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# B.Tech. (Sem. - 4th)

## MATHEMATICS - III

**SUBJECT CODE : CS - 204**

**Paper ID : [A0495]**

[Note : Please fill subject code and paper ID on OMR]

**Time : 03 Hours** **Maximum Marks : 60**

**Instruction to Candidates:**

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

## Section - A

***Q1)*** ***(10 x 2 = 20)***

a) Define the Rolle's Theorem and Mean Value Theorem.

b) Find the poles from $\frac{e^z}{1+z^2}$.

c) How Taylor series is different from Laurent series?

d) Using Picard's method to find first approximation of $\frac{dy}{dx} = x + y^2, y(0) = 1$.

e) Explain Crank-Nicholson difference scheme for PDEs.

f) Find the inverse Laplace transform of $\frac{1}{(s-2)^2+3^2}$.

g) Define Translational transformation with example.

h) Name few methods used to solve boundary value problems.

i) Change $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}\,dydx$, into polar co-ordinates.

j) Show that the function $f(x)=\sin\frac{1}{x}$ is continuous in $\left(0, \frac{2}{\pi}\right)$.

## Section - B

**(4 x 5 = 20)**

***Q2)*** Solve the equation $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$ by the method of separation of variables.

***Q3)*** Use residue calculus to evaluate the integral $\int_0^{2\pi} \frac{d\theta}{5 - 4\sin\theta}$.

***Q4)*** Prove that the function $\sin z$ is analytic and find its derivative.

***Q5)*** Evaluate $\iint_R e^{2x+3y}\,dxdy$ over the triangle bounded by $x = 0, y = 0$ and $x + y = 1$.

***Q6)*** Employ Taylor's method to obtain approximate of $y$ at $x = 0.02$ for differential equation $\frac{dy}{dx} = 2y + 3e^x, y(0) = 0$.

## Section - C

**(2 x 10 = 20)**

***Q7)*** (a) Expand $f(z) = \frac{1}{z(z^2 - 3z + 2)}$ in a Laurent's series valid for the regions $|z| > 2$.

(b) Give an example of bounded function which is not Riemann integrable on [0, 1].

***Q8)*** (a) Using Runge Kutta method of order 4, find $y(0.1)$ and $y(0.2)$ given that $\frac{dy}{dx} = xy + y^2, y(0) = 1$. (Take $h = 0.1$).

(b) If $A\frac{\partial^2 u}{\partial x^2} + B\frac{\partial^2 u}{\partial x \partial y} + C\frac{\partial^2 u}{\partial y^2} + D\frac{\partial u}{\partial x} + E\frac{\partial u}{\partial y} = 0$, then what are the conditions for this equation to be elliptic, parabolic and hyperbolic.

***Q9)*** (a) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to the conditions $u(0, y) = u(1, y) = u(x, 0) = 0$ and $u(x, a) = \sin n\pi x$.

(b) Find all singularities of the function $f(z) = \frac{z - i}{(z^2 + 1)(z - 3)}$.

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