MAKE-UP EXAM

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BMATS101

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

Mathematics – I for CSE Stream

Time: 3 hrs. 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.

			M	L	C
		Module – 1			
Q.1	**a.**	With usual notation, prove that $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$.	6	L2	CO1
	b.	Find the angle of intersection between the curves $r = ae^{\theta}$ and $re^{\theta} = b$.	7	L2	CO1
	c.	Find the radius of curvature of the curve $x = a \log(\sec t + \tan t)$, $y = a \sec t$ at any point 't'.	7	L2	CO1
		OR			
Q.2	**a.**	Show that the curves $r = a(1 + \sin\theta)$ and $r = a(1 - \sin\theta)$ cuts each other orthogonally.	6	L2	CO1
	b.	Find the Pedal equation of the curve $r(1 - \cos\theta) = 2a$.	7	L2	CO1
	c.	Using modern mathematical tool, write a programe / code to plot the sine and cosine curves.	7	L3	CO5
		Module – 2			
Q.3	**a.**	Expand $\sqrt{1 + \sin 2x}$ upto the term containing x^4 using Maclaurin's series.	6	L2	CO2
	b.	If $u = f(2x - 3y , 3y - 4z , 4z - 2x)$, then prove that $\frac{1}{2}u_x + \frac{1}{3}u_y + \frac{1}{4}u_z = 0$.	7	L2	CO2
	c.	Find the extreme values of the function $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$.	7	L2	CO2
		OR			
Q.4	**a.**	Evaluate $\lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{1/x}$.	8	L2	CO1
	b.	If $u = \log\left(\frac{x^2 + y^2}{x + y}\right)$, show that $xu_x + yu_y = 1$.	7	L2	CO2
	c.	Using modern mathematical tool, write a programe / code to evaluate $\lim_{x\to\infty}\left(1 + \frac{1}{x}\right)^x$.	5	L3	CO5

Module – 3					
Q.5	**a.**	Solve $\frac{dy}{dx} + y \tan x = y^3 \sec x$.	6	L2	CO2
	b.	Find the orthogonal trajectories of $r = a(1 - \cos\theta)$, where a is parameter.	7	L3	CO2
	c.	Find a solution for the non – linear differential equation $xy\,p^2 - (x^2 + y^2)p + xy = 0$.	7	L2	CO2
OR					
Q.6	**a.**	Solve $(y \cos x + \sin y + y)dx + (\sin x + x \cos y + x)\, dy = 0$.	6	L2	CO2
	b.	Find the general solution of the equation $(px - y)(py + x) = 2p$ by reducing into Clairauts form by taking the substitution $X = x^2$, $Y = y^2$.	7	L3	CO2
	c.	If the temperature of the air is 30°C and the substance cools from 100°C to 70°C in 5 minutes. Find 't' when the temperature will be 40°C.	7	L2	CO2
Module – 4					
Q.7	**a.**	Find the unit digit in the remainder 7^{289}.	6	L1	CO3
	b.	Solve the system of linear congruence $x \equiv 2 \pmod{3}$, $x \equiv 3 \pmod{5}$, $x \equiv 2 \pmod{7}$ by using CRT.	7	L2	CO3
	c.	Find the remainder when 146! is divided by 149.	7	L2	CO3
OR					
Q.8	**a.**	Find the remainder when $135 \times 74 \times 48$ is divided by 7.	6	L2	CO3
	b.	Using RSA algorithm decrypt 09810461 using d = 937, p = 43, q = 59.	7	L2	CO3
	c.	Using Fermat's little theorem, find the remainder when 11^{104} is divided by 7.	7	L2	CO3
Module – 5					
Q.9	**a.**	Find the rank of the matrix $\begin{bmatrix} 91 & 92 & 93 & 94 & 95 \\ 92 & 93 & 94 & 95 & 96 \\ 93 & 94 & 95 & 96 & 97 \\ 94 & 95 & 96 & 97 & 98 \\ 95 & 96 & 97 & 98 & 99 \end{bmatrix}$.	6	L2	CO4
	b.	Solve the system of equation by using Gauss – Jordan method. $x + y + z = 9$, $x - 3y + 4z = 13$, $3x + 4y + 5z = 40$.	7	L2	CO4
	c.	Using Power method, find the largest eigen value and corresponding eigen vector of the matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ by considering Initial vector as $[1, 1, 1]^T$.	7	L2	CO4

		OR			
Q.10	a.	Solve the following system of equations by Gauss – Seidel method. $x + y + 54z = 110$. $27x + 6y - z = 85$, $6x + 15y + 2z = 72$. Carry out four iterations.	8	L1	CO4
	b.	Investigate the values of λ & μ, such that the system of equations $x + y + z = 6$ $x + 2y + 6z = 10$ $x + 2y + \lambda z = \mu$ may have i) Unique solution ii) No solution and iii) Infinitely many solution.	7	L2	CO4
	c.	Using modern mathematical tool write a program / code to test the consistency of the equations $x + 2y - z = 1$; $2x + y + 4z = 2$; $3x + 3y + 4z = 1$.	5	L3	CO5

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