Sample Questions

Chemical Engineering

Subject Name: Engineering Mathematics IV **Semester: IV**

Multiple Choice Questions

Choose the correct option for following questions. All the Questions carry equal marks	
1.	The order of the pole of $f(z) = \frac{sinhz}{z^7}$
Option A:	7
Option B:	6
Option C:	5
Option D:	0
2.	Find the residue at z = -2 of the function $f(z) = \frac{z^2}{(z-1)^2(z+2)}$
Option A:	4
Option B:	5/9
Option C:	4/9
Option D:	5
3.	What is the expectation of heads if an unbiased coin is tossed 12 times
Option A:	4
Option B:	6
Option C:	8
Option D:	12
4.	Find r if $\sum xy = 24, \sum x^2 = 36$ and $\sum y^2 = 44$
Option A:	0.0151
Option B:	0.6030
Option C:	0.9062
Option D:	0.3504
5.	If F $= (x + 2y + 4z)i + (ax - 3y - z)j + (4x - y + 2z)k$ is irrotational then find the constants a
Option A:	4
Option B:	1
Option C:	-1
Option D:	2
6.	If a random variable X follows Poisson distribution such that $P(X = 1) = P(X = 2)$ Find the mean.
Option A:	1
Option B:	2
Option C:	3
Option D:	4

7.	If X is a normal variate with mean 10 and standard deviation 4. The value of standard normal variate Z is
Option A:	2
Option B:	1
Option C:	3
Option D:	2.5
8.	Given $N = 10, \sum d_i^2 = 96$. Find the rank correlation coefficient R.
Option A:	$R = 0.4181$
Option B:	$R = 0.5181$
Option C:	$R = 0.2524$
Option D:	$R = 0.3524$
9.	A continuous random variable X has the p.d.f $f(x) = kx^2, 0 \leq x \leq 2$ The value k is
Option A:	8/3
Option B:	1/12
Option C:	3/8
Option D:	2/7
10.	There are in a bag three true coins and one false coin with head on both sides. A coin is chosen at random and tossed four times. If head occurs all the four times, what is the probability that the false coin was chosen and used?
Option A:	1/16
Option B:	3/4
Option C:	1/4
Option D:	16/19
11.	IF $\vec{F} = (y + kx)\hat{i} + (y - 2z)\hat{j} + (x - 2z)\hat{k}$ is solenoidal, Find the value of k
Option A:	-2
Option B:	3
Option C:	1
Option D:	-3
12.	If $\vec{F}$ is the gradient of some scalar point function .then what is nature of Line integral .
Option A:	Dependent of path
Option B:	Independent of path
Option C:	Closed path
Option D:	Straight line
13.	What is the Value $\int_C \frac{dz}{z-2}$ Where C is the circle $\|z - 2\| = 1$
Option A:	0
Option B:	$4\pi i$
Option C:	$2\pi i$
Option D:	$3\pi i$
14.	Find Residue at z = -1 of $f(z) = \frac{7z-2}{z(z-2)(z+1)}$

Option A:	3
Option B:	-3
Option C:	5
Option D:	-5
15.	Value of Correlation coefficient lies between
Option A:	0 and 1
Option B:	1 and -1
Option C:	0 and -1
Option D:	2 and 1
16.	Karl Pearson's coefficient of correlation symbol represented by
Option A:	r
Option B:	K
Option C:	R
Option D:	S
17.	What is r -th Moment about origin μ_r' ?
Option A:	$E(x)^r$
Option B:	$E(x)^2$
Option C:	$E(x)^3$
Option D:	$E(x)^0$
18.	Which of the following can't be Probability
Option A:	5%
Option B:	$\frac{3}{8}$
Option C:	0.5
Option D:	-0.5
19.	What is the size of Large sample
Option A:	Less than 30
Option B:	More than 30
Option C:	More than 50
Option D:	Less than 50
20.	Chi Square test used to analyze
Option A:	Mean
Option B:	Variance
Option C:	Frequencies
Option D:	Rank
21	$\vec{A} = (y+z)i + (x+z)j + (x+y)k$ *is*
Option A	Solenoidal and not irrotational
Option B	Neither solenoidal nor irrotational
Option C	Solenoidal and irrotational
Option D	Not solenoidal but irrotational
22	If S is a closed surface enclosing a volume V and $\vec{F} = axi + byj + czk$, *then* $\iint \overrightarrow{F}.\hat{n}ds$ is
Option A	(a+b+c)V

Option B	a+b+c
Option C	abcV
Option D	abc
23	The value of $\int_C \frac{1}{z-a} dz$;Where C is the circle with centre at z=a and radius c units is equal to
Option A	0
Option B	2πi
Option C	2π
Option D	πi
24	Value of $\int_c (z+1)dz$; where c: $boundary\ of\ the\ square\ with\ vertices\ at\ (0,0);(1,0);(1,1);(0,1)\ \ is$
Option A	2i
Option B	3+2i
Option C	5
Option D	0
25	Residue of f(z) = $\frac{1}{z^3(z+4)}\ at\ z=0\ is$
Option A	$\frac{1}{64}$
Option B	$\frac{1}{32}$
Option C	$\frac{-1}{64}$
Option D	$\frac{-1}{32}$
26	If f(a)=$\int_c \frac{4z^2+z+5}{z-a} dz$ where c is an ellipse $\frac{x^2}{4}+\frac{y^2}{9}=1$ then the value of f(i) is
Option A	2π+2πi
Option B	0
Option C	2π−2πi
Option D	−2π+2πi
27	Given: $\sum X = 21$; $\sum Y = 24$; $\sum XY = 75$; $\sum Y^2 = 106$; $n = 6$. The Line of best fit to the above data for determining the best estimate of X corresponding to specified value of Y is
Option A	X=0.9Y−7.1
Option B	X=7.1−0.9Y
Option C	Y=7.1+0.9X
Option D	Y=7.1−0.9X
28	The Regression line of X on Y is 3Y−5X=−180 and Var(X)=$\frac{9}{16}$Var(Y) .The Karl Pearson's correlation coefficient is equal to
Option A	−0.8
Option B	0.93
Option C	0.8
Option D	−0.93

29	Given: $\sum xy = -93;\ \sum x^2 = 140\ ;\sum y^2 = 398\ ;$ [x and y denote the deviations of X and Y from their respective means] .The regression coefficients of X on Y and Y on X are respectively
Option A	{0.234 ;0.664}
Option B	$\{-0.664\ ;\ -0.234\}$
Option C	$\{-0.664\ ;\ 0.234\}$
Option D	$\{\ -0.234; -0.664\ \}$
30	Given: Rank correlation coefficient between X and Y is 2/3 .The number of pairs of observations is 10.{No ranks are repeated in both X and Y series} .Then the sum of the squares of the differences between the corresponding rank is
Option A	110
Option B	55
Option C	165
Option D	330
31	Given: P(A)=$\frac{1}{12}$; P(B)=$\frac{5}{12}$; $\mathrm{P}(B/A) = \frac{1}{15}; Then\ \ \mathrm{P(AUB)}$ is equal to
Option A	$\frac{89}{180}$
Option B	$\frac{8}{9}$
Option C	$\frac{17}{18}$
Option D	$\frac{91}{180}$
32	A R.V. X has a probability density function $f(x) = \begin{cases} xe^{-x} & ;\ x \geq 0 \\ 0 & ;otherwise \end{cases}$. Then mean of X is
Option A	6
Option B	1
Option C	4
Option D	2
33	A R.V. X has a probability mass function P(x) = kx^3 ; x={1 ,2 ,3 ,4}.Then value of k is
Option A	$\frac{1}{30}$
Option B	$\frac{1}{10}$
Option C	$\frac{1}{100}$
Option D	$\frac{1}{5}$
34	In usual notation :E(X)=4 ; E(Y)= -2 then E(2X+4Y-3)
Option A	13
Option B	-3
Option C	0
Option D	16

35	X is a Poisson Variate with mean 1.8 .Then P[X≥1] is
Option A	0.1653
Option B	0.2975
Option C	0.7025
Option D	0.8347
36	A R.V. X follows a Normal distribution with mean 105 units and standard deviation of 5 units .[X denotes the weight of boys].If 228 boys weigh more than 115 units ,then the total number of boys in the group is [Area under S.N.C. between z=0 and z=2 is 0.4772]
Option A	1000
Option B	4780
Option C	10000
Option D	2330
37	A R.V. X has Moment Generating function $\frac{2}{2-t}$ .Then mean of X is
Option A	$\frac{1}{2}$
Option B	$\frac{-1}{2}$
Option C	$\frac{1}{4}$
Option D	1
38	A sample of size 10 (drawn from a normal population) had a mean 165 cms with s,d . of 7.6.Then 95% confidence limits for the population mean [given :Table value of t=2.26] are
Option A	(162.74,167.26)
Option B	(157.4,172.6)
Option C	(113.5,216.5)
Option D	(159.3,170.7)
39	Given:the observed frequencies {200,300} and the corresponding expected frequencies{300,200} , the value of the Chi-square Statistic is
Option A	$\frac{1}{6}$
Option B	$\frac{500}{3}$
Option C	$\frac{250}{3}$
Option D	$\frac{5}{6}$
40	Two sample of size 10 and 12 are drawn from two normal population.Their sum of the squares of the deviations from the respective means are 120 and 314 respectively.Then the calculated value of the F-Statistic is
Option A	2.1806
Option B	2.1409
Option C	0.4585
Option D	1.4671
41.	Find the value of a if $\bar{F} = (x - 2z)i + (y - 5x)j + (az + 2x)k$ is solenoidal

Option A:	$a = 2$
Option B:	$a = -2$
Option C:	$a = -4$
Option D:	$a = 4$
42.	Vector field is Irrotational if
Option A:	$\nabla \times \vec{f} = 0$
Option B:	$\nabla . \vec{f} = 0$
Option C:	$\nabla \times \vec{f} \neq 0$
Option D:	$\nabla . \vec{f} = 1$
43.	The residue at the pole z =-1 of $f(z) = \frac{1}{(z+1)(z-2)^2}$is
Option A:	1/3
Option B:	-1/3
Option C:	1/9
Option D:	-1/9
44.	The poles of $f(z) = \frac{3z-1}{(z+1)(z-2)}$ are
Option A:	1,-2
Option B:	-1,-2
Option C:	-1,2
Option D:	1,2
45.	Value of $\int_c \frac{sin2z\ dz}{(z+\pi/3)^4} dz$ is where C:$\|z\| = 2$
Option A:	$4\pi i/3$
Option B:	$\pi i/3$
Option C:	$2\pi i/3$
Option D:	$4\pi i$
46.	$The\ value\ of\ \int_0^{1+i} \bar{z}$ dz along straight line y=x is
Option A:	0
Option B:	2
Option C:	3
Option D:	1
47.	If the two regression coefficient are -8/15 and -5/6 then the correlation coefficient is
Option A:	0.667
Option B:	- 0.507
Option C:	-0.667
Option D:	0.607
48.	Line of regression y on x is 8x-10y +66 =0. Line of regression x on y is 40x -18y -214 =0. The value of variance of y is 16. The standard deviation of x is
Option A:	3
Option B:	2
Option C:	6
Option D:	7

49.	$\sum xy = 2638,\ \bar{x} = 14, \bar{y}$ =17, n=10 then cov (x,y) is
Option A:	24.2
Option B:	25.8
Option C:	23.9
Option D:	20.5
50.	Least square fit for the straight line y= ax + b to the data x: 1, 2, 3 y: 5, 7, 9
Option A:	y = 2x +4
Option B:	y = 2x -3
Option C:	y = 2x +3
Option D:	y = 3x - 4
51.	A random variable X has the following probability distribution. The value of K is x: 2, 3, 4, 5 P(x): 5/K, 7/K, 9/K, 11/K
Option A:	16
Option B:	8
Option C:	48
Option D:	32
52.	In Poisson distribution if n = 100, p = 0.01, then the value of P (r = 0)
Option A:	1/e
Option B:	2/e
Option C:	3/e
Option D:	1/4e
53.	A continuous random variable X has pdf f(x) = kx; $0 \leq x \leq 1$ and k; $1 \leq x \leq 2$ .then the value of k
Option A:	2
Option B:	2/3
Option C:	3/2
Option D:	3
54.	If random variable X takes the values of x =1,2,3 with corresponding Probabilities 1/6, 2/3 1/6 then E(x) is
Option A:	1
Option B:	3
Option C:	4
Option D:	2
55.	Number of road accident on a highway during a month follows a Poisson distribution with mean 2. Probability that in certain month number of accidents in the highway will be equal to 2 is
Option A:	0.354
Option B:	0.2707
Option C:	0.435
Option D:	0.521

56.	In a normal distribution when mean is 1 and S.D =3 then for the intervals $-1.43 \leq x \leq 6.19$ (for z = -0.81, A= 0.2910, for z =1.73 ,A = 0.4582)
Option A:	0.7492
Option B:	0.4582
Option C:	0.2910
Option D:	0.1672
57.	X is normally distributed $\mu = 15,\ \sigma^2 = 9.$ Given that for z=1, A=0.3413 P(X ≥ 18) is given by
Option A:	0.1587
Option B:	0.4231
Option C:	0.2231
Option D:	0.3413
58.	In normal distribution. The area under standard normal curve to the right of y axis is
Option A:	1
Option B:	0
Option C:	0.5
Option D:	0.6
59.	If observed frequencies are 5,10,15 and expected frequencies are each equal to 10 then chi square value is
Option A:	20
Option B:	10
Option C:	15
Option D:	5
60.	Among 64 offspring of a certain cross between guinea pig 34 were red,10 were black and 20 were white, According to genetic model these number should in the ratio 9:3:4. Expected frequencies in the order
Option A:	36,12,16
Option B:	12,36,16
Option C:	20,12,16
Option D:	36,12,35
61.	Find the constants *a, b, c* if $\overline{F} = \left(axy + bz^3\right)i + \left(3x^2 - cz\right)j + \left(3xz^2 - y\right)k$ is irrotational.
Option A:	*a = 6, b = 1, c = 1*
Option B:	*a = 6, b = – 1, c = 1*
Option C:	*a = 6, b = – 1, c = – 1*
Option D:	*a = 6, b = 1, c = – 1*
62.	If $f(a) = \int_C \frac{4z^2 + z + 5}{z - a} dz$ where C is a ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$, then what is the value of $f'(-1)$?
Option A:	0
Option B:	$-14\pi i$
Option C:	$14\pi i$
Option D:	$18\pi i$

63.	If null hypothesis is $H_0 : \mu = 10$ and alternate hypothesis is $H_a : \mu < 10,$ then the test is
Option A:	right tailed
Option B:	left tailed
Option C:	two tailed
Option D:	cross tailed
64.	If X is a Poisson variate with mean *m*, then $P(X = x)$ is given by
Option A:	$\frac{e^{-m}m^{x}}{x!}$
Option B:	$\frac{e^{-x}m^{x}}{x!}$
Option C:	$\frac{e^{-m}x^{m}}{x!}$
Option D:	$\frac{e^{-x}x^{m}}{x!}$
65.	If two lines of regression are $x + 3y = 5$ and $4x + 3y = 8$, then the correlation coefficient is
Option A:	2
Option B:	1
Option C:	0.8
Option D:	0.5
66.	If we have two samples of sizes n_1 and n_2 with standard deviations s_1 and s_2 respectively, then to test the equality of population variances, the test statistic F is given by
Option A:	$F = \frac{s_1^2/(n_1 - 1)}{s_2^2/(n_2 - 1)}$
Option B:	$F = \frac{n_1 s_1^2/(n_1 - 1)}{n_2 s_2^2/(n_2 - 1)}$
Option C:	$F = \frac{n_1 s_1^2/(n_2 - 1)}{n_2 s_2^2/(n_1 - 1)}$
Option D:	$F = \frac{s_2^2/(n_1 - 1)}{s_1^2/(n_2 - 1)}$
67.	Find $\int_C \frac{z+2}{(z-3)(z-4)} dz$ where C is $\lvert z \rvert = 1$.
Option A:	$2\pi i$
Option B:	$-10\pi i$
Option C:	0
Option D:	$6\pi i$
68.	Fit a straight line $y = a + bx$ into the given data. x: 10, 20, 30, 40, 50 y: 22, 23, 27, 28, 30 What is the value of b?

