Birla Institute of Technology & Science, Pilani

Work Integrated Learning Programmes Division
M Tech (Software Engineering) at Wipro Technologies (WASE)
II Semester 2015 - 2016
MID Semester Examination (MAKEUP)

Course Number	:	SEWP ZC132
Course Title	:	LINEAR ALGEBRA & OPTIMIZATION
Type of Exam	:	Closed Book
Weightage	:	30%
Duration	:	90 minutes
Date of Exam	:	17th May 2016

Session : FN (9 to 10.30 AM)

No. of Pages:-	**2**
No. of Questions:-	**3**

Note:
1. Please read and follow all instructions given on the cover page of the question paper & answer script.
2. Start each answer from a fresh page. All parts of a question should be answered consecutively.

Ques1.

(a) (2 Marks). Convert the following matrix into row-reduced echelon form.

$$A = \begin{bmatrix} 3 & 5 & -4 \\ -3 & -2 & 4 \\ 6 & 1 & -8 \end{bmatrix}$$

(b) (2 Marks). Determine if the vector $(1, 1, 0)$ is in the span of the following basis vector set $S = \{(1,2,1),(1,1,-1),(4,5,-2)\}$

(c) (3 Marks). Solve the following system of equations:

$$\begin{gathered} x + y + z = 0 \\ x + z = 0 \\ 2x + y - 2z = 0 \\ x + 5y + 5z = 0 \end{gathered}$$

(d) (1 Mark). Find the value of p for which A= $\begin{bmatrix} 3 & p & p \\ p & 3 & p \\ p & p & 3 \end{bmatrix}$ is of rank 1.

(e) (2 Marks). Do you think that there is a 2×2 matrix A such that $A.\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} c & d \\ a & b \end{bmatrix}$ for all values for a, b, c and d. Explain your reasoning.

Ques2.

(a) (4 Marks). Consider the mapping $T : R^2 \to R^3$ defined by

$$T(x_1, x_2) = (x_1 + x_2 + 1,\ 2x_1 - x_2,\ x_1 + 3x_2)$$

Check whether T is linear or not.

(b) (6 Marks). Solve the following equations using Gauss Seidel iteration starting from

$x = 0,\ y = 0,\ z = 0.$

$$6x + 15y + 2z = 72; \quad x + y + 54z = 110; \quad 27x + 6y - z = 85.$$

Ques3.

(a) (6 Marks). In the Leslie model of population growth, the oldest age attained by the females in some animal population is 6 years. Divide the population into three age classes of 2 years each. Let the Leslie Matrix be

$L = [l_{jk}] = \begin{bmatrix} 0 & 2.3 & 0.4 \\ 0.6 & 0 & 0 \\ 0 & 0.3 & 0 \end{bmatrix}$ where l_{1k} is the average number of daughters born to a single female during the time she is in the age class k, and $l_{j,j-1}\,(j = 2,3)$ is the fraction of females in the age class $j-1$ that will survive and pass into class j.

(i). What is the number of females in each class after 2, 4 and 6 years if each class initially consists of 500 females?

(ii). For what initial distribution will the number of females in each class change by the same proportion and what is this rate of change?

(b) (4 Marks) Apply power method (2 steps) with scaling using $[1\ \ 1\ \ 1]^T$ as initial approximation. Give Rayleigh quotients and error bounds.

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

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