

R15

Code No: 123AH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, November/December - 2016
MATHEMATICS-III

(Common to EEE, ECE, EIE, ETM)

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) Solve $(x^2 D^2 + x D - 4)y = 0$. [2]
- b) Find the particular solution of $4x^2 \left(\frac{d^2 y}{dx^2} \right) + 8x \left(\frac{dy}{dx} \right) + y = \frac{4}{\sqrt{x}}$. [3]
- c) Express $x^2 - 1$ in terms of $P_n(x)$. [2]
- d) Express J_2 in terms of J_0 and J_1 . [3]
- e) Show that $f(z) = z |z|$ is not analytic anywhere. [2]
- f) Find the harmonic conjugate of $u = 2xy + 3y$. [3]
- g) Expand $\frac{1}{(z+1)^2}$, when $z > 1$. [2]
- h) Find the co-efficient of z^3 in the expansion of $\frac{1}{z^2(1-z)}$. [3]
- i) Evaluate the residue of $\frac{e^z}{z^2(z^2+9)}$ at $z = 0$. [2]
- j) Find the image of $c < y < d$ under the transformation $w = e^z$. [3]

PART-B
(50 Marks)

2. Solve in series $3x^2 \left(\frac{d^2 y}{dx^2} \right) + 8x \left(\frac{dy}{dx} \right) + y = x$. [10]

OR

3. Solve $(1+x)^2 \left(\frac{d^2 y}{dx^2} \right) + (1+x) \left(\frac{dy}{dx} \right) + y = 4 \cos \log(1+x)$. [10]

- 4.a) Prove that $\cos(x \cos \theta) = J_0 - 2J_2 \cos 2\theta + 2J_4 \cos 4\theta - \dots$

- b) Prove that $\sin(x \cos \theta) = 2J_1 \cos \theta + 2J_3 \cos 3\theta + \dots$. [5+5]

OR

5. Show that $\int_0^1 p_m(x) p_n(x) dx = \begin{cases} 0 & \text{if } m \neq n \\ \frac{2}{2n+1} & \text{if } m = n \end{cases}$. [10]

6.a) Find the analytic function whose real part is $\left(r - \frac{1}{r}\right) \sin \theta$

b) Evaluate $\int_C x^2 y \, dx + (x^2 - y^2) \, dy$ from (0,0) to (1,3) along $y=x^2$. [5+5]

OR

7. If $F(z) = \int_C \frac{(3z^2 + 7z + 1)}{(z-a)} dz$ using Cauchy's integral formula where C is $|z|=2$.

Find $F(1)$, $F(3)$, $F''(1-i)$. [10]

8. Expand $\frac{z}{(z+1)(z-3)}$ where (a) $c: |z| > 3$ (b) $c: |z| < 1$. [10]

OR

9. Expand $f(z) = \frac{z+3}{z(z^2-z-2)}$ in power of z

(a) $c: 0 < |z| < 1$ (b) $c: 1 < |z| < 2$ (c) $c: |z| > 2$. [10]

10.a) Prove that under the transformation $w=1/z$, the image of the lines $y=x-1$ and $y=0$ are the circle $u^2 + v^2 - u - v = 0$ and the line $v=0$, respectively.

b) Find the bilinear transformation which maps the points $(-1, \infty, 1)$ to $(-1, -2, i)$. [5+5]

OR

11.a) Find the image of the triangle with vertices $i, 1+i$ and 1 in Z -plane under the transformation $w=3z+4-2i$. [5+5]

b) Show that the transformation $w = \frac{5-4z}{4z-2}$ transforms the circle $|z|=1$ into a circle of radius unity in w -plane and find the centre of the circle. [5+5]

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