

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/SP20**)

CLASS: IMSC.
BRANCH: PHYSICS

SEMESTER : I
SESSION : MO/2022

SUBJECT: PH105R1 MATHEMATICAL PHYSICS - I
TIME: 02 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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		CO	BL
Q.1(a)	Explain Taylor and Binomial expansion using an example.	[2] 1	1,2
Q.1(b)	Compute the first and second partial derivative of $f(x,y) = 2x^3y - 3x^2$	[3] 1	2
Q.2(a)	Consider the differential: $f(x,y) = xdy + 3ydx$. Is it exact? Show your result.	[2] 1	2
Q.2(b)	Solve the differential equation: $\frac{dy}{dx} + 4xy = 2x^2$	[3] 1	3
Q.3(a)	Show that the dot product between two vectors remains invariant under rotations.	[2] 2	2
Q.3(b)	Consider a harmonic oscillator (spring-mass system) defined by the natural frequency ω_0 and the initial conditions: $x(t=0) = A, \dot{x}(t=0) = 0$ (where the terms have usual meaning) under a driving force $a \sin(\omega t)$. Obtain the time-dependent motion of the oscillator.	[3] 1	3
Q.4(a)	Write down the properties of Levi-Civita tensor ϵ_{ijk} .	[2] 2	1
Q.4(b)	Consider a vector \vec{v} in the x-y plane undergoing a passive rotation by θ . Obtain how the vector \vec{v} transforms.	[3] 2	2
Q.5	Show that $\vec{A} \times (\vec{B} \times \vec{C}) = \vec{B}(\vec{C} \cdot \vec{A}) - \vec{C}(\vec{A} \cdot \vec{B})$	[5] 2	1,2

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