Mathematical Methods in Chemical Engineering

CH 803: Elective XI

Id	**1**
Question	If ‘A’ is rate of accumulation, ‘I’ is rate of input, ‘O’ is rate of output, ‘G’ is rate of generation and ‘D’ is rate of depletion, which equation holds true for conservation principle of mass?
A	A=I+O+G+D
B	A=I–G+O+D
C	A=I–D+G–O
D	A=I–G–O+D

Id	2
Question	Mathematical models dealing with biochemical reactions usually don’t involve
A	Algebraic equations
B	Ordinary differential equations
C	Quadratic equations
D	Partial differential equations

Id	**3**
Question	When accumulation in process is zero, it is termed as
A	Steady state process
B	Unsteady state process
C	Dynamic process
D	Linear process

Id	**4**
Question	Ordinary differential equations are usually solved by
A	Numerical methods
B	Converting ODE into set of PDEs
C	Finding general solution
D	Multiple imultaneous equations

Id	5
Question	For system of ‘N’ number of components, total number of continuity equations are
A	N
B	N + 1
C	N – 1
D	2.N + 1

Id	**6**
Question	Thermal conductivity is usually expressed in
A	J/(m.s.K)
B	kcal/(m^2.h.^oC)
C	W/(m.s.K)
D	W/(m^2.s)

Id	**7**
Question	For the tank of volume ‘V’ with input and output volumetric flow rates (VFR) of F_i anf F_o respectively, equation is [(dV/dt)= F_i – F_o]. Following is not true
A	It is state equation
B	‘V’ is state variable
C	‘t’ is independent variable
D	VFR is state variable

Id	**8**
Question	Unit of thermal diffusivity is
A	cm^2/s
B	cm/s^2
C	$kg/cm^2.s$
D	kg/cm^2

Id	**9**
Question	Axial velocity of any specific liquid flow at the center of the pipe is
A	Infinite
B	Finite
C	Zero
D	Constant

Id	**10**
Question	Heat transfer coefficient is expressed by
A	W/(m.s.K)
B	kcal/(m^2.h.^{o}C)
C	W/(m.K)
D	W/(m^2.s)

Id	**11**
Question	Second order reaction rate constant has the units of
A	m^3/(mol.s)
B	mol/(L.s)
C	m^3.mol/s
D	s/(mol.s)

Id	**12**
Question	Unit of mass diffusivity is
A	m^2/s
B	m/s^2
C	$kg/m^2.s$
D	kg/m^2

Id	**13**
Question	When accumulation in process is nonzero, it is termed as
A	Steady state process
B	Unsteady state process
C	Dynamic process
D	Linear process

Id	**14**
Question	For system of ‘N’ number of components, total number of continuity equations are
A	2. N
B	2.N + 1
C	N + 1
D	2.N + 1

Id	**15**
Question	For the conditions given, momentum balance equation is given by: Conditions: ‘A’ is rate of accumulation, ‘I’ is rate of input, ‘O’ is rate of output, ‘F’ is rate of forces acting on volume element
A	A=I+O+F
B	A=I–O–F
C	A=I–O+F
D	A=I+O–F

Id	16
Question	Energy balance equation, when ‘A’ is accumulation, ‘I’ is rate of input, ‘G’ is rate of generation, ‘O’ is rate of output and ‘E’ is rate of expenditure, is given as
A	A=I+G+O–E
B	A=I+G–O–E
C	A=I–G+O–E
D	A=I–G–O+E

Id	**17**
Question	Software MATLAB is used for
A	Determining climatic conditions
B	Solving matrix form equations
C	Predicting monsoon pattern
D	Nuclear fission reaction optimization

Id	**18**
Question	Mass transfer in porous membranes takes place by
A	Conduction
B	Bulk motion
C	Diffusion
D	Convection

Id	**19**
Question	Component continuity equation deals with __________ balance
A	Mass
B	Enthalpy
C	Momentum
D	Mass and Enthalpy

Id	**20**
Question	All mathematical models usually involve
A	Algebraic equations
B	Ordinary differential equations
C	Algebraic and Ordinary differential equations
D	Partial differential equations

Id	**21**
Question	Partial differential equations are usually solved by
A	Numerical method
B	Converting PDE into set of ODEs
C	Converting PDE into set of Algebraic equations
D	System of simultaneous equations

Id	**22**
Question	Van der Waal equation for gases is the example of
A	Dynamic model
B	Linear model
C	Fundamental model
D	Static model

Id	**23**
Question	Meaning of MATLAB
A	Matrix Laboratories
B	Mathematical Laboratories
C	Mathematical and Technological Laboratories
D	Mathematical Testing Laboratories

