CITY COLLEGE

Internal Examination 2021−2022

Physics (Hons.) CBCS Semester 3

Paper: CC5 (Mathematical Physics II)

Time: 1 Hour; Full Marks: 20

Answer any <u>ten</u> questions from the following:　　　　　　　**10×2=20**

1. What do you mean by a regular singularity?
2. Show that Legendre's equation has regular singularities at x = -1, 1 and ∞.
3. For Legendre's Functions plot the graphical variations of P_0 and P_1.
4. Show that $P_n(-1) = (-1)^n$.
5. In case of Legendre polynomial, prove that $P_3(x) = \frac{1}{2}(5x^3 - 3x)$.
6. Prove that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} \cos x$?
7. What do you mean by orthogonality of Legendre polynomials?
8. Prove that $\int x J_0^2(x) dx = \frac{1}{2} x^2 [J_0^2(x) + J_1^2(x)]$.
9. What do you mean by discontinuous functions?
10. Write down the Dirichlet condition.
11. If the probability density function of a random variable χ is

    $\chi = x^2$ for -1 ≤ x ≤ 1

    　= 0 for any other value of x, then find the percentage probability P $(\frac{-1}{3} \le x \le \frac{1}{3})$.
12. A probability density function of the form $p(x) = k\, e^{-\alpha|x|}$, where $x \in (-\infty, \infty)$ then, find the value of k.
13. Find the Fourier series of function

    f(x) = 1 if 0 ≤ x ≤ π

    　　= 0 if -π ≤ x ≤ 0.
14. Find the Fourie transform of e^{-r^3/a^2} where 'a' is a constant and $r^2 = x^2 + y^2 + z^2$.
15. Find the function whose cosine transform is $\sqrt{\frac{2}{\pi}} \frac{\sin a\omega}{\omega}$.