# MAKE-UP EXAM

USN ☐☐☐☐☐☐☐☐☐☐

**BMATE201**

## Second Semester B.E/B.Tech. Degree Examination, Nov./Dec. 2023

## Mathematics - II for EEE Stream

Time: 3 hrs. Max. Marks:100

**Note:** *1. Answer any FIVE full questions, choosing ONE full question from each module.*
*2. M : Marks , L: Bloom's level , C: Course outcomes.*
*3. VTU formula hand book is permitted.*

| | | **Module – 1** | **M** | **L** | **C** |
|---|---|---|---|---|---|
| **1** | **a.** | If $\phi = x^2 + y - z - 1$ find grad $\phi$ at (1, 0, 0). Also find its magnitude. | **6** | **L3** | **CO1** |
| | **b.** | Find the divergence and curl of the vector : $\vec{F} = (xyz)\hat{i} + (3x^2y)\hat{j} + (xz^2 - y^2z)\hat{k}$ at (2, –1, 1). | **7** | **L2** | **CO1** |
| | **c.** | Show that $\vec{F} = (y^2 - z^2 + 3yz - 2x)\hat{i} + (3xz + 2xy)\hat{j} + (3xy - 2xz + 2z)\hat{k}$ is both solenoidal and irrotational. | **7** | **L2** | **CO1** |
| | | **OR** | | | |
| **2** | **a.** | Suppose $\vec{F} = x^3\hat{i} + y\hat{j} + z\hat{k}$ is the force field. Find the work done by $\vec{F}$ along the line from (1, 2, 3) to (3, 5, 7). | **6** | **L2** | **CO1** |
| | **b.** | Verify Green's theorem in the xy – plane for $\int_c (xy + y^2)dx + x^2dy$, where C is the closed curve of the region bounded by y = x and $y = x^2$. | **7** | **L3** | **CO1** |
| | **c.** | Using modern mathematical tools, write the code to find the divergence of $\vec{F} = x^2y\hat{i} + yz^2\hat{j} + x^2z\hat{k}$. | **7** | **L3** | **CO5** |
| | | **Module – 2** | | | |
| **3** | **a.** | Define a subspace. Show that a subset $S = \{x_1, x_2, x_3 \mid x_1 + x_2 + x_3 = 0\}$ of $V_3(R)$ is a subspace of $V_3(R)$. | **6** | **L2** | **CO2** |
| | **b.** | Prove that in $V_3(R)$ the vectors {(1, 2, 1) (3, 1, 5), (3,–4, 7)} are linearly independent. | **7** | **L2** | **CO2** |
| | | Find <p, q> and \|\|P\|\|. Given $P(x) = x^2 - x$, q(x) = x + 1, the innerproduct space <p, q> = $\int_{-1}^{1} P(x);q(x)dx$. | **7** | **L2** | **CO2** |

| | | | | | |
|---|---|---|---|---|---|
| | | **OR** | | | |
| **4** | **a.** | Let T : U → V be a linear transformation defined by, $T(x, y, z) = \{(x + y, x - y, 2x + z)/x, y, z, \in R)$. Verify Rank Nullity theorem. | 6 | L2 | CO2 |
| | **b.** | Explain the vector (2, −5, −1) as a linear combination of the vectors (1, 2, 3)(2, 1, 1) (1, 3, 2) of $V_3(R)$. | 7 | L2 | CO2 |
| | **c.** | Using the modern mathematical tool write the code to represent the reflection transformation $T : R^L \to R^2$ and to find the image of vector (10, 0) when it reflected about the y – axis. | 7 | L3 | CO5 |
| | | **Module – 3** | | | |
| **5** | **a.** | Find the Laplace transform of $\left(\frac{\sin 2t}{\sqrt{t}}\right)^2$. | 6 | L2 | CO3 |
| | **b.** | Find $L^{-1}\left\{\frac{1}{s(s^2+1)}\right\}$ using convolution theorem. | 7 | L2 | CO3 |
| | **c.** | Express $f(t) = \begin{cases} \cos t & 0 < t < \pi \\ \cos 2t & \pi < t < 2\pi \\ \cos 3t & t > 2\pi \end{cases}$ interms of unit step function and find $L\{f(t)\}$. | 7 | L3 | CO3 |
| | | **OR** | | | |
| **6** | **a.** | Find the inverse Laplace transform of<br>i) $\frac{(s+2)^3}{s^6}$ ii) $\frac{2s+5}{4s^2+25}$. | 6 | L2 | CO3 |
| | **b.** | Solve by Laplace transform method :<br>$y'' + 4y' + 3y = e^{-t}$; $y(0) = 1 = y'(0)$. | 7 | L2 | CO3 |
| | **c.** | Find the Laplace transform of the square wave function of period a, defined by $f(t) = \begin{cases} K & 0 < t < a/2 \\ -K & a/2 < t < a \end{cases}$. | 7 | L2 | CO3 |
| | | **Module – 4** | | | |
| **7** | **a.** | Evaluate $\int_2^7 \left(\frac{1}{x}\right) dx$, using Trapezodial rule, taking n = 5. | 6 | L3 | CO4 |
| | **b.** | Find the real toot of the equation $e^x - 3x - \sin x = 0$ by the Regula – Falsi method between 0 and 1. (carry out three iterations) x is in radions. | 7 | L2 | CO4 |
| | **c.** | Find y at x = 1 using Newton divided difference formula for the following data : | 7 | L2 | CO4 |

| x | 0 | 2 | 3 | 4 | 7 | 9 |
|---|---|---|---|---|---|---|
| y | 4 | 26 | 58 | 112 | 466 | 922 |

**OR**

**8 a.** Evaluate : $\int_{2}^{\pi/2} \cos x \, dx$, using Simpson's ($\frac{1}{3}$)rd rule with n = 8 [x in radian]. **6** **L3** **CO4**

**b.** Construct Newton's forward interpolation polynomial for the data : **7** **L2** **CO4**

| x | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| f(x) | 3 | 6 | 11 | 18 | 27 |

**c.** Find y when x = 10 for the following data by using Kagrange's interpolation formula : **7** **L2** **CO4**

| x | 5 | 6 | 9 | 11 |
|---|---|---|---|---|
| y | 12 | 13 | 14 | 16 |

## Module – 5

**9 a.** Using Taylor's method to find y(0.2) by considering the terms upto 4th degree, given $\frac{dy}{dx} - 2y - 3e^{x} = 0$ ; y(0) = 0. **6** **L3** **CO4**

**b.** Given $\frac{dy}{dx} = x + y; \ y(0) = 1$. Compute y(0.2) using Runge – Kutta 4th order method [h = 0.2]. **7** **L2** **CO4**

**c.** Apply Milne's predictor and corrector method find y at x = 2 given $\frac{dy}{dx} = \frac{2y}{x} (x \neq 0)$ **7** **L2** **CO4**

| x | 1 | 1.25 | 1.5 | 1.75 |
|---|---|---|---|---|
| y | 2 | 3.13 | 4.5 | 6.13 |

**OR**

**10 a.** Using Modified Euler's method to find y at x = 0.2 given $y' = \frac{x-y}{2}$; y(0) = 1 [h = 0.1]. **6** **L3** **CO4**

**b.** Find y(1.1) by using Runge-Kutta method of fourth order. Given $\frac{dy}{x} = x(y)^{1/3}; \ y(1) = 1$ [take h = 0.1]. **7** **L2** **CO4**

**c.** Using modern mathematical tools, write a code to find y(0.1) given $\frac{dy}{dx} = x - y, \ y(0) = 1$, by Taylor's series. **7** **L3** **CO5**

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