Id	**24**
Question	Algebraic equation $x^4 - 2x^3 + 4x^2 - 3x - 180 = 0$ has the solution for the value of x as
A	3
B	4
C	6
D	8

Id	**25**
Question	For the system of equations $4x + 5y = 52$ and $5x - 4y = -17$, solutions of the respective values of x and y are
A	7, 6
B	4, 7
C	3, 8
D	6, 4

Id	**26**
Question	Nuclear fission reaction is the example of
A	Dynamic model
B	Empirical model
C	Fundamental model
D	Distributed parameter model

Id	**27**
Question	Polymer reactor system with continuous process without stirring mechanism in which the temperature of liquid is varying represents the system of
A	Distributed parameters
B	Lumped parameters
C	Complex parameters
D	Unified parameters

Id	**28**
Question	Mass balance doesn’t deal with
A	Molecular balance
B	Continuity equation
C	Component continuity equation
D	Momentum balance

Id	29
Question	Pressure at the bottom of tank is the example of
A	Dynamic model
B	Linear model
C	Fundamental model
D	Static model

Id	**30**
Question	Changing height of liquid in the tank due to difference in input and output variable is the case of
A	Pseudo state
B	Correlative state
C	Unsteady state
D	Steady state

Id	**31**
Question	Flow of liquid through valve is given by
A	Linear relationship
B	Non-linear relationship
C	Steady state relationship
D	Parabolic relationship

Id	**32**
Question	Software SCILAB is used for
A	Determining monsoon pattern
B	Extrapolating the impact of COVID 19
C	Performing mathematical operations
D	Determining ambient temperature conditions

Id	**33**
Question	In the algebraic equation $x^3 - 3x^2 + 2x - 24 = 0$, value of ‘x’ is
A	2
B	4
C	6
D	8

Id	**34**
Question	In system of equations 3 x – 4 y = – 14 and 6 y – 4 x = 4, respective values of x and y are
A	6, 8
B	4, 8
C	8, 6
D	8, 12

Id	**35**
Question	CSTR in which the temperature of liquid is uniform, is the system of
A	Distributed parameters
B	Lumped parameters
C	Complex parameters
D	Unified parameters

Id	36
Question	For CSTR system with standard conventions of parameters, following equation is not true
A	$A.(dh/dt) = F_i – F_o$
B	$(\pi.d^2/4).(dh/dt) = F_i – F_o$
C	$(dV/dt) = F_i – F_o$
D	$(\pi.\square.d^2/4).(dh/dt) = F_i – F_o$

Id	**37**
Question	For CSTR system assuming □, C_p and □ constant, overall mass balance equation is
A	$A.(dh/dt) = F_i – F_o$ = finite
B	$(\pi.d^2/4).(dh/dt) = F_i – F_o$ = finite
C	$(dV/dt) = F_i – F_o = 0$
D	(π.□.$d^2/4).(dh/dt) = F_i – F_o = 0$

Id	**38**
Question	For the tank of volume 'V' with input and output volumetric flow rates (VFR) of F_i anf F_o respectively, equation is [(dV/dt)= F_i – F_o]. Following is not true
A	VFR is state variable
B	'V' is state variable
C	't' is independent variable
D	It is state equation

Id	**39**
Question	When fluid is flowing through the pipe at reasonable velocity, axial velocity of liquid flow at the wall of the pipe is
A	Infinite
B	Finite
C	Zero
D	Constant

Id	**40**
Question	In case of conductive heat transfer, heat transfer coefficient is expressed by
A	W/(m.s.K)
B	kcal/(m^2.h.^{o}C)
C	J/(m.s.K)
D	W/(m^2.s)

Id	**41**
Question	Unit of mass diffusivity is
A	cm/s^2
B	cm^2/s
C	$g/cm^2.s$
D	g/cm^2

Id	**42**
Question	Whenever we are developing any mathematical model for any chemical engineering system, it usually involve
A	Algebraic equations
B	Ordinary differential equations
C	Algebraic and Ordinary differential equations
D	Partial differential equations

Id	**43**
Question	In order to solve partial differential equations as a part of mathematical model representing typical chemical engineering system, approach of solution usually involve
A	Converting PDE into set of ODEs
B	Converting PDE into set of Algebraic equations
C	Numerical methods
D	Set of simultaneous equations

Id	**44**
Question	Ideal gas law is the example of
A	Fundamental model
B	Linear model
C	Dynamic model
D	Static model

Id	**45**
Question	Nuclear fusion reaction is the example of
A	Dynamic model
B	Fundamental model
C	Empirical model
D	Distributed parameter model

