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TM242477Y

Reg. No :..............................

Name :..............................

MASTER'S DEGREE (C.S.S) EXAMINATION, MARCH 2024

2023 ADMISSIONS REGULAR

SEMESTER II - CORE COURSE

PH2C05TM20 - Mathematical Methods in Physics - II

Time : 3 Hours **Maximum Weight : 30**

Part A

I. Answer any Eight questions. Each question carries 1 weight **(8x1=8)**

1. Show that the function $f(x) = x^2$ satisfies Cauchy Riemann conditions.
2. Expand $f(z) = 1/(1-z)$ in a Taylor's series about $z_0 = i$.
3. Differentiate essential and removable singularity.
4. State and prove Parseval's identity for Fourier series.
5. Find $L(F'(t))$ *if* $F(t) = e^{5t}$.
6. If $J_n(x)$ is the n th order Bessel function , Show that $\frac{d}{dx}[x^n J_n(x)] = x^n J_{n-1}(x)$
7. Prove that β(m,n) = $\int_0^\infty \frac{x^{m-1}}{(1+x)^{m+n}}\, dx$
8. Show that for x>0 , Γ(n+1) = n Γ(n)
9. Write any three partial differential equation in Physics
10. Find the potential outside a sphere assuming the outside of the sphere is free of charges.

Part B

II. Answer any Six questions. Each question carries 2 weight **(6x2=12)**

11. Show that $\int_c \frac{z^3+2z}{(z-z_0)^3}dz = 6\pi i\, z_0$, whare c is a closed contour described in positive sense and z_0 is inside the contour.
12. State and prove Cauchy's Residue theorem. Evaluate $\int_c \frac{5z-2}{z(z-1)}dz$, where c is the circle with z=2.
13. Expand output of a half wave rectifier circuit as Fourier series.
14. Deduce Laplace transform of $t^n F(t)$ anf find $L(t^2\cos 2t)$.
15. Evaluate $J_{1/2}(x)$.
16. Find the Hermite polynomials for n=1,2,3.
17. Prove that Green's function is symmetric.
18. Determine the steady-state temperature distribution in a thin plate bounded by the lines x=0, x=l and y= ∞ which are maintained at zero temperature and y=0 is kept at steady-state temperature f(x)

Part C

III. Answer any Two questions. Each question carries 5 weight **(2x5=10)**

19. Explain Laurent's expansion of a function by deducing the series expansion.

20. Explain Fourier Transform of a function. Find the Fourier tansform of $f(x) = 1, \ |x| < a$ and deduce

$0, \ |x| > a > 0$

$$\int_0^{\infty} \left(\frac{\sin t}{t}\right) dt = \frac{\pi}{2} \ and \ \int_0^{\infty} \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}.$$

21. Obtain the orthogonality properties of Bessel functions.

22. Discuss scattering of charged particle by applying Green's theorem.