UTTARAKHAND OPEN UNIVERSITY, HALDWANI (NAINITAL)
उत्तराखंड मुक्त विश्वविद्यालय, हल्द्वानी(नैनीताल)

M.A./ M.Sc. Mathematics
ASSIGNMENT- FIRST YEAR

Last Date of Submission:	*15 May*	जमा करने की अन्तिम तिथि:	**15 मई**

Cosurse Title: Differential Geometry and Tensors   **Course code:**   MAT 504

Year: **2012-13**   **Maximum Marks :**   **40**

Section 'A'
भाग क

Section 'A' contains 08 short answer type questions of 5 marks each. Learners are required to answers 4 questions only. Answers of short answer-type questions must be restricted to 250 words approximately.

Briefly discuss the following:

1. Show that a necessary and sufficient condition that a curve be a straight line is that $\kappa=0$ at all points.
2. Find the equation of osculating plane at a general point on the curve given by
   $r= (u, u^2, u^3)$
3. Calculate the fundamental magnitudes for the right helicoid given by,
   $x= u \cos v, y= u \sin v, z= cv$.
4. A particle is constrained to move a smooth surface under no forces except the normal reaction. Show that its path is a geodesic.
5. Prove that the normal curvature in a direction perpendicular to an asymptotic line is twice the mean normal curvature.
6. Show that Kronecker delta is a tensor of rank two.
7. Show $g_{ij} dx^i dx^j$ is an invariant.
8. Show that the christoffel's symbols of first and second kind are symmetric.

Section 'B'
भाग ख

Section 'B' contains 04 long answer-type questions of 10 marks each. Learners are required to answers 02 questions only.

1. Show that the spherical indicatrix of the tangent of a curve is a circle if and only if the curve is a helix.
2. The necessary and sufficient condition for a surface to be developable surface is that its Gaussian curvature should be zero.
3. Find the metric of a Euclidean space referred to
   (i) Cylindrical coordinates and
   (ii) Spherical coordinates.

4. Show that the covariant derivative of a contravariant vector is a mixed tensor of second order.