M.Sc. 4th Semester Examination, 2013

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

(Differential Geometry & Magneto Hydrodynamics)

PAPER — MTM - 402

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

GROUP— A

(Differential Geometry)

[*Marks* : 25]

Answer Q.No.1 and any **three** from the rest

1. (*a*) Define christoffel symbols of 1st kind and 2nd kind.   2

(b) Find the curvature and torsion of the cubic curve $r = (u, u^2, u^3)$. 　3

2. Define first fundamental form of a surface. Show that the metric in the first fundamental form is invariant under a parametric transformation. 　1 + 4

3. Find the curve whose intrinsic equations are $k = \dfrac{1}{\sqrt{2as}}$ and $\tau = 0$. 　5

4. Deduce the equation of a 'geodesic' in curvilinear co-ordinates. 　5

5. Find the normal curvature of the right helicoid $r(u,v) = (u \cos v, u \sin v, cv)$ at a point on it. 　5

6. Establish weingarten equations on a surface. 　5

[*Internal Assessment* : 5 Marks]

GROUP—B

(*Magneto Hydrodynamics*)

[*Marks* : 25]

Answer any **two** questions

1. A viscous in compressible conducting fluid of uniform density is confined between the horizontal prefectly conducting plate of $z = 0$ and non-conducting plate at $z = h$. The plate at $z = 0$ is held at rest and the plate at $z = h$ is moved in its own plane with uniform velocity U. A uniform magnetic field H_0 acts perpendicular to the plates. Find the velocity and the magnetic field. **10**

2. Define :

   (*i*) Hartmann number.

   (*ii*) Magnetic pressure. .

   (*iii*) Magnetic Reynolds number.

   (*iv*) State Alfren theorem. ·

   (*v*) What is meant by Lorentz force ?

   2 + 2 + 2 + 2 + 2

3. What is meant by 'iso-rotation' ? State and prove Ferraro's law of iso-rotation. 3 + 7

[*Internal Assessment* : 5 Marks]