Option A:	2.1
Option B:	0.21
Option C:	1.2
Option D:	0.8
69.	If the probability density function of a continuous random variable is given by $f(x) = kx^2,\ 0 \le x \le 1,$ then what is the value of k ?
Option A:	1
Option B:	2
Option C:	3
Option D:	4
70.	What is the value of $\int_0^{1+i} \left(x - y + ix^2\right) dz$ along the line from $z = 0$ to $z = 1 + i$?
Option A:	$\frac{1-i}{3}$
Option B:	$\frac{i-1}{2}$
Option C:	$\frac{1-i}{6}$
Option D:	$\frac{i-1}{3}$
71.	The value of rank correlation coefficient R lies between
Option A:	– 1 and 1
Option B:	– 0.5 and 0.5
Option C:	0 and 1
Option D:	– 1 and 0
72.	There are 11 tickets in a box bearing numbers 1 to 11. Three tickets are drawn one after the other without replacement. What is the probability that they are drawn in the order bearing even, odd, even number?
Option A:	$\frac{5}{33}$
Option B:	$\frac{4}{33}$
Option C:	$\frac{3}{22}$
Option D:	$\frac{5}{22}$
73.	It is known that the probability of an item produced by a certain machine will be defective is 0.05. If the produced items are sent to the market in packets of 20, then the number of packets containing at most 2 defective items in a consignment of 1000 packets will be
Option A:	918
Option B:	916
Option C:	922

Option D:	920
74.	In order to investigate the association between education of fathers and intelligence of sons from the following data, what will be the expected frequency of intelligent sons with educated fathers?

	Intelligent sons	Unintelligent sons	Total
Educated fathers	40	35	75
Uneducated fathers	35	85	125
Total	75	125	200

Option A:	40
Option B:	75
Option C:	15
Option D:	28
75.	If $f(z) = e^{1/z}$, then $z = 0$ is
Option A:	a simple pole
Option B:	an isolated essential singularity
Option C:	a removable singularity
Option D:	a non-isolated essential singularity
76.	If a random variable X has probability density function $f(x) = \begin{cases} \frac{3}{4}x(2-x), & 0 \le x \le 2 \\ 0, & elsewhere \end{cases}$, then what is *E(X)*?
Option A:	1
Option B:	$\frac{1}{2}$
Option C:	3
Option D:	$\frac{1}{3}$
77.	If X is normal variate with mean 10 & standard deviation 4, then what is $P(X \le 12)$? (Given: Area from z = 0 to z = 0.5 is 0.1915)
Option A:	0.6915
Option B:	0.1915
Option C:	0.5
Option D:	0.36
78.	When the values of two variables move in the same direction, correlation is said to be
Option A:	Linear
Option B:	Non-linear
Option C:	Positive
Option D:	Negative
79.	What is the scalar potential of the vector function $\overline{F} = \left(y^2 \cos x + z^3\right) i + \left(2y \sin x - 4\right) j + \left(3xz^2 + 2\right) k$?
Option A:	$2y^2 \sin x + xz^3 - 4y + 2z$
Option B:	$y^2 \sin x + xz^3 - 4y + 2z$

Option C:	$y^2 \sin x + 2xz^3 + 4y - 2z$
Option D:	$y^2 \sin x - xz^3 + 4y + 2z$
80.	The means of two independent samples of size 8 and 7 are 1134 and 1024 respectively. The standard deviation of these two samples is 35 and 40 respectively. What is the value of test statistic *t* in order to test the significance of difference between sample means?
Option A:	5.788
Option B:	6.235
Option C:	5.288
Option D:	4.135

Descriptive Questions

1	Evaluate $\int_C \frac{z^2+3}{z^2-1}$ where C is circle $\|z-1\| = 1$
2	Find the coefficient of correlation between height of father and height of son from the following data Height of father: 65, 66, 67, 67, 68, 69, 71, 73 Height of son: 67, 68, 64, 68, 72, 70, 69, 70
3	The marks obtained by students in a college are normally distributed with mean 65 and variance 25. If 3 students are selected at random from this college what is the probability that at least one of them would have scored more than 75 marks?
4	Based on the following data determine if there is a relational between literacy and smoking Literates: Smokers 83, Non smokers 57 Illiterates: Smokers 45, Non smokers 68
5	Show that $\bar{F} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is conservative field. Find its scalar potential.
6	Find the mean and variance of the following distribution X: 1, 3, 4, 5 P(X=x): 0.4, 0.1, 0.2, 0.3
7	Calculate the value of rank correlation coefficient form the following data regarding the marks of 6 students in statistics and accountancy in a test Marks in Statistics: 40, 42, 45, 35, 36, 39 Marks in Accountancy: 46, 43, 44, 39, 40, 43
8	Find all possible Laurent's expansion $\frac{z}{(z-1)(z-2)}$ about z = **-2**
9	Find the probability that at most 4 defective bulbs will be found in a box of 200 bulbs, if it is known that 2% of the bulbs are defective.
10	A continuous random variable X has probability density function $f(x) = kx^2e^{-x}, x \geq 0$. Find k, mean and variance.
11	Evaluate by Greens Theorem $\oint(x^2ydx + y^3dy)$

<table>
<tr><td></td><td>where C is the closed path formed by $y = x$ and $y = x^2$</td></tr>
<tr><td>12</td><td>Sample of electric tubes of two companies were tested for lengths of their life and following information was obtained
<table>
<tr><td></td><td>Company A</td><td>Company B</td></tr>
<tr><td>No. of sample</td><td>8</td><td>7</td></tr>
<tr><td>Mean life (in hours)</td><td>1210</td><td>1314</td></tr>
<tr><td>Standard deviation (in hours)</td><td>36</td><td>42</td></tr>
</table>
Test at 5% level of significance whether the difference in the sample means is significance.</td></tr>
<tr><td>13</td><td>A random variable X has the following probability
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td></tr>
<tr><td>P(X=x)</td><td>1/3</td><td>1/3</td><td>1/3</td></tr>
</table>
Find moment generating function and first four raw moments.</td></tr>
<tr><td>14</td><td>Ten individuals are chosen at random from population and their heights are found to be 63, 63, 64, 65, 66, 69, 69, 70, 70, 71 inches. Test if the mean height is 65.</td></tr>
<tr><td>15</td><td>Evaluate $\int_0^{1+i} z^2 dz$ along the parabola $x = y^2$</td></tr>
<tr><td>16</td><td>It is given that the means of x and y are 5 and 10. If the line of regression of y on x is parallel to the line $20y = 9x + 40$, estimate the value of y for x = 30.</td></tr>
<tr><td>17</td><td>Using Divergence theorem, evaluate $\iint_S \bar{F}.\hat{n}\, ds$; $F = 4xi + 3yj - 2zk$ and S is closed surface bounded by the planes x = 0, y = 0, z = 0 and 2x + 2y + z = 4</td></tr>
<tr><td>18</td><td>A die was thrown 132 times and the following frequencies were observed
<table>
<tr><td>No. Obtained</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Frequency</td><td>15</td><td>20</td><td>25</td><td>15</td><td>29</td><td>28</td></tr>
</table>
Test the hypothesis that the die is unbiased.</td></tr>
<tr><td>19</td><td>Using Cauchy's Residue theorem Evaluate $\int_c \frac{\sin 3z}{z+\frac{\pi}{2}}\, dz$</td></tr>
<tr><td>20</td><td>Find Rank correlation coefficient for the following data
x : 12 17 22 27 32
y : 113 119 117 115 121</td></tr>
<tr><td>21</td><td>The mean I.Q. of a large number of children of age 14 is 100 with S.D. 16 .Assuming the distribution Of I.Q. to be normal , find the percentage of children having I.Q. between 70 and 120.(Area for S.N.V.Z from z =0 to z=1.875 is 0.4696 and that from z = 0 to z = 1.25 is 0.3944)</td></tr>
<tr><td>22</td><td>If the probability density of a random variable is given by $f(x) = kxe^{\frac{-x}{3}}$ for $x > 0$ otherwise zero . Find value of k and mean</td></tr>
<tr><td>23</td><td>Evaluate by Green's theorem $\int_c (e^{-x}\sin y dx + e^{-x}\cos y\, dy)$ where c is the Rectangle whose vertices are (0,0) $(\pi, 0)$ $(\pi, \frac{\pi}{2})$ $(0, \frac{\pi}{2})$</td></tr>
<tr><td>24</td><td>Using Gauss Divergence theorem, prove that
$\iint (y^2z^2i + z^2x^2j + y^2z^2k) \cdot \bar{N}\, dS = \frac{\pi}{12}$
where S is the part of the sphere $x^2 + y^2 + z^2 = 1$ above the XY plane</td></tr>
<tr><td>25</td><td>Find mean and Variance of the following distribution
X : 1 3 4 5
P(X) : 0.4 0.1 0.2 0.3</td></tr>
<tr><td>26</td><td>Given var(x) =25. The equation of two lines of regression are 5x - y = 22 and 64x -45y =24 ,then Find (i) $\bar{x}$, $\bar{y}$ (ii) r (iii) σ_y</td></tr>
</table>

27	Obtain all possible Laurent 's series of $\frac{z}{(z-1)(z-2)}$ about $Z = -2$
28	Evaluate $\int_A^B (ydx + xdy)$ along $y = x^2$ from A (0,0) to B (1,1)
29	A machine is designed to produce insulating washers for electrical devices of average thickness of 0.024cms. A random sample of 10 washers was found to have average thickness of 0.024cms.with standard deviation of 0.002cms.Test the significance of deviation.
30	Based on the following data determine if there exist is a relation between literacy and smoking. Smokers Non Smokers Literates 83 57 Illiterates 45 68
31	If the probability density of a random variable is given by $f(x) = kxe^{\frac{-x}{3}}$ for $x > 0$ otherwise zero . Find value of k and mean
32	Fit Poisson Distribution to the following data X : 0 1 2 3 4 Frequency : 12 66 109 59 10
33	Obtain the Line of regression of y on x for the data given below X : 1.53 1.78 2.60 2.95 3.42 Y : 33.50 36.30 40.00 45.80 53.50
34	Evaluate $\int_0^{1+i} (x^2 - iy)\,dz$ along the path (i) $y = x$. (ii) $y = x^2$
35	Show that $\bar{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both irrotational and solenoidal.
36	In a test given to two groups of students drawn from two normal populations marks obtained Were as follows. Group A ; 18 , 20 , 36 , 50 , 49 , 36 , 34 , 49 , 41 . Group B : 29 , 28 , 26 , 35 , 30 , 44 , 46 . Examine the equality of variances at 5 % level of significance. (Given : = 4.65 with d.o.f. 6 and 8)
37	If $\vec{F} = (z^2 + 2x + 3y)i + (3x + 2y + z)j + (y + 2xz)k$ is irrotational, then (i) Find the scalar potential associated with $\vec{F}$ such that $\phi(1,1,0)=4$ (ii) Also the work done in moving a particle under $\vec{F}$ from A(0,1,1) to B(3,0,2)
38	Evaluate: $\int_c \frac{z^2}{(z-1)^2(z-2)}dz$; c is $\|z\| = 2.5$
39	Estimate the test score (X) when sales (Y in hundreds of Rs) is Rs 3000 using the following data X: 14 19 24 21 26 22 15 20 19 Y: 31 36 48 37 50 45 33 41 39
40	The chance that a doctor will diagnose a disease correctly is 60%. The chance that a patient will die by his correct diagnosis is 40% and that by his wrong diagnosis is 70%. A patient dies on a particular day. What is the chance that he was diagnosed correctly?
41	(i) Verify whether probability mass function of R.V.X. $p(x) = \frac{(\|X\|+1)^2}{9}$ for $x = \{-1,0,1\}$ is well defined (ii) If so find its mean and variance .

