Course: Vector Calculus, Laplace Transform and Numerical Methods	**Improvement Quiz & Test**	**Maximum Marks:** 10+50
Course Code: MA221TA	**Second Semester 2023-2024** **Branch: EC, EE, EI, ET**	**Time:** 02:00 PM to 04:00 PM **Date:** 01/07/2024

Instructions to students: ***Answer all questions.***
Quiz should be answered in the first two pages of answer booklet.

Q.No.	Quiz	M	BTL	CO
1	The real root of the equation $x = e^{-x}$ lies in the interval _____.	1	1	1
2	The Runge-Kutta method for solution of $y' = \frac{y^2-x^2}{y^2+x^2}$, $y(0) = 1$ at $x = 0.2$, $h = 0.2$ yields $k_1 = 0.2$, $k_2 = 0.19672$, then values of k_3 = _____ and k_4 = _____.	2	2	1
3	The unit normal to the surface $\phi(x, y, z) = xy^2 + 3x^2 - z^3$ at the point $(2, -1, 4)$ is _____.	2	1	2
4	If the vector $\vec{F} = (2x^2y^2 + z^2)\hat{\imath} + (3xy^3 - x^2z)\hat{\jmath} + (\lambda xy^2z + xy)\hat{k}$ is solenoidal, then the value of the constant 'λ' is _____.	2	2	3
5	The line integral $\frac{1}{2}\int_C (Pdx + Qdy)$ represents the area of region bounded by C if P = ____ and Q = _____.	1	1	2
6	The work done by the force $\vec{F} = 5xy\hat{\imath} + 2y\hat{\jmath}$, in displacing a particle from $x = 1$ to $x = 2$ along $y = x^3$ is _____.	2	3	4

Q.No.	Test	M	BTL	CO
1a	Find the directional derivative of $\phi = x^2y^2z^2$ at the point $(1,1,-1)$ in the direction of the tangent to the curve $x = e^t, y = 1 + 2\sin t, z = t - \cos t, -1 \le t \le 1$.	6	2	3
1b	If $\vec{f} = (x^2y^3 - z^4)\hat{\imath} + 4x^5y^2z\hat{\jmath} - y^4z^6\hat{k}$, find $div(curl\,\vec{f})$.	4	1	1
2a	If $r = \sqrt{x^2 + y^2 + z^2}$, show that $\nabla^2(r^n) = n(n+1)r^{n-2}$, hence deduce that $\frac{1}{r}$ is harmonic function.	6	2	3
2b	Show that the vector $\vec{f} = \frac{\cos\theta}{r^3}\left[\left(\frac{1}{\sin\theta}\right)\widehat{e_r} + \frac{1}{cos\theta}\widehat{e_\theta} + r^4\widehat{e_\phi}\right]$ in spherical polar coordinate system is solenoidal.	4	3	1

3	Verify Green's theorem for $\int_C (xy + y^2)dx + x^2dy$, where C is the closed curve bounded by the line $y = x$ and the parabola $y = x^2$.	10	2	4
4a	Find a positive real root of the equation $xlog_{10}(x) = 1.2$ in $[2.6, 3]$ by the method of false position up to four places of decimals. Perform four iterations.	6	1	2
4b	By using Newton-Raphson method find a real root of the equation $3x = \cos x + 1$ correct to four places of decimals by taking initial approximation to root as 0.5	4	2	2
5a	Apply Milne's to find the solution of initial value problem $y' + y^2 = x$ at $x = 0.8$, 1.0 given $y(0) = 0, y(0.2) = 0.020, y(0.4) = 0.0795$ and $y(0.6) = 0.1762$.	10	2	2

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Marks Distribution Test	**Particulars**	**CO1**	**CO2**	**CO3**	**CO4**	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**
	Max Marks	**08**	**20**	**12**	**10**	**10**	**36**	**4**	**--**	**--**	**--**
Quiz		**03**	**03**	**02**	**02**	**04**	**04**	**02**	**--**	**--**	**--**

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks