GALGOTIAS UNIVERSITY

School of Basic Sciences
Master of Science in Physics
Mid Term Examination - May 2024

Duration : 90 Minutes
Max Marks : 50

Sem II - C1PO201T - Mathematical Physics-II

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1) Find the value of $J_{-1}(x) + J_1(x)$. — K2 (2)

2) Show that $\int_{-1}^1 P_n(x)dx = 0, n \neq 0$ and $\int_{-1}^1 P_n(x)dx = 2, n = 0.$ — K1 (3)

3) Express $f(x) = 4x^3 + 6x^2 + 7x + 2$ in terms of Legendre polynomials. — K2 (4)

4) Explain that Bessel's function is an even function when n is even and is an odd function when n is odd. — K2 (6)

5) Show that $\int_0^x x^{-n}J_{n+1}(x)dx = \frac{1}{2^n n!} - x^n J_n(x)$, if n>-1. — K3 (6)

6) Find the Fourier sine series for the function $f(x) = e^{ax} \, for \, 0 < x < \pi$, where a is constant. — K3 (9)

7) Show that $(n+1)P_{n+1} = (2n+1)xP_n - nP_{n-1}$ — K4 (8)

8) Show that $\int_{-1}^1 P_n(x)(1 - 2xt + t^2)^{-\frac{1}{2}}dx = \frac{2t^n}{2n+1}$ — K4 (12)

OR

Analyze that $J_{-1/2}(x) = \sqrt{\left(\frac{2}{\pi x}\right)}$ cos x — K4 (12)