

Code No: 113AH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B.Tech II Year I Semester Examinations, May/June - 2019****MATHEMATICS – III****(Common to EEE, ECE, EIE, ETM, AGE)****Time: 3 Hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART- A**(25 Marks)**

- 1.a) Determine the nature of the point $x = 0$ for the equation $(x^2 + 1)y'' + (x^2 - 1)y' + 2y = 0$ [2]
- b) Find the indicial equation of $x^2y'' - 2xy' - (x^2 - 2)y = 0$. [3]
- c) Write the value of $J_{\frac{1}{2}}(x)$ [2]
- d) Obtain the value of $P_2(x)$. [3]
- e) Write the Cauchy Riemann equations in polar form. [2]
- f) Show that the function $f(z) = \sin x \cosh y + i \cos x \sinh y$ is continuous and analytic everywhere. [3]
- g) Define essential singularity. [2]
- h) Expand $\log z$ by Taylor's series about $z = 1$. [3]
- i) Find the image of $z=2-i$ under the transformation $w = z + 2 - 3i$. [2]
- j) Prove that $w = \frac{1}{z}$ is circle preserving. [3]

PART-B**(50 Marks)**

2. Find the series solution of $4xy'' + 2y' + y = 0$. [10]
- OR**
3. Solve the equation $3x \frac{d^2y}{dx^2} + (1-x) \frac{dy}{dx} - y = 0$ in power series. [10]
- 4.a) Prove that $\int_{-1}^1 x P_n(x) P_{n-1}(x) dx = \frac{2n}{4n^2-1}$.
 - b) Show that $J_0^2 + 2(J_1^2 + J_2^2 + J_3^2 + \dots) = 1$. [5+5]
- OR**
5. If m_1, m_2 are roots of $J_n(x) = 0$, then prove that $\int_0^1 x J_n(m_1 x) J_n(m_2 x) dx = 0$. [10]
 6. State and prove Cauchy's Integral formula. [10]
- OR**
7. Evaluate $\int_c (y - x - 3x^2 i) dz$, where c consists of the line segments from $z = 0$ to $z = i$ and the other from $z = i$ to $z = 1+i$. [10]

8. Evaluate $\int_{-\infty}^{\infty} \frac{z^2 - z + 2}{z^4 + 10z^2 + 9} dz$. [10]

OR

9. Find Laurent expansion of $\frac{1}{z^2 - 4z + 3}$ for $1 < |z| < 3$. [10]

10. Determine the region of the w - plane into which the first quadrant of z - plane is mapped by the transformation $w = z^2$. [10]

OR

11. Show that every bilinear transformation maps the circles in the z - plane onto the circles in the w - plane. [10]

---ooOoo---