Roll No.						
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Total No. of Pages : 03

Total No. of Questions : 09

B.Tech (Food Technology) (2018 & Onwards) (Sem.–1) MATHEMATICS-I Subject Code : BTAM-106-18

M.Code : 75368

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

- 1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
- 2. SECTION B & C have FOUR questions each.
- 3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
- 4. Select atleast TWO questions EACH from SECTION B & C.

SECTION-A

- 1. Answer briefly :
 - a) Define rank of a matrix.
 - b) For any nonsingular matrix $A = (a_{ij})$ of order *n*, show that $|Adj(A)| = |A|^{n-1}$
 - c) Determine the values of k for which the system of equations

$$x + ky + z = 0$$
, $kx + 3y - kz = 0$, $3x + y - z = 0$

has a nontrivial solution.

- d) Define orthogonal matrices.
- e) Is the following matrix diagonalizable? Give reason to your answer.

$$\begin{array}{ccc|c} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{array}$$

f) Find the length of the following curve

$$r(t) = a \cos^3 t \, \mathbf{i} + a \sin^3 t \, \mathbf{j}, \, 0 \, | \quad t \, | \quad \mathbf{A} 2$$

- g) Find gradient of the scalar field $f(x, y, z) = x^2y^2 + xy^2 z^2$ at (3, 1, 1)
- h) Define curl of a vector field.

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- i) Find the length of the arc $r(t) = 3 \cos t \, i + 3 \sin t \, j, 0 \mid t \mid \mathcal{M}$
- j) Evaluate $\int_C x^2 y \, ds$, where C is the curve defined by $x = \cos t$, $y = \sin t$, $0 \mid t \mid \mathbb{A}$.

SECTION-B

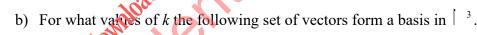
2. a) Show that :

$$\begin{vmatrix} a^2 & ab & ac \\ ab & ||b^2 & bc \\ ac & bc & ||c^2 \end{vmatrix} || 4a^2b^2c^2$$

b) Solve the following system of equations

$$x - y + 3z = 3$$
, $2x + 3y + z = 2$, $3x + 2y + 4z = 5$

3. a) Use Gauss Jordan method to find the inverse of the matrix



 $\{(k, 1-k, k), (0, 3k-1, 2), (-k, 1, 0)\}.$

4. Find all the eigen values and the corresponding eigenvectors of the following matrix.

- 5. a) The eigen values of 3×3 matrix A corresponding to the eigenvalues 1, 1, 3 are $[1, 0, -1]^t$, $[0, 1, -1]^t$, $[1, 1, 0]^t$ respectively. Find the matrix A.
 - b) Prove that eigen values of a skew-symmetric matrix are zero or purely imaginary.

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SECTION-C

- 6. a) Find directional derivative of the function $f(x, y, z) = x^2y + 4xyz + z^2$ at a point (1, 2, 3) in the direction of 3i + 4j 5k.
 - b) If r = xi + yj + zk and r = |r|, show that div $(r/r^3) = 0$.
- 7. a) For the vector field $v = xyz(yz \ i + xz \ j + xy \ k)$ find a scalar function f(x, y, z) such that $v = \nabla f$.
 - b) Find the angle between the surface $z = x^2 + y^2$ and $z = 2x^2 3y^2$ at the point (2, 1, 5)
- 8. a) Show that $\int_C (yz [1])dx [(z [xz [z^2])dy [(y [xy [2yz])dz] is independent of the path of integration from (1, 2, 2) to (2, 3, 4). Evaluate the integral.$
 - b) Evaluate the integral of $v = x^2 i 2y j + z^2 k$ over the straight line path from (-1, 2, 3) to (2, 3, 5).
- 9. Find the work done by the force $F = (x^2 y^2)i + (x^2 + y^2)j$ in moving a particle along a closed path C bounding the region $x^2 + y^2 | 16, x^2 + y^2 \equiv 4, x \equiv 0$.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.

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