**Code No: 133BD** **R16**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B.Tech II Year I Semester Examinations, November/December - 2017**
**MATHEMATICS – IV**
**(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, MMT, AE, MIE, PTM, CEE, MSNT)**

**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) Show that $f(z) = z + \bar{z}$ is not analytic any where in the complex plane. [2]

b) Write Cauchy-Remainn equations in Polar form. [3]

c) Find the residues at the poles of the function $f(z) = \dfrac{1}{(z+1)(z+2)}$. [2]

d) Expand $f(z) = Tanz$ in Taylor's series about the point z=0. [3]

e) Define Bilinear transformation. [2]

f) Define for a complex function: i) Isolated Singularity ii) Removable Singularity. [3]

g) If $f(x) = x^2$ in [-π,π], find $a_0$ in Fourier series. [2]

h) State Fourier integral theorem. [3]

i) Write the one dimensional Heat equation in steady state. [2]

j) Classify partial differential equation $\dfrac{\partial^2 z}{\partial x^2} - 2\dfrac{\partial z}{\partial x} + \dfrac{\partial z}{\partial y} = 0$. [3]

## PART-B

**(50Marks)**

2.a) Determine $p$ so that the function $f(z) = \frac{1}{2}\log(x^2 + y^2) + Tan^{-1}(\frac{px}{y})$ is analytic.

b) Find the analytic function $f(z) = u + iv$ if $u - v = e^x[\cos y - \sin y]$. [5+5]

**OR**

3.a) Determine the analytical function whose real part is $x^3 - 3xy^2 + 3x^2 - 3y^2 = 1$. Also find the harmonic conjugate of this real part.

b) Prove that $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right]|f(z)|^2 = 4|f'(z)|^2$. [5+5]

4.a) Using Cauchy integral formula, find $\int_c \frac{e^{2z}}{(z+1)^3} dz$, where $C$ is the curve $|z| = 2$.

b) Evaluate $\int(x^2 - iy^2)dz$ along a straight line from (0,0) to (0,1) and then from (0.1) to (2,1). [5+5]

**OR**

5. Find Laurent's series of $\frac{z}{(z-1)(z-2)}$ about:

a) $|z| < 1$ b) $|z| > 1$ c) $1 < |z| < 2$ [10]

6. Evaluate $\int_0^{2\pi} \frac{cos3\theta}{5-4cos\theta} d\theta$. [10]

**OR**

7. Find Mobius transformation that maps:
a) $0,1,\infty$ into $-5,-1,3$, Find fixed points.
b) $\infty, i, 0$ to $0,-i,\infty$. [5+5]

8. Find the Fourier series of $f(x) = e^{-x}$ in the interval$(0.2\pi)$. Hence, deduce that $\frac{\pi}{2}\frac{1}{sinh\pi} = \sum_{n=2}^{\infty} \frac{(-1)^n}{n^2+1}$ [10]

**OR**

9.a) Find the Fourier series for $f(x) = x + x^2 \; in -\pi < x < \pi$.

b) Find the Fourier cosine transform of $e^{-x^2}$ [5+5]

10. Solve $\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y}, u(0,y) = 8e^{-3y}$ by the method of separation of variables. [10]

**OR**

11. The ends of a uniform string of length $2l$ are fixed. The initial displacement is m $y(x.0) = 3x(2l-x), 0 < x < 2l,$ while the initial velocity is zero, Find the displacement at any distance *x* from the end *x=0* at any time 't'. [10]

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