Id	**46**
Question	Software MATLAB is not used for
A	Determining climatic conditions
B	Solving matrix form equations
C	Plotting 3 dimensional figures
D	Function optimizations

Id	**47**
Questio n	Algebraic equation $2 x^3 + 4 x^2 - 3 x - 81 = 0$ has the solution for the value of x as
A	3
B	4
C	6
D	8

Id	**48**
Question	For the system of equations $5x + 3y = 41$ and $6x - 4y = -4$, solutions of the respective values of x and y are
A	7, 4
B	4, 7
C	3, 6
D	6, 3

Id	**49**
Question	Reactor system without stirrer in which the temperature of liquid is varying represents the system of
A	Distributed parameters
B	Lumped parameters
C	Complex parameters
D	Unified parameters

Id	50
Question	For the bottom of any tank holding liquid, pressure at the bottom is the example of
A	Dynamic model
B	Linear model
C	Fundamental model
D	Static model

Id	**51**
Question	Porous membranes are very commonly used for the separation of different components based on their molecular size. In membrane, diffusion takes place by
A	Convection
B	Bulk motion
C	Diffusion
D	Conduction

Id	**52**
Question	In system of set of 2 equations 2 x – 5 y = – 19 and 3 x – 4 y = – 11, respective values of x and y are
A	6, 8
B	3, 5
C	8, 6
D	5, 3

Id	**53**
Question	In a particular functional CSTR system, stirring mechanism suddenly fails. In case of temperature parameter of the fluid inside the reactor, system representation has changed from --- to ---
A	Distributed parameters to lumped parameters
B	Lumped parameters to distributed parameters
C	Complex parameters to lumped parameters
D	Unified parameters to complex parameters

Id	**54**
Question	Changing volume of liquid in the tank due to difference in input and output flow rate variables is the case of
A	Pseudo state
B	Correlative state
C	Unsteady state
D	Steady state

Id	**55**
Question	Flow of easy liquid through gate valve is given by
A	Linear relationship
B	Non-linear relationship
C	Steady state relationship
D	Parabolic relationship

Id	**56**
Question	Mathematical models dealing with polymerization reactions usually doesn’t involve
A	Algebraic equations
B	Ordinary differential equations
C	Quadratic equations
D	Partial differential equations

Id	**57**
Question	Ordinary differential equations are usually solved by
A	Numerical methods
B	Converting ODE into set of algebraic equation
C	Finding general solution
D	System of simultaneous equations

Id	**58**
Question	Thermal conductivity is usually expressed in
A	W/(m.K)
B	kcal/(m^2.h.^oC)
C	W/(m.s.K)
D	W/(m^2.s)

Id	**59**
Question	Unit of thermal diffusivity is
A	m^2/s
B	m/s^2
C	$kg/m^2.s$
D	kg/m^2

Id	**60**
Question	Second order reaction rate constant has the units of
A	L/(mol.s)
B	Mol/(L.s)
C	L.mol/s
D	s/(mol.s)

Id	**61**
Question	For any reactor system, residence time is represented by
A	F/V
B	V/F
C	F.V
D	V^2/F

Id	**62**
Question	For any given chemical reaction, reaction rate constant ‘k’ and temperature ‘T’ are correlated by Arrhenius rate law which is
A	$k = -\alpha.e^{(-E/RT)}$
B	$k = \alpha.e^{(-E.A/RT)}$
C	$k = \alpha.e^{(E/RT)}$
D	$k = \alpha.e^{(-E/RT)}$

Id	**63**
Question	Tank is having 1.5 m diameter and 2.5 m height. Estimate the time taken in minutes to fill the tank to half level when F_i = 30 LPM and F_o = 12 LPM. Initially tank is empty.
A	246 minute
B	120 minute
C	130 minute
D	123 minute

Id	**64**
Question	For the exothermic reaction A B following 2nd order kinetics, rate of energy added to the reaction volume 'V' is
A	$-2. (\Delta H).k. C_A^2.V$
B	$+ (\Delta H).k. C_A.V$
C	$- (\Delta H).k. C_A^2$
D	$- (\Delta H).k. C_A^2.V$

Id	65
Question	Tank is being filled with 40 LPM rate of water. Calculate the volume of tank filled after 50 minutes. Leakage rate from the tank is 6 LPM.
A	3.4 m^3
B	1.7 m^3
C	2.0 m^3
D	2.3 m^3

Id	**66**
Question	Inverse of the 2x2 matrix of [5, 2; -7, -3] is
A	[3, -2; 7, -5]
B	[3, 2; 7, -5]
C	[3, 2; -7, -5]
D	[3, 2; -7, 5]

