18P209 (Pages: 2) Name:……………………..

Reg. No:…………………..

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2019
(Regular/Supplementary/Improvement)

(CUCSS – PG)

CC15P PHY2 C06 / CC17P PHY2 C06 – MATHEMATICAL PHYSICS – II

(Physics)

(2015 Admission onwards)

Time: 3 Hours   Total : 36 Weightage

SECTION A
Answer *all* questions. Each question carries 1 weightage.

1. State and prove Cauchy's integral theorem.

2. Prove that the Laurent expansion of a complex function about a given point is unique.

3. Can a group of order five have a subgroup of order three? Support your argument with necessary theory.

4. Check the analyticity of the complex function f(z) = ln z

5. Define classes of a group. Prove that all elements of a class have the same order.

6. Distinguish between reducible and irreducible representations.

7. Show that the Euler equation leads to $\frac{\partial f_1}{\partial y} - \frac{\partial f_2}{\partial x} = 0$ if the integrand has the form

   $f(y_x, y, x) = f_1(x, y) + f_2(x, y) y_x$

8. Discuss Hamilton's principle as a variational problem of several dependent variables.

9. Integrating twice, determine the integral equation corresponding to $y''(x) - y(x) = 0$, given $y(0) = 1$ and y′(0) = −1

10. What do you mean by a separable Kernel? Give an example.

11. How is Green's function related to integral equations?

12. Prove the symmetric property of Green's function.

(12 x 1 = 12 Weightage)

SECTION B
Answer any *two* questions. Each question carries 6 weightage.

13. Derive the necessary and sufficient conditions for a complex function to be analytic. Also, show that the real and imaginary parts of an analytic function are harmonic functions.

14. Explain the homomorphism between SU(2) and SO(3) groups.

15. Explain the concept of variation and hence solve the soap film problem.

16. Expand Green's function in terms of the eigen functions of the corresponding Sturm-Liouville's eigen value problem. Determine the eigen function expansion of the Green's function associated with $y''(x) = f(x)$ with boundary conditions y(0) = 0 and y'(1) = 0

(2 x 6 = 12 Weightage)

SECTION C

Answer any *four* questions. Each question carries 3 weightage.

17. Find the residue of $f(z) = \frac{e^z}{z^2+a^2}$ at its singularities.

18. By the method of contour integration, prove that $\int_0^{2\pi} \frac{d\theta}{1-2p\cos\theta+p^2} = \frac{2\pi}{1-p^2}$

19. Show that the symmetry transformations of a square constitute a group.

20. Determine the ratio *h/r* of a right circular cylinder of radius *r* and height *h* that will minimize its surface area for a fixed enclosed volume.

21. Solve $\varphi(x) = 1 + \int_0^x (x - t)\varphi(t)dt$

22. Solve $y''(x) = sin\pi x$, given $G(x,t) = \begin{cases} x(1-t), & 0 \le x < t \\ t(1-x), & t < x \le 1 \end{cases}$

(4 x 3 = 12 Weightage)

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