Program: BE Chemical Engineering
Curriculum Scheme: Revised 2016
Examination: Final Year Semester VIII
Course Code: CHC801 and Course Name: Modelling, Simulation & Optimization
Time: 1 hour
Max Marks:50

1   Empirical Models can be used for?
(a)   System which are simple
(b)   System which is understood
(c)   System which are highly complex
(d)   System have one independent variable
2   Theoretical Modelling is based on?
(a)   Chemistry & Physics of Process
(b)   Experiments data
(c)   Rigorous data
(d)   Simulation
3   Empirical Modelling is basically derived using?
(a)   Conservation Equations
(b)   Experimental data
(c)   Chemistry & Physics of Process
(d)   Simulation
4   For Complex model which modelling technique is not mostly preferred?
(a)   Empirical Modelling
(b)   Theoretical Modelling
(c)   Variable Modelling
(d)   Parameter Modelling
5   Parameter estimation on model development using regression is based on?
(a)   Maximisation of difference between model predictions and data.
(b)   Model predictions are varying exponential as data calculated.
(c)   Minimisation of difference between model predictions and data.
(d)   Model predictions are square of the data.
6   Equation of motion is
(a)   Conservation of mass
(b)   Conservation of energy
(c)   Conservation of momentum
(d)   Component continuity equation
7   The model equation describe chemical kinetics
(a)   Law of mass action
(b)   Raoult's law
(c)   Daltons's law
(d)   Phase equilibrium relations
8   Which model follows the changes over time that results from the system activities
(a)   Dynamic model
(b)   Static model
(c)   Analytical model
(d)   Numerical model
9   Mathematical models are based on
(a)   Analogy between such systems are mechanical and electrical
(b)   Mathematical equations to represent the system
(c)   Analysis
(d)   Numerical methods
10   Which model based on physical and chemical laws, thermodynamics, chemical reaction, kinetics are frequently employed in optimization application
(a)   Process model
(b)   Mathematical model
(c)   Empirical model
(d)   Linear model

Which model can be devised to correlate input output data without any physiochemical analysis of

11 the process
(a)   Linear model
(b)   Process model
(c)   Mathematical model
(d)   Empirical model

Which type of mathematical model takes into account detailed variations in behavior from point to
12 point throughout the system?
(a)   Distributed parameter model
(b)   Lumped parameter model
(c)   Steady state model
(d)   Unsteady state model

13 The process of proving that a mathematical model describes the real world situation is known as :
(a)   Tearing
(b)   Optimization
(c)   Verification
(d)   Initialization

In a perfectly insulated well stirred tank a hot liquid stream at 60 deg C is mixed with a cold stream at 10 deg C .The well mixed assumption means that the fluid temperature in the tank is uniform and equal to the temperature at the exit from tanl. This is an example of _____parameter
14 system
(a)   Distributed
(b)   Lumped
(c)   Unsteady state
(d)   Non Linear

15 What is a Process Model?
(a)   It is a set of equations that allows us to predict the behavior of a chemical process system
(b)   It describes processes in flow diagrams where unit operations are positioned and connected by product streams
(c)   It is number of independent variables whose value must be assigned to obtain the values of other variables and to completely define the system.
(d)   It is the discipline of adjusting a process so as to optimize some specified set of parameters without violating some constraint

16 . Antoine model is applicable for which of the following cases?
(a)   High Pressure System
(b)   Low Pressure System that behaves ideally
(c)   High Pressure System that behaves ideally
(d)   Low Pressure System

17   For a system to be exactly specified
(a)   No of equations=no of unknown variables
(b)   No of equations< no of unknown variables
(c)   No of equations > no of unknown variables
(d)   No of equations < no of all variable present

For a CSTR with cooling jacket, the model used with breakup of the jacket volume into number of
18 perfectly mixed lumps is_____
(a)   Plug flow cooling jacket
(b)   Lumped jacket model
(c)   Perfectly mixed cooling jacket
(d)   Isothermal CSTR model