42	Discuss whether drug and sugar pills differ in curing cold(at 5% level of significance)and Table value of Chi-square statistic is 3.84 using the data:- | | Helped | Harmed | | Drug | 150 | 30 | | Sugar pills | 130 | 40 |
43	Evaluate: $\int \vec{F}.\overrightarrow{dr}$; where $\vec{F} = (x^2 - y^2)i + (x + y)j$ and c is the triangle with vertices (0,0),(1,1),(2,1) using Green's theorem.
44	Expand: f(z)=$\frac{7z-2}{z(z+1)(z-2)}$ $about\ z = -1, for\ 1 < \|z+1\| < 3$ as a Laurent's Series
45	Find the Spearman's Rank correlation between X and Y using data | X | 100 | 98 | 85 | 92 | 90 | 84 | 88 | 90 | 93 | 95 | | Y | 500 | 610 | 700 | 630 | 670 | 800 | 800 | 750 | 700 | 690 |
46	In a normal Distribution, 58% of students scored below 75 and 4% scored above 80. Find the mean and s.d. of the distribution. Area 0.08 is between z=0 and z=0.21 and Area 0.46 is between z=0 and z=1.76
47	An experiment conducted on nine people showed the following changes in pulse rate due the smoking: - {5,3,4, −1,2, −3,4,3,1} . Test whether 'smoking leads to increase in pulse rate' in general. (Given: Table value of t =1.86 at 5% L.O.S.)
48	Test whether the two samples given below are drawn from normal populations with same variance at 5% L.O.S. | Sample-I | 9 | 11 | 13 | 11 | 15 | 9 | 12 | 14 | Given : Table value of F(7,6) =4.21 | Sample-II | 10 | 12 | 10 | 14 | 9 | 8 | 10 | – |
49	
50	*Evaluate by Green's theorem for the field* $\vec{F} = x^2\hat{i} + xy\hat{j}$ *over the region R enclosed by* y=x² and line y=x
51	Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$; c *is* $\|z\| = 3$
52	Determine the coefficient of correlation between X & Y from the following data | X | 51 | 54 | 56 | 59 | 65 | 60 | 70 | | Y | 38 | 44 | 33 | 36 | 33 | 23 | 13 |
53	There is working women's hostel in a town where 75 % are from neighboring town, the rest all are from same town. 48% of women who hail from same town are graduates and 83 % of the women who have come from neighboring town are also graduates. Find the probability that a woman selected at a random is graduates from the same town.
54	In a certain examination test 2000 students appeared in a subject of statistics. Average marks obtained were 50% with standard deviation 5%. How many students do you expect to obtain more than 60% of marks, supposing that marks are distributed normally? (For z =2, A =0.4772)
55	The following table gives the number of accidents in a district during a week. Apply chi-square test to find whether the accidents are uniformly distributed over the week. | Day | Sun | Mon | Tues | Wed | Thu | Fri | Sat |

	<table><tr><td>No.of accidents</td><td>13</td><td>12</td><td>11</td><td>9</td><td>15</td><td>10</td><td>14</td></tr></table> ($Table\ value\ of\ \chi^2 = 12.59, d.f = 6, level\ of\ significance = 5\%$)
56	$Evaluate\ using\ Stokes\ theorem\ \iint_s (\nabla \times \bar{f}).\hat{n}\, d\, s$ *where s is curve surface of the paraboloid* $x^2 + y^2 = 2z$ *bounded by the plane z=2 where* $\vec{f} = 3(x-y)\hat{i} + 2xz\hat{j} + xy\hat{k}$
57	Obtain Laurent's series expansions of f(x) = $\frac{z-1}{z^2-2z-3}$; $\|z\| > 3$
58	Calculate the Spearman's rank correlation coefficient for the following data. <table><tr><td>x</td><td>32</td><td>55</td><td>49</td><td>60</td><td>43</td><td>37</td><td>43</td><td>49</td><td>10</td><td>20</td></tr><tr><td>y</td><td>40</td><td>30</td><td>70</td><td>20</td><td>30</td><td>50</td><td>72</td><td>60</td><td>45</td><td>25</td></tr></table>
59	A C.R.V X has the following pdf. $f(x) = k(x - x^2); 0 \le x \le 1$ Find K and mean
60	Ten individuals are chosen at random from a population & their height are found to be (inches): 63,63,64,65,66,69,69,70,70 &71. In the light of the data, discuss the suggestion that the mean height in the population is 66 inches. (Table value of t_α=2.6, d.f =9, $level\ of\ significance = 5\%$))
61	Standard deviation of two samples of size 9 & 13 were found to be 12.15 & 11.85. Can it be concluded that the samples were drawn from the normal population with the same standard deviation? (Given $F_{0.025} = 3.51\ for\ d.o.f.\ 8\&\ 12$ & $F_{0.025} = 4.20\ for\ d.o.f.\ 12\&\ 8$)
62	Evaluate $\int_C (xy + y^2)\,dx + x^2\,dy$ where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.
63	Evaluate $\int_C \tan z\ dz$ by Cauchy's residue theorem, where C is $\|z\| = 2$.
64	From the following table showing age of cars of a certain make and annual maintenance costs, obtain the regression equation for cost related to age. <table><tr><td>Age of cars (years)</td><td>2</td><td>4</td><td>6</td><td>7</td><td>8</td><td>10</td><td>12</td></tr><tr><td>Annual Maintenance Cost (Rs.)</td><td>1600</td><td>1500</td><td>1800</td><td>1900</td><td>1700</td><td>2100</td><td>2000</td></tr></table>
65	A coin is tossed. If it turns up heads two balls are drawn from urn A otherwise two balls are drawn from urn B. Urn A contains 3 black and 5 white balls. Urn B contains 7 black and one white ball. What is the probability that urn A was used, given that both balls drawn are black?
66	The marks obtained by students in an examination are normally distributed with mean 70 and standard deviation 5. Find the probability of securing mark (i) between 60 and 75 (ii) more than 75. (Given: Area from z = 0 to z = 1 is 0.3413 and area from z = 0 to z = 2 is 0.4772)
67	A die was thrown 132 times and the following frequencies were observed. <table><tr><td>No. obtained</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>Total</td></tr><tr><td>Frequency</td><td>15</td><td>20</td><td>25</td><td>15</td><td>29</td><td>28</td><td>132</td></tr></table> Test the hypothesis that the die is unbiased at 5% level of significance. (Given: Table value of χ^2 at 5% level of significance and 5 degree of freedom is 11.07)

68	Use Gauss Divergence theorem to evaluate $\iint_S \overline{N} \cdot \overline{F}\, ds$ where $\overline{F} = 2xi + xyj + zk$ over the region bounded by the cylinder $x^2 + y^2 = 4$ between $z = 0$ and $z = 6$.
69	Find Laurent's series for $f(z) = \dfrac{4z+3}{z(z-3)(z+2)}$ valid for (i) $2 < \lvert z \rvert < 3$ (ii) $\lvert z \rvert > 3$
70	Obtain the rank correlation coefficient from the following data. X: 10, 12, 18, 18, 15, 40 Y: 12, 18, 25, 25, 50, 25
71	A random variable X has the following probability function: X: 1, 2, 3, 4, 5, 6, 7 $P(X = x)$: k, $2k$, $3k$, k^2, $k^2 + k$, $2k^2$, $4k^2$ Find (i) k (ii) $P(X < 5)$ (iii) $P(X > 5)$.
72	An I.Q. test was taken of 5 persons before and after training. The results are given below: I.Q. before training: 110, 120, 123, 132, 125 I.Q. after training: 120, 118, 125, 136, 121 Test whether there is any charge in I.Q. after the training program. Use 1% level of significance. (Given: The table value of t at 1% level of significance and 4 degree of freedom is 4.604)
73	Apples were grown under two different conditions. Two random samples of sizes 11 and 9 showed the standard deviations of weights as 0.8 and 0.5 respectively. Test the hypothesis that population variances are equal at 10% level of significance. (Given: The table value $F_{(8,10)}(0.05) = 3.07$ and $F_{(10,8)}(0.05) = 3.34$)

Sample Questions

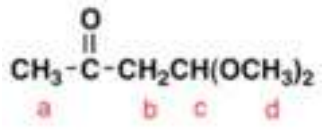
Chemical Engineering

Subject Name: Industrial & Engineering Chemistry-II **Semester: IV**

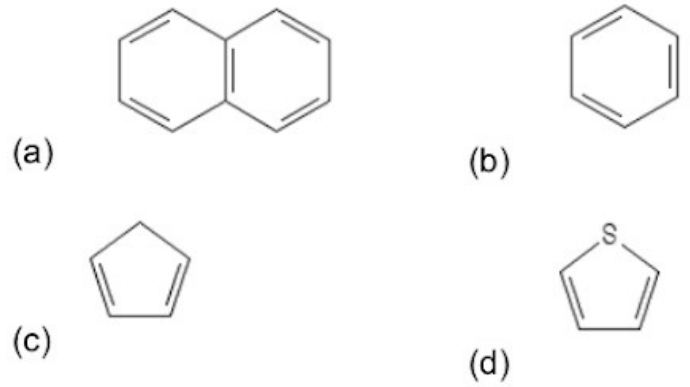
Multiple Choice Questions

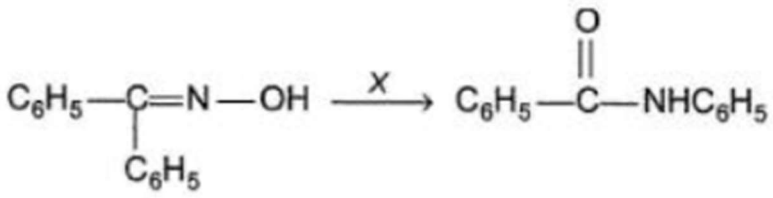
	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The movement of dispersed phase in colloids is observed in ---
OptionA:	Sedimentation potential
Option B:	Electroosmosis
Option C:	Streaming potential
Option D:	Electrolysis
2.	Which of the following properties does aprotic solvents possess?
Option A:	Strong tendency to donate protons.
Option B:	Strong tendency to accept protons
Option C:	Inert to proton transfer
Option D:	Function as proton donator and proton acceptor
3.	Keto-enol tautomerism involves migration of _____
Option A:	Hydride ion
Option B:	Hydrogen atom
Option C:	Hydrogen ion
Option D:	Hydroxyl ion
4.	Which of the following options is incorrect?
Option A:	Micelle formation by soap in aqueous solution occurs above a particular conc.
Option B:	Micelles are not always spherical.
Option C:	Micelles form only when the concentration of surfactant is greater than critical micelle conc.
Option D:	Ionic micelles influence many properties of the mixture.
5.	Favorskii reaction results in formation of _____
Option A:	An Amide
Option B:	ß- hydroxy ester
Option C:	α – hydroxy carboxylic acid
Option D:	A carboxylic acid derivative
6.	State the correct statement.
Option A:	Catalyst is most active at any temp.
Option B:	Catalyst does not affect the final state of equilibrium.
Option C:	Catalyst can change in chemical composition.
Option D:	Acitvity of catalyst can never be inhibited.
7.	In preparation of unsaturated carboxylic acid from acetoacetic ester which of the following compounds is used?

Option A:	A carbonyl compound
Option B:	A halogen ester
Option C:	Urea
Option D:	A dihaloalkane
8.	NaCl is insoluble in Carbon tetrachloride because _____
Option A:	Carbon tetrachloride has high dielectric constant
Option B:	Carbon tetrachloride has low dielectric constant
Option C:	Carbon tetrachloride is polar in nature
Option D:	Carbon tetrachloride is a volatile solvent
9.	The most abundant fragment give rise to ----- peak on mass spectrum.
Option A:	Base
Option B:	Molecular ion
Option C:	Least fragmented
Option D:	Non fragmented
10.	How many signals in NMR are expected in ethyl acetate?
Option A:	3
Option B:	2
Option C:	1
Option D:	0
11.	The diagnostic region in the IR spectrum is the ---- IR.
Option A:	Mid
Option B:	Far
Option C:	Near
Option D:	Very far
12.	Friedal Craft's reaction is an example of
Option A:	Adsorption Theory
Option B:	Autocatalysis
Option C:	Catalyst promoters
Option D:	Intermediate compound theory
13.	Pyridine is strongly alkaline in nature because _____
Option A:	It has delocalised pi electron cloud
Option B:	It has six membered ring with nitrogen atom
Option C:	Lone pair of nitrogen is involved in conjugated system
Option D:	Lone pair of nitrogen is not a part of conjugated system
14.	In reversed phase HPLC, the polar component (analyte) is --- retained.
Option A:	Most
Option B:	Moderate
Option C:	Least
Option D:	Maximum
15.	Absorption of radiation in the UV region causes ---- transition.
Option A:	Vibrational
Option B:	Rotational
Option C:	Electronic
Option D:	Nuclear
16.	The example of homogeneous catalysis is ----
Option A:	Formation of methanol from (CO +H2) gases, with ZnO catalyst.
Option B:	Acid - base catalysis
Option C:	Formation of H2 & CO2 from formic acid in presence of Cu foil.

Option D:	Formation of ammonia over powdered Fe catalyst.
17.	On autoionization of liq. NH3 which of the following species are generated?
Option A:	Ammonium ion and Ammonia gas
Option B:	Hydrogen ion and Amide ion
Option C:	Ammonium ion and Amide ion
Option D:	Only Ammonium ion
18.	The temperature of the sample is compared with that of reference material as both are heated at uniform rate.
Option A:	TGA
Option B:	DTA
Option C:	DSC
Option D:	TSC
19.	In which chromatography, the second development of analyte is performed at right angle to the detection of the first run.
Option A:	Radial
Option B:	Two dimensional
Option C:	Ascending
Option D:	Descending
20.	Example of" Oil is dispersed phase and water is dispersion medium" is
Option A:	Gel
Option B:	Milk
Option C:	Cheese spread
Option D:	Vanishing cream
21.	Comparing H_2O and NH_3 as solvents leads to analogies between which pair of species?
Option A:	NH_3 and $[OH]^-$
Option B:	$[NH_2]^-$ and H_2O
Option C:	$[NH_2]^-$ and $[OH]^-$
Option D:	$[NH_4]^+$ and H_2O
22.	Which of hydrogens a-d in the following molecule gives a triplet signal in a normal 1H NMR spectrum? 
Option A:	Hydrogen a
Option B:	Hydrogen b
Option C:	Hydrogen c
Option D:	Hydrogen d
23.	In a chromatographic separation, which of the following is most appropriate for the qualitative analysis of a substance?
Option A:	Taking factor
Option B:	Capacity factor
Option C:	Retention time
Option D:	Resolution
24.	Which of the following is not a feature of carrier gas used in gas chromatography?
Option A:	It must be chemically inert
Option B:	It should not be completely pure

Option C:	It should be suitable for the detector employed
Option D:	It should be cheap
25.	The active site of an enzyme remains
Option A:	At the center of globular proteins
Option B:	Rigid and does not change shape
Option C:	Complementary to the rest of the molecule
Option D:	On the surface of catalyst
26.	Movement of colloidal particles under the influence of electrostatic field is
Option A:	Electrophoresis
Option B:	Electrolysis
Option C:	Dialysis
Option D:	Ionization
27.	In infrared spectroscopy which frequency range is known as the fingerprint region?
Option A:	400 - 1400cm-1
Option B:	1400 - 900cm-1
Option C:	900 - 600cm-1
Option D:	600 - 250cm-1
28.	Which of the following is not true for acid base catalysis?
Option A:	Bases catalyze the reaction by accepting a proton
Option B:	Bases increases the reaction rate by increasing the nucleophilic character of the attacking group
Option C:	Acid base is heterogeneous catalysis.
Option D:	Specific hydroxide ion catalysis of reaction in water is an example of this type of catalysis
29.	Choose the correct order of dielectric constant of solvents
Option A:	NH3<H2O<CCl4
Option B:	H2O>NH3>CCl4
Option C:	H2O<CCl4<NH3
Option D:	CCl4>NH3>H2O
30.	An example of an associated colloid is
Option A:	Milk
Option B:	Soap solution
Option C:	Rubber latex
Option D:	Vegetable oil
31.	Which of the following compounds is not aromatic?

