

Model Question Paper –II with effect from 2022

USN

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First Semester B. E Degree examination

Mathematics-1 for Computer Science Stream (22MATS11)

Time: 03 Hours

Max. Marks: 100

Note: Answer any FIVE full questions, choosing at least ONE question from each module.

| | | Module-1 | Marks |
|-----------------|---|--|-------|
| Q. 01 | 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 |
| | b | Find the angle between the curves $r = \frac{a}{1+\cos\theta}$ and $r = \frac{b}{1-\cos\theta}$ | 7 |
| | c | Find the radius of curvature of the curve $y = x^3(x - a)$ at the point $(a, 0)$ | 7 |
| OR | | | |
| Q. 02 | a | Show that the curves $r = a(1 + \cos \theta)$ and $r = a(1 - \cos \theta)$ cuts each other orthogonally | 6 |
| | b | Find the pedal equation of the curve $r(1 - \cos\theta) = 2a$ | 7 |
| | c | Find the radius of curvature for the curve $y^2 = \frac{a^2(a-x)}{x}$, where the curve meets the x-axis. | 7 |
| Module-2 | | | |
| Q. 03 | a | Expand $\log(1 + \sin x)$ up to the term containing x^4 using Maclaurin's series. | 6 |
| | b | If $u = \log(\tan x + \tan y + \tan z)$ show that $\sin 2x \frac{\partial u}{\partial x} + \sin 2y \frac{\partial u}{\partial y} + \sin 2z \frac{\partial u}{\partial z} = 2$. | 7 |
| | c | Find the extreme values of the function $f(x, y) = x^2 + y^2 + 6x - 12$. | 7 |
| OR | | | |
| Q. 04 | a | Evaluate $\lim_{x \rightarrow 0} \left(\frac{a^x + b^x + c^x}{3} \right)^{1/x}$ | 6 |
| | b | If $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$ show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 0$ | 7 |
| | c | If $x = r \sin \theta \cos \phi$, $y = r \sin \theta \sin \phi$, $z = r \cos \theta$ find the value of $\frac{\partial(x,y,z)}{\partial(r,\theta,\phi)}$. | 7 |
| Module-3 | | | |
| Q. 05 | a | Solve $\frac{dy}{dx} + \frac{y}{x} = y^2 x$ | 6 |
| | b | Find the orthogonal trajectories of $r = a(1 + \cos\theta)$ where a is parameter. | 7 |
| | c | Solve $p^2 + 2p \cot x - y^2 = 0$. | 7 |
| OR | | | |

| | | | |
|-----------------|---|---|---|
| Q. 06 | a | Solve $y(2xy + 1)dx - xdy = 0$ | 6 |
| | b | Find the orthogonal trajectories of the family $r^n \sin n\theta = a^n$. | 7 |
| | c | Find the general solution of the equation $(px - y)(py + x) = 2p$ by reducing into Clairaut's form by taking the substitution $X = x^2, Y = y^2$ | 7 |
| Module-4 | | | |
| Q. 07 | a | (i) Find the remainder when 2^{23} is divided by 47. (ii) Find the last digit in 7^{118} . | 6 |
| | b | Find the solutions of the linear congruence $11x \equiv 4 \pmod{25}$. | 7 |
| | c | Encrypt the message STOP using RSA with key (2537, 13) using the prime numbers 43 and 59. | 7 |
| OR | | | |
| Q. 08 | a | Using Fermat's Little Theorem, show that $8^{30} - 1$ is divisible by 31. | 6 |
| | b | Solve the system of linear congruence $x \equiv 3 \pmod{5}, \quad y \equiv 2 \pmod{6}, \quad z \equiv 4 \pmod{7}$ using Remainder Theorem. | 7 |
| | c | (i) Find the remainder when $175 \times 113 \times 53$ is divided by 11. (ii) Solve $x^3 + 5x + 1 \equiv 0 \pmod{27}$. | 7 |
| Module-5 | | | |
| Q. 09 | a | Find the rank of the matrix $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ | 6 |
| | b | Solve the system of equations by using Gauss-Jordan method: $x + y + z = 9$ $2x + y - z = 0$ $2x + 5y + 7z = 52$ | 7 |
| | c | Using power method, find the largest eigenvalue and corresponding eigenvector of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ | 7 |
| OR | | | |
| Q. 10 | a | Solve the following system of equation by Gauss-Seidel method: $20x + y - 2z = 17$ $3x + 20y - z = -18$ $2x - 3y + 20z = 25$ | 6 |
| | b | Test for consistency $x - 2y + 3z = 2,$ $3x - y + 4z = 4,$ $2x + y - 2z = 5$ and hence solve | 7 |
| | c | Solve the system of equations by Gauss elimination method $2x + y + 4z = 12, \quad 4x + 11y - z = 33, \quad 8x - 3y + 2z = 20$ | 7 |

| Table showing the Blooms Taxonomy Level, Course outcome and Program outcome | | | | |
|---|----|--------------------------------|----------------|-----------------|
| Question | | Blooms Taxonomy level attached | Course outcome | Program outcome |
| Q.1 | a) | L1 | CO 01 | PO 01 |
| | b) | L2 | CO 01 | PO 01 |
| | c) | L3 | CO 01 | PO 02 |
| Q. 2 | a) | L1 | CO 01 | PO 01 |
| | b) | L2 | CO 01 | PO 01 |
| | c) | L3 | CO 01 | PO 02 |
| Q. 3 | a) | L2 | CO 02 | PO 01 |
| | b) | L2 | CO 02 | PO 01 |
| | c) | L3 | CO 02 | PO 03 |
| Q. 4 | a) | L2 | CO 02 | PO 01 |
| | b) | L2 | CO 02 | PO 01 |
| | c) | L3 | CO 02 | PO 02 |
| Q. 5 | a) | L2 | CO 03 | PO 02 |
| | b) | L3 | CO 03 | PO 03 |
| | c) | L2 | CO 03 | PO 01 |
| Q. 6 | a) | L2 | CO 03 | PO 02 |
| | b) | L3 | CO 03 | PO 03 |
| | c) | L2 | CO 03 | PO 01 |
| Q. 7 | a) | L2 | CO 04 | PO 01 |
| | b) | L2 | CO 04 | PO 01 |
| | c) | L2 | CO 04 | PO 02 |
| Q. 8 | a) | L2 | CO 04 | PO 01 |
| | b) | L2 | CO 04 | PO 01 |
| | c) | L2 | CO 04 | PO 02 |
| Q. 9 | a) | L2 | CO 05 | PO 01 |
| | b) | L3 | CO 05 | PO 01 |
| | c) | L3 | CO 05 | PO 02 |
| Q. 10 | a) | L2 | CO 05 | PO 01 |
| | b) | L3 | CO 05 | PO 02 |
| | c) | L3 | CO 05 | PO 01 |

| Bloom's Taxonomy Levels | Lower order thinking skills | | |
|-------------------------------|--|--|---|
| | Remembering (knowledge): L ₁ | Understanding (Comprehension): L ₂ | Applying (Application): L ₃ |
| | Higher-order thinking skills | | |
| | Analyzing (Analysis): L ₄ | Valuating (Evaluation): L ₅ | Creating (Synthesis): L ₆ |