ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27
M.Sc. MATHEMATICS– IV SEMESTER
SEMESTER EXAMINATION: APRIL 2018
<u>MT 0317 : MAGNETOHYDRODYNAMICS</u>

Time- 2 ½ hrs   **Max Marks-70**

This paper contains 1 printed page

ANSWER ANY 7 OUT OF THE FOLLOWING QUESTIONS   **10*7=70 Marks**

1. a. Derive Faraday's law of induction for stationary circuit.
    b. Prove or disprove the statement that the tangential component of magnetic field is continuous across the interface of two media.   [5 + 5]

2. a. State Continuum Hypothesis.
    b. Derive the magnetic induction equation for a perfectly conducting fluid in its real form.   [2+8]

3. Show that the tangential component of electric field is continuous at the interface between the two electromagnetic media.   [10]

4. Derive $\nabla \times \vec{H} = \vec{J} + \dfrac{\partial \vec{D}}{\partial t}$. Also discuss the solenoidal property of magnetic field.   [10]

5. Show that in a magnetostatic configuration with axisymmetric poloidal magnetic field. The magnetic stream function U satisfies the equation $\dfrac{\partial \left(r^{-2}\Delta U, U \right)}{\partial \left(r, z \right)} = 0.$ [10]

6. State and prove Chandrashekhar's theorem on force free magnetic field.   [10]

7. Examine the nature of a force free magnetic field in a rectangular coordinate system.   [10]

8. a. What is Toroidal Magnetic field?
    b. Derive Bennet's relation.   [2 + 8]

9. Discuss the applications of Alfven's waves.   [10]

10. Derive the Walen's relation.   [10]