Name:

Enrolment No:



UPES

End Semester Examination, December 2024

Course: Introductory Mathematical Physics Semester: I

Program: BSC-H-Geology, BSC-H-Mathematics & BSC-H-Mathematics by Research, BSC-H-Chemistry

Time: 03 hours

Course Code: PHYS1031 Max. Marks: 100

Instructions:

- (1) All questions are compulsory. Section A has 5 questions; Section B has 4 questions with an internal choice in one question; Section C has 2 questions with an internal choice in one question.
- (2) Use of scientific calculators is permitted.

SECTION A (5Qx4M=20Marks)

S. No.		Marks	со	
Q 1	List any two properties of the Dirac-Delta function.	4	CO1	
Q2	If any two complex numbers $a + ib$ and $c + id$ are equal, show that $a = c$ and $b = d$.	4	CO2	
Q3	Solve the following integral: $\int_{-\infty}^{\infty} e^{-5t} \delta(t-2) dt$.	4	CO2	
Q4	$Solve \frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 4y = 0.$	4	CO3	
Q5	Determine the constant 'a' such that the vector $\vec{A} = (x + 3y)\hat{\imath} + (2y + 3z)\hat{\jmath} + (x + az)\hat{k}$ is solenoidal.	4	CO3	
	SECTION B			
(4Qx10M= 40 Marks)				
There is an internal choice in Q8.				
Q6	Prove that $\Gamma(n+1) = n\Gamma(n)$ where Γ is the Gamma function.	10	CO2	
Q7	Derive a relation between the Beta function and Gamma function.	10	CO2	
Q8	Show that $e^{i\theta} = \cos \theta + i \sin \theta$. OR	10	CO3	
	Express in polar form the complex number: $1 - \sqrt{2} + i$.			
Q 9	Find the Fourier Series representation of the function $f(x) = x$ where $0 < x < 2\pi$.	10	CO3	

SECTION-C (2Qx20M=40 Marks) There is an internal choice in Q11.				
Q10	Use the technique of separation of variables to find the solution $u(x,t)$ to the following Partial Differential Equation (k is a constant): $\frac{\partial^2 u}{\partial x^2} = \frac{1}{k} \cdot \frac{\partial u}{\partial t}$	20	CO4	
Q11	(a) Using the Divergence Theorem, illustrate that $\iint \nabla(x^2 + y^2 + z^2) d\vec{s} = 6V$ where <i>S</i> is any closed surface enclosing the volume <i>V</i> .	15	CO4	
	(b) Determine the value of: $i^{49} + i^{103} + 3$. OR	5	CO3	
	(a) Evaluate $\iint \vec{F} \cdot \overrightarrow{dS}$ where $\vec{F} = 4x\hat{\imath} - 2y^2\hat{\jmath} + z^2\hat{k}$ and S is the surface bounding the region $x^2 + y^2 = 4$, $z = 0$ and $z = 3$.	15	CO4	
	(b) Solve: $\frac{1+i}{3+4i}$.	5	CO3	
