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Reg. No. : ....

Name : ....

First Semester M.Sc. Degree Examination, August 2021

Physics

PH 212 – MATHEMATICAL PHYSICS

(2014–2017 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

I. Answer **any five** questions. Each question carries **3** marks.

(a) What are errors? Distinguish between systematic and random errors.

(b) If A and B are diagonal matrices. Show that A and B commute.

(c) Can Fourier series be developed for a function with a discontinuity?

(d) Explain the shifting property of Laplace transform.

(e) If A^i and B_j are the components of a contravariant and convariant tensor, respectively, show that A^i and B_i is a scalar.

(f) S.T.the cubic roots of unity forms an abelian group under multiplication.

(g) Show that the identity element in a group is unique.

(h) Explain singularity with an example.

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer A or B of questions from II to IV. Each question carries **15** marks.

II. (A) (a) Discuss the properties of Poisson distribution. **8**

(b) Solve the differential equation $\frac{df}{dx} = \lambda f(x)$, where both λ and b are constants, using the Laplace transform method. **7**

OR

(B) (a) State and prove the Residue theorem. **8**

(b) Discuss the method of χ^2 fitting. **7**

III. (A) (a) Obtain the eigen function expansion of Green's function. **8**

(b) Obtain the orthogonality relation for Legendre polinomial. **7**

OR

(B) (a) Prove that $xP_n(x) - P_{n-1}(x) = nP_n(x)$. **8**

(b) Prove that $\sin x = 2\sum_{n=1}^{\infty}(-1)^{n+1}J_{2+1}(x)$. **7**

IV. (A) (a) Show that a second order homogenous differential equation can have a maximum of two linearly independent solutions. **9**

(b) What are cyclic groups? Show that group with a prime order is cyclic. **6**

OR

(B) (a) What are Christoffel symbols? S.T. they do not transform as a components of a third rank tensor. **9**

(b) From Schur's Lemmas, obtain the great orthogonality theorem. **6**

(3 $\times$ 15 = 45 Marks)

PART – C

V. Answer **any three** questions. Each question carries **5** marks.

(a) Show that the Laplace transform $L(t \sin \omega t) = \dfrac{2\omega s}{\left(s^2 + \omega^2\right)^2}$.

(b) Show that $(A + B)(A - B) = A^2 - B^2$, if A and B are commuting matrices.

(c) Evaluate $\int_{-\infty}^{+\infty} \dfrac{dx}{\left(1 + x^2\right)}$, applying Cauchy's residual theorem.

(d) Prove that $H_n(x) = (-1)^n H_n(-x)$.

(e) Show that a group G is Abelian if and only if $(ab)^{-1} = b^{-1}a^{-1}, \forall a, b \in G$.

(f) Obtain the probability that at least one head is obtained when five fair coins are tossed simultaneously.

(3 × 5 = 15 Marks)