetics in designing the suspended and attached growth reactors for the removal of organics |
| CO4 | Explain the working principles of electrochemical and membrane technologies in removing suspended and dissolved solids |
| CO5 | Compare the performance of natural treatment systems in treating organic and inorganic pollutants |
| CO6 | Elaborate the operational and monitoring aspects of wastewater treatment plants |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  |  | 10 | 8 |  |  | 18 |
| CO2 |  | 15 | 13 |  |  |  | 28 |
| CO3 |  | 5 | 6 | 24 |  |  | 35 |
| CO4 |  |  | 3 | 13 |  |  | 16 |
| CO5 |  |  | 8 | 13 |  |  | 21 |
| CO6 |  |  | 4 |  | 10 |  | 14 |
|  | | | | | | | **132** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **24WI3004** | **Duration** | **3hrs** |
| **Course Title** | **IRRIGATION WATER MANAGEEMNT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | What do you understand about the historical development on irrigation? Explain. | CO1 | U | 8 |
|  | b. | Briefly discuss about National water policy and action plan for India 2020. | CO1 | R | 8 |
|  |  |  |  |  |  |
| 2. | a. | Compare tank and well irrigation practices with benefits and issues faced by the farmers. | CO2 | A | 8 |
|  | b. | Derive the relation between duty and delta. What are the factors affecting duty? | CO2 | An | 8 |
|  |  |  |  |  |  |
| 3. | a. | How to estimate evapotranspiration by empirical methods? | CO2 | E | 8 |
|  | b. | Derive the Parker and Israelson’s equation for rate of water front advance for furrows. | CO3 | C | 8 |
|  |  |  |  |  |  |
| 4. | a. | What are the different methods developed for irrigation scheduling? Explain. | CO3 | U | 6 |
|  | b. | A stream of 16 lps is supplied to a border strip 6 m wide such that the average depth of flow is 6 cm; while the soil has an average infiltration rate of 2 cm/hr. a) Calculate the times of water front advance to reach 25m, 50 m, 75 m and 100 m from the head of the border strip b) Calculate the average depth of water applied to the border strip during the time water reaches each intermediate distance c) If 5 cm depth of water is desired as irrigation, what is the application efficiency for a strip of 100 m length when the irrigation stream is cut off as soon as water reaches the end of the border? d) Calculate the distribution efficiency for depths of water applied at the intermediate points e) What will be the maximum distance upto which water will advance? | CO4 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Briefly explain the different types of furrow irrigation with neat sketches. | CO4 | A | 8 |
|  | b. | How to evaluate the wetting pattern in drip and sprinkler irrigation methods? | CO5 | E | 8 |
|  |  |  |  |  |  |
| 6. | a. | Explain the different components of drip irrigation and their functions with a neat illustrative sketch. | CO5 | U | 8 |
|  | b. | Explain the types of canal structures used for flow regulation and control with neat sketches. | CO3 | R | 8 |
|  |  |  |  |  |  |
| 7. | a. | Discuss about rainwater harvesting and waste water reuse for sustainability. | CO6 | C | 8 |
|  | b. | Derive the Parker and Israelson’s equation for rate of water front advance for borders. | CO3 | C | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | A farm of 25 ha is planned to be brought under sprinkler irrigation. The textural class of the soil is loam-to-silt loam, having moisture content at field capacity (FC) and permanent wilting point (WP) of about 42% (by volume) and 26% (by volume), respectively. An infiltration test data showed that constant (basic) infiltration rate is 2 mm/h. A hard pan (relatively impervious layer) exists at a depth of 2.0 m below the soil surface. Long-term average reference evapotranspiration (ET0) rate in that area is 4.5 mm/d. Vegetable crops are planned to grow in the farm, and the crop coefficient (*K*c) at maximum vegetative period is 1.1. The climate is moderately windy in a part of the season. Design the sprinkler irrigation system (various components) for the farm. Assume standard value of any missing data. | CO5 | An | 10 |
|  | b. | Discuss anyone case study conducted on drip irrigation in Israel. | CO6 | E | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Describe the irrigation practices and techniques on agricultural productivity in India |
| CO2 | Estimate crop water requirement, assess soil and water quality to identify suitable irrigation strategies |
| CO3 | Elaborate the methods of water distribution in canal networks and irrigation scheduling |
| CO4 | Classify surface irrigation methods based on the design and wetting pattern |
| CO5 | Compare the performance of drip and sprinkler irrigation techniques in terms of water use efficiency and crop yield |
| CO6 | Explain the practices of sustainable irrigation through water harvesting and wastewater reuse |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 8 | 8 | - | - | - | - | 16 |
| CO2 | - | - | 8 | 8 | 8 | - | 24 |
| CO3 | 8 | 6 | - | - | - | 16 | 30 |
| CO4 | - | - | 8 | 10 | - | - | 18 |
| CO5 | - | 8 | - | 10 | 8 | - | 26 |
| CO6 | - | - | - | - | 10 | 8 | 18 |
| Subtotal | 16 | 22 | 16 | 28 | 26 | 24 | **132** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| **Course Code** | **24WI3007** | **Duration** | **3hrs** |
| **Course Title** | **WATER SUPPLY DISTRIBUTION AND MAINTENANCE** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Describe four major sources of surface water, including their characteristics within the context of a water supply distribution system. | CO1 | U | 8 |
