National University of Technology, Islamabad
Assignment II (Calculus II), Spring 2019
Due Date: April 30, 2019

Q.1 Find the distance between the line L_1 through the points $A(1,0,-1)$ and $B(-1,1,0)$ and the line L_2 through the points $C(3,1,-1)$ and $D(4,5,-2)$.

(*Hint: The distance is to be measured along the line perpendicular to the two lines.*)

Q.2 Find the point in which the line through the origin perpendicular to the plane $2x-y-z=4$ meets the plane $3x-5y+2z=6$.

Q.3 Show that the line in which the planes $x+2y-2z=5$ and $5x-2y-z=0$ intersect is parallel to the line $\begin{cases} x=-3+2t \\ y=3t \\ z=1+4t \end{cases}$.

Q.4 The planes $3x+6z=1$ and $2x+2y-z=3$ intersect in a line. Show that the planes are orthogonal. Also find parametric equations for the line of intersection.

Q.5 A particle moves around the ellipse $(y/3)^2+(z/2)^2=1$ in the $yz-$plane in such a way that its position at time t is $\mathbf{r}(t)=(3\cos t)\mathbf{j}+(2\sin t)\mathbf{k}$. Find the maximum and minimum values of the speed $|\mathbf{v}|$ and the magnitude of acceleration $|\mathbf{a}|$.

(*Hint: Find the extreme values of* $|\mathbf{v}|^2$ *and* $|\mathbf{a}|^2$ *and take square roots at the end*).

Q.6 Find the point on the curve $\mathbf{r}(t)=(5\sin t)\mathbf{i}+(5\cos t)\mathbf{j}+(12t)\mathbf{k}$ at a distance 26π units along the curve from the origin in the direction of increasing arc length.

Q.7 Find the length of the curve $\mathbf{r}(t)=(\sqrt{2}t)\mathbf{i}+(\sqrt{2}t)\mathbf{j}+(1-t^2)\mathbf{k}$ from $(0,0,1)$ to $(\sqrt{2},\sqrt{2},0)$.

Q.8 Find the tangent vector $\mathbf{T}$, normal vector $\mathbf{N}$ and curvature κ for the plane curve $\mathbf{r}(t)=(t)\mathbf{i}+(\ln\cos t)\mathbf{j}$ where $-\pi/2<t<\pi/2$.

"Every stumble is not a fall, and every fall does not mean failure." ~ Oprah Winfrey