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EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY
An Autonomous Institution Affiliated to Visvesvaraya Technological University (VTU) Belagavi

USN | | | | | | | | | | |

25MTE21

Second Semester B.E. Degree Examination,June/July 2026
Calculus, Laplace Transforms and Numerical Techniques: EEE Stream

TIME:3 hrs. Max.Marks:100

Note: 1. Answer **any FIVE** full questions, choosing **ONE** question from **each MODULE.**
2. Formula Hand Books Permitted.
3. M: Marks, L: Bloom's level, C: Course outcomes.
4. Assume missing data suitably.

		Module-1	M	L	C
Q.1	a	Evaluate $\int_0^1 \int_x^{\sqrt{x}} (x^2+y^2)dydx$.	6	L2	CO1
	b	Change the order of integration and $\int_0^1 \int_x^{\sqrt{1-x^2}} ydydx$	7	L3	CO1
	c	PProve that $\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$	7	L3	CO1
		OR			
Q.2	a	Change into polar coordinates and evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\,dxdy$	6	L2	CO1
	b	Find the area of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ by double integration	7	L3	CO1
	c	Show that $\int_0^{\pi/2} \sqrt{\sin\theta}\,d\theta \times \int_0^{\pi/2} \frac{1}{\sqrt{\sin\theta}}d\theta = \pi$	7	L3	CO1
		Module–2			
Q.3	a	Find the directional derivative for the surface $\phi = x^2yz+4xz^2$ along $2i-j-2k$ at (1, -2, -1)	6	L2	CO2
	b	Show that $\vec{F}=\frac{xi+yj}{x^2+y^2}$ is both solenoidal and irrotational.	7	L3	CO2
	c	Evaluate using Green's theorem in a plane $\oint_c (3x^2-8y^2)dx+(4y-6xy)dy$ where C is the boundary of the region enclosed by $y=\sqrt{x}$ and $y=x^2$	7	L3	CO2
		OR			
Q.4	a	Find $div\,\vec{F}$ and $curl\,\vec{F}$ where $\vec{F}=grad\left(x^3+y^3+z^3-3xyz\right)$	6	L2	CO2
	b	Show that $\vec{F}=2xyz^3\,i+x^2z^3\,j+3x^2yz^2\,k$ is an irrotational vector field. Hence find the scalar function ϕ such that $\vec{F}=\nabla\phi$.	7	L3	CO2
	c	If $\vec{F}=(3x^2+6y)\hat{i}-14yz\,\hat{j}+20zx^2\,\hat{k}$ evaluate $\int_c \vec{F}.d\vec{r}$ from (0,0,0) to (1,1,1) along the curve given by $x=t, y=t^2, z=t^3$ (t varies from 0 to 1).	7	L3	CO2

Module–3

Q.5 a Find the real root of the equation $\cos x = 3x - 1$ which lies between (0, 1) by using Regula- Falsi Method. carryout FOUR iterations — **6 L2 CO3**

b From the following table estimate the number of students who have obtained the marks between 40 and 45 — **7 L3 CO3**

Marks	30- 40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

c Use Lagrange's interpolation to fit a polynomial for the following data. — **7 L3 CO3**

x	1	3	4	6
$f(x)$	3	9	30	132

OR

Q.6 a F Find the real root of the equation $x \log_{10}^{x} - 1.2 = 0$ which lies between (2, 3) by using Newton- Raphson Method. carryout FOUR iterations — **6 L2 CO3**

b Find $f(4)$ using Newton's divided difference formula — **7 L3 CO3**

x	0	2	3	6
$f(x)$	–4	2	14	158

c Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ by Simpson's $\left(\frac{3}{8}\right)^{th}$ rule divide the interval into 6 equal parts and hence find an approximate value of π. — **7 L3 CO3**

Module–4

Q.7 a Using the Taylor's series method, find the third order approximate solution at x = 0.4 of the problem $\frac{dy}{dx} = x^2 y + 1$, with y (0) = 0. Consider terms up to fourth degree. — **6 L2 CO4**

b Employ Runge – Kutta method to solve $\frac{dy}{dx} = 3e^x + 2y$, $y(0) = 0$ find y at x = 0.1 by taking $h = 0.1$. — **7 L3 CO4**

c Find $y(1.4)$ by using Milne's Predictor and Corrector method, using the following data given that $\frac{dy}{dx} = x^2 + \frac{y}{2}$ — **7 L3 CO4**

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514

OR

Q.8 a Using Euler's modified method solve for y at $x = 0.1$, $h = 0.1$ and $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ carry out three modifications. — **6 L2 CO4**

	b	Employ Runge – Kutta method to solve $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$ find y at x = 0.2 by taking $h = 0.2$.	7	L3	CO4
	c	The following table gives the solution of $5xy' + y^2 - 2 = 0$. Find the value of y at x = 4.4 using Adams Bashforth predictor method .Use the corrector formula twice x: 4, 4.1, 4.2, 4.3 y: 1, 1.0049, 1.0097, 1.0143	7	L3	CO4
		Module–5			
Q.9	a	Find the Laplace transform of $2^t + \frac{(cos2t - cos3t)}{t} + tsint$.	6	L2	CO5
	b	A A Periodic function of the period 'a' is defined by $f(t) = \begin{cases} E, & 0 < t \le a/2 \\ -E, & a/2 < t \le a \end{cases}$ Show that $L[f(t)] = \frac{E}{s} tanh\left(\frac{as}{4}\right)$	7	L3	CO5
	c	Express the following functions in terms Unit step function and hence find its Laplace transform $f(t) = \begin{cases} cost, & 0 < t \le \pi \\ cos2t, & \pi < t \le 2\pi \\ cos3t, & t > 2\pi \end{cases}$	7	L3	CO5
		OR			
Q.10	a	Find the Laplace transform of $te^{2t} - \frac{2sin3t}{t}$.	6	L2	CO5
	b	A periodic function of the period 'a' is defined by $f(t) = \begin{cases} t, & 0 < t \le a \\ 2a - t, & a < t \le 2a \end{cases}$ Show that $L[f(t)] = \frac{1}{s^2} tanh\left(\frac{as}{2}\right)$.	7	L3	CO5
	c	Express the following functions in terms Unit step function and hence find its Laplace transform $f(t) = \begin{cases} 1 & 0 < t \le 1 \\ t & 1 < t \le 2 \\ t^2 & t > 2 \end{cases}$	7	L3	CO5

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