19P208 (Pages: 2) Name……………………….

Reg. No………..…..…………..

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2020

(CUCSS – PG)

CC19P PHY2 C06 – MATHEMATICAL PHYSICS – II

(Physics)

(2019 Admissions - Regular)

Time: Three hours Maximum: 30 Weightage

SECTION A

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

1. Check the analyticity of the complex function $f(z) = ze^{iz}$.
2. Using Cauchy's integral formula, evaluate $\oint \frac{sin^2 z}{(z-a)^4} dz$ for a contour encircling z = a.
3. Find the subgroups of $= \{E, A, B, C\}$, if AB = BA = C, AC = CA = B and BC = CB = A.
4. Check whether the group $\{\mathrm{i}, -1, -\mathrm{i}, 1\}$ is cyclic?
5. Write a note on Lie groups.
6. How can you transform a differential equation into an integral equation?
7. Explain the Rayleigh-Ritz variational technique.
8. Prove the symmetric property of Green's function.

(8 x 1 = 8 Weightage)

SECTION B

Answer any ***two*** questions. Each question carries 5 weightage.

9. State and prove the Cauchy residue theorem. Hence evaluate the integral $\int_0^\infty \frac{cosx}{x^2+1} dx$.
10. Describe the symmetry transformations of an equilateral triangle and deduce its multiplication table. Also, find the classes of this group.
11. Explain the concept of variation and using it, solve the soap film problem.
12. Explain the Neumann series solution technique of solving integral equations. Hence find the solution of $\phi(x) = x - \int_0^x (t - x)\,\phi(t) dt$.

(2 x 5 = 10 Weightage)

SECTION C

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

13. Find the poles and residues at the poles of $f(z) = cotz$.
14. Expand $f(z) = \frac{1}{(z+1)(z+3)}$ as a Laurent's series valid for $1 < |z| < 3$.
15. Determine the multiplication table for the set of matrices:

$$I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, A = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, C = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}.$$

16. Prove that two right cosets of a subgroup of a given group are either equal or have no elements in common.

17. Apply Euler equation to find the shortest distance between two points in a Euclidean space.
18. Solve the integral equation $f(x) = \int_{-1}^{1} \frac{\varphi(t)}{(1-2xt+x^2)^{1/2}} dt$ if $f(x) = x^{2s}$.
19. Find the eigen function expansion of Green's function for a harmonic oscillator problem.

(4 x 3 = 12 Weightage)

****