	
Option A:	Option A
Option B:	Option B
Option C:	Option C
Option D:	Option D
32.	Which of the following statements is not true for a lyophilic sol?
Option A:	It can be easily solvated
Option B:	It carries no charge
Option C:	Coagulation of this sol is reversible in nature
Option D:	It is not very stable in a solvent
33.	When energy is absorbed by the sample, the absorption can be observed as a change in signal developed by which of the following components?
Option A:	Amplifier
Option B:	Any type of detector
Option C:	GM counter
Option D:	Photomultiplier tube
34.	Which of the following is used as a catalyst for the following reaction? $N_2 + 3H_2 \longrightarrow 2NH_3$
Option A:	Zinc
Option B:	Chlorine
Option C:	Iron
Option D:	Water
35.	Which of the following is not soluble in Liq.Ammonia
Option A:	Alkali Metals
Option B:	Esters
Option C:	Alcohols
Option D:	Alkanes
36.	Preparation of β- hydroxy ester is favoured by which reaction?
Option A:	Cannizaro's Reaction
Option B:	Reformatsky Reaction
Option C:	Favorskii Reaction
Option D:	Wittig reaction
37.	In reverse phase HPLC, there is a

Option A:	Non-polar solvent/polar column
Option B:	Polar solvent/Non-polar column
Option C:	Polar solvent/Polar column
Option D:	Non-polar solvent/Non-polar column
38.	The benzylic acid rearrangement reaction of a cyclic diketone leads to _____
Option A:	Ring expansion
Option B:	Ring contraction
Option C:	Ring fusion
Option D:	Isomers
39.	H2, CH4, C2H6 and C6H6 exhibit which NMR spectra?
Option A:	Singlet
Option B:	Doublet
Option C:	Triplet
Option D:	Quintet
40.	 **Reagent X could be**
Option A:	KOH
Option B:	NaOH
Option C:	dil.H2SO4
Option D:	Conc.H2SO4
41.	Which is the example of aprotic solvent ?
Option A:	H2SO4
Option B:	KOH
Option C:	HAC
Option D:	Benzene
42.	Which of the following is a Lewis acid?
Option A:	BF_3
Option B:	$[SbF_6]^-$
Option C:	$[AlCl_4]^-$
Option D:	NF_3
43.	Which of the following non-aqueous solvents has the longest liquid range?
Option A:	H_2SO_4
Option B:	N_2O_4
Option C:	NH_3
Option D:	HF
44.	What is the range of UV spectrum of light?
Option A:	400 nm – 700 nm
Option B:	200 nm – 400 nm
Option C:	800 nm – 900 nm
Option D:	700 nm to 1 mm

45.	How many proton signals in NMR spectra will present in Benzene?
Option A:	6
Option B:	3
Option C:	1
Option D:	2
46.	In which type of chromatography, the stationary phase held in a narrow tube and the mobile phase is forced through it under pressure?
Option A:	Column chromatography
Option B:	Paper chromatography
Option C:	Liquid chromatography
Option D:	Gas chromatography
47.	The paper chromatography is type of ____chromatography.
Option A:	Column
Option B:	Adsorption
Option C:	Partition
Option D:	Gas-liquid
48.	IR spectrum is a plot of
Option A:	% Transmittance versus time
Option B:	% Transmittance versus wavenumber
Option C:	Peak area versus time
Option D:	Peak area versus wavenumber
49.	In thin layer chromatography, the stationary phase is made of _____ and the mobile phase is made of _____
Option A:	Solid, liquid
Option B:	Liquid, liquid
Option C:	Liquid, gas
Option D:	Solid, gas
50.	Which of the following is used as a carrier gas in gas chromatography ?
Option A:	Carbon dioxide
Option B:	Oxygen
Option C:	Methane
Option D:	Helium
51.	Potential developed at the surface of the fixed layer is called
Option A:	Nernst potential
Option B:	Liquid junction potential
Option C:	Theta potential
Option D:	Zeta potential
52.	Which of the following process is not responsible for the presence of electric charge on sol particle?
Option A:	Electron capture by sol particles
Option B:	Adsorption of ionic species from solution
Option C:	Formation of Helmholtz electrical double layer
Option D:	Absorption ionic species from solution.
53.	Sedimentation potential is the reverse of

Option A:	Electrosmosis
Option B:	Electrophoresis
Option C:	Electrokinetic potential
Option D:	Dorn effect
54.	In which name reaction product β-hydroxy ester is formed…..
Option A:	Beckmann Reaction
Option B:	Favorskii Reaction
Option C:	Claisen condensation
Option D:	Reformatsky Reaction
55.	Select the correct aromatic compound
Option A:	Cyclobutadiene
Option B:	Cyclopentadienyl cation
Option C:	Naphthalene
Option D:	Cyclobutane
56.	The conversion of R2CNOH to RCONHR is the --- with Lewis acid.
Option A:	Intramolecular arrangement
Option B:	intermolecular arrangement
Option C:	Trimolecular arrangement
Option D:	Intermediate arrangement
57.	Which of the following statements is FALSE about aromatic compounds?
Option A:	They are made of rings consisting of alternating double bonds
Option B:	They are non cyclic
Option C:	They are planar and contain pi bond.
Option D:	Aromatic compounds follow Huckel's Rule.
58.	In chemical reaction, catalyst
Option A:	Alters the amount of product
Option B:	Lowers the activation energy
Option C:	Increases the activation energy
Option D:	Increase the amount of product
59	------is used as a catalyst in the conversion of SO_2 to SO_3 in the manufacture of sulphuric acid.
Option A:	Pt
Option B:	Ca
Option C:	Pb
Option D:	Co
60.	Positive catalyst is

Option A:	When rate of reaction is accelerated by the foreign substance
Option B:	When rate of reaction is retarded by the foreign substance
Option C:	When rate of reaction is accelerated and retarded by the foreign substance
Option D:	Only rate of reaction is retarded by the foreign substance
61.	…how closely a computed value agrees with the true value
Option A:	Accuracy
Option B:	Bias
Option C:	Precision
Option D:	Truncation Error
62.	Diagonal Matrix Is one in which
Option A:	All diagonal elements are zero
Option B:	All diagonal elements are one
Option C:	All elements are zero
Option D:	All elements except diagonal elements are zero
63.	Approximate (absolute) error = Current approximation - Previous approximation. It is used to measure the.....
Option A:	lack of precision of an estimate
Option B:	lack of accuracy of an estimate
Option C:	Truncation error
Option D:	Round off error
64.	The convergence of which of the following method is sensitive to starting value?
Option A:	Guass Elimination Method
Option B:	Guass Jordon Method
Option C:	Newton Raphson Method
Option D:	Euler's Method
65.	Select the incorrect statement in case of interpolation
Option A:	It is used in statistical analysis
Option B:	It is used to predict intermediate value of dependent variable for given value of independent variable
Option C:	It is used in research analysis
Option D:	It is used to solve ODE function
66.	Given is the formula for $y_p = y_0 + p\Delta y_0 + \frac{p(p-1)}{2!}\Delta^2 y_0 + \frac{p(p-1)(p-2)}{3!}\Delta^3 y_0 + \ldots$
Option A:	Newton's forward interpolation formula
Option B:	Newton's backward interpolation formula
Option C:	Newton's central interpolation formula
Option D:	Taylor series expansion
67.	Power function of the form $y= ab^x$ can be linearized by performing
Option A:	y= a+b
Option B:	cos(y)= cos(a)+cos(b)
Option C:	sin y = sin(b^x)

Option D:	Log y = log a +x log b
68.	Find the solution of ODE using Euler's method dy/dx= x+y y(0)= 1 at x= 0.2 with h= 0.1
Option A:	0.3678
Option B:	1
Option C:	0.133
Option D:	1.362
69.	Classify the following partial differential equation $u_{xx} + 4u_{xy}+(x^2+4y^2)u_{yy}= \sin(x+y)$
Option A:	Elliptic Equation
Option B:	Parabolic Equation
Option C:	Linear Equation
Option D:	Hyperbolic Equation
70.	In case of interpolating data points with unequal interval size_____is used
Option A:	Method of divided difference
Option B:	Liebman's method
Option C:	Bendre Schmidt Scheme
Option D:	Crank Niicholson scheme
71.	The predictor-corrector method takes
Option A:	Current value into consideration
Option B:	Previous value into account
Option C:	Next value into account
Option D:	doesn't take any value for calculation
72.	General form of second order partial differential equations is $Au_{xx}+ Bu_{xy}+Cu_{yy}+Du_x+Eu_y+Fu = 0$. The equation is said to be elliptic at a point (x,y) in the plane if
Option A:	$B^2 - 4AC =0$
Option B:	$B^2 - 4AC <0$
Option C:	$B^2 - 4AC >0$
Option D:	$B^2 - 4AC =$constant
73.	Trapezoidal formula is also known as _____
Option A:	Simpson's rule
Option B:	Co-ordinate method
Option C:	Prismoidal method
Option D:	Average end area method
74.	In Simpson's 3/8 rule , y(x) is polynomial of degree
Option A:	1
Option B:	2
Option C:	3
Option D:	4

75.	Errors may occur in performing numerical computation on the computer due to
Option A:	Rounding errors
Option B:	Power fluctuation
Option C:	Operator fatigue
Option D:	All of these
76.	Truncation error is difference between
Option A:	the exact solution of the partial differential equation and the discretized equations
Option B:	the exact partial differential equation and the discretized equations
Option C:	the exact solution and the numerical solution of the partial differential equations
Option D:	the exact partial differential equation and its solution
77.	The convergence of which of the following method is sensitive to starting value?
Option A:	Guass Siedel Method
Option B:	Newton Raphson Method
Option C:	Runge Kutta method
Option D:	Bisection method
78.	For the given equation x^2=2. Calculate x1, If initial guess x0= 1 (Use Newton Raphson Method)
Option A:	1.05
Option B:	1.25
Option C:	1.5
Option D:	2.0
79.	If the equation y = a*exp^(bx) can be written in linear form Y=A + BX, what are Y, X, A, B?
Option A:	Y = logy, A = loga, B=b and X=x
Option B:	Y = y, A = a, B=b and X=x
Option C:	Y = y, A = a, B=logb and X=logx
Option D:	Y = logy, A = a, B=logb and X=x
80.	Newton forward interpolation formula is used for _____ intervals.
Option A:	Open
Option B:	Unequal
Option C:	Equal
Option D:	Closed
81.	The convergence of which of the following method is sensitive to starting value?
Option A:	A. False position
Option B:	B. Gauss seidal method
Option C:	C. Newton-Raphson method
Option D:	D. All of these
82.	The Bisection method is also known as
Option A:	A. Binary Chopping
Option B:	B. Quarternary Chopping
Option C:	C. Tri region Chopping
Option D:	D. Hex region Chopping
83.	The Gauss Jordan method reduces a original matrix into a _____

Option A:	A. Identity matrix
Option B:	B. Null matrix
Option C:	C. Skew Hermitian matrix
Option D:	D. Non-symmetric matrix
84.	How the transformation of coefficient matrix A to upper triangular matrix is done?
Option A:	A. Elementary row transformations
Option B:	B. Elementary column transformations
Option C:	C. Successive multiplication
Option D:	D. Successive division
85.	As soon as a new value for a variable is obtained by iteration, it is used immediately in the following equation. This method is called _____.
Option A:	A. Gauss Elimination Method
Option B:	B. Gauss Seidal Method
Option C:	C. Gauss Jacobi Method
Option D:	D. Gauss Jacobi Method
86.	The equation of straight line is
Option A:	$y=a+bx+cx$
Option B:	$y=a+bx$
Option C:	$y=a+bx+cx^2$
Option D:	$y=c$
87.	In Euler's method: Given initial value problem $y'=dy/dx=f(x, y)$ with $y(x0) = y0$, then approximation is given by_____.
Option A:	A. $yn+1=yn+hf(xn-1, yn-1)$
Option B:	B. $yn+1=yn+hf(xn, yn)$
Option C:	C. $yn+1=yn+hf(xn-1, yn)$
Option D:	D. $yn+1=yn+hf(xn, yn-1)$
88.	The modified Euler method is based on the average of _____.
Option A:	A. straight line
Option B:	B. ellipse
Option C:	C. chord
Option D:	D. points
89.	The Laplace equation is of _____ type.
Option A:	A. Elliptic
Option B:	B. Hyperbolic
Option C:	C. Parabolic
Option D:	D. Circular
90.	$xu_{xx} + u_{yy} = 0$ is hyperbolic if _____
Option A:	A. $x=0$
Option B:	B. $x>0$
Option C:	C. $x<0$
Option D:	D. $x=1$

Descriptive Questions

1	Explain concept of Zeta potential in detail.
2	Give a note on enzyme catalysis.
3	Write, with examples, the shielding & deshielding effects involved in NMR spectroscopy. Give the multiplicity of each kind of Hydrogen in the following molecule—i) CH3-CH2-CH3 (propane) ii) CH3-O-CH2-CH3 (Ethyl methyl ether)
4	Give principle & describe any 2 applications of HPLC.
5	Explain Dipole moment & Dielectric constants of ionising solvents.
6	Describe Beckmann rearrangement with its mechanism & application.
7	Give application of surfactants in detergents.
8	Give the principle & describe any 3 important applications of Thin Layer chromatography.
9	Explain any 5 characteristics of catalysts.
10	Describe Principle & Application of Thermogravimetric analysis.
11	What is importance of non aqueous solvents? Give Acid-base & Redox reactions in Liq SO2.
12	Explain the aromatic character of Furan.
13	Write a short note on Electroosmosis.
14	Write in detail how to determine purity of given sample using TLC technique?
15	Write in detail about amphoteric behaviour of Liq.NH3 with examples
16	Write the mechanism for formation of carboxylic salts from Haloketones.
17	Describe the Autocatalysis & Catalyst poisons.
18	Give the basic requirement of IR radiation absorption. Give any two applications of IR spectroscopy.
19	Write about how activation energy changes in a chemical reaction using a catalyst? Write in brief Adsorption theory of catalysis
20	Explain the difference between water and Liq.NH3 as non aqueous solvent based on their properties.
21	Write in detail the concept of Electrical double layer using Helmholtz and Stern Model.
22	Write in detail about the aromaticity of Naphthalene .
23	Write short notes on ThermoGravimetric Analysis (TGA). Give examples of it.
24	Explain in detail working of HPLC,along with examples.
25	Give the preparation of ethylacetoacetate with mechanism.
26	Write the classification of solvents with suitable examples.
27	What is the principle of infrared spectroscopy? Give applications in detail.
28	Explain the principle, instrumentation and applications of HPLC.
29	Explain the applications of surfactants in detail.
30	What is acid-base catalysis? Give the mechanism for both acid and base catalysis.
31	Explain with suitable examples, acid base reaction and redox reaction in liquid ammonia.
32	Write the principle. Instrumentation and application of TGA
33	. Explain the principle, instrumentation and applications of TLC
34	Write short note on electrophoresis.

