Exam. Code: 0907
Sub. Code: 6695

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B. Engg. (Bio-Technology)-3rd Semester

MATHS-302: Linear Algebra and Operations Research

(Common with IT)

Time allowed: 3 Hours | Max. Marks: 50

NOTE: *Attempt five questions in all, including Q. No. 1 which is compulsory and selecting atleast two questions from each Unit. Use of simple calculator is allowed.*

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I. (a) Define dimension of a vector space with suitable examples. Give example of finite dimensional vector space.

(b) Explain the difference between Gauss-elimination method and Gauss-Jordan method.

(c) Prove that if λ be an eigenvalue of matrix A (non-singular matrix), than $\frac{1}{\lambda}$ is an eigenvalue of A^{-1}.

(d) Explain the following with respect to L.P.P.:
(i) Extering variable (ii) Leaning variable

(e) What is cycling? State the rules to avoid cycling.

(f) Explain the advantages of duality.

(g) State complementary slackness theorem.

(h) Explain different types of transportation problem.

(i) Explain briefly the difference between transportation problem and assignment problem.

(j) Define:
(i) Total float (ii) Critical path (10×1)

UNIT-I

II. (a) Let $\vec{u} = (1,2,-1)$, $\vec{v} = (2,3,4)$, *and* $\vec{w} = (1,5,-3)$. Determine whether or not $\vec{x} = (3,2,5)$ is a linear combination of $\vec{u}, \vec{v}, \vec{w}$.

(b) Reduce the matrix $A = \begin{bmatrix} 3 & 1 & 7 \\ 1 & 2 & 4 \\ 4 & -1 & 7 \\ 4 & -1 & 5 \end{bmatrix}$ to column echelon form and its rank.

(c) Test for consistency the following system and if consistent, solve them:
$x + 2y - z = 3$, $3x - y + 2z = 1$, $x - y + z = -1$ (3+3+4)

III. (a) Examine whether or not the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ is diagonalizable or not? If diagonalizable then diagonalize it.

(b) Find the characteristics equation of the matrix $A = \begin{bmatrix} 4 & 3 & 1 \\ 2 & 1 & -2 \\ 1 & 2 & 1 \end{bmatrix}$. Hence, find A^{-1}. (5+5)

IV. (a) Solve the following problem graphically:

Max. $z = -x_1 + 2x_2$,

Subject to $x_1 - x_2 \le -1$

$-0.5x_1 + x_2 \le 2$, $x_1, x_2 \ge 0$

(b) Find all the basic feasible solution of the equations:

$2x_1 + 6x_2 + 2x_3 + x_4 = 3,$

$6x_1 + 4x_2 + 4x_3 + 6x_4 = 2,$

(c) Maximize $2x_1 + 3x_2 + 10x_3,$

Subject to $x_1 + 2x_3 = 0,$

$x_2 + x_3 = 1, \quad x_1, x_2, x_3 \geq 0$ (3+3+4)

UNIT-II

V. (a) Use dual simplex method to

Minimize $z = 2x_1 + x_2,$

Subject to $3x_1 + x_2 \geq 3,$

$4x_1 + 3x_2 \geq 6,$

$x_1 + 2x_2 \leq 3, \quad x_1, x_2 \geq 0$

(b) Find the initial basic feasible solution to the following transportation problem by:

(i) North-west corner cell method

(ii) Least cost cell method (5+5)

VI. (a) Consider the following unbalanced transportation problem:

		To 1	2	3	Supply
From	1	5	1	7	10
	2	6	4	6	80
	3	3	2	5	15
Demand		75	20	50	

Since there is not enough supply. Some of the demands of these destinations may not be satisfied. Suppose these are penalty costs for every unsatisfied demand unit which are given by 5, 3 and 2 for destination 1, 2 and 3 respectively. Find the optimal solution.

(b) Solve the assignment problem:

	A	B	C	D
I	1	4	6	3
II	9	7	10	9
III	4	5	11	7
IV	8	7	8	5

(5+5)

VII. (a) Compare CPM and PERT explaining similarities and mentioning where they mainly differ.

(b) A project schedule has the following characteristics:

Activity	Preceding Activities	Duration (Day)
A	------	4
B	------	7
C	------	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

(i) Draw the network and find the project completion time.

(ii) Calculate the three floats for each activity. (5+5)

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