

Sample Question Paper – I

9003

Course Name :- All Engineering Branches
Semester :- First
Subject :- Basic Mathematics
Duration :- 3 hours

Marks: 80

Instructions :

1. All the Questions are compulsory.
2. Figures to the right indicate full marks.
3. Assume suitable additional data, if necessary.
4. Use of Non-programmable Electronic pocket calculator is permissible.

Q1. Attempt Any Eight

Marks-16

a. Resolve into partial fractions $\frac{1}{x^2 + x}$

b. Evaluate $\begin{vmatrix} -1 & 2 & -3 \\ 2 & -3 & -1 \\ 3 & -1 & 2 \end{vmatrix}$

c. Find the 7th term in the expansion of $(x^2 - \frac{1}{x})^{11}$

d. Show that the vectors $\vec{a} = 2\vec{i} + 3\vec{j} + \vec{k}$ and $\vec{b} = 4\vec{i} - 3\vec{j} + \vec{k}$ are perpendicular to each other.

e. If $\cos A = \frac{1}{2}$, find the value of $\cos(3A)$

f. Prove that $\frac{\sin 2A}{1 + \cos 2A} = \tan A$

g. If $2 \sin 60^\circ \cos 20^\circ = \sin A + \sin B$, Find A and B

h. Verify $\tan^{-1} \infty = \sin^{-1}(\frac{1}{2}) + \cos^{-1}(\frac{1}{2})$

i. Prove that the points (2,3), (-1,0) and (4,5) are collinear.

j. Compute centre and radius of $x^2 + y^2 + 6x + 8y + 10 = 0$

Q2. Attempt any Three

Marks-12

- a. Resolve into partial fractions

$$\frac{3x-1}{(x-4)(2x+1)(x-1)}$$

- b. Resolve into partial fractions

$$\frac{x^4}{x^3-1}$$

- c. Using Binomial theorem prove that

$$((\sqrt{3}+1)^5 - (\sqrt{3}-1)^5) = 152$$

- d. In a given electrical work the simultaneous equations for currents I_1, I_2 and I_3 are

$$I_1 + 2I_2 - I_3 = -1$$

$$3I_1 + 8I_2 - 2I_3 = 28$$

$$4I_1 + 9I_2 + I_3 = 14$$

Find I_1 & I_2 by using Cramer's rule

Q3. Attempt Any Three

Marks-12

a. If $A = \begin{bmatrix} 1 & 2 \\ -2 & 3 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$

$C = \begin{bmatrix} -3 & 1 \\ 2 & 0 \end{bmatrix}$ then verify that $A[B + C] = AB + AC$

b. If $A = \begin{bmatrix} 5 & 6 & -1 \\ 2 & 3 & 2 \\ 1 & 2 & -3 \end{bmatrix}$ $B = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 1 & -1 \\ 1 & -1 & 0 \end{bmatrix}$

Verify that $(AB)' = B' A'$

- c. Prove that

$$\frac{\sin A}{1 + \cos A} + \frac{1 - \cos A}{\sin A} = 2(\sec A - \cot A)$$

- d. Prove that

$$\tan(3A) - \tan(2A) - \tan(A) = \tan(A) \tan(2A) \tan(3A)$$

Q4. Attempt Any Four

Marks-16

- a. Find adjoint of matrix A if

$$A = \begin{bmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & 7 \end{bmatrix}$$

- b. Using matrix inversion method solve the simultaneous equations

$$x + 3y + 3z = 12$$

$$x + 4y + 4z = 15$$

$$x + 3y + 4z = 13$$

- c. Find the unit vector perpendicular to vectors

$$\vec{a} = \vec{i} - \vec{j} + \vec{k} \text{ and } \vec{b} = 2\vec{i} + 3\vec{j} - \vec{k}$$

- d. Find the equation of the line which makes an equal intercepts of opposite sign on coordinate axis and passing through the point (4,3).

- e. Prove that

$$\frac{\cos 3A}{\cos A} + \frac{\sin 3A}{\sin A} = 4 \cos 2A$$

- f. Prove that

$$\frac{\sin 2A + 2\sin 4A + \sin 6A}{\sin A + 2\sin 3A + \sin 5A} = \cos A + \sin A \cot 3A$$

Q5. Attempt Any Three

Marks-12

- a. A(3,1), B(1,-3) and C(-3,-2) are vertices of ΔABC . Find the equation of median AD

- b. Find the equation of line passing through the point of intersection of lines $2x+y=10$ $2x-y=14$ and perpendicular to the line $3x-y+6=0$

- c. Find the equation of the line which is perpendicular bisector of the line joining the points (4,8) and (-2,6).

- d. Prove that

$$\tan^{-1}(1) + \tan^{-1}(2) + \tan^{-1}(3) = \pi$$

Q6. Attempt Any three

Marks-12

- a. If in a ΔABC

$$\cos B = \frac{\sin A}{2\sin C}. \text{ Prove that the } \Delta ABC \text{ is an isosceles triangle.}$$

- b. Find the area of quadrilateral whose vertices are (-5,12), (-2,-3), (9,-10) and (6,5).

- c. Find the equation of the circle passing through (6,4) and concentric with the circle $x^2 + y^2 - 4x - 2y - 35 = 0$.

- d. Find the equation of the circle joining (-3,4) and (1,-8) as diameter.

- e. Find the work done by a force

$$\vec{F} = 3\vec{i} - 2\vec{j} + 4\vec{k} \text{ when its point of application moves from A(3,2,-1) to B(2,5,4)}$$