

Enrollment No: _____

Exam Seat No: _____

C.U.SHAH UNIVERSITY

Summer Examination-2016

Subject Name: Engineering Mathematics-II

Subject Code: 4TE02EMT1

Branch: B.Tech(All)

Semester: 2 Date: 09/05/2016

Time: 10:30 to 1:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

Q-1 Attempt the following questions:

(14)

a) A square matrix A is called symmetric matrix if

- (a) $A^T = -A$ (b) $A^2 = A$ (c) $A^T = A$ (d) $A^2 = I$

b) The determinant of the matrix $\begin{bmatrix} 1 & 5 & 3 \\ 0 & -2 & 4 \\ 0 & 0 & 3 \end{bmatrix}$ is

- (a) 1 (b) 2 (c) 6 (d) - 6

c) A $n \times n$ Non-Homogeneous system of equations $AX = B$ is given. If

$\rho(A) = \rho(A : B) < n$ then the system has

- (a) No solutions (b) Unique solutions
(c) Infinite solution (d) None of these

d) The sum of the Eigen values of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 2 \\ 0 & 0 & 3 \end{bmatrix}$ is

- (a) 1 (b) 2 (c) 6 (d) - 6

e) The rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 7 \end{bmatrix}$ is

- (a) 1 (b) 2 (c) 3 (d) 0

f) $\int_0^2 \int_2^4 \int_4^6 dx dy dz = \underline{\hspace{2cm}}$

- (a) 1 (b) 6 (c) 4 (d) 8



g) $\int_0^1 \int_0^{\sqrt{x}} dy dx = \underline{\hspace{2cm}}$

- (a) $\frac{1}{2}$ (b) $\frac{2}{3}$ (c) 0 (d) y

h) $\int_{-\pi/2}^{\pi/2} \sin^9 x dx = \underline{\hspace{2cm}}$

- (a) 0 (b) 1 (c) $\frac{\pi}{2}$ (d) $\frac{1}{2}$

i) The value of $\int_{-\pi}^{\pi} \sin mx \sin nx dx$ for $m \neq \pm n$ is

- (a) 2π (b) π (c) $\frac{\pi}{2}$ (d) 0

j) $\int_1^{\infty} \frac{1}{x^2} dx$ is

- (a) Converges (b) Diverges (c) Oscillatory (d) None of these

k) The order of the differential equation $\frac{d^2y}{dx^2} = \left[1 + \left(\frac{dy}{dx} \right)^3 \right]^{2/3}$ is

- (a) 1 (b) 2 (c) 3 (d) 6

l) The equation $P(x, y) dx - Q(x, y) dy = 0$ is exact if

- (a) $P_x = Q_y$ (b) $P_y = Q_x$ (c) $P_x = -Q_y$ (d) $P_y = -Q_x$

m) A vector \vec{F} is said to be solenoidal if

- (a) $\nabla \times \vec{F} = 0$ (b) $\nabla \cdot \vec{F} = 0$ (c) $\nabla \times (\nabla \cdot \vec{F}) = 0$ (d) None of these

n) If $r = xi + yj + zk$ then $\text{div } r$ is

- (a) 0 (b) r (c) 3 (d) -r

Attempt any four questions from Q-2 to Q-8

Q-2 Attempt all questions

a) Find the volume common to the cylinder $x^2 + y^2 = a^2$ and $x^2 + z^2 = a^2$. (05)

b) Evaluate: $\int_0^{\pi} x \sin^8 x \cos^6 x dx$ (05)

c) Solve: $\frac{dy}{dx} - \frac{3y}{x} = x^3$, $y(1) = 4$ (04)



Q-3 Attempt all questions

a) Find the inverse of the matrix $A = \begin{bmatrix} -1 & 1 & 2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$ by using determinant method. (05)

b) Solve the following system of equations by Cramer's rule: (05)
 $x + y + z = 6$; $x + 2y + 3z = 14$; $x + 4y + 9z = 36$

c) Reduce the matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 5 \\ 4 & 5 & 6 & 7 \\ 11 & 12 & 13 & 14 \end{bmatrix}$ to the normal form and find its rank. (04)

Q-4 Attempt all questions

a) Find the inverse of the following matrix by using elementary transformation (05)

$$A = \begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$$

b) Obtain Reduced row echelon form of the following matrix: (05)

$$A = \begin{bmatrix} 1 & 3 & 2 & 1 \\ 2 & 3 & 3 & 2 \\ 3 & 4 & -1 & 3 \\ 6 & 10 & 4 & 6 \end{bmatrix}$$

c) Solve the system of equation (04)
 $x + 2y - z = 3$; $3x - y + 2z = 1$; $2x - 2y + 3z = 2$; $x - y + z = -1$

Q-5 Attempt all questions

a) Evaluate: $\int_0^{\log 2} \int_0^x \int_0^{x+y} e^{x+y+z} dz dy dx$ (05)

b) Solve: $\frac{dy}{dx} + x \sin 2y = x^2 \cos^2 y$ (05)

c) Evaluate $\int_c \vec{F} \cdot d\vec{r}$ along the parabola $y^2 = x$ between the points (0,0) and (04)
 where $\vec{F} = x^2 \hat{i} + xy \hat{j}$.



Q-6 Attempt all questions

a) Find the eigenvalues & eigenvectors of a matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. (05)

b) Show that $\vec{F} = (y^2 - z^2 + 3yz - 2x)\hat{i} + (3xz + 2xy)\hat{j} + (3xy - 2xz + 2z)\hat{k}$ is both solenoidal and irrotational. (05)

c) Define: Gradient and find $\nabla\phi$ at $(1, -2, 1)$, if $\phi = 3x^2y - y^3z^2$. (04)

Q-7 Attempt all questions

a) Change the order of integration and evaluate $\int_0^a \int_{\frac{x}{a}}^{\sqrt{x}} (x^2 + y^2) dx dy$. (05)

b) Find the area bounded by the parabola $y^2 = 4x$ and the line $2x - 3y + 4 = 0$. (05)

c) Solve: $2xy dy + (x^2 + y^2 + 1) dx = 0$ (04)

Q-8 Attempt all questions

a) State and verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$. (07)

b) Verify Green's theorem for $\oint_C [(x^2 - 2xy) dx + (x^2y + 3) dy]$ where C is the boundary of the region bounded by the parabola $x^2 = y$ and the line $x = y$. (07)

