Curves and Surfaces (MTH201)
Academic Session 2012-13

Tutorial Sheet 7   **October 19 2012**

Instructions: Write main ideas / hints for solving questions in your tutorial noteook. There is no need to write full and formal solution during the tutorial session. However during off class hours you should practice writing these solutions in a formal manner. **Get the signature of your tutor after each session**.

1. Find the equation of tangent plane for the surface patch $\sigma(u, v) = (u, v, u^2 - v^2)$ at the point $(1, 1, 0)$.

2. Consider a circle of radius r in XZ-plane with its center at $(R, 0, 0) \in \mathbb{R}^3$. Revolve this circle in $\mathbb{R}^3$ about Z-axis to obtain a *torus*. Use this description to write a surface patch for a torus. It is given that $r < R$.

3. A *hyperboloid* $\mathcal{H}$ is the surface obtained by revolving the hyperbola $x^2 - z^2 = 1$ in XZ-plane about Z-axis.

   (a) Find an appropriate surface patch for hyperboloid considering it as a surface of revolution.

   (b) Find a surface patch of hyperboloid which is of the form $\sigma(u, v) = \gamma(u) + v\lambda(u)$, where γ and λ are functions taking values in $\mathbb{R}^3$.

   (c) Make a computation of normal at $(1, 0, 0)$ using patches (a) and (b) above.

4. Write a surface patch for a bucket (which is portion of a cone) and compute its first fundamental form.

5. Compute the first fundamental form of the *paraboloid* $\sigma(u, v) = (u, v, u^2 + v^2)$.

6. Can you give an example of a regular surface patch for which $EG = F^2$ at some point?

7. What is more? Area of hemisphere $x^2 + y^2 + z^2 = 1$; $z \le 0$ or area of portion of the paraboloid $z = x^2 + y^2$ below $z = 1$.