Code No: R201101 **R20** SET - 1

I B. Tech I Semester Regular Examinations, July/August-2021

MATHEMATICS-I

(Com. to All Branches)

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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1 a) Examine the convergence of $\sum \frac{[(n+1)!]^2 x^{n-1}}{n}$,(x > 0) (7M)

b) Find Maclaurin's series expansion of the f(x, y) = $\sin^2 x$ and hence find the approximate value of $\sin^2 16^\circ$. (7M)

Or

2. a) Prove using mean value theorem $|\sin u - \sin v| \leq |u - v|$. (7M)

b) Examine the convergence of $x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + ...(x > 0)$. (7M)

3. a) Solve $(x + 2y^3)\frac{dy}{dx} = y$. (7M)

b) Solve $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$ (7M)

Or

4. a) Find the orthogonal trajectories of $r^2 = a\sin 2\theta$. (7M)

b) Solve (xysinxy + cosxy) ydx + (xysinxy – cosxy) xdy = 0. (7M)

5. a) $Solve\ (D^3 - D)y = 2x + 1 + 4Cosx + 2e^x$ (7M)

b) In an L-C-R circuit, the charge q on a plate of a condenser is given by (7M)

$$L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{C} = ESinpt$$

The circuit is tuned to resonance so that q^2=1/LC. If initially the current ***I*** and the charge q be zero , show that, for small values of R/L, the current in the circuit at time t is given by (Et/2L)sin pt.

Or

6. a) Solve $\frac{d^2y}{dx^2}$ + y = cosec x by the method of variation of parameters. (7M)

b) Solve $x^2\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + y = \frac{1}{(1-x)^2}$. (7M)

7. a) If u = $\sin^{-1}\left(\frac{x^2 + y^2}{x + y}\right)$ prove that x$\frac{\partial u}{\partial x}$ + y$\frac{\partial u}{\partial y}$ = tan u. (7M)

b) Investigate the maxima and minima, if any, of the function f(x) = $x^3y^2(1 - x - y)$. (7M)

Or
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8. a) Prove that $u = \frac{x^2 - y^2}{x^2 + y^2}$, $v = \frac{2xy}{x^2 + y^2}$ are functionally dependent and find the relation between them. (7M)

b) Expand $f(x, y) = e^{x+y}$ in the neighborhood of (1, 1). (7M)

9. a) Evaluate $\iint_R xy\,dx\,dy$ where R is the region bounded by the x-axis, ordinate $x = 2a$ and the curve $x^2 = 4ay$. (7M)

b) By changing the order of integration, evaluate $\int_0^3 \int_1^{\sqrt{4-y}} (x + y)\,dx\,dy$. (7M)

Or

10 a) Evaluate the following integral $\int_0^{\pi/2} \int_0^{2a\sin\theta} \int_0^{(a^2 - r^2)/a} r\,dr\,d\theta\,dz$ (7M)

b) Evaluate $\int_0^a \int_0^{\sqrt{a^2 - x^2}} \sqrt{x^2 + y^2}\,dy\,dx$ by changing into polar coordinates. (7M)