**Birla Institute of Technology & Science, Pilani**

**Work Integrated Learning Programmes Division**

**M. S/M Tech (Software Engineering) at Wipro Technologies (WASE)**

**II Semester 2015 - 2016**

**MID Semester Examination (Regular)**

Course Number : SEWP ZC132

Course Title : LINEAR ALGEBRA & OPTIMIZATION

Type of Exam : Closed Book

**No. of Pages:- 3**

**No. of Questions:- 3**

Weightage : 30%

Duration : 90 minutes

Date of Exam : 8th May 2016 Session : FN (9 to 10.30 AM)

**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.

**(a) (4 Marks)**The following figure shows four major roads of a certain city. Each of these roads are one-way roads and the direction of the same is shown in the figure through arrows. On a particular hour of the traffic on a typically week-day, the average number of vehicles per hour entering and leaving each intersectionare shown in the figure beside each road. GulmoharRoad and MagnoliaRoad can each handle up to2000 vehicles per hour each without causing congestion, whereas the maximum capacity of both Palm Road and Girnar Road is 1000 vehicles per hour. The flow of trafficis controlled by traffic lights installed at each of the four intersections.

500

300

*x1*

Gulmohar Road

800

1200

*x4*

*x2*

*x3*

Magnolia Road

1400

1300

400

700

Palm Road

Girnar Road

(i) Write a general expression of traffic flow at each intersection involving the rates of flow , , and and prove that there is no unique flow pattern (i.e. solution for , , and )

(ii) Suggest two possible flow patterns that will ensure no traffic congestion.

(iii) How many flow patterns are possible assuming that , , and are all positive integers and limited to their individual road capacities?

**(b) (2 Marks)** Find a set of linearly independent vectors that spans the infinite plane in Show the working steps.

**(c) (3 Marks)**Check whether the following set of matrices is a vector space or not. The + and ∙ operations applicable are the usual matrix addition and multiplication of a matrix with a scalar.

**(d) (1 Mark)** Find a basis for the vector space of all skew symmetric matrices.

**(a) (4 Marks)** Using Gauss Seidel method, solve the following system of equations.

With initial values.

Do only two iterations.How can you improve the chance of success with the Gauss-Seidel method?

**(b) (3 Marks)**Solve the following system of equations by LU decomposition methods.

The decomposition of the coefficient matrix is given below.



**(c) (3 Marks)** Find the matrix which gives the reflection about the plane in in the linear transformation . Find the transformation matrix and its eigenvalues and eigenvectors.

**(a) (5 Marks)** An elastic membrane in the plane with boundary circle is stretched so that a point goes over a point with transformation function given by, *i.e.*

Find the principal directions *i.e.* the directions of position vectorsof for which the direction of the position vector of is either same or exactly opposite. What shape does the boundary circle take under this deformation?

**(b) (5 Marks)** Apply Power method with scaling to find the dominant eigenvector and eigenvalue for the following matrix. Perform four iterations with initial vector as .



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