19 MAR 2022

SVKM'S
Mithibai College of Arts, Chauhan Institute of Science &
Amrutben Jivanlal College of Commerce and Economics (Autonomous)
Academic Year (2021-22)
Class: SYBSc Semester: IV

Program: Bachelor of Science
Subject: Computer Science
Course Name: Linear Algebra with Python
Course Code: USMACS405
Date:

Max. Marks: 50
Time: 7:30 am to 9:15 am
Duration: 1 hr 45 minutes

REGULAR EXAMINATION

Instructions: **Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.**

1) This question paper contains 03 pages.
2) All questions are compulsory.
3) Answer to each new question to be started on a fresh page.
4) Figures in brackets on the right-hand side indicate full marks.
5) Assume Suitable data if necessary
6) Use of only non-scientific calculators is allowed

Q 1. Attempt any two 14

A. Given u = (3, -2, -3, 1, -2), v = (2, -1, -2, 2, -1), find 07
   i. distance between the vectors **u** and **v**
   ii. angle between the vectors **u** and **v**
   iii. projection between the vectors **u** and **v**
   iv. norm of the vector **u**

B. Given **z** and **w** are complex numbers where $z = 2 - i$ and $w = 3 + 2i$ then find 07
   i. $z + w$
   ii. zw
   iii. conjugate of **z**
   iv. w / z
   v. $|z|$

C. i. Solve the following triangular system of linear equations: 07

$$2p - 4q - 3r - 2s = -9$$
$$q + 4r - s = 4$$
$$3r + s = -6$$
$$2s = -6$$

ii. Determine whether the following homogeneous system of linear equations have non zero solution

$$x + y - z = 0$$
$$2x + 4y - z = 0$$
$$3x + 2y + 2z = 0$$

Q 2. Attempt any two 14

A. Given that 07

$$A=\begin{bmatrix} -7 & -12 & 1 \\ -4 & 3 & 4 \\ -2 & 5 & 2 \end{bmatrix} \quad B=\begin{bmatrix} 4 & 1 & -2 \\ 5 & 4 & 2 \\ -2 & -3 & -1 \end{bmatrix}$$

i. Find the sum of the matrices
ii. Find the transpose of matrix A
iii. Find the inverse of matrix B from its adjugate matrix

B. Given that 07

$$A=\begin{bmatrix} 3 & -4 & 4 \\ 1 & 3 & -2 \\ 1 & 6 & 1 \end{bmatrix} \quad B=\begin{bmatrix} 4 & -1 & 2 \\ 3 & 2 & 2 \\ -1 & -2 & 4 \end{bmatrix}$$

i. Find the difference A - B
ii. Find the transpose of matrix A
iii. Find the product of matrices

C. Find the basis and the rank of following matrix: 07

$$\begin{bmatrix} 1 & 2 & 0 & -1 \\ 2 & 6 & -3 & -3 \\ 3 & 5 & 4 & 0 \\ -2 & 2 & 1 & 2 \end{bmatrix}$$

Q 3. Attempt any two 14

A. Reduced the following matrix to it echelon form and then to its row-canonical form 07

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & -1 \\ 3 & 2 & 4 \end{bmatrix}$$

B. Solve the following system of linear equations using Gaussian Elimination 07

$3x + 5y + 2z = -5$
$x + 3y + 2z = -7$
$3x + y - 2z = 11$

C. For the following matrix A 07

i. Find all eigenvalues and corresponding eigenvectors.
ii. Find matrices P and D such that P is nonsingular and $D = P^{-1}AP$ is diagonal.

$$A = \begin{bmatrix} 4 & 1 \\ 7 & -2 \end{bmatrix}$$

Q 4. Attempt any four 08

A. Explain norm of a vector. 02
B. Describe linearly dependent vectors. 02
C. Explain degenerate linear equations and its solutions. 02
D. What are the elementary row operations allowed on system of linear equations? 02
E. Explain homogeneous system of linear equations 02
F. Define eigenvalue and eigenvector. 02