End Semester Examination, 2021

Semester - III

Physics

PAPER - CC5T

Full Marks : 40

Time : 2 Hours

Gr - A

1. ***Answer any five of the following :-***

a) What do you mean by ordinary and singular points in relation to linear differential equations ? 2

b) Write down the applications of Fourier series. 2

c) Write down the Legendre differential equation with index l. What are the ordinary and singular points of this equation ? 2

d) What are the mathematical forms of Fourier series for even and odd functions ? 2

e) Give the distribution law of random errors occured in an experiment. What is the significance of the standard devialion ? 1+1

f) What is Parseval's formula ? What is its importance ? 1+1

g) Write down Fuch's theorem ? 2

h) Find the value of x given by 2

$$x = \frac{28.21 \times 2.5 \times 31.4}{315 \times 22.7 \times 1.513}$$

Gr - B

Answer any four of the following :-

2. Compute the relative error in determining acceleration due to graceity from the simple pendulum formula $T = 2\pi\sqrt{\frac{l}{g}}$ for l = 1m and T = 2s. 5

3. Prove the generating function formula for $P_n(x)$

$$\sum_{n\geq 0}^{\infty} h^n P_n(x) = (1 - 2xh + h^2)^{-1/2}$$

Hence prove $P_n(1) = 1$. 4+1

4. Use the method of Frobenius to find one solution near $x = 0$ of $x^2y'' + (x^2 + 2x)y' - 2y = 0$. 5

5. Prove that $2^{\frac{1}{2}} + 2^{\frac{1}{2}}$

a) $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}}\sin x$

b) $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}}\cos x$

6. If $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the range of 0 to 2π,

show that $f(x) = \frac{\pi^2}{12} + \sum_{n=1}^{\infty}\frac{\cos nx}{n^2}$ 5

7. Evaluate $\beta\left(\frac{7}{2}, -\frac{1}{2}\right)$ 5

Gr - C

Answer any one of the following :-

8. Obtain the solution of Laplace's equation for azimuthal symmelny in spherical co-ordinates. 10

9.a) Find the complex form of the fourier series

$f(x)=e^{-x}$ for $-1\le x\le 1$

b) Evaluate $\int_{o}^{\infty}\sqrt{x}e^{-3\sqrt{x}}dx$ in terms of gamma function.

c) Show that

$$\beta(p,q)=\int_{0}^{1}\frac{x^{p-1}+x^{q-1}}{(1+x)^{p+q}}\,dx$$

3+2+5