FYUGP B.Sc 2nd Semester Sessional Examination 2026
Paper Code: PHY-MAJ-2014
Paper Name: Mathematical Physics & Electricity and Magnetism

Time: 90 minutes **Total marks: 30**

1. Answer the following questions: 1 x 5 =5
   a) Write the condition of a matrix to be symmetric.
   b) When does a square matrix become singular?
   c) What is the dimension of solid angle?
   d) What is magnetic vector potential? What is its SI unit.
   e) Write the standard form of linear 1st order differential equation?
   f) Find the order and degree of the differential equation:

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

2. Answer the following questions: (**any five**) 5 x 5=25

   a) If the square matrix A satisfy $A^3 + A - 2I = 0$, prove that $A^{-1} = 1/2(A^2 + I)$
   b) For the given matrix below, show that $A^3 = A^{-1}$.

$$A = \begin{matrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & -1 \end{matrix}$$

   c) State and prove the Gauss's theorem.
   d) Show that the functions x^2, $x^2 logx$ are linearly independent with the help of Wronskian.
   e) Show that any square matrix can be expressed as the sum of two matrices-one symmetric and the other antisymmetric.
   f) Derive Gauss's law in differential form from its integral form.
   g) Solve **any one** of following differential equations:
      i. $(y^2 - xy)dx + x^2 dy = 0$ ii. $\frac{dy}{dx} + \frac{1}{x}y = x^3 - 3$
   h) Using the Biot–Savart law, derive the magnetic field at a point on the axis of a circular current loop.
   i) A circular coil of radius 6 cm carries a current of 4 A. Find the magnetic field at the centre and compare it with the magnetic field at a distance of 6 cm from a long straight conductor carrying the same current.