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National Institute of Technology Goa

Programme Name: B.Tech

Online Mid Semester Examinations, October 2021

Course Name: **Mathematics-III**

Date: 29/10/2021

Duration: 50 Minutes

Course Code: **MA200**

Time: 10:00AM - 11:00 AM

Max. Marks: 20

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1. Apply Rouché's theorem and find the roots of $z^4 + 6z + 1 = 0$ that lies inside the circle $|z| = 3/2$, is
(1) 3 (2) 2 (3) 1 (4) 4.
 2. The coefficient of $1/z$ in Laurent series expansion of $f(z) = \frac{1+2z^2}{z^3+z^5}$ is
(1) -1 (2) 2 (3) 1 (4) 0.
 3. Which of the following is an entire function
(1) $\sin z$ (2) $\frac{1}{z-1}$ (3) $\frac{1}{e^z-1}$ (4) $\frac{1}{z(z-1)}$.
 4. The value of i^i
(1) $e^{-\pi/2}$ (2) $e^{\pi/2}$ (3) $e^{-\pi}$ (4) e^{π} .
 5. The value of the expression $\frac{-5+10i}{3+4i}$
(1) $1 - 2i$ (2) $-1 + 2i$ (3) $-1 - 2i$ (4) $1 + 2i$.
 6. The equation $\sin z = 10$ has
(1) infinite solutions (2) no solution (3) one solution (4) two solutions.
 7. The argument of $\frac{1+i}{1-i}$
(1) π (2) $\frac{\pi}{2}$ (3) $-\frac{\pi}{2}$ (4) π .
 8. Let $u = x^2 - y^2$ is a real part of analytical function $f = u + iv$, then $v =$
(1) $2x + c$ (2) $2y + c$ (3) $2x/y + c$ (4) $2xy + c$.
 9. Which of the following is a meromorphic function
(1) $\sin z$ (2) $\frac{1}{z-1}$ (3) e^z (4) $z - 1$.
 10. The value of $\int_c \frac{1}{z^2+1} dz$, where $c: |z| = \frac{1}{2}$
(1) 0 (2) 1 (3) ∞ (4) none.
 11. The value of $\int_c \frac{\cos z}{z} dz$, where $c: |z| = 1$
(1) 0 (2) 1 (3) $2\pi i$ (4) none.
 12. The singular points $e^{\frac{1}{z^2}}$ are
(1) 1 (2) 0 (3) infinite (4) none.

13. Which of the following function has an essential singularity
 (1) e^z (2) $\sin \frac{1}{z}$ (3) $\sin z$ (4) all.
14. Which of the following function has an isolated singularity
 (1) $\sec \frac{1}{z}$ (2) $\cot \frac{1}{z}$ (3) $\tan \frac{1}{z}$ (4) $\cos \frac{1}{z}$.
15. Which of the following function has a non-isolated singularity
 (1) $\sec \frac{1}{z}$ (2) $\cot z$ (3) $e^{\frac{1}{z}}$ (4) none.
16. For the equation $(x-1)y'' + \cot \pi xy' + \csc^2 \pi xy = 0$
 (1) $x = 0$ is regular singular point and $x = 1$ is irregular singular point
 (2) $x = 0$ is irregular singular point and $x = 1$ is regular singular point
 (3) Both $x = 0$ and $x = 1$ are regular singular points
 (4) Both $x = 0$ and $x = 1$ are irregular singular points.
17. The indicial equation of the differential equation $x^2 y'' - xy' + (1+x^2)y = 0$ is $m(m-1) + mp_1 + p_2 = 0$ then
 (1) $p_1 = 1, p_2 = -1$ (2) $p_1 = -1, p_2 = 1$ (3) $p_1 = -1, p_2 = 0$ (4) $p_1 = 0, p_2 = -1$.
18. If $y = \sum_{n=0}^{\infty} a_n x^n$ is a solution of $y'' + xy' + 3y = 0$ then $\frac{a_n}{a_{n+2}}$
 (1) $\frac{(n+1)(n+2)}{n+3}$ (2) $\frac{n(n-1)}{n+3}$ (3) $-\frac{(n+1)(n+2)}{n+3}$ (4) $-\frac{n(n-1)}{n+3}$.
19. For the n th order Legendre polynomial $c_n \frac{d^n y}{dx^n} [(x^2 - 1)^n]$, the value of c_n is
 (1) $\frac{1}{n!2^n}$ (2) $\frac{n!}{2^n}$ (3) $\frac{2^n}{n!}$ (4) $n!2^n$.
20. $J_{-\frac{3}{2}}(x) =$
 (1) $\sqrt{\frac{2}{\pi x}} \cos x$ (2) $\sqrt{\frac{2}{\pi x}} \sin x$ (3) $\sqrt{\frac{2}{\pi x}} \left(\frac{\cos x}{x} + \sin x \right)$ (4) $-\sqrt{\frac{2}{\pi x}} \left(\frac{\cos x}{x} + \sin x \right)$.

ALL THE BEST