

KATHMANDU UNIVERSITY
End Semester Examination [C]
June, 2018

Marks Scored:

Level : B. Tech.

Year : IV

Exam Roll No. :

Time: 30 mins.

Course : ENVS 404

Semester : I

F. M. : 10

Registration No.:

Date JUN 13 2018

SECTION "A"
[20 Q. × 1 = 20 marks]

Select the correct answer from the given choices. Attempt all the questions.

1. What of the following is the best application of predictive modeling?
(a) cost estimation (b) extrapolate results to other situations
(c) quantify expected results (d) site-specific kinetic parameter estimation
2. Which of the following can be used to compare the effects of two alternative theories in the future scenarios?
(a) stochastic model (b) functional model
(c) predictive model (d) mechanistic model
3. If a model shows that there is 40% probability that rainfall will increase by 20 to 30% tomorrow, what is the type of the model?
(a) qualitative deterministic (b) qualitative stochastic
(c) quantitative deterministic (d) quantitative stochastic
4. Which of the following can be used to explain why the rain is falling every evening this week?
(a) statistical (b) functional (c) mechanistic (d) static input
5. What contains a list of the main hypotheses and assumptions that constitute the model?
(a) conceptual model (b) mathematical model
(c) computer model (d) numerical model
6. Which type of model is best suited to model the hydrology of a small catchment with significant variation in land-use?
(a) conceptual (b) lumped (c) distributed (d) linear
7. Which of the following is generally solved in lumped modeling?
(a) ODE (b) PDE (c) difference equation (d) algebraic
8. The initial evaluation of a model may be carried out by:
(a) uncertainty analysis (b) graphical time series analysis
(c) sensitivity analysis (d) bias analysis
9. Out of the following processes, which one is the most deductive and deterministic in nature?
(a) electrical (b) economic (c) ecological (d) social
10. In an environmental system with the concentration of a pollutant undergoing a first-order reaction, the reaction rate constant is 0.2/min, and the initial concentration is 100 mg/L. What is the time taken to drop the concentration to 10 mg/L?
(a) 0.11 (b) 2.3 (c) 9.2 (d) 10
11. A model predicts the concentration of a chemical as 3.3 mg/L but the analytical result shows the concentration to be 4.4 mg/L. What is the bias of the model in mg/L?
(a) -1.1 (b) 1.1 (c) 0.33 (d) 1.33

12. The coupling of ocean and atmosphere is found in:
(a) EBM (b) regional model (c) GCM (d) urban model
13. Which one of the following models is derived from Saint-Venant equation?
(a) Green-Ampt (b) Tank (c) TOPMODEL (d) kinematic wave
14. If the storage constant of a linear reservoir is 2.3 hr, and the flow rate is $2.5 \text{ m}^3/\text{s}$, what is the storage of the reservoir?
(a) 4.8 m^3 (b) $8282 \text{ m}^3/\text{s}$ (c) $5.75 \text{ m}^3/\text{s}$ (d) 20700 m^3
15. If the effective saturation of soil layer is 0.3, and its effective porosity is 0.5, find the change in the moisture content when a wetting front passes during infiltration.
(a) 0.35 (b) 1.4 (c) 0.6 (d) 0.15
16. Which one of the following models is best suited for distributed modeling of infiltration in unsaturated soil?
(a) Green Ampt (b) Richard's equation
(c) Darcy's equation (d) Tank model
17. According to Fick's First Law, the molar rate of transport by diffusion is directly proportional to:
(a) temperature (b) concentration gradient
(c) concentration (d) temperature gradient
18. Fugacity is related to:
(a) concentration (b) concentration gradient
(c) volume (d) specific volume
19. In river modeling, Streeter-Phelps model assumes that an input flows along the river as:
(a) completely mixed flow (b) plug flow
(c) turbulent flow (d) laminar flow
20. Which of the following models will be suitable for modeling a wastewater treatment system for a suburban area having three lagoons in series?
(a) plug flow reactor model (b) CSTR model
(c) batch reactor model (d) TOPMODEL

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Time : 2 hrs. 30 mins.

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SECTION "B"

Answer ALL the questions. The data or information not given in the questions should be assumed properly.

1. You are assigned to develop an integrated modeling system to assess the environmental impact of an industry to air and water pollution. Answer the following:
 - (a) What are the steps that you will employ to develop the modeling system? [3]
 - (b) What will be the inputs to the modeling system? [2]
 - (c) Explain the validation step for the modeling system. [2]
 - (d) How will you evaluate the modeling system? [3]
2. Explain the importance of advective-dispersive transport modeling with first-order decay in environmental modeling. How do you solve this model numerically? [3+3]
3.
 - (a) What are the different spatial scales of atmospheric motion? [3]
 - (b) How are energy balance models used in climate modeling? [3]
4. How are the conceptual models and physics-based models applied in hydrological modeling of large river basins? [3+3]
5. A reservoir of volume $4.33 \times 10^6 \text{ m}^3$ is receiving a flow of $3 \text{ m}^3/\text{s}$. An incoming contaminant has a load of 430 kg/day . The contaminant is decaying at the rate of $0.9/\text{yr}$.
 - (a) Calculate the steady-state concentration of the contaminant in the reservoir. [5]
 - (b) How can you use a multimedia model in this scenario? [3]
6. A city is facing air pollution problem due to the pollutant entering from outside area as well as the emission from various sources like vehicles and industries inside the city. The city is 30 km long, 15 km wide, and the mixing height is 500 m . Air blowing into the city at the rate of 5 m/s is bringing the pollutant having concentration of $100 \mu\text{g}/\text{m}^3$. The flux of the emission of the same pollutant inside the city is $80 \mu\text{g}/\text{m}^2\text{s}$.
 - (a) What is the expected concentration of the pollutant in the city? Use a box model. [3]
 - (b) Derive the box model equation. [3]
7. A food industry emits $350 \text{ grams per second}$ of particulate matter from a chimney with the height of 55 m . If the wind speed is 3.8 m/s , and dispersion parameters are $\sigma_y = 202 \text{ m}$ and $\sigma_z = 56 \text{ m}$ at 2 km downwind, find the particulate matter concentration at ground level 2 km downwind from the source at the plume centerline. [5]
8. In a wastewater treatment system, two CSTRs are kept in series. The hydraulic residence times of the two reactors are 4 days and 12 days respectively. What is the percentage reduction of a pollutant that can be obtained by this system if the rate constants for the decaying reactions in the two reactors are $1.4/\text{day}$ and $0.5/\text{day}$? [5]
9. Explain any computer program-based function to visualize two-dimensional environmental data by showing the parameters required to implement the function. [3]

