

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION SP/2025)

CLASS: I MSc  
BRANCH: PHYSICS

SEMESTER : IV<sup>th</sup>  
SESSION : SP/2025

SUBJECT: PH213R1 MATHEMATICAL PHYSICS-II

TIME: 03 Hours

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 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)	From the generating function of Legendre Polynomial prove that $lP_l(x) = xP_l'(x) - P_{l-1}'(x).$	[5]	1 5
Q.1(b)	Define Gamma and Beta functions in two different forms for each.	[5]	1
Q.2(a)	Solve the Laplace's equation in cylindrical coordinate system, using separation of variable method.	[5]	2 3
Q.2(b)	Establish Euler-Lagrange equation.	[5]	6
Q.3(a)	State and construct Cauchy's integral theorem.	[5]	3 3
Q.3(b)	Using Taylor's series, expand the function $\frac{\sin z}{z-\pi}$ about $z \rightarrow \pi$ .	[5]	5
Q.4(a)	Show that a second rank tensor is a combination of symmetric and antisymmetric tensors.	[5]	4 2
Q.4(b)	Define Kronecker delta tensor.	[5]	1
Q.5(a)	Show the Ven diagrams for the outcomes of the die-throwing trials. Explain the following relations using these diagrams. $A \cup \bar{A} = S$ and $A \cap \bar{A} = \emptyset$	[5]	5 2
Q.5(b)	Calculate the probability of drawing an ace of a spade from a pack of cards.	[5]	5

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