

Code No: 134SC

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, November/December - 2020

MATHEMATICS – IV

(Mechanical Engineering (Mechatronics))

Time: 2 hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

- 1.a) Find the analytic function whose real part is $\frac{\sin 2x}{\cosh 2y + \cos 2x}$
- b) If $f(z)$ is an analytic function then show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$ [7+8]
- 2.a) Evaluate $\int_C \frac{dz}{(z^2 - 4)(z + 1)}$ where C is $|z| = 3$
- b) Find the Laurent series for $f(z) = z^2 e^{\frac{1}{z}}$ about $z=0$. [7+8]
3. Expand $\frac{1}{(z-1)(z-2)}$ about
- a) $|z| < 1$ b) $|z| > 2$ [7+8]
- 4.a) State and prove Cauchy's integral formula.
- b) Find the Taylor's series expansion of $\frac{1}{(z+1)(2z+5)}$. [7+8]
- 5.a) Evaluate by $\int_0^{2\pi} \frac{d\theta}{(5-3\cos\theta)^2}$ contour integration in complex plane.
- b) Under the transformation $w = \frac{z-i}{1-iz}$ find the image of the circle $|z|=1$. [8+7]
- 6.a) Evaluate using residue theorem $\int_0^\infty \frac{dx}{(x^2+1)^2}$
- b) Find the bilinear transformation which maps the points $z = i, -i, 1$ in z plane to $w = 0, 1, \infty$ in w - plane. [8+7]
- 7.a) Obtain the Fourier series for the function $f(x) = |x|$ in $-\pi < x < \pi$ and deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$
- b) Find the half range Sine series for $f(x) = \pi x - x^2$ in $[0, \pi]$. [8+7]
- 8.a) Find the fourier sine transform of x^{n-1} ($0 < n < 1$).
- b) Find the fourier sine transform of $\frac{x}{a^2 + x^2}$. [5+10]