

Roll No.

Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (CE/ME/ECE/EE) (2018 & Onward) (Sem.-1)
B.Tech. (Agriculture Engineering)/(Automation & Robotics)
/(Automobile Engineering)/(CSE)/(Electrical & Electronics
Engineering)/(Electronics & Electrical Engineering)

MATHEMATICS-I

Subject Code : BTAM-101-18

M.Code : 75353

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 from SECTION - B & C.

SECTION-A

1. Test the convergence of the following series $\frac{2!}{3} + \frac{3!}{3^2} + \frac{4!}{3^3} + \dots$
2. State the Raabe's test.
3. State Rolle's theorem.
4. State Langrange's mean value theorem.
5. Prove that $\int_0^{\frac{\pi}{2}} \log \tan x \, dx = 0$.
6. Evaluate $\int_0^1 \int_0^x e^{\frac{x}{y}} \, dy \, dx$.
7. Change the order of integration of $\int_0^1 \int_{y^2}^{y^3} f(x, y) \, dx \, dy$.
8. Find the first order derivative of $z = x^3 + y^3 - 3axy$.
9. Find the rank of the following matrix $\begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$.

10. Find the determinant of the following matrix $\begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 6 \\ 1 & 4 & 7 \end{bmatrix}$

SECTION-B

11. If $u = x^2 \tan^{-1} \frac{y}{x} - y^2 \tan^{-1} \frac{x}{y}$. Show that $\frac{\partial^2 u}{\partial x \partial y} = \frac{x^2 - y^2}{x^2 + y^2}$.
12. Evaluate $\iint \frac{xy dx dy}{(1 - y^2)^{1/2}}$ over the first quadrant of the circle $x^2 + y^2 = 1$.
13. Test the convergence of the series $\sum \frac{4.7 \dots (3n+1)x^n}{n!}$.
14. Verify if the matrix $A = \frac{1}{3} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$ is orthogonal and hence find its inverse.

SECTION-C

15. Find the maximum and minimum value of $x^3 + y^3 - 3axy$.
16. a) Solve the simultaneous equations $x + y + z = 3$, $x + 2y + 3z = 4$, $x + 4y + 9z = 6$.
- b) Find the inverse of the matrix $\begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$.
17. a) Find the area of the surface of revolution generated by revolving the curve $x = y^3$ from $y = 0$ to $y = 2$.
- b) Evaluate $\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} (x+y+z) dx dy dz$.
18. a) Test the convergence of the series $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^2}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \dots$
- b) Find the Maclaurin's series of $f(x) = \cos x$.

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.