Id	**67**
Question	Respective values of X, Y, Z in the set of equation 2 X + 6 Y – Z = 7; X + 5 Y + 2 Z = 13; 3 X – 2 Y + 3 Z = 13 are
A	2, 3, 1
B	2, 1, 3
C	1, 2, 3
D	3, 2, 1

Id	**68**
Question	While developing mathematical model for CSTR with the exothermic first order reaction A B, following assumption doesn’t hold true
A	Temperature is uniform everywhere
B	Density is constant
C	Mass of reactor holds negligible heat
D	Spatial variation in concentration throughout reactor

Id	**69**
Question	Find the inverse of 3x3 matrix [3,2,4; 4,5,6; 2,3,5]
A	(1/13)[7,2,-8; -8,7,-2; 2,-5,7]
B	(1/26)[7,2,8; -8,7,-2; 2,-5,7]
C	(1/17)[7,2,-8; -8,7,2; 2,-5,7]
D	(1/26)[7,2,-8; -8,7,-2; 2,5,7]

Id	**70**
Question	Transpose of 3x3 matrix [5,2,3; 4,7,3; 6,3,5] is
A	[6,4,2; 4,7,3; 5,3,5]
B	[5,4,6; 2,7,3; 3,3,5]
C	[4,4,6; 2,6,3; 8,3,5]
D	[3,4,5; 7,7,3; 2,3,5]

Id	**71**
Question	Tank is having 5 m diameter and 3 m height. Estimate the time taken in minutes to fill the tank to 2/3 level from bottom when F_i = 180 LPM and F_o = 30 LPM. Initially tank is empty.
A	262 minute
B	131 minute
C	393 minute
D	226 minute

Id	**72**
Question	In double pipe ‘U’ tube heat exchanger with cocurrent flow, process variables vary with
A	Spatial position
B	Spatial position and time, both
C	Time
D	None of the two

Id	73
Questio n	In double pipe heat exchanger with countercurrent flow, process variables vary with
A	Spatial position
B	Time
C	Spatial position and time, both
D	None of the two

Id	**74**
Question	In the petrochemical industry, shell and tube heat exchanger system is best described as
A	Empirical system
B	Lumped parameter system
C	Distributed parameter system
D	Fundamental system

Id	**75**
Question	Find the determinant of 3x3 matrix [10,20,10; 4,5,6; 2,3,5]
A	60
B	-60
C	-70
D	70

Id	**76**
Question	Multiplication of the matrices [5,8; 3,8] and [3,8; 8,9] is
A	[79,96; 73,112]
B	[79,112; 73,96]
C	[112,79; 93,96]
D	[73,112; 79,96]

Id	**77**
Question	Square of 3x3 matrix [5,-5,6; 4,-4,6; -2,3,5] is
A	[-7,13,30; -8,14,30; -8,13,31]
B	[7,13,30; 8,14,30; -8,13,31]
C	[-7,-13,30; -8,14,30; -8,-13,31]
D	[-7,-13,30; -8,14,-30; 8,13,31]

Id	**78**
Questio n	In double pipe heat exchanger with countercurrent flow, process variables vary with
A	Spatial position
B	Time
C	Spatial position and time, both
D	None of the two

Id	**79**
Question	In case of ideal gas, van der Waals equation of state to calculate molar volume and compressibility factor consists of
A	Single nonlinear algebraic equation
B	Single linear algebraic equation
C	Ordinary differential equation
D	Partial differential equation

Id	**80**
Question	Rate of accumulation for simple batch reactor in which reactant ‘A’ is giving product ‘B’ with second order kinetics, is
A	Non zero
B	Finite
C	Infinite
D	Zero

Id	**81**
Question	Shell and tube heat exchanger system is best described as
A	Empirical system
B	Lumped parameter system
C	Distributed parameter system
D	Fundamental system

Id	**82**
Question	van der Waals equation of state to calculate molar volume and compressibility factor for a gas consists of
A	Single linear algebraic equation.
B	Single nonlinear algebraic equation.
C	Ordinary differential equation
D	Partial differential equation

Id	**83**
Questio n	For simple batch reactor in which reactant ‘A’ is giving product ‘B’ with first order kinetics, rate of accumulation is
A	Zero
B	Finite
C	Infinite
D	Non zero

Id	84
Question	Rate of change of concentration of reactant component 'X' in case of the reaction X $\rightarrow$ Y which follows 2nd order kinetics, is given by
A	$(dC_X/dt) = -2.k.\ C_X^{1/2}$
B	$(dC_X/dt) = k.\ C_X^2$
C	$(dC_X/dt) = -k.\ C_X^2$
D	$(dC_X/dt) = -k.\ C_X$