For a CSTR with perfectly mixed cooling jacket with temp Tj. The temperature inside the reactor is T. U is overall heat transfer coefficient and A is area of heat transfer. What is the model equation to
19 find heat transfer rate
(a) $Q=UA(T_j-T)$
(b) $Q=UA(T-T_j)$
(c) $Q=UA(T+T_j)$
(d) $Q=UA/(T-T_j$

20   According to phase rule, Degree of freedom analysis is done by
(a) $F = C - P$

(b)   F = C - P + 1
(c)   F = C - P + 2
(d)   F = P - C + 1

21   For "n" component flash operation Degree of freedom is
(a)   0
(b)   1
(c)   2
(d)   3

22   Recovery of a component in multi-component flash is defined as a ratio of:
(a)   Amount of component in Liquid phase to that in Gas phase
(b)   Amount of component in Gas phase to that in Feed
(c)   Amount of component in Gas phase to that in Liquid phase
(d)   Amount of component in Liquid phase to that in Feed

23   For multi-component flash system, ratio of relative volatility to average relative volatility is given by

(a) P_k^0 / P

(b) P_n^0 / P

(c) P / P_k^0

(d) P_k^0 / P_n^0

24   For a system of isothermal CSTR in series having a compressible fluid and constant hold-up, which of the following variable is not a function of time
(a)   Flow-rate
(b)   Volume of tank
(c)   Concentration
(d)   Density

25   For a system of isothermal CSTR in series with constant hold-up having a reaction, which of the following is not a forcing function:
(a)   Concentration of un-reacted A leaving first tank
(b)   Feed flow rate
(c)   Concentration of reactant A in the feed
(d)   Concentration of B in the feed

26   In comparison to 3 isothermal CSTR in series with constant holdup, which fundamental equation is needed to solve a system of 3 isothermal CSTR in series with variable hold-up:
(a)   Energy equation
(b)   Component continuity equation
(c)   Equation of state
(d)   Continuity equation

27   Which equation is used to solve multi-component flash systems?
(a)   Ergun's Equation
(b)   Bernoulli's Equation
(c)   Rashford-Rice Equation
(d)   Gibbs-Duhem Equation

28   For a mathematical model consisting of five equations to be solved there should be five :
(a)   Parameters
(b)   Forcing functions
(c)   Independent variables
(d)   Dependent variables

29   In thermal equilibrium model for LPG vaporizer
(a)   Vapour and liquid temperatures are equal
(b)   Vapour temperature is higher than liquid temperature
(c)   Liquid temperature is higher than vapour temperature
(d)   The temperature is always below $-100^0 C$

30   In models where mass transfer effects have to be considered, the units of mass transfer coefficient are :
(a)   Area per time
(b)   Length per time
(c)   Volume per time

(d)   Velocity per time
. In _____ problem of heat exchanger, size and configuration is known but heat duty is unknown :
31
(a)   design
(b)   synthesis
(c)   rating
(d)   construction
32   In _____ problem of heat exchanger, heat duty is known but area is unknown.
(a)   design
(b)   synthesis
(c)   rating
(d)   construction
33   In stream tearing if row k dominates row l then :
(a)   Add row l
(b)   Add row k
(c)   Delete row l
(d)   Delete row k
34   In stream tearing if column k dominates column j then :
(a)   Delete column j
(b)   Delete column k
(c)   Add column j
(d)   Add column k
       In flowsheet partitioning, groups of units which must be solved together are called _____
35   groups.
(a)   reducible
(b)   irreducible
(c)   irrelevant
(d)   redundant
       In Sequential Modular approach of simulation, _____ is required because of loops of information
36   created by recycle streams.
(a)   partitioning
(b)   precedence ordering
(c)   tearing
(d)   mixing
       In Equation-Oriented approach of simulation, _____ for the set of unknown variables is
37   very important.
(a)   initialization
(b)   normalization
(c)   minimization
(d)   maximization
       Precedence ordering is used to partition the set of equations into a sequence of smaller sets of
38   _____ equations
(a)   reducible
(b)   redundant
(c)   irrelevant
(d)   irreducible
39   represents some aspects of the real world by numbers or symbols.
(a)   Process simulation
(b)   Process control
(c)   Optimization
(d)   Process intensification
40   Which algorithm is used to find the partitions and precedence ordering in a flow sheet?
(a)   Newton method algorithm
(b)   Armijo line search
(c)   Sargent and Westerberg algorithm
(d)   Broyden method algorithm
41   BTA method is used for :
(a)   Determination of partitions in flow sheets
(b)   Determination of tear streams in flow sheets

