

USN

First Semester B.E./B.Tech. Degree Examination, June/July 2025

Mathematics – I for EEE Stream

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. VTU Formula Hand Book is permitted.
 3. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1			M	L	C
Q.1	a.	With usual notations prove that $\tan \phi = r \frac{d\theta}{dr}$	06	L2	CO1
	b.	Find the angle between the curves $r = \sin \theta + \cos \theta$ and $r = 2 \sin \theta$	07	L2	CO1
	c.	Find the radius of curvature of the cardioid $r = a(1 + \cos \theta)$	07	L2	CO1
OR					
Q.2	a.	Derive the radius of curvature in Cartesian form.	08	L2	CO1
	b.	Find the pedal equation of the curve $r^m = a^m(\cos m\theta + \sin m\theta)$	07	L2	CO1
	c.	Using Modern Mathematical Tool, write a program/code to plot the curve $r = 2 \cos 2\theta $	05	L3	CO5
Module – 2					
Q.3	a.	Using Maclaurin's series prove that $\sqrt{1 + \sin 2x} = 1 + x - \frac{x^2}{2} - \frac{x^3}{6} + \frac{x^4}{24} + \dots$	06	L2	CO1
	b.	If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ show that $6 \frac{\partial u}{\partial x} + 4 \frac{\partial u}{\partial y} + 3 \frac{\partial u}{\partial z} = 0$	07	L2	CO1
	c.	Find the maximum and minimum value of $x^3 + y^3 - 3axy$.	07	L3	CO1
OR					
Q.4	a.	Evaluate (i) $\lim_{x \rightarrow 0} (\cos x)^{\frac{1}{x^2}}$ (ii) $\lim_{x \rightarrow \frac{\pi}{2}} (\tan x)^{\tan 2x}$	08	L2	CO1
	b.	If $u = \frac{yz}{x}$, $v = \frac{xz}{y}$, $w = \frac{yx}{z}$ find the value of $\frac{\partial(u, v, w)}{\partial(x, y, z)}$	07	L2	CO1
	c.	Using Modern Mathematical Tool, write a program/code to show that $u_{xx} + u_{yy} = 0$ Given $u = e^x(x \cos y - y \sin y)$	05	L2	CO5
Module – 3					
Q.5	a.	Solve $\frac{dy}{dx} + y \tan x = y^3 \sec x$	06	L2	CO2
	b.	Find the orthogonal trajectories of the family of curves $r^n = a \sin n\theta$	07	L3	CO2
	c.	Solve $xyp^2 - (x^2 + y^2)p + xy = 0$	07	L2	CO2

OR

Q.6	a.	Solve $(xy^3 + y)dx + 2(x^2y^2 + x + y^4)dy = 0$	06	L2	CO2
	b.	When a resistance R ohms connected in series with an inductance L Henries with an emf of E volts. The current i amperes at time t is given by $L \frac{di}{dt} + Ri = E$. If $E = 100 \sin t$ volts and $i = 0$ when $t = 0$, find i as a function of t.	07	L3	CO2
	c.	Solve $(px - y)(py + x) = a^2p$ reducing into Clairaut's form, using the substitution $X = x^2$, $Y = y^2$.	07	L2	CO2

Module - 4

Q.7	a.	Evaluate $\int_c^c \int_b^b \int_a^a (x^2 + y^2 + z^2) dx dy dz$	06	L2	CO3
	b.	Evaluate by changing the order of integration $\int_0^x \int_x^y \frac{e^{-y}}{y} \cdot dy dx$	07	L2	CO3
	c.	Derive the relation between beta and gamma function $\beta(m,n) = \frac{\gamma(m) \cdot \gamma(n)}{\gamma(m+n)}$	07	L2	CO3

OR

Q.8	a.	Evaluate $\int_0^a \int_0^{\sqrt{a^2 - y^2}} y \sqrt{x^2 + y^2} dx dy$ by changing into polar coordinates.	06	L2	CO3
	b.	Show that $\int_0^{\pi/2} \sqrt{\sin \theta} d\theta \times \int_0^{\pi/2} \frac{1}{\sqrt{\sin \theta}} d\theta = \pi$	07	L2	CO3
	c.	Find the volume of the solid bounded by the planes $x = 0$, $y = 0$, $z = 0$, $x + y + z = 1$.	07	L3	CO3

Module - 5

Q.9	a.	Find the rank of the matrix $\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$	06	L2	CO4
	b.	Solve the system of equations by Gauss Elimination Method. $2x + 5y + 7z = 52$, $2x + y - z = 0$, $x + y + z = 9$	07	L3	CO4
	c.	Using the Gauss Seidel Iteration Method solve the equations $20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$	07	L3	CO4

OR

Q.10	a.	For what values of λ and μ the system of equations $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ has (i) no solution (ii) a unique solution and (iii) Infinite number of solutions.	08	L2	CO4
	b.	Solve the system of equations by Gauss Jordan Method, $x + y + z = 10$, $2x - y + 3z = 19$, $x + 2y + 3z = 22$	07	L3	CO4
	c.	Using Modern Mathematical Tool, write a program/code to find the largest eigen value of $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ by power method.	05	L3	CO5