<table>
<tr><td>35</td><td>Explain the aromaticity of pyridine.</td></tr>
<tr><td>36</td><td>Write the distinguish between homogeneous and heterogeneous catalysis.</td></tr>
<tr><td>37</td><td>Explain and derive the formula for Regula-falsi method to find the root of equation with the help of graph.
Find the root of equation 2x -logx = 7 using the regula-falsi method</td></tr>
<tr><td>38</td><td>Solve the following system of equations using Jacobi's Method
5x – y + z= 10
2x + 4y = 12
x + y + 5z = -1
Start the solution with (2,3,0)</td></tr>
<tr><td>39</td><td>Using Newton's divided difference obtain the polynomial and find f(8) and f(15)

X 4 5 7 10 11 13
F(x) 48 100 294 900 1210 2028</td></tr>
<tr><td>40</td><td>Write the algorithm for RK 2 method
A mass balance for a chemical in a completely mixed reactor can be written as
$V\,(dc/dt) = F - Qc - kVc^2$
where V = volume (12 m^3), c = concentration (g/m^3), F = feed rate (175 g/min), Q = flow rate (1 m^3 /min), and k = a second-order reaction rate (0.15 m^3 /g/min). If c(0) = 0, solve the ODE until t= 3 . Use the RK2 method (h = 0.5)</td></tr>
<tr><td>41</td><td>The specific volume of a superheated steam is listed in steam tables for various temperatures. For example, at a pressure of 3000 lb/in2 , absolute:
<table>
<tr><td>T (◦F)</td><td>700</td><td>720</td><td>740</td><td>760</td><td>7</td></tr>
<tr><td>V(ft^3 /lbm)</td><td>0.0977</td><td>0.12184</td><td>0.14060</td><td>0.15509</td><td>0</td></tr>
</table>
Determine the v at T= 750 F using linear regression</td></tr>
<tr><td>42</td><td>Write the general form of partial differential equation and how the PDE are classified.
Find the values u(x,t) satisfying the equation $\frac{\partial u}{\partial t} = 4\,\frac{\partial^2 u}{\partial x^2}$ and the boundary conditions
u(0,t)= 0 u(8,t)= 0
$u(x,0) = 4x - \frac{1}{2}x^2$
0<x<8 h= 1 t= 0 to 5 Use Bander Schmidt method</td></tr>
<tr><td>43</td><td>Define Accuracy, Precision, and True Error

The following sequence of estimates was obtained when a numerical method was applied to solve the equation: x4 – 5x – 7 = 0.

1.8254 1.9633 2.0121 2.0283 2.0335 2.0351 2.0356 2.0358

Calculate the all four errors for these estimates, given that one of the roots of the equation is 2.0359</td></tr>
<tr><td>44</td><td>Evaluate $\int_0^1 \frac{1}{(1+x)}\,dx$ (h= ¼) using i)Simpson's 1/3 Rule ii) Simpson's 3/8th Rule
iii) Trapezoidal Rule</td></tr>
<tr><td>45</td><td>Given the following table for x and y
<table>
<tr><td>x</td><td>1</td><td>1.05</td><td>1.10</td><td>1.15</td><td>1.20</td><td>1.25</td><td>1.30</td><td></td><td></td></tr>
<tr><td>y</td><td>1</td><td>1.025</td><td>1.049</td><td>1.072</td><td>1.095</td><td>1.118</td><td>1.140</td><td></td><td></td></tr>
</table></td></tr>
</table>

	Find y' and y'' at a)x= 1.05 b)x=1.25 and c) x=1.50
46	Solve the following system of equations using Gauss-Elimination method x + y + z = 7, x+ 2y + 3z = 16 & x + 3y + 4z = 22
47	Using modified Euler's Method find an approximate value of y when x = 0.3 given that $dy/dx = x + y$ and y = 1 when x = 0, Assume step size h = 0.1
48	Consider a reaction A----> B carried out in a batch reactor. The differential equation for species A is $\frac{dCA}{dt} = -k\,CA$ The initial condition is at t = 0, C_A = 1 mol/m^3. The rate constant of the reaction is 1s^{-1}. Using the Runge-Kutta 4th order method, determine the concentration of A at 3 s.
49	Explain with neat sketch Reguli Falsi Method
50	Solve the following system of equations by LU decomposition $x_1 + 7\,x_2 - 4x_3 = -51$ $4x_1 - 4x_2 + 9\,x_3 = 62$ $12x_1 - x_2 + 3\,x_3 = 8$
51	The table below gives the temperature T(°C) and length of heated rod. If length $l = a_0 + a_1T$, find the best value of a_0 and a_1 T (°C): 20, 30, 40, 50, 60, 70 l (mm): 800.3, 800.4, 800.6, 800.7, 800.9, 801
52	List various open & close methods of root finding. Also show the progress of bisection method using graphical representation.
53	For the reaction A ----> B, data of conversion (x) vs. rate of reaction ($-r_A$) is given in the table. Calculate volume of the reactor using Simpson's 1/3 rule. Design equation for volume of reactor is given as: $V = F_{A0}\int_0^{XA}(dX/-rA)$ Take initial feed rate F_{A0} = 2 mol/sec. Conversion, X: 0, 0.4, 0.8 Rate of reaction, $-r_A$ (mol/lit.s): 0.01, 0.008, 0.002
54	Solve the folllowing heat condcution equation using Bender-Schmidt relation $u_{xx} - u_t = 0$ with the conditions $u(x,0) = 4x-x^2$ u (0,t) = u (3, t) = 0 Take h =1, Compute the value of u at internal mesh for two time step i.e. t = 1 sec.
55	Fit a Curve (Straight Line) y = a + bx, for following data using Least Square Method. X: 1, 2, 3, 4, 6, 8 Y: 2.4, 3, 3.6, 4, 5, 6
56	The concentration of salt x in a homemade soap maker is given as a function of time by $\frac{dx}{dt} = 37.5 - 3.5\,x$ at the initial time t=0,the salt concentration in the tank of 50 g/l. using Euler's method and step size of h=1.5 min; what is the salt concentration after 3 min?
57	Using Crank - Nicholson scheme solve $u_{xx} = 16ut$, 0<x<1, t>0 given u(x,0) = 0, u(0,t) = 0, u(1,t) = 100t Compute u for one step in t direction taking h=$\frac{1}{4}$
58	Solve by Gauss - Seidel Method. The following system. 28X - 4Y - Z = 32; X + 3Y + 10Z = 24; 2X + 17Y + 4Z = 35

<table>
<tr><td>59</td><td>Evaluate $\int_0^1 \frac{1}{1+x^2}$ dx using
1. Trapezoidal Rule
2. Simpsons 1/3rd rule
3. Simpsons 3/8th rule, also find value of Π (pie) in each case.</td></tr>
<tr><td>60</td><td>Fit a Least Square geometric curve y = a.x^b; for following data.
<table>
<tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Y</td><td>0.5</td><td>2</td><td>4.5</td><td>8</td><td>12.5</td></tr>
</table></td></tr>
<tr><td>61</td><td>Show progress of Bisection Method using graphical representation also find real root of the equation $X^3 - X - 1 = 0$ using Bisection method.</td></tr>
<tr><td>62</td><td>A ball at 1200 K is allowed to cool down in air ambient temperature of 300K. Assuming heat is lost only due to radiation, the differential equation for the temperature of the ball is given by
$\frac{d\theta}{dt} = -2.2067 \times 10^{-12}(\theta^4 - 81 \times 10^8)$, θ(0) = 1200 k

Where θ is in K and t is in seconds. Find the temperature at t = 480 seconds, using Euler's Method. Assume a step size of t = 240 seconds.</td></tr>
<tr><td>63</td><td>What is accuracy and precision in Numerical Methods? Explain with the help of diagram also enlist various types of errors in Numerical Methods.</td></tr>
</table>

Sample Questions

Chemical Engineering

Subject Name: Numerical Methods in Chemical Engineering **Semester: IV**

Multiple Choice Questions

Choose the correct option for following questions. All the Questions carry equal marks	
1.	"----------is a systematic deviation from the truth"
Option A:	Inaccuracy
Option B:	Accuracy
Option C:	Precision
Option D:	Approximate error
2.	_____ occurs when only certain digits and decimal places are used to represent exact numbers.
Option A:	Truncation error
Option B:	Round-off error
Option C:	Approximate error
Option D:	True error
3.	Consider the number 7.1275432 If the number is written correct to 3 decimal places, then it is approximated as 7.127 If the number is written correct to 4 decimal places, then it is approximated as 7.1275 Error involved on this kind of approximation is called as
Option A:	Truncation error
Option B:	Round-off error
Option C:	Approximate error
Option D:	True error
4.	Difference between True value and Approximation gives_____ .It is a measure of accuracy of the system
Option A:	Truncation error
Option B:	Round-off error
Option C:	True error
Option D:	Approximate error
5.	The general form of linear algebraic equations is given by $a_{11}x_1 + a_{12}x_2 + \ldots\ldots + a_{1n}x_n = b_1$ $a_{21}x_1 + a_{22}x_2 + \ldots\ldots + a_{2n}x_n = b_2$.

	. .. . $a_{n1}x_1 + a_{n2}x_2 + \ldots.. + a_{nn}x_n = b_n$
Option A:	• The x's = the forcing functions acting on the system • The a's= the properties and characteristics that bear on the interactions between components. • The b's = measures of the magnitudes of the responses of the individual components.
Option B:	• The x's = measures of the magnitudes of the responses of the individual components. • The a's= the properties and characteristics that bear on the interactions between components. • The b's = the forcing functions acting on the system
Option C:	• The x's = the properties and characteristics that bear on the interactions between components. • The a's= measures of the magnitudes of the responses of the individual component • The b's = the forcing functions acting on the system
Option D:	• The x's = the forcing functions acting on the system. • The a's= measures of the magnitudes of the responses of the individual component • The b's = the properties and characteristics that bear on the interactions between components
6.	To use Jacobi iteration method elements of leading diagonal elements must be
Option A:	Larger compared to other elements
Option B:	Smaller compared to other elements
Option C:	All zeros
Option D:	All ones
7.	LU decomposition method is based on the fact that the matrix A can be expressed as product of lower triangular and upper triangular matrices provided
Option A:	Matrix is diagonal
Option B:	All the principle minors of matrix a are non-singular.
Option C:	Matrix is singular
Option D:	Matrix is symmetric
8.	Select the incorrect statement in case of interpolation
Option A:	It is used in statistical analysis
Option B:	It is used to predict intermediate value of dependent variable for given value of independent variable
Option C:	It is used in research analysis
Option D:	It is used to solve ODE function
9.	Given is the formula for _____ $y_p = y_0 + p\Delta y_0 + \frac{p(p-1)}{2!}\Delta^2 y_0 + \frac{p(p-1)(p-2)}{3!}\Delta^3 y_0 + \ldots$
Option A:	Newton's forward interpolation formula
Option B:	Newton's backward interpolation formula

Option C:	Newton's central interpolation formula
Option D:	Taylor series expansion
10.	In case of interpolating data points with unequal interval size_____ is used
Option A:	Method of divided difference
Option B:	Liebman's method
Option C:	Bendre Schmidt Scheme
Option D:	Crank Niicholson scheme
11.	Regression analysis is not used for
Option A:	Trend analysis
Option B:	Curve fitting
Option C:	Hypothesis testing
Option D:	Finding solution of ODE
12.	Data points which are not linearly spread can be fitted by
Option A:	Non-linear or polynomial regression
Option B:	Interpolation
Option C:	Linear regression
Option D:	Line of regression
13.	Power function of the form $y= ab^x$ can be linearized by performing
Option A:	y= a+b
Option B:	cos(y)= cos(a)+cos(b)
Option C:	sin y = sin(b^x)
Option D:	Log y = log a +x log b
14.	Using Bisection method find the root of $3x^2 = 5x+2$ in the interval [0.5, 0.6].up to 3 digit
Option A:	0.517
Option B:	0.522
Option C:	0.532
Option D:	0.542
15.	For an equation to be an ordinary differential equation
Option A:	It will have one dependent variable one independent variable
Option B:	It will have one dependent variable two or more independent variable
Option C:	It will have two or more dependent variable one independent variable
Option D:	It will have two dependent variable one independent variable
16.	Find the solution of ODE using Euler's method dy/dx= x+y y(0)= 1 at x= 0.2 with h= 0.1
Option A:	0.3678
Option B:	1
Option C:	0.133
Option D:	1.362
17.	Which of the following equations is an exact DE?
Option A:	$(x^2 + 1)\, dx – xy\, dy = 0$

Option B:	$x\,dy + (3x - 2y)\,dx = 0$
Option C:	$2xy\,dx + (2 + x^2)\,dy = 0$
Option D:	$x^2y\,dy - y\,dx = 0$
18.	Laplace equation is represented by elliptic equation it defines _____heat conduction in an element
Option A:	Steady state
Option B:	Unsteady state
Option C:	Linear
Option D:	Non linear
19.	Classify the following partial differential equation $u_{xx} + 4u_{xy} + (x^2+4y^2)u_{yy} = \sin(x+y)$
Option A:	Elliptic Equation
Option B:	Parabolic Equation
Option C:	Linear Equation
Option D:	Hyperbolic Equation
20.	The classification of PDEs are governed by _____
Option A:	Their highest order derivatives
Option B:	Their least order derivatives
Option C:	The number of terms
Option D:	The constants
21.	In which of the following methods proper choice of initial value is very important?
Option A:	Bisection method
Option B:	False Position method
Option C:	Newton's method
Option D:	Regula Falsi method
22.	The improved Euler method is based on the average of _____.
Option A:	straight line
Option B:	Ellipse
Option C:	Slopes
Option D:	Chord
23.	The modification of Gauss elimination method is called as _____
Option A:	Gauss Seidal
Option B:	Gauss Jordan
Option C:	Jacobi's Method
Option D:	Relaxation Method
24.	The bisection method of finding roots of nonlinear equations falls under the category of a (an) _____ method.
Option A:	Open
Option B:	Bracketing
Option C:	Random
Option D:	Graphical

25.	The differential equation with more than one independent variable is called _____
Option A:	An Ordinary Differential Equation
Option B:	Partial Differential Equation
Option C:	Simultaneous Equation
Option D:	Simple Equation
26.	Which of these does not come under partial differential equations?
Option A:	Laplace's equation
Option B:	Equations of motion
Option C:	1-D wave equation
Option D:	Heat equation
27.	Errors may occur in performing numerical computation on the computer due to
Option A:	Rounding off answers
Option B:	Power fluctuation
Option C:	Operator fatigue
Option D:	Bad weather
28.	In solving simultaneous equations by Gauss Jordan method, the coefficient matrix is reduced to _____ matrix.
Option A:	Identity
Option B:	Diagonal
Option C:	Upper triangular
Option D:	Lower triangular
29.	False Position Method is also called as
Option A:	Linear Interpolation Method
Option B:	Users Method
Option C:	Exact Method
Option D:	Logical Method
30.	The equation of straight line is
Option A:	$y=a+bx+cx$
Option B:	$y=a+bx$
Option C:	$y=a+bx+cx^2$
Option D:	$y=c$
31.	If a matrix has one row, it is called a _____ vector
Option A:	Row
Option B:	Column
Option C:	Active
Option D:	Passive
32.	Formula of Secant Method is same as that of
Option A:	Bisection method
Option B:	False Position method
Option C:	Newton's Method
Option D:	Iteration Method
33.	A square matrix with all non-diagonal elements equal to zero is called _____ matrix.

