PG/IVS/MTM-402/14

M.Sc. 4th Semester Examination, 2014

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

(*Differential Geometry and Magneto Hydrodynamics*)

PAPER—MTM-402

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

Notations have their usual meanings

GROUP – A

(*Differential Geometry*)

[*Marks* : 25]

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

1. (*a*) Define second fundamental form of the surface. 2

(*b*) Define Geodesic curve on a surface. 2

(*c*) Define normal curvature of a surface. 1

2. Show that a given curve is a plane curve if and only if $\tau = 0$ at all points of the curve. 5

3. Show that the first fundamental form of a surface is a positive definite quadratic form. 5

4. Show that the curve $v = c$ for all values of u is a geodesic if and only if $EE_2 + FE_1 - 2EF_1 = 0$. 5

5. Calculate the second fundamental form for the right helicoid given by

$$\vec{r} = (u\cos v,\ u\sin v,\ cv)$$ 5

6. Establish Gauss's equation on a surface. 5

[*Internal Assessment* : 5 Marks]

GROUP – B

(*Magneto Hydrodynamics*)

[*Marks* : 25]

Answer any **two** questions

1. When a conducting fluid is said to perfectly conduction ? State and prove the Alfve'n theorem in MHD. 2 + 2 + 6

2. Write down the basic equation of magneto hydrodynamics and hence deduce the magnetic induction equation in MHD flows. Define magnetic Reynolds number and explain the significance of high and low magnetic Reynolds number. 2 + 2 + 2 + 2 + 2

3. Find the velocity for Hartmann flow between two non-conducting parallel plates separated by a distance '2*l*'. Also, obtain the expression for the induced magnetic field. 7 + 3

[*Internal Assessment* : 5 Marks]