

Total No. of Questions : 9]

SEAT No. :

P9066

[Total No. of Pages : 4

[6178]1

F.E.

ENGINEERING MATHEMATICS - I

(2019 Pattern) (Semester - I/II) (Credit System) (107001)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of electronic pocket calculator is allowed.
- 6) Assume suitable data, if necessary.

Q1) Write the correct option for the following multiple choice questions.

a) If $u = x^3 + y^3 - 3xy$ then $\frac{\partial^2 u}{\partial x \partial y}$ is equal to [1]

- i) 3
- ii) -3
- iii) 2
- iv) 0

b) If $x = r \cos \theta$, $y = r \sin \theta$ then the value of $\frac{\partial(x, y)}{\partial(r, \theta)}$ is [1]

- i) $\frac{1}{r}$
- ii) r
- iii) r^2
- iv) None

c) The vectors $X_1 = (-1, 0, 3)$, $X_2 = (2, 4, 6)$ are [2]

- i) linearly dependent
- ii) linearly independent
- iii) mutually orthogonal
- iv) none of these

d) The characteristic equation for the square matrix A is [2]

- i) $|A - \lambda I| = 0$
- ii) $|A + \lambda I| = 0$
- iii) $|A^2 - \lambda I| = 0$
- iv) None

P.T.O.

Q5) a) If $x = v^2 + w^2$, $y = w^2 + u^2$, $z = u^2 + v^2$ find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$. [5]

b) In calculating volume of right circular cylinder, errors of 2% and 1% are found in measuring height and base radius respectively. Find the percentage error in calculating volume of the cylinder. [5]

c) Use Lagrange's method to find the minimum distance from origin to the plane $3x + 2y + z = 12$. [5]

Q6) a) Examine following system for consistency $x + y - 3z = 1$; $4x - 2y + 6z = 8$; $15x - 3y + 9z = 20$. [5]

b) Examine for linear dependency or independence of following set of vectors. If dependent, find the relation between them $X_1 \equiv (3, 1, 1)$, $X_2 \equiv (2, 0, -1)$, $X_3 \equiv (1, 1, 2)$. [5]

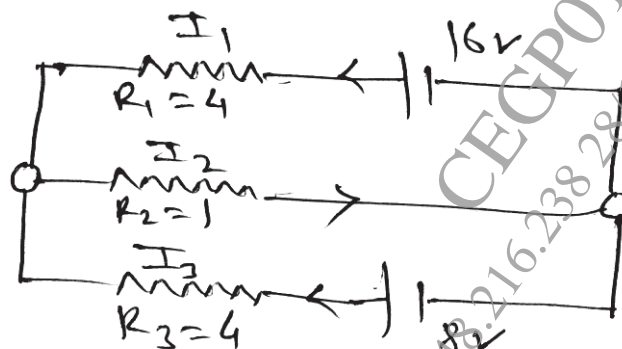
c) Show that $A = \begin{bmatrix} \frac{1}{\sqrt{2}} & 0 & \frac{1}{\sqrt{2}} \\ 0 & 1 & 0 \\ \frac{1}{\sqrt{2}} & 0 & \frac{-1}{\sqrt{2}} \end{bmatrix}$ is orthogonal matrix & hence find A^{-1} . [5]

OR

Q7) a) Determine values of k, for which following system have non-trivial solution. $5x + 2y - 3z = 0$; $3x + y + z = 0$; $2x + y + kz = 0$ [5]

b) Show that following set of vectors are linearly dependant $X_1 \equiv (2, 3, 4, -2)$, $X_2 \equiv (-1, -2, -2, 1)$, $X_3 \equiv (1, 1, 2, -1)$ [5]

c) Find the currents I_1, I_2, I_3 in the circuit, shown in the figure :- [5]



Q8) a) Find eigen values and corresponding eigen vectors of the following matrix

$$A = \begin{bmatrix} 1 & -2 \\ -3 & 0 \end{bmatrix}. \quad [5]$$

b) Verify Cayley Hamilton theorem for given matrix $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$. [5]

c) Find the modal matrix P which diagonalises the given matrix $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. [5]

OR

Q9) a) Find eigen values and eigen vector corresponding to largest eigen value

of a following matrix $A = \begin{bmatrix} 15 & 0 & -15 \\ -3 & 6 & 9 \\ 5 & 0 & -5 \end{bmatrix}$. [5]

b) Verify Cayley Hamilton theorem and hence find A^{-1} for given matrix

$$A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix}. \quad [5]$$

c) Express the following quadratic form as “sum of the squares form” by consruent transformation. Write down the corresponding linear transformation $Q(x) = x_1^2 + 6x_2^2 + 18x_3^2 + 4x_1x_2 + 8x_1x_3 - 4x_1x_3$. [5]

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