

Roll No. 

Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (CSE/IT) (2018 Batch) (Sem.-1)

**MATHEMATICS-I**

Subject Code : BTAM-104-18

M.Code : 75362

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) Can Rolle's theorem be applied to the function  $f(x) = 2 + (x - 1)^{2/3}$ ,  $x \in [0, 2]$ .
- 2) Define beta function.
- 3) Evaluate  $\lim_{x \rightarrow 0} \frac{x \cos x - \sin x}{x^2 \sin x}$
- 4) Find the values of  $x, y, z, a$  which satisfy the relation  $\begin{bmatrix} x+3 & 2y+x \\ z-1 & 4a-6 \end{bmatrix} = \begin{bmatrix} 0 & -7 \\ 3 & 2a \end{bmatrix}$ .
- 5) Find adjoint of  $\begin{bmatrix} 1 & -1 \\ -2 & 0 \end{bmatrix}$
- 6) Define basis of vector spaces.
- 7) Give the statement of rank nullity theorem.
- 8) Give any two properties of Eigen values.
- 9) Define symmetric matrix with an example.

- 10) Find sum and product of latent roots of the matrix  $\begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$ .

### SECTION-B

- 11) a) Expand  $f(x) = \sin^{-1}x$  by Maclaurin's theorem.

b) Evaluate  $\lim_{x \rightarrow a} \frac{x^a - a^x}{x^x - a^a}$ .

- 12) a) Evaluate the integral  $\int_0^1 \frac{1}{\sqrt{1-x^4}} dx$  in terms of gamma function.

b) Find maxima of  $f(x, y) = 2(x^2 - y^2) - x^4 + y^4$ .

13) a) Prove that  $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc \left( 1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c} \right)$ .

b) Solve the equations  $x + y + z = 1$ ,  $x + 2y + 3z = 6$ ,  $x + 3y + 4z = 6$  using Cramer's rule.

- 14) a) Are the vectors  $(2, 1, 1)$ ,  $(2, 0, -1)$ ,  $(4, 2, 1)$  linearly dependent.

b) Find the rank of the matrix :  $\begin{bmatrix} 5 & 3 & 7 \\ 3 & 26 & 2 \\ 7 & 2 & 10 \end{bmatrix}$

### SECTION-C

- 15) Show that the matrix  $\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$  satisfies the equation  $A^3 - 6A^2 + 11A - I = 0$ .

- 16) Let  $T : \mathbb{R}^3 \rightarrow \mathbb{R}^2$  be the linear transformation defined by  $T \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} x+y \\ x-z \end{bmatrix}$ , then find the matrix representation of  $T$  w.r.t. the ordered basis  $X = \{(1, 0, 1), (1, 1, 0), (0, 1, 1)\}^T$  in  $\mathbb{R}^3$  and  $Y = \{(1, 0), (0, 1)\}^T$  in  $\mathbb{R}^2$ .

- 17) a) Is the matrix  $\begin{bmatrix} 4 & 2 & 1 \\ 6 & 3 & 4 \\ 2 & 1 & 0 \end{bmatrix}$  orthogonal ?

- b) Write the matrix  $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & -8 & 9 \end{bmatrix}$  as the sum of symmetric and skew symmetric matrices.

- 18) Reduce the matrix  $\begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$  to the diagonal form.

**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.**