

(b) Write down the first five terms of the sequence given by the recursion formula :

$$a_1 = 1, a_2 = -1, a_{n+2} = \frac{a_{n+1}}{a_n} \quad (5)$$

(c) Draw the graph of $y = \sin x$, $0 \leq x \leq 2\pi$. (6)

3. (a) Find $\frac{d^2y}{dx^2}$ if

(i) $y = 5x^4 + e^x + \sin x$

(ii) $y = \tan^2 x + \frac{3}{x^2}$ (6)

(b) Examine the nature of the roots of the equation $3x^2 - 8x + 4 = 0$. (4.5)

(c) Integrate the following :

(i) $\int \frac{x}{x^2 + 1} dx$

(ii) $\int \left(x + \frac{1}{x^2}\right)^2 dx$ (6)

4. (a) Evaluate :

$$\int_1^2 (2x^3 + x^2 - 4) dx \quad (6)$$

(b) If the distance S covered by a particle in t seconds is given by

$$S = ae^t + be^{-t}$$

Find the velocity and show that the acceleration at time t is equal to the distance travelled by it up to time t . (6)

(c) Find the sum of the infinite series

$$1 + \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \dots \quad (4.5)$$

SECTION - II

5. (a) If $A = \begin{pmatrix} 6 & 1 \\ 7 & -4 \end{pmatrix}$ and $B = \begin{pmatrix} 10 & -2 \\ -4 & 11 \end{pmatrix}$

Find the matrix $5A-2B$. (5)

(b) Find the value of x such that

$$(1 \ 1 \ x) \begin{pmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = 0 \quad (6)$$

6. (a) Find the values of x, y, z and w which satisfy the matrix equation :

$$3 \begin{pmatrix} x & y \\ z & w \end{pmatrix} = \begin{pmatrix} x & 6 \\ -1 & 2w \end{pmatrix} + \begin{pmatrix} 4 & x+y \\ z+w & 3 \end{pmatrix} \quad (5)$$

(b) Find the image of the point $(5,3)$ under the following transformations using matrix multiplication.

(i) Dilation by a scale factor 2.

(ii) Reflection in x -axis.

(iii) Rotation through an angle 45° in the counter clockwise direction. (6)

7. (a) If $A = \begin{pmatrix} 1 & 3 \\ 5 & 2 \end{pmatrix}$ $B = \begin{pmatrix} 2 & 3 \\ -1 & 4 \end{pmatrix}$

Calculate $AB + BA$. (5)

(b) Find $A = \begin{pmatrix} 1 & 4 \\ 4 & -2 \\ 2 & 6 \end{pmatrix}$, $B = \begin{pmatrix} -1 & -2 \\ 4 & 5 \\ 3 & 1 \end{pmatrix}$

Find matrix X such that $A + 2B - 3X = 0$. (6)

SECTION – III

8. (a) Find the Arithmetic Mean of the following frequency distribution. (5)

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	4	10	8	20	15	12

- (b) The following frequency table gives the ages (in years) of a group of 50 children invited to a birthday party. Find the standard deviation of the distribution. (5)

Age (in years)	5-7	7-9	9-11	11-13	13-15
Frequency	16	13	10	6	5

9. (a) Two random variables have the least squares regression lines $3x + 2y = 26$ and $6x + y = 31$. Find the mean values and the coefficient of correlation. (5)

- (b) The probability that a student passes in physics is 0.8 and the probability he passes mathematics is 0.7. If 0.6 is the probability that he will pass in both examination then what is the probability that he will pass in at least one of them. (5)

10. (a) A die (unbiased) is rolled. A person gets Rs. 10, if he gets an even number and loses Rs. 5 for an odd number. What is his expectation? (5)

- (b) An oil exploration firm finds that 5% of the test wells it drills, yields a deposit of natural gas if the firm drills six wells, use Poisson distribution to find the probability that

(i) Exactly two wells

(ii) At least one well

yield gas? ($e^{-0.3} = 0.7408$) (5)

11. (a) The heights of plants of a certain species are normally distributed, the mean height being 30 cm and the standard deviation being 5 cm. What proportion of plants are greater than 40 cm in height?

- (b) A certain stimulus administered to each of 12 patients resulted in the following increase in B.P.

5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6.

Can it be concluded that the stimulus will in general be accompanied by an increase in blood pressure. ($t_{0.05}$ at 11 d.f. = 2.201) (5)

(4000)