

M.Sc. I Semester Degree Examination, April/May - 2023**PHYSICS****Mathematical Methods of Physics****(CBCS)**

Time : 3 Hours

Maximum Marks : 70

Notes : (i) Question No. 1 is **compulsory**.(ii) Answer **any four** questions from Q.No. 2 to Q.No. 8.

1. (a) Solve $L \frac{di}{dt} + \frac{\int i dt}{C} = 0$, the differential equation which means that the self-induction and capacity in a circuit neutralize each other. Determine the constants in such a way that I is the maximum current and $i=0$ when $t=0$.
 (b) Using Hermite differential equation show that $H_n(-x) = (-1)^n H_n(x)$.
 (c) By using Bessel's differential equation, Show that $xJ_n(x) = -nJ_n(x) + xJ_{n-1}(x)$.
6+4+4=14
2. (a) Find the fourier series of function as $f(x) = \sin x$ for $-\pi < x < \pi$.
 (b) Find the Laplace Transform of (i) $t e^{at}$ (ii) $t^n e^{at}$ **8+6=14**
3. (a) What is linear operator ? Explain the algebra of linear operators.
 (b) Show that (i) $IT = TI = T$ (ii) $T_1(T_2T_3) = (T_1T_2)T_3$ where, T, T1, T2 and T3 be linear operators on vector space V.
 (c) Explain in brief matrix representation of operators. **6+4+4=14**
4. (a) Show that the real and imaginery parts of the function $\log z$ satisfy Cauchy-Riemann equations when z is not zero. Also find the derivative of $\log z$.
 (b) State and prove Cauchy residue theorem. **7+7=14**
5. (a) Define the terms with an example :
 (i) Group (ii) Subgroup (iii) Classes.
 (b) Explain the irreducible representations of SU(2) group.
 (c) Write a note on tensor algebra. **6+4+4=14**

6. (a) Find the Fourier sine and cosine transform of $f(x) = x^2$; $0 < x < 4$.
(b) State and prove Cayley-Hamilton Theorem for the square matrices. **8+6=14**
7. (a) State and prove Stoke's theorem in vector analysis.
(b) State and prove quotient law of tensors. **9+5=14**
8. (a) Find the Laplace transform of the function $F(t) = \frac{e^{at}-1}{a}$
(b) Write a note on Norms in linear algebra.
(c) What are lie groups ? Explain with an example. **5+4+5=14**

- o o o -

