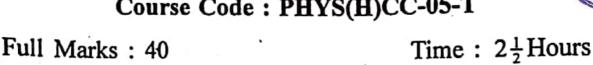
# U.G. 3rd Semester Examination - 2019

## **PHYSICS**

### [HONOURS]

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



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

Answer any five questions:

 $2 \times 5 = 10$ 

State Dirichlet's conditions for a Fourier series.

What do you mean by the orthogonality special functions?

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

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

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

What do you mean by random error?

[Turn over]

g) Write down the Parseval's formula.

Write down the relation between the Beta and Gamma function.

#### GROUP-B

Answer any two questions:

5×2=10

- a) i) When does a Laguerre function transform to a Laguerre Polynomials? 2
  - ii) Find the constant  $a_b$  of the Fourier series for the function f(x)=x in  $0 \le x \le 2\pi$ .
- (b) i) Evaluate  $\int_{0}^{\pi} \sqrt{x} e^{-\sqrt{x}} dx$ . 2
  - 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

Prove the orthogonality condition of Legendre
Polynomials

$$\int_{-1}^{1} P_{m}(x) P_{n}(x) dx = 0, \quad m \neq n$$

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

#### GROUP-C

3. Answer any two questions:

function.

10×2=20

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

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

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

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

(3)

6

10

539/Phs.

[Turn over]

539/Phs.

(2)

### ii) Prove that

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

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

 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).