Id	**85**
Question	For the reaction A $\longrightarrow$ B following 2nd order kinetics, rate of change of concentration of component 'A' is
A	$(dC_A/dt) = -k.\ C_A^{1/2}$
B	$(dC_A/dt) = k.\ C_A^{2}$
C	$(dC_A/dt) = -k.\ C_A^{2}$
D	$(dC_A/dt) = -k.\ C_A$

Id	**86**
Question	Mild steel tank of rectangular size has the dimensions: length of 4.5m, width of 3.5m and height of 3m. Pump has been put into service to fill the tank @ 240 LPM rate of water. On other side, water is being taken out @20 LPM from bottom for process. In such condition, calculate the time required to fill the tank to full level, which earlier was empty.
A	41.5 min
B	21.5 min
C	215 min
D	315 min

Id	**87**
Questio n	Stainless steel tank with cylindrical size is made up of 4m diameter and 6m height which is used to store alcohol based sanitizer for Covid 19. The tank is filled initially to the level of ¾ from bottom. Sanitizer is taken out @ 210 liter per minute for refilling purpose. Calculate the volume of sanitizer left in the tank after 210 min of operation.
A	52.11 m^3
B	521.1 m^2
C	5.211 m^3
D	58.1 m^3

Id	88
Question	Calculate the determinant for the 3x3 matrix of [10, 20, 10; 4, 5, 6; 2, 3, 5] is
A	140
B	70
C	-70
D	-140

Id	**89**
Question	For the exothermic reaction A $\rightarrow$ B following 2^{nd} order kinetics, rate of energy added to the reaction volume 'V' is
A	$-2. (\Delta H).k. C_A^2.V$
B	$-(\Delta H).k. C_A.V$
C	$-(\Delta H).k. C_A^2$
D	$-(\Delta H).k. C_A^2.V$

Id	**90**
Question	Inverse of the 3x3 matrix of [10, 20, 10; 4, 5, 6; 2, 3, 5] is
A	(1/70) [-7, 70, -70; 8, 30, 20; -2, 10, 30]
B	(1/70) [-7, 70, -70; 8, -30, 20; -2, -10, 30]
C	(1/70) [-7, 70, 70; 8, -30, 20; 2, -10, 30]
D	-(1/70) [-7, 70, -70; 8, -30, 20; -2, -10, 30]

Id	**91**
Question	For CSTR with the exothermic first order reaction A $\rightarrow$ B, following assumption doesn't hold true
A	Rate of reaction is constant
B	Temperature is uniform everywhere
C	Metal mass holds negligible heat
D	Spatial variation in concentration throughout reactor

Id	**92**
Question	Adjugate of matrix of [10, 20, 10; 4, 5, 6; 2, 3, 5] is
A	[7, -70, 70; -8, 30, -20; 2, 10, -30]
B	[7, -70, 70; -8, 30, 20; 2, 10, -30]
C	[7, -70, 70; -8, 30, -20; 2, 10, 30]
D	[7, 70, 70; -8, 30, -20; 2, 10, -30]

Id	**93**
Question	Square of matrix of [10, 20, 10; 4, 5, 6; 2, 3, 5] is
A	[200, 330, 270; 72, 133, 100; 42, 70, 63]
B	[200, 330, 270; 72, 123, 100; 42, 70, 63]
C	[200, 330, 270; 72, 123, 100; 52, 70, 63]
D	[200, 370, 270; 72, 123, 100; 42, 70, 63]

Id	**94**
Question	Following can be the best example of distributed parameter system
A	High pressure reactor
B	Floating head ‘U’ tube heat exchanger system
C	Batch reactor
D	CSTR

Id	**95**
Question	For any reactor system, residence time is represented by
A	F/V
B	V/F
C	F.V
D	V^2/F

Id	**96**
Question	Tank is having 6 m diameter and 3 m height. Estimate the time taken in minutes to fill the tank to 2/3 level from bottom when F_i = 120 LPM and F_o = 30 LPM. Initially tank is empty.
A	618 minute
B	31.4 minute
C	314 minute
D	61.8 minute

Id	**97**
Question	Rectangular tank has the length of 4m, width of 3m and height of 2m. Tank is being filled with 60 LPM rate of water. Calculate the time required to fill the tank. Leakage rate from the tank is 6 LPM.
A	444 min
B	44.4 min
C	222 min
D	666 min

Id	**98**
Question	Cylindrical tank is having diameter of 5m and height of 8m and is filled with ethanol to the level of ¾ from bottom. Ethanol is being emptied in another tank at the rate of 118 liter per minute. Calculate the volume of ethanol remained in the tank after 150 min.
A	105 m^3
B	100 m^2
C	100 m^3
D	120 m^3