(c)   Determination of modules in flow sheets
(d)   Determination of precedence ordering in flow sheets
42   In Equation-Oriented approach of simulation storage requirement is :
(a)   Very low
(b)   Low
(c)   Zero
(d)   High
        The identification of recycle loops and methodical separation of the flowsheet into groups of process
43   units required to be solved collectively is known as
(a)   Partitioning
(b)   Tearing
(c)   Topology
(d)   Ordering
44   is the first step for solving the material balance of a flow sheet.
(a)   Recycling
(b)   Tearing
(c)   Partitioning
(d)   Precedence ordering
        In direct substitution method, the necessary and sufficient condition for convergence is that the
45   maximum eigen value should be :
(a)   Greater than 1
(b)   Less than 1
(c)   Less than 0
(d)   Equal to 1
46   Wegstein method is used for :
(a)   Numerical integration
(b)   Solution of linear algebraic equations
(c)   Solution of non-linear algebraic equations
(d)   Solution of ordinary differential equations
47   The steepest descent method has a _____ rate of convergence :
(a)   linear
(b)   quadratic
(c)   cubic
(d)   logarithmic
48   In Levenberg-Marquardt method if λ =0 then the method reduces to the:
(a)   Secant method
(b)   Steepest descent method
(c)   Direct substitution method
(d)   Newton's method
49   The search direction p^k in Newton's method is given by the equation :
(a) $p^k = -(J^k)^{-1} f(x^k)$
(b) $p^k = +(J^k)^{-1} f(x^k)$
(c) $p^k = -(J^k)^T f(x^k)$
(d) $p^k = +(J^k)^T f(x^k)$
        If the starting point is poor then which of the following is used with Newton's method to solve
50   nonlinear algebraic equations?
(a)   Trapezoidal rule
(b)   Cramer's rule
(c)   Armijo line search
(d)   Runge-Kutta method
51   Which of the following is not used to solve nonlinear algebraic equations?
(a)   Secant method
(b)   Bisection method
(c)   Successive substitution method
(d)   Cramer's rule
        In direct substitution method the speed of convergence will be highest when the maximum eigen
52   value is :
(a)   0.99

(b) 0.5
(c) Close to zero
(d) 0.75

53 In Levenberg-Marquardt method, the value of the parameter that adjusts the direction and length of the step is :
(a) -0.25
(b) -0.5
(c) -1
(d) Non-negative

54 The search direction in Newton's method for solving nonlinear algebraic equations involves calculation of :
(a) Hessian matrix
(b) Inverse of Hessian matrix
(c) Inverse of Jacobian matrix
(d) Transpose of Hessian matrix

55 In Newton's method for solving non-linear algebraic equations the rate of convergence is :
(a) Linear
(b) Very Slow
(c) Slow
(d) Fast (Quadratic)

56 Which of the following statements is true for Secant method?
(a) It has quadratic rate of convergence
(b) It can be used to solve nonlinear algebraic equations
(c) It cannot be used to solve nonlinear algebraic equations
(d) It is used for numerical integration

57 Which method for solving nonlinear algebraic equations requires calculation of derivatives?
(a) Direct substitution method
(b) Secant method
(c) Bisection method
(d) Newton's method

58 Which of the following is NOT required for using Newton's method for optimization?
(a) The lower bound for search region.
(b) Twice differentiable optimization function.
(c) The function to be optimized.
(d) A good initial estimate that is reasonably close to the optimal.