|  | b. | i. Examine the importance of planning and estimation activities in the development of water supply systems.  ii. Analyze any two population projection methods used to estimate future water demand. | CO1  CO1 | An  A | 4  4 |
|  |  |  |  |  |  |
| 2. | a. | Enumerate the primary objectives of water treatment and explain how they influence the design of a treatment plant layout. Provide examples of how specific unit operations address these objectives. | CO2 | An | 8 |
|  | b. | Explain the principles behind the operations of coagulation and flocculation in water treatment, their importance in particle removal, and the factors affecting their efficiency. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | Outline the purposes of constructing distribution reservoirs and the key considerations when selecting their locations. Highlight the key accessories of an elevated water reservoir. | CO3 | A | 8 |
|  | b. | Water is circulating through a closed system of pipes in a two-floor apartment. On the first floor, the water has a gauge pressure of 3.4×1053 pa and a speed of 2.1 m/s. However, on the second floor, which is 4 m higher, the speed of the water is 3.7 m/s. The speeds are different because the pipe diameters are different. What is the gauge pressure of the water on the second floor? | CO3 | A | 8 |
|  |  |  |  |  |  |
| 4. | a. | i. Analyze three flow regimes that influence the rate of water inflow into a reservoir.  ii. Calculate the required diameter of a pipe to achieve a discharge of 8 MLD (megalitres per day) with a pressure of 40 meters, assuming a velocity coefficient (Cv) of 0.6, applying Bernoulli’s equation and the continuity equation. | CO3  CO4 | An  A | 4  4 |
|  | b. | i. Identify eight design parameters in water supply systems and explain their significance.  ii. List six key data points that must be collected when designing a water supply system for an urban area. | CO4  CO4 | An  A | 4  4 |
|  |  |  |  |  |  |
| 5. | a. | Outline the steps involved in designing a water supply system for an urban community. | CO4 | E | 8 |
|  | b. | Discuss the functions of District Metered Areas (DMAs) and zoning in water distribution systems, highlighting their benefits. | CO5 | U | 8 |
|  |  |  |  |  |  |
| 6. | a. | List the primary considerations in network design and specify the details required for input into a hydraulic model (e.g., EPANET). | CO5 | A | 8 |
|  | b. | Assess the different types of water demand and the corresponding per capita water supply requirements in communities | CO1 | An | 8 |
|  |  |  |  |  |  |
| 7. | a. | Explain the working principle of sand filters and the factors that impact their efficiency in removing suspended solids. | CO2 | A | 6 |
|  | b. | Explain the role of SCADA system in monitoring and controlling the water distribution in the network. | CO5 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | i. Analyze the benefits and challenges of Digital Transformation in water distribution management.  ii. Demonstrate how Drone and GIS technologies are applied in smart water distribution management. | CO6  CO6 | An  A | 6  8 |
|  | b. | Evaluate the features of manual metering and smart metering in water distribution systems. | CO6 | E | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Estimate the population forecast and analyze the water samples of the selected water sources. |
| CO2 | Apply the design and working principles of physio-chemical unit operations in water treatment. |
| CO3 | Describe the layout of the water supply, conveyance and distribution system. |
| CO4 | Determine the flow and pressure distribution in a small water distribution system using Hardy Cross method. |
| CO5 | Elaborate the concepts of DMA and simulate the continuous flow in WDN using in Water GEMS |
| CO6 | Explain the concepts of digitalization in the water distribution network |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 8 | 4 | 12 |  |  | 24 |
| CO2 |  |  | 14 | 8 |  |  | 22 |
| CO3 |  |  | 16 | 4 |  |  | 20 |
| CO4 |  |  | 8 | 4 | 8 |  | 20 |
| CO5 |  | 8 | 8 | 10 |  |  | 26 |
| CO6 |  |  | 8 | 6 | 6 |  | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **24WI3030** | **Duration** | **3hrs** |
| **Course Title** | **BASICS OF AGRIVOLTAICS TECHNOLOGY** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | 1. Explain the main components of a solar PV system with a neat sketch. 2. List the design considerations (layout, shading, and land use) for integrating solar PV systems. | CO2 | U | 10 |
|  | b. | Compare and contrast different types of solar cells and explain how their specifications affect their applications in agriculture. | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss different types of solar PV modules for energy generation. List the factors that determine the choice of a particular PV module for agrivoltaics projects. | CO2 | An | 10 |
|  | b. | Examine the application of solar PV systems in rural agriculture and their impact on local economies and energy accessibility. | CO2 | Ap | 10 |
|  |  |  |  |  |  |
| 3. | a. | 1. How should the agrivoltaics system be managed to ensure optimal light exposure for crops? 2. Analyze the effects of partial shading from solar panels on crop yield and quality. | CO3  CO3 | An  An | 5  5 |
