PUSASQF2.1
Numerical Methods and Algebra

Time: 2 hours
Total Marks: 60 marks

Note:

1) **The candidate has option to either attempt question 4A or question 4B. Rest all questions are mandatory.**
2) **Numbers to the right indicate full marks.**
3) **The candidates will be provided with the formula sheet and graph papers (if required) for the examination.**
4) **Use of approved scientific calculator is allowed.**

Q1. Attempt All Questions

A) **5 Marks**

Explain with an example the dot product two vectors. Find dot product of vectors **a**=3i+4j+k and **b**=i+3j+6k

B) **5 Marks**

Obtain a root of the equation correct to three decimal places for the equation $x^3 - 4x - 9 = 0$ using Bisection method in (2, 3)

C) **5 Marks**

The sum of three consecutive numbers in AP is 42 and their product is 2688. What are the numbers?

Q2. Attempt All Questions

A) **5 Marks**

Rajiv and Vijay both started with an initial salary of Rs. 50000 and Rs. 64000 respectively with an annual increment of Rs. 2500 and Rs. 2000 respectively. In which year will Rajiv start earning more salary than Vijay?

B) **5 Marks**

Find Determinant of the Matrix $\begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & 1 \\ 1 & 2 & -1 \end{bmatrix}$

C) **5 Marks**

Sketch the graph of $y = x^2$

Q3. Attempt All Questions

A) **5 Marks**

What is $\min(x^2, 15)\ \ for\ (0 \leq x \leq 6)$?

B) **5 Marks**

Find these to three significant digits without using a calculator

$i)\ (2.01)^3 \qquad ii)\ (1.02)^8$

C) **5 Marks**

Define Inverse of a Matrix

Find A^{-1} if $A = \begin{bmatrix} 9 & 2 \\ 13 & 3 \end{bmatrix}$

Q4. Attempt Q4 A or Q4 B

A) **15 Marks**

Given Matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 2 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 2 & 1 & 1 \end{bmatrix}$, find

i) AB
ii) A^{-1}
iii) A^T

B) **15 Marks**

i) Give an example of each of the following matrices :
Diagonal Matrix, Scalar Matrix, Singular Matrix, Skew-symmetric Matrices, Triangular Matrices

ii) State True or False :
a) Inverse of a singular Matrix does not exist
b) Two matrices can always be multiplied
c) A Matrix multiplied by its Inverse gives Identity Matrix
d) Dot product of two vectors is a vector
e) Absolute error can never be negative