



**Gandhi Institute of Engineering and Technology University, Odisha, Gunupur  
(GIET UNIVERSITY)**

M.Sc. (First Semester - Regular) Examinations, January – 2026  
**24PHPC11001– Mathematical Methods In Physics**  
(Physics)

Time: 3 hrs

Maximum: 60 Marks

**Answer ALL questions**  
(The figures in the right hand margin indicate marks)

**PART – A****(2 x 5 = 10 Marks)**Q.1. Answer **ALL** questions

	CO #	Blooms Level
a. Write an expression of C-R equation in Cartesian and Polar form.	CO1	K1
b. Define Christoffel symbol.	CO2	K1
c. Write the value of $\epsilon_{ilm}\epsilon_{jlm}$ .	CO3	K1
d. Write the shifting properties of Laplace transformation.	CO4	K1
e. Evaluate the value of $\Gamma(5/2)$ .	CO5	K2

**PART – B****(10 x 5 = 50 Marks)**Answer ALL the questions

	Marks	CO #	Blooms Level
2. a. State and Prove Laurent series.	7	CO1	K2
b. Find the value of 'a' for which $f(x, y) = 2x + 4(x^2 - y^2) + 6i(3xy + ay)$ is analytic? (OR)	3	CO1	K1
c. State and Prove Taylor series.	7	CO1	K2
d. Find the value of 'b' for which $f(x, y) = 4x + 4(x^2 - y^2) + 6i(3xy + by)$ is analytic?	3	CO1	K1
3.a. Derive transformation laws for the Christoffel's symbols of the first and Second kind. (OR)	10	CO2	K2
b. Show that if $A_i$ and $B_j$ are the components of a contravariant and covariant tensor of rank one $C_{ij} = A_i B_j$ are the components of mixed tensor of rank two?	10	CO2	K2
4.a. Prove that the set $\{2^n: n \in \mathbb{Z}\}$ with multiplication operation is an abelian group. (OR)	10	CO3	K2
b. Derive an expression for Direction cosines in Tensor using rectangular coordinate system.	10	CO3	K2
5.a. Find the Laplace transform of $f(t) = \begin{cases} \sin\left(t - \frac{\pi}{3}\right), & t > \frac{\pi}{3} \\ 0, & t < \frac{\pi}{3} \end{cases}$ (OR)	10	CO4	K2
b. Using Legendre polynomial show that $P'_n(-x) = (-1)^{n+1} P'_n(x)$ .	10	CO4	K2
6.a. Evaluate $\int_0^\infty \frac{x^7}{7^x} dx$ (OR)	10	CO5	K2
b. Evaluate $\int_0^1 (x \log x)^4 dx$	10	CO5	K2

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