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Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (Reg./Suppl./Imp.) Examination, April 2019
(2014 Admission Onwards)
PHYSICS
PHY 2C07 – Mathematical Physics – II

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer both questions, either (**a**) or (**b**). **Each** question carries **12** marks.

1. a) i) Derive binomial theorem for the expansion of $(1 + x)^m$.

   ii) The total relativistic of particle of mass m and velocity v is $E = mc^2\left(1-\frac{v^2}{c^2}\right)^{-1/2}$.

   Compare this expression with the classical kinetic energy $\frac{mv^2}{2}$.

   OR

   b) Using the method of separation of variables, solve Laplace equation.

2. a) Using Laplace transform method, solve the Bessel's equation $x^2y''(x) + xy'(x) + x^2y(x) = 0$.

   OR

   b) State and prove Schur's Lemma 2. **(2×12=24)**

SECTION – B

Answer **any four** (**1** mark for Part '**a**', **3** marks for Part '**b**', **5** marks for Part '**c**').

3. a) State D'Alembert's ratio test for convergence of series.

   b) Discuss the convergence of $\sum_{n=2}^{\infty}\frac{1}{n \ln n}$.

   c) What do you mean by uniform convergence of series of functions ? State Abel's test for the uniform convergence. What are the conditions for term by term derivation and integration of an infinite series of functions ?

P.T.O.

4. a) What do you mean by a partial differential equation ? Write one dimensional wave equation.

   b) Find the general solution of $\frac{\partial \phi}{\partial x} + \frac{\partial \phi}{\partial y} + (x+y)\phi = 0$.

   c) Solve the equation $y'' + y = f(x)$ by Green's function method.

5. a) Write any one property of Fourier transform.

   b) Find the Fourier transform of $f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$.

   c) Find the Fourier transform of Gaussian function $e^{-a^2t^2}$.

6. a) Define Laplace transform.

   b) Find Laplace transform of Unit step function.

   c) Find inverse Laplace transform of $\frac{1}{(s+a)(s+b)}$, $a \neq b$ by convolution theorem.

7. a) Give an example for a finite non-abelian group.

   b) What do you mean by a cyclic group ? Give an example.

   c) Construct the multiplication table for the permutation group on 3 symbols, S_3.

8. a) What do you mean by an invariant subspace ?

   b) Explain characters and orthogonality of characters of a representation.

   c) What do you mean by irreducible representation ? Explain the criterion for irreducibility of a group representation. **(4×9=36)**
