CENTRAL LIBRARY AND INFORMATION CENTRE
Kandi Raj College
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Estd - 1950
Kandi, Murshidabad

U.G. 3rd Semester Examination - 2019

PHYSICS

[HONOURS]

Course Code : PHYS(H)CC-05-T

Full Marks : 40 Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP–A

1. Answer any **five** questions: 2×5=10

a) State Dirichlet's conditions for a Fourier series.

b) What do you mean by the orthogonality special functions?

c) Evaluate $\Gamma\left(-\frac{1}{2}\right)$.

d) Prove the following property of the Beta function $\beta(l, m)=\beta(m, l)$.

e) What are the singular points of a second order linear differential equations?

f) What do you mean by random error?

g) Write down the Parseval's formula.

b) Write down the relation between the Beta and Gamma function.

GROUP–B

2. Answer any two questions: 5×2=10

a) i) When does a Laguerre function transform to a Laguerre Polynomials? 2

ii) Find the constant a_0 of the Fourier series for the function $f(x)=x$ in $0 \le x \le 2\pi$. 3

b) i) Evaluate $\int_0^{\infty} \sqrt[4]{x}\, e^{-\sqrt{x}} dx$. 2

ii) Find the regular singular points of the differential equation

$$2x^2\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+(x^2-4)y=0$$ 3

c) Prove the orthogonality condition of Legendre Polynomials

$$\int_{-1}^{+1} P_m(x)P_n(x)\,dx=0, \quad m\neq n$$ 5

d) Write down the Bessel's differential equation of n-th order and its solution $J_n(x)$. 5

GROUP–C

3. Answer any two questions: 10×2=20

a) i) Find the Fourier series for the function $f(x)=e^{ax}$ for $0<x<\pi$, where a is constant. 5

ii) Find the integral $\int_0^{\frac{\pi}{2}} \sin^p\theta \cos^9\theta\, d\theta$ using $\beta(m, n)$ function in terms of $\Gamma(x)$ function. 5

b) Using Froberius method, obtain a series solution in powers of x for differential equation:

$$2x(1-x)\frac{d^2y}{dx^2}+(1-x)\frac{dy}{dx}+3y=0 \text{ about } x=0.$$

10

c) i) Find three dimensional Laplace's equation in cylindrical co-ordinates. 6

ii) Prove that

$$\int_{-1}^{+1} P_n(x)\left(1-2xt+t^2\right)^{-\frac{1}{2}} dx = \frac{2t^n}{2n+1}, \text{ given,}$$

$$\int_{-1}^{+1} \left[P_n(x)\right]^2 dx = \frac{2}{2n+1} \quad \text{where n is a positive integer.} \qquad 4$$

d) A tightly stretched string with fixed end points at x=0 and x=l is initially in a position given by

$$y = y_0 \sin^3\left(\frac{\pi x}{l}\right).$$

If it is released from rest from position x (within $0<x<l$), find the displacement $y(x, t)$. 10

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