Visva-Bharati

Department of Agricultural Engineering

PhD Course Work Examination, Sem-I, 2023

AEG-612: Advanced Hydrology

Time: 3 hours | Marks: 80

Questions carry marks as indicated in the margin

(Answer any **five** questions)

1. (a) Explain the different stages of the Hydrologic Cycle. (8+8=16)
   (b) Explain the uses of IDF (Intensity Duration Frequency) curve.
2. (a) Briefly describe ways of cloud formation. (8+8=16)
   (b) At a particular time, the storage in a river reach is 60 x 103 m^3. At that time, the inflow into the reach is 10 m^3/s and the outflow is 16 m^3 /s. After two hours, the inflow and the outflow are 18 m^3/s and 20 m^3/s respectively. Determine the changes in storage for two hours period and the storage volume after two hours.
3. (a) Elaborate on indicators used to estimate infiltration. Which one is the best to be used? (8+8=16)
   (b) The average annual precipitation amounts for the gauges A, B, C and D are 1120, 935, 1200 and 978 mm. In the year 1975, station D was out of operation. Station A, B, and C recorded rainfall amounts of 107, 89 and 122 mm respectively. Estimate the amount of precipitation for station D in the year 1975.
4. (a) In your opinion, what is the most significant source of groundwater pollution in the country? (8+8=16)
   (b)What is meant by "Unit Hydrograph"? Indicate assumptions involved in the hydrograph theory
5. (a) Explain in detail about the challenges in surface water quality modeling. (8+8=16)
   (b) What are some the advanced techniques and general guidelines used for model calibration and validation in hydrological modelling?
6. Compare and contrast the three main types of hydrological models: empirical, conceptual, and physically based models. Include a discussion on their applications and limitations. 16
7. A fully penetrating well, with an outside diameter of 50 cm, discharges a constant 3 m^3/min from an aquifer whose coefficient of transmissibility is 0.03 m^2/s. The aquifer is in contact with a lake 2 km away and having no other source of supply. 16
   i. Estimate the drawdown at the well surface. (Take R_0 as twice the distance between aquifer lake).
   ii. Assuming expected well yield estimates, comment about yield of the well as related to its diameter and suggest a more suitable well diameter. Explain your answer.
   iii. Give a suggestion for type of aquifer soil, with assuming aquifer thickness of 20 m.
8. Write short notes on (any Four): (4x4=16)
   (a) Real-Time Flood Forecasting
   (b) Groundwater simulation models
   (c) SNOWMOD
   (d) Digital elevation model (DEM)
   (e) Nash-Sutcliffe coefficient
   (f) Land cover and land use maps

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AEG-607: Advances in Irrigation and Drainage

Time: 3 hours | Marks: 80

Questions carry marks as indicated in the margin

(Answer any **five** questions)

1.	(a) Explain the core components of the SWAT model and how they contribute to the simulation of watershed hydrology and water quality. (b) Explain bio drainage and mole drainage. Discuss conjunctive use of saline and fresh water.	(8+8=16)
2.	(a) Evaluate the potential challenges and limitations associated with the adoption of cablegation systems in irrigation. (b) Design a drip irrigation system for a 1.5 hectare vegetable farm with a daily water requirement of 5 mm. Calculate the total water requirement per day, the number of emitters needed, and the flow rate per emitter, if the irrigation time is 2 hours per day. Assume each emitter has a flow rate of 4 L/hr.	(8+8=16)
3.	(a) Design a drainage system for a residential area using synthetic materials. Outline the key engineering considerations, including hydrological analysis, material selection, and installation procedures (b) Derive Hooghoudt equation with neat diagram.	(8+8=16)
4.	(a) Discuss the role of drainage systems in sustainable development. How can modern engineering practices enhance the sustainability of these systems? (b) Describe the principle of surge irrigation and explain how it impacts surface flow Hydraulics as compared to traditional continuous flow irrigation.	(8+8=16)
5.	(a) Discuss the role of soil drainage characteristics in determining the effectiveness of different irrigation methods. How do soil texture and structure influence irrigation outcomes? (b) Enumerate the advantages and disadvantages of surface irrigation methods.	(8+8=16)
6.	Design a micro irrigation system for a 1hectare orchard with a slope of 2%. Explain the steps involved in the design process, showing calculations for emitter spacing, lateral line sizing, and pressure regulation. Include a graph of the pressure distribution along the lateral line.	16
7.	Discuss the application and advantages of simulation models in designing and managing agricultural drainage systems. How can these models improve the efficiency and environmental sustainability of drainage practices?	16
8	Write Short notes on (Any four) a) DRAINMOD b) Irrigation Scheduling c) Steady-State Versus Unsteady-State Drainage Equations d) Salt Intrusion e) Economic feasibility of subsurface drainage system f) Manning's equation and its application	(4x4=16)

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PhD Course Work Examination, Sem-I, 2023

AEG 613 Modelling Soil Erosion Processes

Time: 3 hours | Marks: 50

Questions carry marks as indicated in the margin

(Answer any **five** questions)

1. Describe the engineering principles behind check dams and their role in controlling gully erosion. 10
2. Describe the integration of Geographic Information Systems (GIS) with dynamic models for predicting sediment transport. 10
3. Discuss the limitations of the Universal Soil Loss Equation (USLE) and how stochastic models can address some of these limitations. 10
4. Explain the principles of agroforestry systems. How does it help in mitigating wind erosion. 10
5. Derive the equation for overland flow velocity using the Manning's equation. Discuss its applicability in different types of terrains. 10
6. Using a case study, demonstrate the calculation of the volume of earth required to construct contour bunds over a specified area. Include all necessary steps and assumptions. 10
7. Discuss different types of sampling methods for sediment measurement. 10
8. Design a suitable profile for a chute spillway with the following data: 10

   Spillway Crest Level = 200 m

   Level of bottom flank at which the low weir to be constructed = 192 m

   Design discharge= 5000 m^3/s

   Downstream tail water level corresponding to 5000 m^3/s = 103 m

   The spillway length consists of 5 spans of 10 m clear width each. The thickness of each spillway pier may be assumed as 3 m. Assume any other required data.