Id	**99**
Question	An empty tank is having 1.5 m diameter and 2.5 m height. It is filled to 2/3 level from bottom with inlet flow rate of F_i = 80 LPM. Estimate the time taken in minutes to achieve the desired level
A	73 minute
B	370 minute
C	37 minute
D	41 minute

Id	**100**
Question	Solution to the set of equation 9 X – 5 Y + 3 Z = 29; – 4 X + 6 Y – 3 Z = – 4; 5 X – 3 Y + 4 Z = 29 is
A	4, 5, 6
B	6, 5, 4
C	5, 6, 4
D	6, 4, 5

Id	**101**
Questio n	Floating head 'U' tube heat exchanger system can be best described mathematically by
A	Distributed parameter system
B	Lumped parameter system
C	Empirical system
D	Fundamental system

Id	**102**
Question	Tank is being filled with 80 LPM rate of water. Calculate the volume of tank filled after 1 hour time. Dead volume of the tank is 1.5 m^3, liquid in which can't be utilized. Calculate the effective liquid volume stored in the tank that can be utilized.
A	3.3 m^3
B	4.8 m^3
C	2.8 m^3
D	4.3 m^3

Id	**103**
Question	Respective values of X, Y, Z in the set of equation 2 X + 6 Y – Z = 7; X + 5 Y + 2 Z = 13; 3 X – 2 Y + 3 Z = 13 are
A	4, 3, 1
B	2, 2, 3
C	2, 1, 3
D	6, 2, 1

Id	**104**
Question	Adjunct of the 2x2 matrix of [5, -5; -4, 7] is
A	[7, -5; 4, 5]
B	[7, 5; -4, 5]
C	[7, 5; 4, 5]
D	[7, 5; 4, -5]

Id	**105**
Question	Transpose of 3x3 matrix [5,2,3; 4,7,3; 6,3,5] is
A	[6,4,2; 4,7,3; 5,3,5]
B	[5,4,6; 2,7,3; 3,3,5]
C	[4,4,6; 2,6,3; 8,3,5]
D	[3,4,5; 7,7,3; 2,3,5]

Id	**106**
Question	Find the determinant of 3x3 matrix [10,20,10; 4,5,6; 2,3,5]
A	60
B	-60
C	-70
D	70

Id	**107**
Question	Multiplication of the matrices [5,8; 3,8] and [3,8; 8,9] is
A	[79,96; 73,112]
B	[79,112; 73,96]
C	[112,79; 93,96]
D	[73,112; 79,96]

Id	**108**
Question	Numerical method known as Secant method is used for
A	Solving the system of algebraic equations
B	To minimize a given function ‘f’
C	To maximize a given function ‘f’
D	Approximate roots of a given function ‘f’

Id	**109**
Question	In jacketed CSTR system with exothermic reaction, rate of accumulation of energy is
A	$(d/dt)(A.\rho.C_p.T)$
B	$(d/dt)(V.\rho.C_p.T).\Delta t$
C	$(d/dt)(V.\rho.C_p.T)$
D	$(d/dt)(V.\rho.C_p)$

Id	110
Question	In continuous stirred tank bioreactor, ‘x’ is biomass concentration, ‘S’ is substrate concentration and ‘F’ is volumetric flow rate. Rate of accumulation of biomass within bioreactor is
A	(d/dt)(V.x)
B	(d/dt)(V.S.x)
C	(d/dt)(V.S)
D	(d/dt)(S.x)

Id	**111**
Question	Numerical method developed by Newton and Raphson can be used to find out
A	Approximate roots of a real value function ‘f’
B	Approximate roots of imaginary function ‘f’
C	Maximize a given function ‘f’
D	Solve system of ODE equations

Id	**112**
Question	Function $y = f(x) = 3x^3 - 4x^2 + 2x - 53 = 0$ is valid for the 'x' value of
A	3
B	4
C	6
D	7

Id	**113**
Question	Function y = $6x^2 - 8x + 19$ has the maximum value when the value of 'x' is
A	2
B	3
C	2/3
D	¾

Id	**114**
Question	Function $y = 5\ x^2 – 11.x – 28$ achieves the minima for the ‘x’ value of
A	-1.2
B	1.2
C	1.1
D	-1.1

Id	115
Question	In biochemical engineering, dilution rate ‘D’ (due to dilution of biomass in reactor with addition of fresh food) for volumetric flow rate ‘F’ and volume ‘V’ is
A	F/V
B	V/F
C	V.F
D	V^2.F

