PAPER ID-311451

Subject Code: KAS103T

Roll No: | | | | | | | | | | | | | |

**BTECH**

**(SEM I) THEORY EXAMINATION 2023-24**

**ENGINEERING MATHEMATICS-I**

**TIME: 3HRS** **M.MARKS: 100**

**Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.

## SECTION A

**1. Attempt *all* questions in brief.** **2 x 10 = 20**

| Qno. | Question | Marks | CO |
|---|---|---|---|
| a. | Find the Rank of the matrix $\begin{bmatrix}10 & 101\\20 & 202\end{bmatrix}$. | 2 | 1 |
| b. | Define singular and non singular matrix. | 2 | 1 |
| c. | Define Rolle's theorem. | 2 | 2 |
| d. | If $y = x^2e^x$, find $y_n$. | 2 | 2 |
| e. | Find the stationary point of f(x,y) = $x^3+y^3+3axy$. | 2 | 3 |
| f. | If u = $\sin^{-1}(x^2 + y^2)^{\frac{1}{5}}$ , then find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ . | 2 | 3 |
| g. | Evaluate $\int_0^1 \int_0^{x^2} x^2y^2 dxdy$. | 2 | 4 |
| h. | Write the formula of area and volume by integration. | 2 | 4 |
| i. | Find the unit normal vector at the surface $z = x^2 + y^2$ at $(1,2)$. | 2 | 5 |
| j. | State Stokes theorem. | 2 | 5 |

## SECTION B

**2. Attempt any *three* of the following:** **10x 3 = 30**

| | | | |
|---|---|---|---|
| a. | Find the Eigen values and Eigen vectors of the following matrix: $\begin{bmatrix}3 & 10 & 5\\-2 & -3 & -4\\3 & 5 & 7\end{bmatrix}$. | 10 | 1 |
| b. | If y = $e^{m\cos^{-1}x}$ show that $(1-x^2)\,y_{n+2} - (2n+1)\,x\,y_{n+1} - (n^2+m^2)\,y_n = 0$ , also calculate $y_n(0)$. | 10 | 2 |
| c. | If $u, v, w$ are the roots of the equation $(\lambda - x)^3 + (\lambda - y)^3 + (\lambda - z)^3 = 0$ , find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$. | 10 | 3 |
| d. | Change the order of integration $\int_1^2 \int_{x2}^{2-x} f(x,y)\,dxdy$ . | 10 | 4 |
| e. | Verify the Greens theorem to evaluate the line integral $\int (2y^2\,dx + 3x\,dy)$, where C is the boundary of the closed region by y = x and $y = x^2$ . | 10 | 5 |

## SECTION C

**3. Attempt any *one* part of the following:** **10x 1 = 10**

| | | | |
|---|---|---|---|
| a. | Find inverse by elementary transformation A = $\begin{bmatrix}2 & -1 & 1\\-1 & 2 & -1\\1 & -1 & 2\end{bmatrix}$ | 10 | 1 |
| b. | Investigate for what values of $\lambda$ and $\mu$ do the system of the equation $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ has i) no solution ii) unique solution iii) infinite no. of solution. | 10 | 1 |

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| **4.** | **Attempt any *one* part of the following:** | **10x 1 = 10** | |
|---|---|---|---|
| a. | If $y^{\frac{1}{m}} + y^{-\frac{1}{m}} = 2x$ prove that $(x^2-1)y_{n+2} + (2n+1)xy_{n+1} + (n^2-m^2)y_n = 0$ | 10 | 2 |
| b. | Verify Lagrange's Mean value theorem for the function $f(x) = x^3$ in [-2,2] | 10 | 2 |

| **5.** | **Attempt any *one* part of the following:** | **10x 1 = 10** | |
|---|---|---|---|
| a. | Expand $x^2+3y^2-9x-9y+26$ in powers of $(x-1)$ and $(y-2)$ by Taylor's theorem up to second degree term. | 10 | 3 |
| b. | In estimating the number of bricks in a pile which is measured to be (5 m × 10 m × 5 m), the count of bricks is taken as 100 bricks per $m^3$. Find the error in the cost when the tape is stretched 2 % beyond its standard length. The cost of bricks is 2000 Rs. per thousand bricks. | 10 | 3 |

| **6.** | **Attempt any *one* part of the following:** | **10x 1 = 10** | |
|---|---|---|---|
| a. | Evaluate $\int_0^{2a}\int_0^{\sqrt{2ax-x^2}}(x^2+y^2)\,dxdy$ by changing into polar Co-ordinates. | 10 | 4 |
| b. | Calculate the volume of solid bounded by the surface x=0,y=0,x+y+z=0 and z=0. | 10 | 4 |

| **7.** | **Attempt any *one* part of the following:** | **10x 1 = 10** | |
|---|---|---|---|
| a. | Prove that $(y^2-z^2+3yz-2x)i + (3xz+2xy)j + (3xy-2xz+2z)k$ is both solenoidal and irrotational. | 10 | 5 |
| b. | Using Green's Theorem evaluate $\int_C (x^2+xy)dx + (x^2+y^2)dy$, where C is the square formed by the lines $x = \pm 1, y = \pm 1$. | 10 | 5 |