Name: **Enrolment No:**	

UPES
End Semester Examination, May 2024

Course: Mathematical Physics II **Semester: II**
Program: BSc Physics (H) **Time : 03 hrs.**
Course Code: PHYS1034 **Max. Marks: 100**

Instructions: All questions are compulsory (Q9 and Q11 have internal choice)

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Convert the given ordinary polynomial into Hermite polynomial $12\,x^2 + 14x + 3$	**4**	**CO1**
Q 2	Discuss briefly 'isomorphism' and 'homomorphism' in group theory	**4**	**CO1**
Q 3	Calculate propagation error for F = x+y and F = x-y. Consider x = 9.51±0.10, y = 5.90±0.10	**4**	**CO2**
Q 4	Evaluate, $\int_0^{\pi/2} \sqrt{\cot\theta}\, d\theta$	**4**	**CO3**
Q 5	From the given data find out 'n' (order of Hermite polynomial) $\int_{-\infty}^{\infty} e^{-x^2} {H_n}^2(x)\, dx = 384\sqrt{\pi}$	**4**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 6	What is probable error? Calculate standard error and probable error for a measurement with correlation coefficient of 0.6 and total observations of 20.	**10**	**CO2**

Q 7	A square membrane (2.5 cm × 2.5 cm) is under tension of 200 dynes/cm and is executing vibration with (4,3) normal modes. Calculate its velocity and frequency if the membrane has areal density of 0.02 g/cm^2.	**10**	**CO4**
Q 8	Show that, $\int_0^\infty e^{-x^4}x^2\,dx \times \int_0^\infty \frac{e^{-x^2}}{\sqrt{x}}dx = \frac{\pi}{4\sqrt{2}}$ [Consider: $\Gamma\left(\frac{3}{4}\right)\Gamma\left(\frac{1}{4}\right) = \pi\sqrt{2}$]	**10**	**CO3**
Q 9	Solve, $\frac{d^2y}{dx^2} + xy = 0$ **OR** Solve, $(x^2+1)\frac{d^2y}{dx^2} + x\frac{dy}{dx} - xy = 0$	**10**	**CO1**
SECTION C (2Qx20M=40 Marks)			
Q 10	(a) Solve 1D vibrating string to find out V (x, t). (b) Show that deflection of a vibrating string of length π fixed at both ends takes the form, $V(x,t) = \lambda\,(\cos t \sin x - \cos 2t \sin 2x)$ [Consider initial deflection, $F(x) = \lambda(\sin x - \sin 2x)$, $v^2 = 1$ and initial velocity $= 0$]	**15** **5**	**CO3**
Q 11	Derive the general solution for Laplace equation in cylindrical coordinates system. **OR** Solve steady state heat flow equation to find out temperature distribution, T (x, y) at any point P (x, y). Assume, plate is finite (length, a) along x and infinite (∞) along y.	**20**	**CO2**