KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.E.
Year : III
Course : CHEG 305
Semester : II

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date 26 NOV 2023

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option.

1. If you are asked to find the optimal input variables for obtaining a desired output, what is this problem known as?
   a. design problem
   b. simulation problem
   c. rating problem
   d. dynamic problem

2. What type of simulation is used to train plant operators to quickly respond to the changing behavior of the system and take appropriate actions?
   a. stochastic
   b. dynamic
   c. static
   d. lumped

3. What type of model would you use to solve a momentum balance equation in the case of steady state and 3D?
   a. Fick's
   b. CFD
   c. ANN
   d. dispersed-phase

4. For process modifications, you may require simulation to test and add a new equipment. What type of system is used for repeated simulation of your designs?
   a. linear computing
   b. static computing
   c. stochastic computing
   d. parallel computing

5. What model is used to immediately simulate the spread of fire in an industrial accident?
   a. dispersion
   b. CFD
   c. ANN
   d. static 3D

6. Which one of the following is a stochastic and discrete-event model?
   a. diffusion
   b. advection
   c. population balance
   d. PFR

7. In Peng-Robinson EOS, what does the largest real root correspond to?
   a. gas phase
   b. liquid phase
   c. catalytic reaction
   d. interphase transport

8. Which one of the following is applicable only in the absence of convection?
   a. CFD
   b. advection
   c. Fick's law
   d. Navier-Stokes

9. In heat transfer, what do you use to provide boundary conditions of the second kind?
   a. Fick's law
   b. Fourier's law
   c. temperature
   d. heat transfer coefficient

10. What is the most suitable model to design a stirred-tank reactor?
    a. lumped
    b. probabilistic
    c. distributed
    d. static

11. In Eulerian-Lagrangian model, dispersed units are modeled as:

12. What does not change during chemical reaction in the dispersed phase of a population balance model?
a. number of units b. size of units c. temperature d. density

13. Which one of the following model depicts the nanoparticle formation in emulsions?
a. CSTR b. population balance
c. CFD d. empirical

14. The process of adjusting the weights of the ANN is known as:
a. activation b. overfitting c. underfitting d. learning

15. The output of an ANN is kept within the required limit by using:
a. bias b. sigmoid
c. sum of square of errors d. weight matrix

16. Which one of the following is a black-box model?
a. ANN b. CFD c. Fick's law d. CSTR

17. What can be used to describe random variation in the input parameters in a model?
a. ANOVA
b. normal distribution function
c. average relative variance
d. integral of the absolute value of the error

18. In process monitoring and control, what type of model evaluation would be most necessary?
a. dynamic b. static c. stochastic d. linear

19. If the output variability is to be calculated around a nominal value of input in sensitivity analysis, what type of analysis do we use?
a. FAST b. Monte Carlo c. local d. global

20. What is used as sensitivity indices in local context?
a. total derivative b. substantial derivative
c. second-order derivative d. partial derivative

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Level : B.E.
Year : III
Time : 2 hrs. 30 mins.

Course : CHEG 305
Semester : II
F.M. : 40

SECTION "B"
[8Q × 5 = 40 marks]

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

1. Provide three real-world examples of static models used in different industrial and chemical engineering processes. When do you need to substitute these models with dynamic models? [3+2]

2. There is a model being used in an industry for simulation of reactors in series. You are asked to evaluate the performance of the model and report any limitations of the model. What procedure would you apply for this? [5]

3. A chemical plant is emitting 0.332 kg/s of VOC from an exhaust that is 45 m above ground-level. Due to the gas velocity, the plume is rising 6 m vertically. The weather station reports that the wind is blowing at 4.4 m/s. What will be the concentration of the emitted VOC that affects people walking in the nearby road, which is downwind from the source at the center-line if the horizontal and vertical dispersion parameters are 200 m and 150 m respectively? [5]

4. Construct any CFD equation using numerical method. Then discuss the importance of stability and Courant condition in CFD simulations in Chemical Engineering. [3+2]

5. What kind of model is a CSTR? How does it differ from the model of a tubular reactor? [3+2]

6. Differentiate between dispersed-phase vector and continuous-phase vector. How can you change the number and size of dispersed phase? [2+3]

7. How can process simulators be useful for ANN model development? What is a back propagation algorithm? [2+3]

8. How do you use integral of the absolute value of the error to validate models? How do you obtain sensitivity equations? [3+2]