|  | b. | 1. Discuss the critical light and growth conditions required for crops using agrivoltaics systems. 2. Assess the types of crops that are most suitable for agrivoltaics systems. | CO3  CO3 | Ap  Ap | 5  5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Examine how agrivoltaics system contribute to energy-food-water nexus. Provide an example. | CO4 | An | 10 |
|  | b. | Compare static, dynamic and greenhouse-integrated agrivoltaics systems and discuss their advantages and limitations. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Evaluate the factors to consider when designing an agrivoltaics system in the context of orientation, spacing, and height. | CO4 | Ev | 10 |
|  | b. | Analyze the role of bifacial and vertical agrivoltaics systems in maximizing energy output and minimizing land use in various agricultural settings. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | List the key factors to be considered in determining the size and configuration of an agrivoltaics system. Explain their importance. | CO5 | Ap | 10 |
|  | b. | Explain single and dual-axis solar tracking systems and fixed tilt systems with a neat sketch. Highlight their suitability for different environments. | CO5 | Ap | 10 |
|  |  |  |  |  |  |
| 7. | a. | 1. Explain the importance of anchoring and foundation techniques for long-term stability in agrivoltaics system installations. 2. Enumerate three challenges involved in the installation of agrivoltaics systems. | CO5  CO5 | U  U | 7  3 |
|  | b. | Discuss how agrivoltaics system design and installation can be optimized to achieve both energy efficiency and crop productivity. | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | 1. Analyze five environmental impacts of agrivoltaics systems concerning land use changes and carbon footprint reduction. 2. Perform a cost-benefit analysis of installing an agrivoltaics system on agricultural land. | CO6  CO6 | An  An | 5  5 |
|  | b. | 1. Evaluate a successful case study of agrivoltaics technology implemented in India. List any two key lessons learned from the case study. 2. Enumerate the socio-economic benefits that agrivoltaics systems provide to farming communities. | CO6  CO6 | E  U | 5  5 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the fundamental principles of agrivoltaics technology in agricultural practices. Highlight the dual benefits of agrivoltaics by integrating energy and crop production. | CO1 | U | 10 |
|  | b. | Outline the major challenges and issues adopting agrivoltaics technology. Propose five practical solutions to overcome these challenges. | CO1 | Ap | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Explain the fundamental concepts and importance of agrivoltaics in integrating energy harvesting with agriculture. |
| CO2 | Assess the suitability and design of PV systems in agrivoltaics systems. |
| CO3 | Identify the crops and agnomical practices suitable in the agrivoltaics system. |
| CO4 | Optimize the design parametersof the agrivoltaics system. |
| CO5 | Elaborate the design and installation procedures of agrivoltaics systems. |
| CO6 | Estimate the cost and environmental analysis of agrivoltaics systems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 10 | 10 | - | - |  | 20 |
| CO2 | - | 10 | 20 | 10 | - |  | 40 |
| CO3 | - | - | 10 | 10 | - |  | 20 |
| CO4 | - | - | - | 30 | 10 |  | 40 |
| CO5 | - | 10 | 20 | 10 | - |  | 40 |
| CO6 | - | 5 | - | 10 | 5 |  | 20 |
|  | | | | | | | **180** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24WI3031** | **Duration** | **3hrs** |
| **Course Title** | **WATER CHEMISTRY** | **Max. Marks** | **100** |

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| **Q. No** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. |  | List the three categories of contaminants found in wastewater and explain how to remove each one. | CO1 | R | 16 |
|  |  |  |  |  |  |
| 2. |  | Describe how water is an essential nutrient for cells. | CO1 | U | 16 |
|  |  |  |  |  |  |
| 3. |  | Discuss physical characteristics of water and their environmental significance. | CO2 | R | 16 |
|  |  |  |  |  |  |
| 4. |  | Textile wastewater is the ultimate source of pollution- Justify.  Brief on the methods employed to treat the same. (any two methods) | CO3 | U | 16 |
|  |  |  |  |  |  |
| 5. |  | Give an overview of the ways that inorganic matter are contaminating the water. Describe the various techniques for removing heavy metals from wastewater. | CO4 | E | 16 |
|  |  |  |  |  |  |
| 6. |  | Analyze the effects of organic pollutants in wastewater to the environment. | CO5 | A | 16 |
|  |  |  |  |  |  |
| 7. |  | Write down the ways to ascertain the importance of COD and BOD in wastewater. | CO6 | U | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | Discuss the challenges in the removal of organic pollutants from wastewater. | CO6 | E | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize the significance of drinking water for health |
| CO2 | Understand the physical characteristics of water. |
| CO3 | Apprehend the chemical characteristics of water. |
| CO4 | Acquire knowledge on heavy metal pollutants. |
| CO5 | Apply the appropriate treatment for the organic pollutants. |
| CO6 | Expand the understanding of different wastewater treatment techniques. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 16 | 16 | - | - | - | - | 32 |
| CO2 | 16 | - | - | - | - | - | 16 |
| CO3 | - | 16 | - |  |  | - | 16 |
| CO4 | - | - | - | - | 16 | - | 16 |
| CO5 | - |  | 16 | - | - | - | 16 |
| CO6 | - | 16 | - | - | 20 | - | 36 |
| 32 48 16 36 | | | | | | | **132** |