Max. Marks: 80
Time: 3 hours

Section A – All Questions Carry 1 Mark Each

1. A variable plane at a distance of 1 unit from the origin cuts the coordinate axes at A, B and C. If the centroid D(x,y,z) of triangle ABC satisfies the relation $1/x^2 + 1/y^2 + 1/z^2 = k$ then the value of k is
   a) 3
   b) 1
   c) 1/3
   d) 9
   e) None of these

2. If A – 2B = (1 -2 3 0) and 2A - 3B = (-3 3 1 -1) . Find B.
3. The number of distinct real values of λ, for which the vectors 2a = i+ j+ k, i-2j+k and , i+ j- 2k are coplanar.
4. If $y = x^3 + 5$ and x changes from 3 to 2.99, then what is approximate change in y?

Section B – All Questions Carry 2 Mark Each

1. If $4 \sin^{-1} x + \cos^{-1} x = \pi$, then find the value of x.
2. Given that M is a 3rd order skewed matrix, write a step wise proof for determinant value of M to be equal to 0, |M| = 0.
3. Find the inverse of matrix. $A = \begin{pmatrix} -1 & 2 \\ 4 & 7 \end{pmatrix}$
4. Find the approximate change in the value of 1/x^2, when x changes from x = 2 to x = 2.002.
5. Find the Projection (vector) of 3i - 2j + k on i + 2j - k.
6. Given function is $f(x) = x^3 - 5x^2 + 2x - 80$ and it is increasing over the set of real numbers R. Prove it.
7. Find out how fast is the surface area of a cube increasing when the length of an edge of the cube is 15 cm and its volume is increasing at a steady rate of 6 cu cm/ sec.
8. If A and B are two events such that P(A) = 0.4, P(B) = 0.8 and P(B|A)=0.6, then find P(A|B).
9. Solve x^2ydx - (x^3+y^3)dy= 0

Section C – All Questions Carry 4 Mark Each

1. There are three urns A, B and C. Urn A contains 4 red balls and 3 black balls. Urn B contains 5 red balls and 4 black balls. Urn C contains 4 red and 4 black balls. One balls is drawn from each of these urns. The probability that 3 balls drawn consist of 2 red balls and a black ball.
2. Using integration, find the area in the first quadrant bc circle x^2 + y^2 = 2 and the y-axis.
3. If $\Delta = \begin{bmatrix} 1 & a & a^2 \\ a & a^2 & 1 \\ a^2 & a & 1 \end{bmatrix}$ = -4 then find the value of $\begin{bmatrix} a^3 - 1 & 0 & a - a^4 \\ 0 & a - a^4 & a^3 - 1 \\ a - a^4 & a^3 - 1 & 0 \end{bmatrix}$
4. Find 'a' and 'b' , if the function given by $f(x) = \begin{cases} ax^2 + b, if\ x < 1 \\ 2x + 1, if\ x \geq 1 \end{cases}$ is differentiable at x = 1.
5. Find the equation(s) of the tangent(s) to the curve y = (x^3-1)(x-2) at the points where the curve intersects the x –axis.
6. Find $\int \frac{Sec\, x}{1+cose\, x}$
7. Find the particular solution of the differential equation :
   ye^y dx = (y^3 + 2xe^y)dy, y(0) = 1
8. Show that (x-y)dy= (x+2y)dx is a homogenous differential equation. Also, find the general solution of the given differential equation.
9. Four bad oranges are accidentally mixed with 16 good ones. Find the probability distribution of the number of bad oranges when two oranges are drawn at random from this lot. Find the mean and variance of the distribution.
10. Bag I contains 1 white, 2 black and 3 red balls; Bag II contains 2 white, 1 black and 1 red balls; Bag III contains 4 white, 3 black and 2 red balls. A bag is chosen at random and two balls are drawn from it with replacement. They happen to be one white and one red. What is the probability that they came from Bag III.

Section D – All Questions Carry 6 Mark Each

1. Solve the system of equations given below:

$$x + y - z = 4$$
$$2x - y + 3z = 9$$
$$4y + 5z = 1$$

2. Region R is enclosed between the parabola $4y = 5x^2$ and the line $5y + 6x = 37.$ Find the area of this region using integrals.

3. A company produces two different products. One of them needs 1/4 of an hour of assembly work per unit, 1/8 of an hour in quality control work and Rs 1.2 in raw materials. The other product requires 1/3 of an hour of assembly work per unit, 1/3 of an hour in quality control work and Rs 0.9 in raw materials. Given the current availability of staff in the company, each day there is at most a total of 90 hours available for assembly and 80 hours for quality control. The first product described has a market value (sale price) of Rs 9 per unit and the second product described has a market value (sale price) of Rs 8 per unit. In addition, the maximum amount of daily sales for the first product is estimated to be 200 units, without there being a maximum limit of daily sales for the second product. Formulate and solve graphically the LPP and find the maximum profit.