Option A:	Square
Option B:	Diagonal
Option C:	Row
Option D:	Column
34.	The equation of second degree parabola is
Option A:	$y=a+bx+cx$
Option B:	$y=a+bx$
Option C:	$y=a+bx+cx^2$
Option D:	$y=c$
35.	Which of the following step is not involved in Gauss Elimination Method?
Option A:	Elimination of unknowns
Option B:	Reduction to an upper triangular system
Option C:	Finding unknowns by back substitution
Option D:	Evaluation of cofactors
36.	The Heat equation is of _____ type.
Option A:	Elliptic
Option B:	Hyperbolic
Option C:	Parabolic
Option D:	Circular
37.	In the Gauss elimination method for solving a system of linear algebraic equations, triangularization leads to
Option A:	Diagonal matrix
Option B:	Lower triangular matrix
Option C:	Upper triangular matrix
Option D:	Singular matrix
38.	The differential equation with one independent variable is called _____
Option A:	An Ordinary Differential Equation
Option B:	Partial Differential Equation
Option C:	Simultaneous Equation
Option D:	Simple Equation
39.	The Newton-Raphson method of finding roots of nonlinear equations falls under the category of _____ methods.
Option A:	Bracketing
Option B:	Open
Option C:	Random
Option D:	Graphical
40.	$y(x+h) = y(x) + h f(x,y)$ is referred as _____method.
Option A:	Euler
Option B:	Modified Euler
Option C:	Taylor's Series
Option D:	Runge-Kutta
41.	**In general the ratio of truncation error to that of round off error is**

Option A:	2:1
Option B:	1:1
Option C:	1:2
Option D:	1:3
42.	**In the Gauss elimination method for solving a system of linear algebraic equations, triangularzation leads to**
Option A:	Diagonal matrix
Option B:	Lower triangular matrix
Option C:	Upper triangular matrix
Option D:	Singular matrix
43.	Least Squares Estimation minimizes:
Option A:	summation of squares of errors
Option B:	summation of errors
Option C:	summation of absolute values of errors
Option D:	All of the above
44.	The equation given is x-sinx = 0.5. The true value is 16 & after first step, approximate value calculated using bisection method is 15. then % error is
Option A:	1
Option B:	6.25
Option C:	6.67
Option D:	100
45.	For the given equation $x^2=2$. Calculate x_1, using Newton Raphson Method. If initial guess is $x_0=1$
Option A:	1.05
Option B:	1.25
Option C:	1.5
Option D:	2.0
46.	In linear algebra, an augmented matrix is a matrix obtained by appending the columns of two given matrices. The augmented matrix in Gauss Jordan method is reduced to
Option A:	Row Echelon form
Option B:	Column Echelon form
Option C:	Matrix Echelon form
Option D:	Augmented form
47.	Algorithms for one-step techniques such as Euler's method are extremely simple to program. General form of all such one-step methods is written as
Option A:	New value = (old value x slope) + step size
Option B:	Old value = New value + (slope x step size)
Option C:	New value = old value + (slope x step size)
Option D:	New value = Old value + Error

48.	The approximation of the derivative taken by the Crank-Nicolson scheme is the same as the _____ of spatial derivative.
Option A:	second order forward difference approximation
Option B:	backward difference approximation
Option C:	forward difference approximation
Option D:	central difference approximation
49.	Truncation error is difference between
Option A:	the exact solution of the partial differential equation and the discretized equations
Option B:	the exact partial differential equation and the discretized equations
Option C:	the exact solution and the numerical solution of the partial differential equations
Option D:	the exact partial differential equation and its solution
50.	A partial differential equation requires ----
Option A:	exactly one independent variable
Option B:	two or more independent variables
Option C:	more than one dependent variable
Option D:	equal number of dependent and independent variables
51.	What is the value of k to solve $du/dt = ½\ u_{xx}$ by Bender Schmidt method with $h = 1$, if h & k are the increments of x & t respectively
Option A:	1/2
Option B:	3/2
Option C:	1/4
Option D:	2/3
52.	The predictor-corrector method takes
Option A:	Current value into consideration
Option B:	Previous value into account
Option C:	Next value into account
Option D:	doesn't take any value for calculation
53.	The convergence of which of the following method is sensitive to starting value?
Option A:	Guass Siedel Method
Option B:	Newton Raphson Method
Option C:	Runge Kutta method
Option D:	Bisection method
54.	General form of second order partial differential equations is $Au_{xx}+ Bu_{xy}+Cu_{yy}+Du_x+Eu_y+Fu = 0$. The equation is said to be elliptic at a point (x,y) in the plane if
Option A:	$B^2 - 4AC =0$
Option B:	$B^2 - 4AC <0$
Option C:	$B^2 - 4AC >0$
Option D:	$B^2 - 4AC =$constant

55.	Errors may occur in performing numerical computation on the computer due to
Option A:	Rounding errors
Option B:	Power fluctuation
Option C:	Operator fatigue
Option D:	All of these
56.	Which of the following is one dimensional wave equation?
Option A:	$\partial^2 u / \partial t^2 = C$
Option B:	$\partial^2 u / \partial t^2 = C\, \partial u / \partial x$
Option C:	$\partial^2 u / \partial t^2 = C^2\, \partial u / \partial x$
Option D:	$\partial^2 u / \partial t^2 = C^2\, \partial^2 u / \partial x^2$
57.	The results obtained by using Simpson's rule will be greater than those obtained by using the trapezoidal rule
Option A:	in all cases
Option B:	provided the intervals are small
Option C:	provided the boundary is concave towards the base line
Option D:	provided the boundary is convex towards the base line.
58.	Trapezoidal formula is also known as _____
Option A:	Simpson’s rule
Option B:	Co-ordinate method
Option C:	Prismoidal method
Option D:	Average end area method
59.	The Gauss-Seidel method is applicable to strictly diagonally dominant or symmetric positive definite matrices because in this case
Option A:	convergence is possible
Option B:	error is less
Option C:	solution is stable
Option D:	solution is unstable
60.	In Simpson’s 3/8 rule , y(x) is polynomial of degree
Option A:	1
Option B:	2
Option C:	3
Option D:	4

Descriptive Questions

1	Using Bisection method find the root of the equation $\mathbf{x^3-1.8x^2-10x+17=0}$ that lies between the interval (1,2) at the end of the iterations n=5.
2	Solve the set of simultaneous equations using LU decomposition method 2x-y+z= -1 2y-z+u= 1 X+2z-u= -1

	X+y+2u=5
3	It is known that the tensile strength of a plastic increases as a function of the time it is heat-treated. The following data are collected: Fit a straight line to these data and use the equation to determine the tensile strength at a time of 45 min

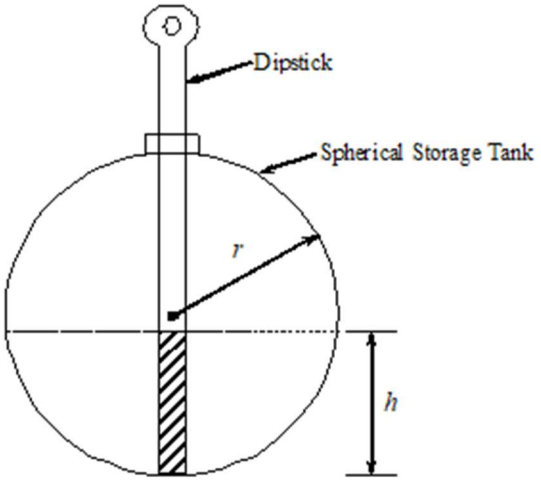
Time	10	15	20	25	40	50	55	60
Tensile strength	8	23	21	40	32	54	70	65

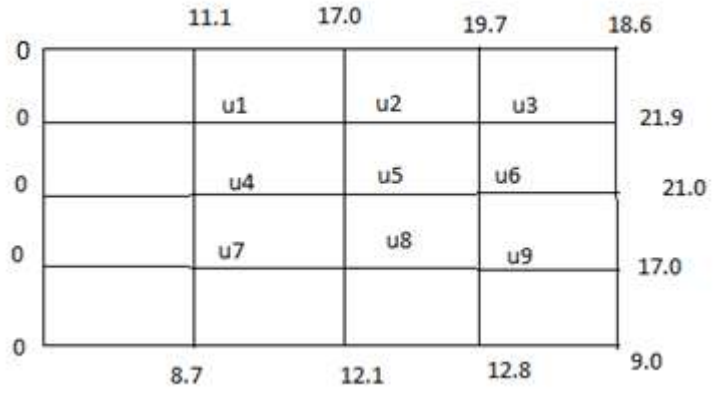
4	Given the following table for x and y

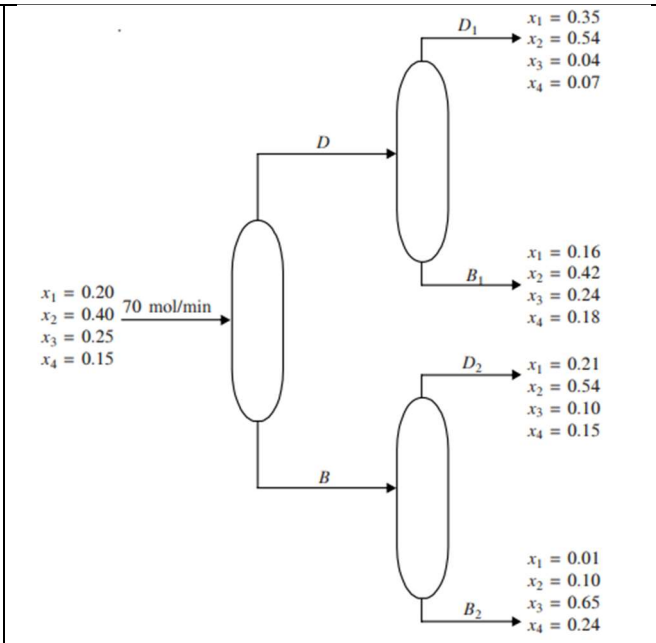
x	1	1.05	1.10	1.15	1.20	1.25	1.30		
y	1	1.025	1.049	1.072	1.095	1.118	1.140		

	Find y' and y'' at a)x= 1.05 b)x=1.25 and c) x=1.50
5	A mass balance for a chemical in a completely mixed reactor can be written as $V\,(dc/dt) = F - Qc - kVc^2$ where V = volume (14 m^3), c = concentration (g/m^3), F = feed rate (200 g/min), Q = flow rate (1 m^3 /min), and k = a second-order reaction rate (0.12 m^3 /g/min). If c(0) = 0, solve the ODE until t= 3 . Use the Runge Kutta 4th order method (h = 0.5)
6	Solve $\partial^2 u/\partial x^2 - \partial u/\partial t = 0$ given Boundary conditions u(0,t)= 0 u(5,t)= 0 And with initial condition u(x,0) = 2x 0<x<1/2 u(x,0)= 2(x-1) ½<x<1 Take h= ¼ and k according to Bendre-Schmidt Scheme
7	Solve the system of equation by Gauss Seidel method, correct to three decimal places. x + y + 54 z = 110 27 x – 6 y – z = 85 6 x + 15 y + 2 z = 72
8	Find the real root of the equation f(x) = $x^3 - 2x - 5 = 0$ by method of False Position.
9	The concentration of salt x in a homemade soap maker is given as a function of time by $\frac{dx}{dt} = 37.5 - 3.5\,x$ at the initial time t=0,the salt concentration in the tank of 50 g/l. using Euler's method and step size of h=1.5 min; what is the salt concentration after 3 min?
10	Solve by LU Decomposition Method $\begin{bmatrix} 25 & 5 & 1 \\ 64 & 8 & 1 \\ 144 & 12 & 1 \end{bmatrix}$
11	Solve numerically y' = y + e^x, y(0) = 0 For x = 0.2, 0.4 by Improved Euler Method.
12	Fit a straight line y = a + bx; for the following data using Least Square Method.

x	1	2	3	4	6	8
y	2.4	3	3.6	4	5	6

13	You have a spherical storage tank containing oil. The tank has a diameter of 6 ft . You are asked to calculate the height h to which a dipstick 8 ft long would be wet with oil when immersed in the tank when it contains 6ft^3 of oil.  **Figure:** Spherical storage tank problem. The equation that gives the height h of the liquid in the spherical tank for the given volume and radius is given by $f(h) = h^3 - 9h^2 + 3.8197 = 0$ Use the Newton-Raphson method of finding roots of equations to find the height h to which the dipstick is wet with oil. Conduct three iterations to estimate the root of the above equation. Find the absolute relative approximate error at the end of each iteration and the number of significant digits at least correct at the end of each iteration.
14	Evaluate $\int_0^1 \frac{1}{1+x^2}\, dx$ using (i) Trapezoidal Rule (ii) Simpson's $\frac{1}{3}rd$ Rule and (iii) Simpson's $\frac{3}{8}th$ Rule; also find value of ∏ in each case.
15	Find by Liebmann's method the values at the interior lattice point of a square region of the harmonic function u whose boundary values are as shown in fig.

