SARASWATHI NARAYANAN COLLEGE

(Autonomous Institution Affiliated to Madurai Kamaraj University)
(Reaccredited with Grade 'B' by NAAC)
Madurai – 625 022.

M.Sc. Physics – Summative Examinations

Code: LPPHCT21 **Semester: II**

MATHEMATICAL PHYSICS-II

Duration: 3 Hrs. **Max. Marks: 75**

Section – A **5 × 1 = 5**

Answer all questions. Choose the correct answer. (K2 Level)

1. If all the elements of a group may be expressed by the powers of a single element, then the group is called _____ group.
   a) cyclic b) sub
   c) non-Abelian d) power
2. The analytic function $f(x)$ whose real part is$x^2 - y^2$ is _____.
   a) Z b) Z^2 c) $|Z|^2$ d) Z^{-2}
3. A tensor of rank 2 in n-dimensional space has _____ components.
   a) n b) $2n$ c) n^2 d) 2^n
4. Legendre differential equation has singular points.
   a) (0,∞) b) $(-\infty, \infty)$ c) $(-1,1)$ d) None of these
5. Which of the following is not equal to 1?
   a) $P_0(x)$ b) $J_0(x)$ c) $H_0(x)$ d) $L_0(x)$

II. Fill in the blanks. (K1 Level) **5 × 1 = 5**

6. Each irreducible representation of an Abelian group is _____.
7. If the value of point $Z_0 = 0$, then the Taylor series is also called the_____.

8. The tensor of order zero is said to be_____.

9. If the solution of Legendre differential equation as infinite series is reduced to finite series, then the solution is called_____.

10. The value of Hermite polynomial $H_1(n)$ is _____.

SECTION – B **5 x 2 = 10**

Answer ALL the questions.

11. Define Coset with an example. **(K2)**

12. Explain the term singular point of an analytic function. **(K2)**

13. Show that Kronecker delta is a mixed tensor of rank 2. **(K3)**

14. Evaluate $\beta(1,2)$. **(K5)**

15. Give the orthonormality relation connecting the Hermite polynomials **(K4)**

SECTION – C **5 x 5=25**

Answer all questions choosing either (a) or (b).

16. a) State and explain rearrangement theorem.(K1)

(Or)

b) Explain reducible and irreducible representations.(K1)

17. a) Obtain the Laplace's equation of an analytic function. (K3)

(Or)

b) Find the residues of $\frac{1}{(Z^2-1)^2}$ at its poles. (K3)

18. a) Describe Symmetric and antisymmetric tensors with an example. (K2)

(Or)

b) Discuss the addition and subtraction operations of tensors.(K2)

19. a) Compute $\int_0^\infty \frac{x^8(1-x^6)}{(1+x)^{24}} dx$. (K4)

(Or)

b) Apply generating function of $P_n(x)$, prove that

$nP_n = (2n-1)xP_{n-1} - (n-1)P_{n-1}$.(K4)

20. a) Explain the orthonormality of Bessel's function.(K1)

(Or)

b) Describe Hermite differential equation and obtain its series solution (K1)

SECTION – D **3 x 10 = 30**

Answer any THREE questions in about 4 pages in each.

21. Describe the great orthogonality theorem with the proof. (K2)

22. State and prove Cauchy Residue theorem for a complex function. (K1)

23. Explain the dynamics of particle by applying tensors. (K4)

24. Derive the relation between beta and gamma functions. (K3)

25. Evaluate the Recurrence formulae for Hermite polynomials.(K5)