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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 $\lim_{x\to 0} \frac{x\cos x - \sin x}{x^2 \sin x}$

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.

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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 $\lim_{x \to a} \frac{x^a - a^x}{x^x - a^a}$.

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 $A^3 - 6A^2 + 11A - I = 0$.

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16) Let T : $R^3 \to R^2$ 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 R^3 and $Y = \{(1, 0), (0, 1)\}^T$ in 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.

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