Id	**116**
Question	In biochemical reaction A P, yield ‘Y’ is given as
A	Mass of ‘P’ formed / Mass of ‘A’ consumed
B	Mass of ‘A’ consumed / Mass of ‘P’ formed
C	Mass of ‘P’ formed * Mass of ‘A’ consumed
D	Mass of ‘A’ formed / Mass of ‘P’ consumed

Id	**117**
Question	In Monod's kinetics for biochemical reactions, if 'V_m' is maximum achievable specific growth rate and 'S' is substrate concentration, then specific growth rate '□' is given by
A	$(V_m.S)/(K_m + 1)$
B	$(V_m.S)/(K_m + S)$
C	$(V_m)/(S.K_m + S)$
D	$(V_m.S)/(K_m + 2.S)$

Id	118
Question	In Monod's kinetics for biochemical reactions, K_m is limiting substrate concentration when
A	$Km = (1/2).S_m$
B	$Km = S_m$
C	$Km = 2.S_m$
D	$Km = (2/3).S_m$

Id	**119**
Question	Steady-State Material Balances on a Separation Train involves
A	Solution of simultaneous linear equations
B	Solution of simultaneous nonlinear equations
C	Solution of simultaneous ODEs
D	Solution of simultaneous PDEs

Id	**120**
Question	System of Heat Exchange in a Series of Tanks involves solution of
A	Simultaneous nonlinear algebraic equation.
B	Simultaneous second-order ODEs
C	Simultaneous first-order ODEs
D	Simultaneous first-order PDEs

Id	121
Question	Cylindrical tank (D-diameter, L-height) has fixed volume V. Cs is per unit area cost of tank's side and Ct is per unit cost of tank's top and bottom. Total cost of tank is given by
A	[Cs.π.D.L] + [Ct (π/2)(D.D)]
B	[Cs.π.D.D] + [Ct (π/2)(D.L)]
C	[Cs.(π/2).D.L] + [Ct (π/2)(D.D)]
D	[Cs.π.D.L] + [Ct (π/2)(L.D)]

Id	**122**
Question	Cylindrical tank (D-diameter, L-height) has fixed volume V. Cs is per unit area cost of tank's side and Ct is per unit cost of tank's top and bottom. Ratio of L/D is equivalent to
A	Cs/Ct
B	Ct/Cs
C	2. Ct.Cs
D	2. Ct/Cs

Id	123
Questio n	In the operation of matrices using Gauss Jordan elimination algorithm, we can find
A	Approximate roots of a real value function ‘f’
B	Solve PDE
C	Maximize a given function ‘f’
D	Solution of set of linear algebraic equations

Id	**124**
Question	In order to get the solution of ordinary differential equations using the fourth order Runge-Kutta method, applicable formula is
A	yi = (1/6) y(i+1) + [k1 + 2.k2 + 2.k3 + k4]
B	y(i+1) = yi + (1/6)[k1 + 4.k2 + 4.k3 + k4]
C	y(i+1) = yi + (1/6)[k1 + 2.k2 + 2.k3 + k4]
D	yi = y(i+1) + (1/6)[k1 + 2.k2 + 2.k3 + k4]

Id	125
Question	ODE can be solved using second order Runge-Kutta method having formula
A	yi = y(i+1) +(h/2)(k1 + k2)
B	y(i+1) = yi +(h/2)(k1 + k2)
C	y(i+1) = (1/2) yi +(h)(k1 + k2)
D	y(i+1) = 2.yi +(h/2)(k1 + k2)

Id	**126**
Question	Solution of non-linear equation by Bi-section method has -------- convergence
A	Linear
B	Nonlinear
C	Superlinear
D	Quadratic

Id	**127**
Question	Following system in chemical engineering doesn't describe the requirement of partial differential equations
A	Diffusion of chemicals in water
B	Fluid flow describing weather
C	Heat flowing through thin long metal rod
D	Wave propagation in water

Id	**128**
Question	Partial differential equations doesn't describe the following system
A	Diffusion of chemicals in water
B	Fluid flow describing weather
C	Heat flowing through thin long metal rod
D	Wave propagation in water

Id	**129**
Question	Elliptic partial differential equations denotes
A	Steady-state in time
B	Unsteady-state in time
C	First derivative in time
D	Second derivative in time

Id	**130**
Question	Ideal gas law represent the pressure–volume–temperature (PVT) relationship of gases
A	Only at low pressures and low temperatures
B	Only at high pressures
C	At all pressures and temperatures
D	At high temperatures and low pressures

