PRN:		Course Code:	PPS114

First Year M.Sc. End Semester Winter 2023

Mathematical Methods in Physics

Day and Date: Tuesday, 19/12/2023 Max Marks: 100

Time: 10.30 am to 1.30 PM Duration: 03 hr

Instructions: 1) All questions are compulsory

		Marks	Bloom level	CO
Q.1	**Attempt any two of the following:**	**25**		
a)	State Laurent series theorem, also derives expression of Laurent series for complex number.	**8**	**L3**	**CO1**
b)	Shows that $$f(z)=\sum_{n=0}^{\infty} a_n (z-a)^n$$ If f(z) analytical function within circle C with center Z_0=a and radius R then every point Z inside the circle satisfies above conditions.	**8**	**L4**	**CO1**
c)	The coefficient of x^3 in the Taylor expansion of sin (sin (x) around $x = 0$ is …	**9**	**L3**	**CO1**
	OR			
c)	State Laurent's series theorem, derive expression of Laurent's series expansion for complex number.	**9**	**L3**	**CO1**
Q.2	**Attempt any two of the following:**	**25**		
a)	State and explain the concept of Singularities.	**8**	**L2**	**CO2**
b)	State and prove the Cauchy residue theorem..	**8**	**L3**	**CO3**
c)	Evaluate value of integral $$\int_{-\infty}^{\infty} \frac{1}{1+x^4} dx$$	**9**	**L3**	**CO2**
	OR			

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C) The principle value of the integral $\int_{-\infty}^{\infty} \frac{\sin(2x)}{x^3} dx$ is — 9 — L3 — CO2

Q.3 Attempt any three of the following: — 25

a) Define Fourier series, and derive expression for Fourier series with evaluate coefficient a_0 a_n, and b_n. — 8 — L4 — CO3

b) State and prove any two properties of Fourier transform. — 8 — L3 — CO3

c) Show that — 8 — L3 — CO3

$$f(x) = \frac{1}{\pi}\int_0^{\infty}\int_{-\infty}^{\infty} f(t).\cos w(t-x)dt.dw$$

OR

c) Derive Fourier series expansion of function is — 8 — L3 — CO3

F(x)=0 if -p≤x≤0

=h if 0≤x≤p

Q.4 **Attempt any three of the following:** — 25

a) State Hermite Differential equation, and derive expression for — 8 — L3 — CO4

$$H_n = \sum_{r=0}^{n/2} \frac{(-1)^r (2x)^{n-2r} n!}{r!(n-2r)!}$$

b) Shows that — 8 — L3 — CO4

$$\sum_{n=0}^{\infty} t^n P_n(x) = (1-2x+t^2)^{-1/2}$$

c) Derive all recurrence relation for Bessel junction $J_n(x)$. — 9 — L4 — CO4

OR

c) Derive Series Solution for fallowing differential equations — 9 — L4 — CO4

$$(1-x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + n(n+1)y = 0$$

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