KUMARAGURU
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M. E / M. Tech DEGREE EXAMINATIONS: NOV /DEC 2024

(Regulation 2024)

First Semester

ENVIRONMENTAL ENGINEERING

24ENI502: Environmental Quality Modelling

COURSE OUTCOMES

CO1: Understand the theoretical basis for environmental modelling.

CO2: Analyze environmental data to solve environmental models using mathematical methods and techniques.

CO3: Develop and interpret models for predicting environmental quality.

CO4: Apply models to real-world environmental problems.

Time: Three Hours   **Maximum Marks: 100**

PART A (4*20 = 80 Marks)

1.	a)	Explain the concept of system thinking in environmental modelling and its importance in addressing complex environmental issues.	10	CO1	[K₂]
	b)	Differentiate between deterministic and stochastic models in environmental studies with appropriate examples that support your viewpoints.	10	CO1	[K₂]
2.	a)	Consider turbulence in the river flow transports particles or contaminants in the same direction as the flow. The transport phenomenon used here can be advection or diffusion. Justify your answer.	7	CO2	[K₃]
	b)	Consider turbulence generated by the air flow that carries particles or contaminants throughout the river's depth. The transport phenomenon used here can be advection or diffusion. Justify your answer.	7	CO2	[K₃]
	c)	When Freshwater from inland flows towards the coastal boundary, can it be considered as seawater intrusion? Please provide justification from your point of view.	6	CO2	[K₃]
3.	a)	Outline the procedural process involved in model development.	10	CO3	[K₂]
	b)	What are performance indicators and how are they used to evaluate the effectiveness of a model? Provide examples of performance indicators commonly used in air and water quality models.	10	CO3	[K₂]

4. a) You are required to create a water quality model for Cauvery River that specifically measures the dissolved oxygen levels. Explain the variables that you will consider as independent and dependent variables for the model that you develop.   10   CO4   [K$_4$]

Scenario: River of depth 0.1 m and a width of 0.2km flows in a urban area. You are required to simulate the flow of the river.

b) Based on the above scenario, state whether you will incorporate atmospheric interaction into the modelling procedure? Justify the rationale for the decision you have chosen to either incorporate or ignore the atmospheric interaction in the model.   10   CO4   [K$_4$]

Answer any ONE Question
PART B (1*20 = 20 Marks)

5. a) An agricultural region has experienced a significant drop in the quality of its groundwater, likely due to pesticide and fertilizer leaching. The local authorities want to predict the extent of contamination and develop a management plan. Using a groundwater contamination model, explain how you would assess the movement of contaminants through the aquifer. What factors would you consider in the model (e.g., soil permeability, water table levels, recharge rates)? Discuss the statistical tools and numerical methods you would use for data analysis and model validation.   10   CO4   [K$_4$]

b) Discuss the role of meteorological models in simulating pollutant dispersion in the atmosphere. How do factors such as wind speed, temperature, and atmospheric stability influence the dispersion of air pollutants? What are the advantages and limitations of using Gaussian dispersion models for predicting air quality in urban environments?   10   CO2   [K$_3$]

OR

6. a) Explain Ecosystem Models. How do ecosystem models incorporate biodiversity and state why is it important to consider species distribution while modelling ecosystem.   10   CO3   [K$_2$]

b) What are spatio-temporal models, and how do they differ from static models in environmental science? Explain how spatio-temporal models can be used to predict the spread of pollutants or changes in ecosystems over both space   5   CO1   [K$_2$]

and time. What are the challenges in applying these models, and how do they help inform environmental management strategies?

c)   Explain the importance of model validation in environmental modeling.   5   CO1   [K$_2$]

Discuss the importance of data preprocessing in environmental modeling.

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