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Total No. of Questions : 09]

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**B.Tech. (Sem. - 4<sup>th</sup>)**  
**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  $\left(0, \frac{2}{\pi}\right)$ .

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P.T.O.

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  $\iint_R e^{2x+3y} dx dy$  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  $f(z) = \frac{z-i}{(z^2+1)(z-3)}$ .