<table>
<tr><td></td><td> 
</td></tr>
<tr><td>16</td><td>Show the progress of bisection method using graphical representation</td></tr>
<tr><td>17</td><td>Solve the following system of equations using Gauss-Elimination method
x + y + z = 7, x+ 2y + 3z = 16 & x + 3y + 4z = 22</td></tr>
<tr><td>18</td><td>Use Crank-Nicolson scheme to solve, $u_{xx} = u_t$, $0 < x < 1$, h =1/4, k = 1/8
Given $u(x,0) = 0$, $u(1,t) = 50t$ Compute u for 1-step in t-direction</td></tr>
<tr><td>19</td><td>Solve $\int ydx$ using Simpson's 1/3 rule
<table>
<tr><td>x</td><td>0</td><td>0.1</td><td>0.2</td><td>0.3</td><td>0.4</td></tr>
<tr><td>y</td><td>1</td><td>0.9975</td><td>0.99</td><td>0.9776</td><td>0.8604</td></tr>
</table></td></tr>
<tr><td>20</td><td>Calculate the value of y (0.2) for the equation $dy/dx = y^2 - x$ if y (0) = 1.0, take step size of 0.1 and use Euler's method.</td></tr>
<tr><td>21</td><td>The table below gives the temperature T(°C) and length of heated rod. If length $l = a_0 + a_1T$, find the best value of a_0 and a_1
<table>
<tr><td>T (°C)</td><td>20</td><td>30</td><td>40</td><td>50</td><td>60</td><td>70</td></tr>
<tr><td>l (mm)</td><td>800.3</td><td>800.4</td><td>800.6</td><td>800.7</td><td>800.9</td><td>801</td></tr>
</table></td></tr>
<tr><td>22</td><td>Consider a reaction A----> B carried out in a batch reactor. The differential equation for species A is
$\frac{dCA}{dt} = -k\,CA$
The initial condition is at t = 0, C_A = 1 mol/m^3. The rate constant of the reaction is 1s^{-1}. Using the Runge-Kutta 4th order method, determine the concentration of A at 3 s.</td></tr>
<tr><td>23</td><td>Friction factor in commercial pipe can be calculated using Colebrook equation. If roughness factor (ε) for carbon steel pipe is 0.0015 m for a pipe with ID 4 mm, using Newton's method calculate the friction factor (f) if the Reynolds number is 13743. Colebrook equation:
$$\frac{1}{\sqrt{f}} = -2.0\log\left(\frac{\varepsilon/D}{3.7} + \frac{2.51}{\mathrm{Re}\sqrt{f}}\right)$$</td></tr>
<tr><td>24</td><td>Benzene (1), toluene (2), styrene (3) and xylene (4) are to be separated in the sequence of distillation column shown in figure. Determine molar flow rates of stream D_1, B_1, D_2 & B_2. The composition of the feed stream and the streams D_1, B_1, D_2 & B_2 is shown in figure. Also determine the molar flow rates and composition of streams B & D. The molar flow rate of the feed stream is 70 mol/min</td></tr>
</table>


D_1
$x_1 = 0.35$
$x_2 = 0.54$
$x_3 = 0.04$
$x_4 = 0.07$
D
$x_1 = 0.16$
$x_2 = 0.42$
$x_3 = 0.24$
$x_4 = 0.18$
B_1
$x_1 = 0.20$
$x_2 = 0.40$
$x_3 = 0.25$
$x_4 = 0.15$
70 mol/min
D_2
$x_1 = 0.21$
$x_2 = 0.54$
$x_3 = 0.10$
$x_4 = 0.15$
B
$x_1 = 0.01$
$x_2 = 0.10$
$x_3 = 0.65$
$x_4 = 0.24$
B_2

Sample Questions

Chemical Engineering

Subject Name: Solid Fluid Mechanical Operations **Semester: IV**

Multiple Choice Questions

	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	In closed circuit grinding as compared to open circuit grinding, the
Option A:	specific surface of product is more.
Option B:	product has lesser size uniformity.
Option C:	production rate at a given limiting size is lower.
Option D:	operation is economical
2.	The most suitable equipment for removing the fine dust particle (< 1 micron dia.) from air below its dew point will be a/an
Option A:	bag filter
Option B:	electrostatic precipitator
Option C:	cyclone separator
Option D:	wet scrubber
3.	The capacity of a pneumatic conveying system depends upon the…….
Option A:	bulk density of materials
Option B:	pressure of the conveying air.
Option C:	diameter of the conveying line.
Option D:	all (a), (b) and (c).
4.	Which of the following with respect to mixing is true?
Option A:	It is used to distribute heat uniformly to all the components of the mixture
Option B:	Mixing becomes difficult when one of the phases to be mixed is in minor quantity
Option C:	Solid-solid mixing is more difficult than other phases
Option D:	All of the mentioned

5.	Which is the most suitable conveyor for transportation of sticky material?
Option A:	Apron conveyor
Option B:	Belt conveyor
Option C:	Screw conveyor
Option D:	Pneumatic conveyor
6.	Solid particles separation based on the difference in their flow velocities through fluids is termed as the
Option A:	Clarification
Option B:	Classification
Option C:	Elutriation
Option D:	Sedimentation
7.	What is the critical rotation speed in revolutions per second, for a ball mill of 1.2 m diameter charged with 70 mm diameter balls?
Option A:	0.5
Option B:	1.0
Option C:	2.76
Option D:	0.66
8.	Range of compressibility co-efficient of the commercial compressible cake obtained in filtration operation is
Option A:	0.01 to 0.1
Option B:	0.1 to 0.3
Option C:	0.2 to 0.8
Option D:	0.2 to 0.4
9.	Fluidization occurs when: Drag force by the upward moving gas …….
Option A:	Weight of the particles
Option B:	Weight of the fluid

Option C:	Volume of the bed
Option D:	Pressure drop across the bed
10.	In continuous filtration (at a constant pressure drop), filtrate flow rate varies inversely as the
Option A:	square root of the velocity.
Option B:	square of the viscosity.
Option C:	filtration time only.
Option D:	washing time only
11.	During the increase of velocity of fluid in the bed, how does the graph of pressure drop follows?
Option A:	Linear
Option B:	Exponential
Option C:	Non-linear
Option D:	Sinusoidal
12.	With an increase in drum speed in a rotary drum filter, the filtration rate
Option A:	increases
Option B:	increases linearly
Option C:	decreases
Option D:	is not affected
13.	Fluidization occurs when: Drag force by the upward moving gas _____
Option A:	Weight of the fluid
Option B:	Volume of the bed
Option C:	Weight of the particle
Option D:	Pressure drop across bed
14.	Which of the following is batch sedimentation equipment?
Option A:	Dust catcher
Option B:	Filter thickener

Option C:	Dry cyclone separator
Option D:	Rotary sprayer scrubber.
15.	How much wash water used when the cakes are washed with a pressure difference of 250 kN/m^2 for 10 minutes when the final rate of filtration is given as 2×10^{-5} m^3/sec at 400 kN/m^2.
Option A:	0.018
Option B:	0.0018
Option C:	0.019
Option D:	0.00019
16.	The shape of individual particles is expressed in the terms of
Option A:	Density
Option B:	Size
Option C:	Volume
Option D:	Sphericity
17.	Which of the following screens has the maximum capacity?
Option A:	Vibrating screen
Option B:	Shaking screen
Option C:	Trommels
Option D:	Grizzlies
18.	In froth floatation, chemical agent added to cause air adherence is called
Option A:	collector
Option B:	frother
Option C:	modifier
Option D:	activator
19.	Calculate the overflow ratio, if the mass fraction in feed is 0.635 and fraction in overflow is 0.945, while in underflow is 0.285?
Option A:	0.85

Option B:	0.66
Option C:	0.75
Option D:	0.50
20.	What is the device that rotates rapidly and uses centrifugal force to separate substances of different densities?
Option A:	Cyclone
Option B:	Floatation
Option C:	Impeller
Option D:	Centrifuge
21.	Which of the following screens has the maximum capacity?
Option A:	Grizzlies
Option B:	Trommels
Option C:	Shaking screens
Option D:	Vibrating screens
22.	In a ball mill, the volume occupied by the balls (when the mill is stopped) is about _____ percent of the volume of the mill
Option A:	35
Option B:	50
Option C:	70
Option D:	85
23.	Out of the following size reduction equipments, the maximum feed size can be accepted by the
Option A:	Tube mill
Option B:	Ball mill
Option C:	Jaw crusher
Option D:	Jet pulveriser
24.	With increase in the capacity of screens, the screen effectiveness

Option A:	Remain unchanged
Option B:	Increases
Option C:	Decreases
Option D:	Decreases exponentially
25.	Crushing efficiency is the ratio of the
Option A:	Surface energy created by crushing to the energy absorbed by the solid
Option B:	Energy absorbed by the solid to that fed to the machine
Option C:	Energy fed to the machine to the surface energy created by crushing
Option D:	Energy absorbed by the solid to the surface energy created by crushing
26.	In filtration, the use of filter aid helps in
Option A:	Reducing the filtration pressure
Option B:	Accelerating the rate of filtration
Option C:	Deplugging the filter medium
Option D:	Enhancing the cake porosity in case of a dense impermeable cake
27.	Which new term is utilized for measuring non spherical particles?
Option A:	Sphericity
Option B:	Volume displacement
Option C:	Geometry
Option D:	None of these
28.	Filtration capacity of a rotary drum vacuum filter depends upon
Option A:	Cake thickness
Option B:	Characteristics of the feed slurry
Option C:	Bothe A & B
Option D:	Neither A nor B
29.	The capacity of a pneumatic conveying system depends upon the

Option A:	Bulk density of material
Option B:	Pressure of the conveying air
Option C:	Diameter of the conveying line
Option D:	All of the above
30.	In continuous filtration (at a constant pressure drop), filtrate flow rate varies inversely as the
Option A:	Square root of the velocity
Option B:	Square root of the viscosity
Option C:	Filtration time only
Option D:	Washing time only

Descriptive Questions

1	Derive the expression for screen effectiveness for solid particles.
2	In context solid storage derive the Jansen equation.
3	If crushing rolls, 1 m in diameter, are set so that the crushing surfaces are 12.5 mm apart and the angle of nip is 31^0, what is the maximum size of particle which should be fed to the rolls? If the actual capacity of the machine is 12 % of the theoretical, calculate the throughput in Kg/sec when running at 2.0 H_z if the working face of the roll is 0.4 m long and the bulk density of the feed is 2500 kg/m^3.
4	Write Short note on vibrating screen
5	Explain Positive pressure pneumatic system in details.
6	Explain construction and working of ball mill in details.
7	Explain Batch sedimentation test in details.
8	Explain with the help of neat sketch construction and working of plate and frame filter press.
9	Write Short note on muller mixer.
10	Explain constant pressure filtration with mathematical expression.
11	Write short note on mixing index.
12	Explain particulate and bubbling fluidization.
13	Derive the expression to estimate the size of smallest particle that can be separated in Cyclone separator.
14	A sample of pyrite was screened. The screen analysis is given below. i) Calculate the mean surface diameter. Specific Gravity of pyrite is 5.0 ii) Find specific surface.

Mesh	8/10	10/14	14/20	20/28	28/35	38/48	48/65
Mass fraction retained	0	21.2	19.6	17.4	14	15.8	12
Aperture, mm	1.651	1.168	0.833	0.589	0.417	0.295	0.208

<table>
<tr><td>15</td><td>Derive the basic filtration equation relating (-Δ P), V and T</td></tr>
<tr><td>16</td><td>Write design equation for cyclone separator or derivation for smallest particle separation in cyclone separator</td></tr>
<tr><td>17</td><td>Write short note on Fabric Filter and Electrostatic precipitator.</td></tr>
<tr><td>18</td><td>Derive the equation for calculating the area of the thickener</td></tr>
<tr><td>19</td><td>Write a note on Energy for size reduction or laws for Crushing.</td></tr>
<tr><td>20</td><td>Explain in details Rotary vacuum filter.</td></tr>
<tr><td>21</td><td>Explain Kynch theory of sedimentation in detail</td></tr>
<tr><td>22</td><td>Derive Janssen Equations</td></tr>
<tr><td>23</td><td>Derive Screen Effectiveness</td></tr>
<tr><td>24</td><td>Write short note on cyclone separator.</td></tr>
<tr><td>25</td><td>Explain with the help of neat sketch construction and working of plate and frame filter press.</td></tr>
<tr><td>26</td><td>Explain in brief Kynch theory of sedimentation.</td></tr>
<tr><td>27</td><td>Write short note on Muller Mixer</td></tr>
<tr><td>28</td><td>Discuss conditions for fluidization in details.</td></tr>
<tr><td>29</td><td>Explain construction and working of Ball mill</td></tr>
<tr><td>30</td><td>Calculate the minimum area and diameter of thickener with circular basin to treat 0.5 m^3/s of slurry having solid concentration 125 kg/m^3 from the following data:

<table><tr><td>Solid concentration (Kg/m^3)</td><td>100</td><td>200</td><td>300</td><td>500</td><td>600</td><td>1000</td></tr><tr><td>Settling Velocity (µm/ sec)</td><td>140</td><td>90</td><td>55</td><td>20</td><td>15</td><td>05</td></tr></table>
Assume Underflow concentration to be 1250 kg/m^3.</td></tr>
<tr><td>31</td><td>Explain the degree of mixing and rate of mixing in case of mixing of dry solids.</td></tr>
<tr><td>32</td><td>Ferric hydroxide is filtered at constant pressure in a plate and frame press having a total filter area of 2 m^2 and frame thickness of 2.5 cm. After 6.5 hr of operation, the press is full and 1.37 m^3 of filtrate are collected per sq. m of filter area. It is decided to wash the cake with one third of the volume of the filtrate collected. How much time will be required to wash the cake, if the same pressure is applied.</td></tr>
<tr><td>33</td><td>A filter press contains 24 frames each of 60 cm x 60 cm x 2.5 cm dimensions. In a filtration cycle, the frames are completely filled with cake in 2 hours. Washing of the cake is done at the same pressure as that of filtration and the volume of wash water is equal to 10% of the volume of filtrate per cycle. Calculate the washing time of filtration. If 0.05 m^3 of final cake is formed per m2 of the filter cloth.</td></tr>
<tr><td>34</td><td>Derive the expression for screen effectiveness.</td></tr>
<tr><td>35</td><td>A quartz mixture having analysis shown in table is screened through a standard 10 mesh screen. Calculate mass ratios of overflow and underflow of feed and overall effectiveness of screen</td></tr>
</table>

