



ID.No./Seat No.

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY,  
JAMSHORO.

SECOND TERM FIRST YEAR (2<sup>ND</sup> TERM) B.E.(EL, ES, TL, CS, SW CH, PG & MN) REGULAR EXAMINATION 2009 OF 09-BATCH.

LINEAR ALGEBRA & ANALYTIC GEOMETRY

Dated: 07-12-2009.

Time Allowed: 03 Hours.

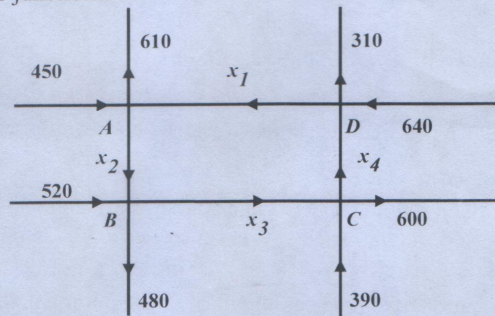
Max.Marks 80

NOTE: ATTEMPT ANY FIVE QUESTIONS.

Q.No.

Marks

- 01 (a) Define linear dependent and independent vectors. Find 'k' for which the vectors  $(1, -1, k)$ ,  $(2, k, -4)$  and  $(0, 2 + k, -8)$  are linearly dependent or independent. (06)
- (b) Define linear transformation. A transformation T from  $R^3$  to  $R^2$  is defined as:  $T(x, y, z) = (x + y, y + z)$ . Is T linear transformation? (05)
- (c) Define Hermitian and Skew-Hermitian matrices. Prove that every Hermitian matrix can be written as  $A+iB$ , where A is real and symmetric and B is real and skew-symmetric. (05)
- 02 (a) Define consistency criteria. Is the following "Road Net-Work" consistent? If so, find its solution. Here  $x_i$  indicate number of vehicles entering and leaving the junctions. (08)



- (b) Define echelon and reduced echelon form of matrices. What is rank of a matrix. Reduce the matrix given below into echelon form by using row operations and find its rank as well. (08)

$$\begin{pmatrix} 1 & 3 & -2 & 5 & 4 \\ 1 & 4 & 1 & 3 & 5 \\ 1 & 4 & 2 & 4 & 3 \\ 2 & 7 & -3 & 6 & 13 \end{pmatrix}$$

- 03 (a) Write down the properties of determinants with examples. (06)

(b) Prove that 
$$\begin{vmatrix} a-b-c & 2b & 2c \\ 2a & b-c-a & 2c \\ 2a & 2b & c-a-b \end{vmatrix} = (a+b+c)^3$$
 (10)

Cont'd on P/-2....

- 04 (a) Find the ratio in which XY and XZ planes cut the join of (3, 6, -8) and (4, -9, 3) Also find the coordinates of these points. (05)
- (b) Find the equation of a line in  $R^3$  that passes through the point (11, 4, -6) and is perpendicular to the line  $x = -t, y = t + 1, z = -2t$ . (05)
- (c) Find the equation of line formed by the intersection of two planes:  $x - y + z = 2$  and  $2x - 3y + z = 1$ . (06)

- 05 (a) Find the distance of the point  $P(3, -4, 5)$  from the plane  $2x - 5y - 6z = 16$  measured parallel to the line  $\frac{x}{2} = \frac{y}{1} = \frac{z}{-2}$ . (05)
- (b) Find the equation of sphere which passes through the point (1, 2, 3) and contains the circle  $x^2 + y^2 + z^2 - 9 = 0 = x + y + z - 5$  (04)
- (c) Do as directed (Any One): (07)
- (i) Show that the lines  $L: x = 1 + 2t, y = 3 + 2t, z = 3 + 4t$  and  $M: x = 2 + 3s, y = 3 + 4s, z = 4 + 5s$  are coplanar. Also find the equation of plane containing them.
- (ii) Show that general equation of the cone with vertex at origin and z-axis with semi-vertical angle 'u' is  $x^2 + y^2 = z^2 \tan^2 u$ .

06 (a) Show that the two lines  $L_1: \begin{cases} x = 4 - t \\ y = -2 + 2t \\ z = 7 - 3t \end{cases}$  and  $L_2: \begin{cases} x = 3 + 2s \\ y = -7 - 3s \\ z = 6 + 4s \end{cases}$  (10)

are skew lines. Hence find the shortest distance between these lines.

- (b) Do as directed: (Any One) (06)
- (i) Find the equation of the sphere which passes through the points  $A(-3, 6, 0)$  and  $B(-2, -5, -1)$  and  $C(1, 4, 2)$  and whose center lies on the hypotenuse of the triangle  $ABC$ .
- (ii) Find the equation of sphere passing through the points (0, 0, 0), (0, 1, -1), (-1, 2, 0) and (1, 2, 3).

- 07 (a) Find the direction of QIBLA from Islamabad having Latitude  $33^\circ 40' N$  and Longitude  $73^\circ 8' E$ . (05)
- (b) Express the equation  $x^2 - y^2 - z^2 = 1$  into cylindrical and spherical coordinates. (05)
- (c) Evaluate  $\iiint_S (x^2 + y^2) dV$  where S is the region bounded by the cylinder  $x^2 + y^2 = 1$  and the planes  $z = 0$  and  $z = 4$ . (06)

- 08 (a) Change the order of integration and hence evaluate  $\int_0^4 \int_{y/2}^2 e^{x^2} dx dy$  (06)
- (b) Find the area bounded by the parabola  $y = x^2$  and the line  $y = 2x + 3$ . Also show this area graphically. (05)
- (c) Evaluate  $\iint_D e^{-(x^2+y^2)} dx dy$ , where D is the closed disk of radius 'a' with center at origin. (05)