59 Which of the following statements is INCORRECT?
(a) if the second derivative at x_i is negative, then x_i is a maximum.
(b) If the first derivative at x_i is zero, then x_i is an optimum.
(c) If x_i is a minimum, then the second derivative at x_i is positive
(d) The value of the function can be positive or negative as any optima.

60 For what value of x, is the function x^2 -2x-6 minimized?
(a) 0
(b) 1
(c) 5
(d) 3

61 The Newton Raphson Method fails when?
(a) Jacobian is singular
(b) Derivative is finite
(c) Jacobian is finite
(d) Jacobian is skew symmetric

62 The maxima can be located by using the condition?
(a) Second derivative positive
(b) First derivative negative
(c) Second Derivative negative
(d) First Derivative equals second derivative

63 The first order Kuhn Tucker should follow these necessary conditions for optimality?
(a) First derivative of Langarange polynomial should be zero
(b) First derivative of Langarange polynomial should be positive

(c)   First derivative should be negative infinite
(d)   First derivative should not exist
64   The first order Kuhn Tucker should follow these necessary conditions for optimality?
(a)   The constraint multipliers should not be negative
(b)   The constraint multipliers square should be positive
(c)   The constraint multipliers should have negative finite value
(d)   The constraint multipliers not depends on function
65   The Newton's method is convergence in what order?
(a)   Quadratic
(b)   Linearly
(c)   Exponential
(d)   Half
66   In Quasi Newton Method the double derivative of the function is approximated by?
(a)   Slope using first order derivative.
(b)   Hessian matrix
(c)   Jacobi Matrix
(d)   Finite difference
67   In which method the search for optimal solution is located with help of vertices of triangle?
(a)   Simplex Method
(b)   Conjugate Search Method
(c)   Newton Method
(d)   Quasi Newton Method
68   Cubic Interpolation method comes under which method?
(a)   Polynomial Approximation method
(b)   Gradient Search Method
(c)   Random Search
(d)   Quasi Search
69   The feasible region for the inequality constraints with respect to equality constraints _____
(a)   Increases
(b)   Decreases
(c)   Does not change
(d)   Slightly changes
70   The degree of freedom for an optimization problem that has four design variables is,
(a)   9
(b)   4
(c)   16
(d)   2
71   While solving a linear graphically the area bounded by the constraints is called
(a)   Feasible region
(b)   Infeasible region
(c)   Unbounded solution
(d)   Bounded Solution
72   If f(x) is continuous at every point in region R then f(x) is said to be ---------- throughout R
(a)   Continuous
(b)   Discontinuous
(c)   Optimum
(d)   Continuously integrable
      Which of the following functions first derivatives are continuous at the break point during
73   interpolation
(a)   Continuous
(b)   Discontinuous
(c)   Splines
(d)   Discrete
74   If feasible region F is empty then the problem is
(a)   Infeasible
(b)   Feasible
(c)   Bounded
(d)   Unbounded
75   In Newtons method if $f''(x) \to 0$ then method converges-------

(a) Slowly
(b) Faster
(c) Moderately
(d) fails

76 The negative gradient of f(x) is the direction that maximizes the rate of change of f(x) in moving towards the -----.
(a) Minimum
(b) Maximum
(c) Zero
(d) Local maximum

77 Which of the following methods is used for optimization?
(a) Armijo Line Search
(b) Gradient Method
(c) Cramer's Rule
(d) Direct Substitution Method

78 Optimization problems that have nonlinear objective and/or constraint functions of the problem variables are referred to as :
(a) Nonlinear programs
(b) Linear programs
(c) Kuhn Tucker conditions
(d) Lagrange multipliers

79 In nonlinear programming problem, the constraints create a region for the variables x which is termed the :
(a) Invalid region
(b) Forbidden region
(c) Feasible region
(d) Boundary region