

Roll.No.

25UAIGT1001

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
B.Sc Cs with AI- END SEMESTER EXAMINATIONS - NOVEMBER 2025
SEMESTER - I
25UAIGT1001 - Mathematical Foundations for AI

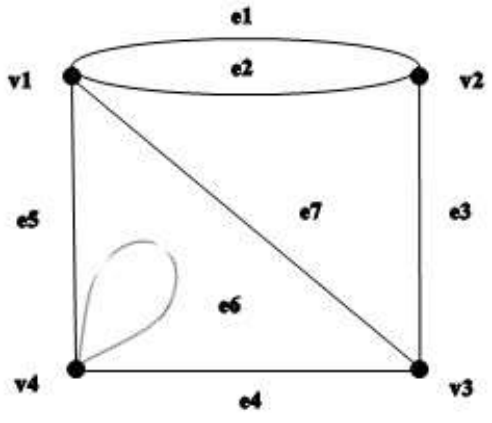
Total Duration : 2 Hrs.30 Mins.

Total Marks : 60

Section B

Answer any **SIX** questions ($6 \times 5 = 30$ Marks)

1. Find the rank of $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 0 & 5 \end{bmatrix}$
2. A machine produces: 90% non-defective items and 10% defective items
Testing:
Non-defective passes test with 95%, Defective passes test with 20%
If an item passes the test, what is the probability that it is non-defective?
3. Discuss about various machine learning optimization techniques.
4. Calculate the Jacobian $f(x, y) = (x^3y^2 - 5x^2y^2, y^6 - 3y^3x + 7)$
5. Find the incidence matrix and the adjacency matrix for the following graph.



6. The savings bank account of a customer showed an average balance of Rs.150 and a standard deviation of Rs.50. Assuming that the account balances are normally distributed.
 1. What percentage of account is over Rs.200?
 2. What percentage of account is between Rs.120 and Rs.170?
 3. What percentage of account is less than Rs.75?

Contd...

7. A factory has 10 machines which may need adjustment from time to time during the day. Three of these machines are old, each having probability of $1/11$ needing adjustment during the day and 7 are new, having the corresponding probability of $1/21$. Assuming that no machine needs adjustment twice on the same day, find the probabilities that on a particular day.
 - (i) just 2 old and no new machine need adjustment and
 - (ii) just 2 machines that need adjustment are of the same type.
8. Compare Newton's method and Quasi-Newton method in optimization.

Section C

Answer any **THREE** questions ($3 \times 10 = 30$ Marks)

9. Apply Gram-Schmidt process to construct an orthonormal basis for $V_3(R)$ with the standard inner product for the basis (v_1, v_2, v_3) , Where $v_1 = (1,0,1)$; $v_2 = (1,3,1)$ and $v_3 = (3, 2, 1)$.
10. Assuming the following probability distribution for X:

$X = x$	0	1	2	3	4	5	6	7
$P(X = x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^{2+k}$

Determine: (i) K (ii) $P(X < 6)$ (iii) find the minimum value of c such that $P(X \leq c) > 1/2$ (iv) the distribution function of X.

11. Minimize $f(x) = x^2 - 4x + 4$ using Newtons method.
12. Compute the Hessian matrix at the point $(0, 1, \pi)$ of $f(x, y, z) = e^{-x} \sin(yz)$
13. Discuss the graph search algorithms and their area of applications.
