QM-5234

M. Sc. (Sem. I) Examination,
Dec. 2023

CHEMISTRY

PAPER - 1.4

CHEM-514

Mathematics for Chemists

Time Allowed : Three Hours

Maximum Marks : 70
Min. Marks : 28

Note : This question paper ***contains two*** *sections as* ***under :***

Section-A ***Max. Marks-20***

This section will have 10 questions, having 02 question from each unit with no internal choice. Answer in about 20 words. All questions carry equal marks. (10×02=20)

Section-B ***Max. Marks-50***

This section contains 10 questions, having 02 questions from each unit. One question to be attempted from each unit. Word limit approximately 400-500 words. Questions may have sub divisions. All questions will have equal marks. (10×05=50)

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SECTION – A

1 (i) Define determinant.

(ii) Define maxima and minima.

(iii) Define order of differential equation.

(iv) Define optimal solution of transportation problem.

(v) State reduction theorem of assignment problem.

(vi) Define cross product of vectors.

(vii) Define median.

(viii) Define standard deviation.

(ix) Define binomial frequency distribution.

(x) Write testing of hypothesis.

SECTION – B

UNIT - I

2 (a) Find eigen values of the matrix A and verify that A satisfies its characteristic equation. Use this fact to find A^{-1}, where

$$A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}.$$

(b) Apply the matrix theory to solve the following system of equations :

$$x + y + z = 6$$

$$x + 2y + 3z = 14$$

$$-x + y - z = -2$$

OR

(a) If $u = e^{xyz}$, then find $\frac{\partial^3 u}{\partial x \partial y \partial z}$.

(b) Find the maximum value of

$$\sin x \sin y \sin(x + y).$$

UNIT - II

3 Solve the following differential equations :

(a) $(D^2 + 3D + 2)y = e^x$

(b) $(D^2 - 2D + 1)y = \sin x$

where $D \equiv \frac{d}{dx}$.

OR

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Solve the following LPP by graphical method :

Min. $Z = 2x + 3y$

s.t. $x + y \geq 5$, $x + 2y \geq 6$

and $x \geq 0$, $y \geq 0$.

UNIT - III

4 There are five jobs to be assigned, one each to five machines and the associated cost matrix is as follows. Solve the following assignment problem :

Jobs ↓	← Machines → I	II	III	IV	V
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	15

OR

A company is spending Rs. 1,000 on transportation of its units to four warehouses from three factories. What can be the maximum saving by optimal scheduling. Solve the following transportation problem :

Factory ↓	← Warehouses → W_1	W_2	W_3	W_4	Factory Capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Warehouse requirement	5	8	7	14	34

UNIT - IV

5 Find Mean, Median and Mode for the following data :

No. of Days absent	≤ 5(below5)	≤ 10	≤ 15	≤ 20	≤ 25	≤ 30	≤ 35	≤ 40	≤ 45
No. of Students	29	224	465	582	634	644	650	653	655

OR

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The first four moments of a distribution about the variable 5 are 2, 20, 40 and 50. Show that the mean 7, variance 16, μ_3 64 and μ_4 162. Also find measures of Skewness and Kurtosis.

UNIT - V

6 (a) A coin is tossed 4 times. Find the probability that at least one head turns up.

(b) 6 dice are thrown 729 times. Find how many times at least 3 of the dice will show 5 or 6?

OR

For Poisson distribution with parameter m, prove that $\mu_{r+1} = mr\mu_{r-1} + m\frac{d\mu_r}{dm}$.

Hence find μ_2, μ_3 and μ_4.

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