Id	**131**
Question	If 'A', 'B' and 'C' are regression constants, 'P' is vapor pressure and 'T' is temperature, vapor pressure data is described by Antoine equation which is represented as
A	Log (P) = B – [A/(T+C)]
B	Log (P) = A – 2. [B/(T+C)]
C	Log (P) = A – [B/(T+C)]
D	Log (P) = A + [B/(T+C)]

Id	132
Question	Drag coefficient on a spherical particle at terminal velocity varies with the low Reynolds number as
A	$C_D = 16 / Re$
B	$C_D = 24 / Re$
C	$C_D = 48 / Re$
D	$C_D = 36 / Re$

Id	**133**
Question	Diffusion and simultaneous first-order irreversible chemical reaction in a single phase containing only Reactant *A* and Product *B* results in
A	First-order ordinary differential equation
B	Second-order ordinary differential equation
C	Third-order ordinary differential equation
D	Second-order partial differential equation

Id	**134**
Question	Function $y = f(x) = x^3 - 3.x^2 + 2.x - 60$ achieves the value of zero for the 'x' value of
A	2
B	4
C	6
D	8

Id	**135**
Question	Secant method is an algorithm used to
A	Approximate roots of a given function ‘f’
B	Minimize a given function ‘f’
C	Maximize a given function ‘f’
D	Solve system of algebraic equations

Id	136
Question	When CSTR is jacketed from sides only, ‘h’ is jacket height and ‘d’ is reactor diameter, heat transfer area is given by
A	$(\pi/4).d + \pi.d.h$
B	$\pi.d.h$
C	$2.\pi.d.h$
D	$(\pi/4).d^2 + \pi.d.h$

Id	**137**
Question	Newton Raphson method is an algorithm used to
A	Approximate roots of a real value function ‘f’
B	Approximate roots of imaginary function ‘f’
C	Maximize a given function ‘f’
D	Solve system of ODE equations

Id	**138**
Question	Gauss elimination algorithm is used for
A	Approximate roots of a real value function ‘f’
B	Solution of set of linear algebraic equations
C	Minimize a given function ‘f’
D	Solve PDE equation system

Id	**139**
Question	In jacketed CSTR system with endothermic reaction, rate of accumulation of energy is
A	- (d/dt)(A.ρ.C_p.T)
B	(d/dt)(V.ρ.C_p.T).Δt
C	- (d/dt)(V.ρ.C_p.T)
D	(d/dt)(V.ρ.C_p)

Id	**140**
Question	In continuous stirred tank reactor, ‘C_A’ is the concentration of reactant and ‘F’ is volumetric flow rate, then rate of accumulation of mass within the reactor is
A	$(d/dt)(V.C_A^2)$
B	$(d/dt)(V.C_A)$
C	$(d/dt)(V.\rho.C_A)$
D	$(d/dt)(\rho.C_A)$

Id	**141**
Question	In jacketed CSTR system, if ‘h’ is jacket height and ‘d’ is the reactor diameter, then heat transfer area is given by
A	$(\pi/4).d^2 + \pi.d$
B	$(\pi/4).d^2 + \pi.d.h$
C	$(\pi/4).d + \pi.d.h$
D	$(\pi/4).d^2 + 2.\pi.d.h$

Id	**142**
Questio n	The rate of accumulation of energy in case of jacketed CSTR system with exothermic reaction where alkylation reaction is in progress, is given by
A	$(d/dt)(A.\rho.C_p.T)$
B	$(d/dt)(V.\rho.C_p.T).\Delta t$
C	$(d/dt)(V.\rho.C_p.T)$
D	$(d/dt)(V.\rho.C_p)$

Id	**143**
Question	In the biochemical reaction, continuous stirred tank bioreactor (CSTBR) is used. If ‘x’ is biomass concentration, ‘S’ is substrate concentration and ‘F’ is volumetric flow rate, then rate of accumulation of biomass within bioreactor is given by
A	(d/dt)(V.S)
B	(d/dt)(V.S.x)
C	(d/dt)(V.x)
D	(d/dt)(S.x)

Id	**144**
Question	In biochemical process in which protein conversion process is in progress, dilution rate ‘D’ (due to dilution of biomass in reactor with addition of fresh food) for volumetric flow rate ‘F’ and volume ‘V’ is
A	F/V
B	V/F
C	V.F
D	V^2.F

Id	**145**
Question	In biochemical reaction A $\longrightarrow$ P, yield 'Y' is given as
A	Mass of 'P' formed / Mass of 'A' consumed
B	Mass of 'A' consumed / Mass of 'P' formed
C	Mass of 'P' formed * Mass of 'A' consumed
D	Mass of 'A' formed / Mass of 'P' consumed