BACHELOR OF SCIENCE INTER-B.SC EXAMINATION, 2019 (**OLD**).
(2nd Year, 1st Semester)
PHYSICS (Honours)
(Ref. No. *EX / Int / Phy / I / V / 22 / 19 (OLD)*)
H05
Time: Two Hours
Full Marks: 50
(25 Marks for each group)

Use separate Answer Scripts for Groups A and B

Group - A (Mathematical Methods)

*Answer any **FIVE** questions.*

1. Show that the eigenvalues of a Hermitean matrix are real and the eigenvectors belonging to two distinct eigenvalues are orthogonal.
Marks: 2 + 3 = 5

2. Use the generating function for Hermite polynomials to evaluate $H_n(0)$.
Marks: 5

3. Find the most general 2×2 unitary matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$, using the basic definition of a unitary matrix.
Marks: 5

4. For two arbitrary vectors $|\alpha\rangle$ and $|\beta\rangle$, show that $\langle\alpha|\alpha\rangle.\langle\beta|\beta\rangle \geq |\langle\alpha|\beta\rangle|^2$ by forming an arbitrary linear combination $|\gamma\rangle = |\alpha\rangle + \lambda|\beta\rangle$, where λ is a complex number and then minimizing the norm of $|\gamma\rangle$ with respect to λ and its complex conjugate.
Marks: 5

5. Given that $\frac{1}{\sqrt{x}}$ is a root of the differential equation $2x^2y'' + xy' - y = 0$, find the other root.
Marks: 5

6. Use variation of parameters to find the particular solution of the equation

$$\frac{d^2f(z)}{dz^2} + f(z) = \text{cosec } z$$

Marks: 5

BACHELOR OF SCIENCE EXAMINATION, 2018
(2nd Year, 1st Semester)
PHYSICS (HONOURS)
Paper : HO-5

GROUP - B

Answer any one from 1 and 2

1 Two infinite grounded metal plates lie parallel to the xz plane, one at y=0, the other at y=a. The left end at x=0, is closed off with an infinite strip insulated from the two plates, and maintained at a specific potential $V_o(y)$, Find the potential inside the 'slot'. 7

2 A sphere of homogeneous linear dielectric material is placed in an otherwise uniform electric field E_0 . Find the new field inside the sphere. 7

Answer any three from 3 to 7

3 Obtain an expression for the magnetic field due to a uniformly magnetized sphere at
(i) external and
(ii) an internal point. 6

4 Find the capacitance of a parallel plate capacitor whose space between the plates filled with a dielectric constant that increases linearly from one plate to the other. 6

5 Find the electric field produced by a uniformly polarized sphere of radius R. 6

6 A electric dipole consists of two equal and opposite charges (+q &-q) separated by a distance d. Find the approximate potential at points far from the dipole. 6

7 Describe the effect of Magnetic field on atomic orbit. 6