

Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Level : B. Tech.

Year : IV

Course : ENV5 404

Semester : I

Exam Roll No. :

Time : 30 mins.

F. M. : 20

Registration No. :

Date : APR 07 2017

SECTION "A"

[20 Q. × 1 = 20 marks]

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

1. What is the type of the model in which there is only 15% chance that the temperature of a city will decrease by 10 °C within one week?
a) quantitative stochastic b) qualitative stochastic
c) qualitative deterministic d) quantitative deterministic
2. A modeler has developed a model to simulate the effect of climate change on lakes in Nepal, which is then successfully used in India and Bhutan. What kind of model is this?
a) functional b) predictive c) descriptive d) mechanistic
3. If you want to find out why the road dust is deteriorating the health of people in a country, which type of model will be the most suitable?
a) statistical b) neural network c) mechanistic d) predictive
4. Which of the following is a step during the conversion of a conceptual hydrological model into a computer model?
a) ask the user to provide the rainfall data
b) ask the experts to assess the land-surface conditions of the area
c) ask the local people to use the forecast of the model
d) ask the policymakers to use the model in watershed management
5. In an air quality model, the simulated PM₁₀ was found to be 0.75 but the observed PM₁₀ was 0.74 (using the same units). What is the bias of the model result in the same unit?
a) 0.0001 b) 0.005 c) 0.0149 d) 0.01
6. If the maximum and minimum output values from the range of the input value used in a model are 350 and 55 respectively, what is the sensitivity index?
a) 5.36 b) 6.36 c) 0.84 d) 295.0
7. Which of the following is used to find the association between the observed and modeled data?
a) bias b) root mean squared error
c) mean difference d) correlation coefficient
8. Which of the following is mostly used to solve stiff ODEs?
a) ode 15 b) ode 15s c) ode 45 d) ode 45s
9. The ambient air quality standard for TSP was 75 µg/m³ annual average in 1971. In 1970, one station showed its value as 190 µg/m³. The background concentration was estimated as 20 µg/m³. By what percentage would the emission rate of particulates have to be reduced below the 1970 level in order to meet the 1971 ambient air quality standard?
a) 67.6 b) 147.8 c) 209.1 d) 309.1

10. A plant is emitting 100 g/s of a pollutant and the wind is blowing at 3 m/s. What is the ground-level concentrations in $\mu\text{g}/\text{m}^3$ directly below the centerline of the plume at distance of 0.2 km downwind? Take the value of cu/Q as $1.7 \times 10^{-6}/\text{m}^2$ at this point, where c is the concentration, u is the wind speed and Q is the rate of pollutant emission.
- a) 0.006 b) 0.051 c) 56.67 d) 510.0
11. Which of the following MATLAB commands is used to generate 2-D grid coordinates?
- a) subplot b) meshgrid c) array d) linspace
12. Which of the following GRASS GIS commands will you use to find the basin area?
- a) watershed b) mapcalc c) gdal d) report
13. What does not necessarily have to actually simulate the physical processes that it is representing to be a realistic representation of these term?
- a) latitude b) mass conservation
c) parameterization d) stoichiometry
14. A rectangular channel is 200 feet wide. If the depth of the flow at a point is 2.89 ft and the flow rate is 5000 cfs, what is the water velocity in ft/s?
- a) 0.1156 b) 8.65 c) 72.25 d) 346020.8
15. What can be the unit of saturated conductivity?
- a) m/s b) m^3/s c) kg/m^3 d) kg/m
16. When water is percolating through a fine sand aquifer (having porosity of 0.4) with the Darcy flux of 0.086 m/day. What is the travel time, in days, of the water to a stream that is 100 m away?
- a) 3.44 b) 21.5 c) 465.1 d) 2906.9
17. During infiltration into a silt loam soil that initially had an effective saturation of 30 percent, determine the change in the moisture content when the wetting front passes. The effective porosity of the soil is 0.486.
- a) 0.146 b) 0.154 c) 0.340 d) 1.44
18. Where can you incorporate the Monod's model?
- a) mass balancing b) energy conservation
c) momentum conservation d) cost optimization
19. In reactor models used in environmental technologies, what can be achieved by increasing the number of continuously stirred tank reactors?
- a) cost is reduced
b) process becomes less complex
c) less construction materials can be used
d) increases the performance to meet the treatment objectives
20. Which of the following models is mostly used for simulating the activated sludge pretreatment system?
- a) plug flow reactor model b) completely mixed flow reactor
c) Streeter-Phelp model d) fugacity model

Level : B. Tech.
Year : IV
Time : 2 hrs. 30 mins.

Course : ENVS 404
Semester : I
F. M. : 55

SECTION "B"

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

1. Select a model used in environmental assessments and answer the following:
 - a) How is the model classified according to the outputs, inputs, scope and application of its hypotheses? [4]
 - b) How do you evaluate the response of the model to the changing initial conditions? [2]
 - c) Explain the calibration and validation of the model. [3]
2. How do you use finite difference method to solve the one-dimensional advection equation with a constant velocity, $u = 1$. If it is used to describe the movement of a homogeneous plume with concentration $c(x, t)$ initially given by square wave where $c(x, 0) = 1$ for $1 \leq x \leq 2$ and $c(x, 0) = 0$ for $x < 1$ and $2 < x$, show the solution to this problem graphically. [4+2]
3. Describe the main components of an atmospheric or climate model. What kind of vertical coordinate systems can be used in such models? [4+2]
4. Show that the linear reservoir model is a special case of the lumped general hydrologic system model. What will be the response of the linear system to impulse inputs? [4+3]
5. What is the importance of Richard's model in environmental models? Why is van Genuchten formulation used in this model? [3+3]
6. A contaminant is emitted at a rate of $310 \mu\text{g m}^{-2} \text{h}^{-1}$ in a Nepalese city. If its background concentration is $2.1 \mu\text{g/m}^3$, calculate its steady-state concentration over a city whose average wind speed is 2.7 m/s . The size of the city is $110 \times 160 \text{ km}$ and the mixing height is 1300 m . [3]
7. A coal-fired industry emits 350 g/s SO_2 from a stack with height of 60 m . Plume rise is 20 m . Wind speed at the effective emission height is 5 m/s . The weather is overcast.
 - a) Calculate the SO_2 concentration at ground level 1.5 km downwind from the source at the plume centerline, and at 100 m lateral distance from the plume centerline. Take the horizontal and vertical dispersion parameters, σ_y and σ_z as 130 m and 62 m respectively. [4+2]
 - b) Compare the values with the 24-h ambient air quality standard of 0.14 ppm by assuming the standard temperature and pressure. [2]
8. Provide a specific example of the application of GIS-based processing in environmental modeling. List and define three GIS commands that can be used in the example. [2+3]
9. Describe the applications of the following models: [5×1]
 - a) Plume model
 - b) Monod model
 - c) Plug Flow Reactor model
 - d) Fugacity model
 - e) Kinematic wave model

