15P207 (Pages: 2) Name…………………

Reg. No………………..

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, JULY 2016

(CUCSS - PG)

(Physics)

CC 15P PHY2 C06 - MATHEMATICAL PHYSICS-II

(2015Admission)

Time: Three Hours Maximum: 36 Weightage

SECTION A

Answer ***all*** questions

Each question carries a weightage of **1**

1. Find the analytic function whose imaginary part is $e^{-y}\sin x$.
2. What do you mean by an essential singularity? Give example.
3. How can you determine the residue at a simple pole and at a pole of order 'm'?
4. Show that $\{i, -1, -i, 1\}$ forms a group under multiplication.
5. State and prove Lagrange theorem of subgroups.
6. What are the features of an SU(2) group.
7. Define a Volterra equation of first and second kind.
8. How can one solve integral equations that involve generating functions of polynomials?
9. Explain how differential equations can be transformed to integral equations.
10. Explain Rayleigh-Ritz variational technique.
11. What is the advantage of using Green's function in solving differential equations?
12. What do you mean by saying that "Green's function is symmetric"?

(12 x 1 = 12 weightage)

SECTION B

Answer any **two** questions

Each question carries a weightage of **6**

13. State and prove Cauchy's integral theorem. Also, explain Cauchy's integral formula for an analytic function f(z) and obtain the expression for its derivatives.
14. Discuss the concept of variation for problems involving constraints. Hence, determine the critical angle at which a particle flies off while sliding on a cylindrical surface.
15. Discuss the solution of integral equations with separable Kernels. Henceforth, determine the eigenvalues and eigenfunctions of $\varphi(x) = \lambda\int_0^{2\pi}\cos(x-t)\,\varphi(t)dt$.
16. Obtain the one-dimensional Green's function of Sturm Liouville differential equation. Hence list out the properties of a 3-D Green's function?

(2 x 6 = 12 weightage)

SECTION C

Answer any ***four*** questions

Each question carries a weightage of **3**

17. Show that div $\mathbf{F} = 0$ and curl $\mathbf{F} = 0$ are equivalent to Cauchy-Reimann conditions for an analytic function f(z), given $\mathbf{F} = v\,\hat{\imath} + u\,\hat{\jmath}$.
18. Evaluate the integral $\int_{-\infty}^{+\infty} \frac{dx}{1+x^2}$ by the method of contour integration.
19. Show that the symmetry transformations of an equilateral triangle constitute a group.
20. Solve the equation $\phi(x) = x + \int_0^x (t-x)\,\phi(t)dt$.
21. Discuss Laplace's equation in electrostatics as a variational problem of several independent variables.
22. Find the eigen function expansion of Green's function for a harmonic oscillator problem.

(4 x 3 = 12 weightag

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