Mesh number	Dp mm	Mass retained in gms		
		Feed	Overflow	Underflow
4	4.699	0	0	—
6	3.327	25	49.7	—
8	2.362	125	251.3	0
10	1.651	320	294	58.5
14	1.168	260	84	115.5
20	0.833	155	15.4	75
28	0.589	55	7	24
35	0.417	20	—	9
65	0.208	20	—	6
Pan	—	20	—	12

Sample Questions

Chemical Engineering

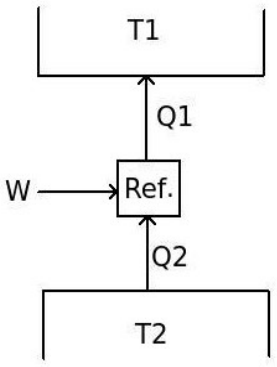
Subject Name: Chemical Engineering Thermodynamics II **Semester: IV**

Multiple Choice Questions

	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which of the following is an example of a non-ideal solution showing positive deviation?
Option A:	Acetone + Carbon disulphide
Option B:	Chlorobenzene + Bromobenzene
Option C:	Chloroform + Benzene
Option D:	Acetone + Aniline
2.	For a regular solution model what is the excess molar free energy dependent upon?
Option A:	Volume occupied by molecules
Option B:	Interaction of molecules
Option C:	Molecular size and intermolecular forces
Option D:	Enthalpy of formation of molecules
3.	How does the UNIQUAC model help?
Option A:	It helps to place calculations of activity coefficients on practical basis
Option B:	It helps to place calculations of activity coefficients on theoretical basis
Option C:	It helps to place calculations of activity coefficients from graph
Option D:	It helps to provide a easier way to place calculations
4.	In Margules equation, what is the one constant form equivalent to?
Option A:	Unsymmetrical activity coefficient curves
Option B:	Symmetrical activity coefficient curves
Option C:	Similar partial fugacity coefficients
Option D:	Dissimilar partial fugacity coefficients
5.	For an ideal solution the partial vapour pressure of a component in solution is equal to the mole fraction of that component times its vapour pressure. Is the
Option A:	Henry`s Law
Option B:	Dalton`s Law
Option C:	Charles Law
Option D:	Raoult`s Law
6.	If standard free energy change is zero, then equilibrium constant(K)
Option A:	$K = 0$
Option B:	$K = 1$
Option C:	$K > 1$
Option D:	$K < 1$

7.	In a binary system at constant temperature and pressure, the equation used to test the thermodynamic consistency of VLE data is
Option A:	Lewis – Randall rule
Option B:	Henry's Law
Option C:	Gibbs – Duhem equation
Option D:	Gibbs – Helmholtz equation
8.	In a refrigeration cycle, the flow of refrigerant is controlled by
Option A:	Compressor
Option B:	Condenser
Option C:	Evaporator
Option D:	Expansion valve
9.	Decomposition of calcium carbonate (solid state) gives carbon dioxide (gas state) and calcium oxide (solid state). Find degree of freedom
Option A:	0
Option B:	1
Option C:	2
Option D:	3
10.	Addition of products to original reactant stream
Option A:	Decreases equilibrium conversion
Option B:	Increases equilibrium conversion
Option C:	Has no effect on equilibrium conversion
Option D:	Increases reaction temperature
11.	The ratio of fugacity to fugacity in the standard state is called
Option A:	Fugacity coefficient
Option B:	Activity coefficient
Option C:	Activity
Option D:	Chemical potential
12.	The constant boiling mixtures are called _____.
Option A:	Amalgams
Option B:	Alloys
Option C:	Azeotropes
Option D:	Colloids
13.	The excess volume and the volume change of mixing are _____.
Option A:	Equal
Option B:	Not equal
Option C:	Always negative
Option D:	Always positive
14.	Chemical potential is an _____ property.
Option A:	Extensive
Option B:	Intensive
Option C:	Path
Option D:	Reference
15.	Free energy change at equilibrium is
Option A:	0

Option B:	<1
Option C:	>1
Option D:	1
16.	The equilibrium can be expected to shift in the exothermic direction if the
Option A:	Temperature is lowered
Option B:	Temperature is increased
Option C:	Temperature remains constant
Option D:	Temperature increased and then decreased
17.	In evaporation process of vapour compression refrigeration system
Option A:	Heat is rejected from refrigerant to surroundings
Option B:	Heat is rejected from surroundings to refrigerant
Option C:	Only pressure change takes place
Option D:	Only temperature change takes place
18.	For obtaining high COP, the pressure range of compressor should be
Option A:	High
Option B:	Low
Option C:	Optimum
Option D:	Any value
19.	Which of the following is incorrect with reference to partial molar properties?
Option A:	They are intensive properties
Option B:	They are always positive
Option C:	They represent the contribution of individual components to the total solution property
Option D:	They vary with composition of the solution
20.	Which refrigerant is widely used in refrigeration facilities of food as cooling of fresh vegetables, dairy products, meat and fish and similar process industries?
Option A:	sulphur dioxide
Option B:	ethyl chloride
Option C:	Propane
Option D:	Ammonia
21.	Raoult's law is valid when :
Option A:	both vapour and liquid are non-ideal
Option B:	both vapour and liquid are ideal
Option C:	vapour is ideal and liquid is non-ideal.
Option D:	vapour is non-ideal and liquid is ideal
22.	A solution exhibiting positive deviation from ideality :
Option A:	Always forms a minimum boiling azeotrope
Option B:	Always forms a maximum boiling azeotrope
Option C:	Has a total pressure that is less than that predicted by Raoult's law
Option D:	When formed from its constituents there is an absorption of heat.
23.	Which one of the following is true for the excess property M^E ?

Option A:	$M^E = M-M^{ig}$
Option B:	$M^E = M-\sum x_i M_i$
Option C:	$M^E = \Delta M$
Option D:	$M^E = M-M^{id}$
24.	Chemical potential is an _____ property.
Option A:	Extensive
Option B:	Intensive
Option C:	Path
Option D:	Reference
25.	The mole fraction of NH_3 in the reaction $N_2 + 3H_2 \rightarrow 2NH_3$ if initial moles of nitrogen if 20 moles and hydrogen is 60 moles and conversion is 80% what is the mole fraction of NH_3
Option A:	0.020408
Option B:	0.244898
Option C:	0.734694
Option D:	0.562
26.	If the reaction proceeds with an increase in the number of moles, presence of inerts in the system will
Option A:	decrease the equilibrium yield
Option B:	increase the equilibrium yield
Option C:	no change in equilibrium yield
Option D:	can not predict
27.	How is the COP of a refrigerator calculated  *Refrigerator COP*
Option A:	$[COP]_{Ref.} = Q1 / W$
Option B:	$[COP]_{Ref.} = Q2 / W$
Option C:	$[COP]_{Ref.} = W / Q1$

Option D:	$[COP]_{Ref.} = W / Q2$
28.	How is the condensation process in vapour compression refrigeration cycle carried out?
Option A:	at constant volume
Option B:	at constant pressure
Option C:	at constant enthalpy
Option D:	at constant entropy
29.	The necessary and sufficient condition for equilibrium between two phases is :
Option A:	Concentration of each component should be same in the two phases
Option B:	The temperature of each phase should be the same
Option C:	The pressure should be the same in the two phases
Option D:	The chemical potential of each component should be the same in the two phases.
30.	Freon group of refrigerants are
Option A:	Inflammable
Option B:	Toxic
Option C:	Non-inflammable and toxic
Option D:	Nontoxic and non-inflammable

Descriptive Questions

1	Show that in a binary solution ,if the molar volume of one of the components increases with concentration ,the molar volume of the other must decrease.
2	State Raoult's law .Show that it is simplified form of Lewis Randall Rule
3	Explain effect of temperature on equilibrium constant
4	Explain Concept of Phase Equilibria
5	Explain Equilibrium conversion
6	Explain Chemical Potential
7	Explain Vapour absorption refrigeration system with principle
8	Define excess property and Property change of Mixing and show that the property change of mixing and excess properties are identical.
9	A vapour compression Refrigerator employing Freon-12 works between pressure limits of 182.5 kPa & 960.6 kPa. The heat transfer from the condenser is found to be 72KJ/min and the heat absorbed in the evaporator is 3200 KJ/hr. The refrigerant Vapor leaves the evaporator in the saturated state. The enthalpy of saturated Vapor at 182.5 kPa = 181.2kJ/Kg & the enthalpy of saturated liquid at 960.6 kPa = 76.2 KJ/Kg. Calculate: a] The refrigerant flow rate through the system in kg/min b] The energy input to the compressor

	c] The COP of the system
10	The NH3 synthesis reaction: $N_2(g) + 3\ H_2(g) \rightarrow 2NH_3(g)$ is carried out under different sets of conditions described below. Calculate equilibrium conversion and fraction of nitrogen reacted if initial mixture consists of 1 mol N_2, 5 mol H_2 and 0.3 mol NH_3 at 800K and 100 bar. Data: K =1.1067 x 10^{-5} at 800 K
11	The vapour pressures of aceton (1) and acetonitrile (2) can be evaluated by the Antoin equations. $\ln p_1^S = 14.5463 - \frac{2940.46}{T-35.93}$ $\ln p_2^S = 14.2724 - \frac{2945.47}{T-49.15}$ where T is in K and P is in kPa. Assuming that the solution formed by these are ideal, calculate a) x_1 and y_1 at 327 K and 65 kPa b) T and y_1 at 65 kPa and x_1 = 0.4
12	The following simultaneous reaction take place in a gas mixture A+B→C+D K_1 =0.1429 A+C → D+E K_2 = 2 Calculate the equilibrium composition at 1 bar if an equimolar mixture of A and B is fed to a reactor to produce D. Assume that the reaction mixture behaves like an ideal gas.
13	Explain vapour absorption cycle with its Principle.
14	Explain the Tangent Intercept method for determination of partial molar Properties.
15	The vapour pressures of aceton(1) and acetonitrile(2) can be evaluated by the Antoin equations. $\ln p_1^S = 14.5463 - \frac{2940.46}{T-35.93}$ $\ln p_2^S = 14.2724 - \frac{2945.47}{T-49.15}$ where T is in K and P is in kPa. Assuming that the solution formed by these are ideal, calculate a) x_1 and y_1 at 327 K and 65 kPa b) T and y_1 at 65 kPa and x_1 = 0.4
16	A gaseous mixture containing 30% CO, 50%H_2 and rest inert gas is sent to a reaction chamber for methanol synthesis. The following reaction occurs at 635 K and 310 bar. $CO(g) + 2\ H_2(g) \rightarrow CH_3OH(g)$

	Assuming that the gas mixture behaves as an ideal solution. Calculate the percentage conversion of CO. given that Kf = $5*10^{(-5)}$ and Kϕ = 0.35
17	Explain with diagram Vapour Absorption refrigeration cycle.
18	Derive the relationship between mole fraction of species in multiple reactions and extent of reactions.
19	Explain the effect of temperature and pressure on Equilibrium constant..
20	Show that the rate of change of chemical potential of a substance with pressure is equal to its partial molar volume in the solution.
21	With the help of T-S diagram Deduce the expressions for the COP of the vapour compression cycles.
22	The molar enthalpy of a binary solution at constant T and P is given by the relation $H= 500\ x_1+ 1000\ x_2 + x_1\ x_2\ (\ 50\ x_1+ 40\ x_2)$ where H is in J/mol. Obtain expression for H_1 and H_2 in terms of x_1 and the numerical values of the pure component enthalpies H_1 and H_2.Also determine the partial molar enthalpies of component 1 and 2 at infinite dilution.
23	Show that $ln\gamma = \frac{\mu_i}{RT}\left[\frac{\partial}{\partial_{n_i}}\left(\frac{nG^E}{RT}\right)\right]_{T,\ P,nj}$
24	The azeotrope of the ethanol benzene system has a composition of 44.8% (mol) ethanol with a boiling point of 341.4 K at 101.3 kPa. At this temperature the vapour pressure of benzene is 68.9 kPa and the vapour pressure of ethanol is 67.4 kPa . What are the activity coefficients in a solution containing 10% alcohol.
25	Calculate maximum conversion of ethylene to ethyl alcohol. The vapour phase hydration of ethylene to alcohol is carried out at 523 K and 34 bar. The reaction occurring is $C_2H_{4(g)} + H_2O_{(g)} \rightarrow C_2H_5OH_{(g)}$ The variation of equilibrium constant with temperature is given by the relation $lnK = \frac{4760}{T} - 1.558\ lnT + 2.22 \times 10^{-3}T - 0.29 \times 10^{-6}T^2 - 5.56$ The steam to ethylene ratio in the initial mixture is 5.
26	Expalin with diagram Vapor Compression Refrigeration cycle
27	Define extent of reaction and The following gas phase reactions occur in a mixture initially containing 3 mol ethylene and 2 mol oxygen . Derive expression for mole fractions in terms of extent of reaction. $CH_4 + ½\ O2 \rightarrow (CH_2)_2\ O$ $C_2H_4 + 3O2 \rightarrow 2\ CO_2 + 2H_2O$
28	Explain Concept of Phase equilibria and prove that chemical potential is criteria of phase equilibria.

29	A refrigerating unit using Freon -12 as the working fluid operates between 18^0C and 37^0C. The rate of circulation of refrigerant is 2 kg/min and the efficiency of the compressor is 0.85. Using the following data of enthalpy, calculate i) The capacity of the plant in tons of refrigeration ii) The power required to run the unit iii) The COP of the unit **Data** : The enthalpies of R-12 liquid at 37^0C is 455 kJ/kg. The enthalpies of R-12 entering and leaving the compressor are 563.15 kJ/kg and 595.4 kJ/kg respectively.
30	For a system excess free energy is given by the relation $\frac{G^E}{RT} = (1.42\,x_1 + 0.59x_2)x_1x_2$ Find out the expression for $ln\gamma_1$ and $ln\gamma_2$ and Do the system satisfy Gibbs Duhem equation ?