**The Open University of Sri Lanka**
**B.Sc/B.Ed. Degree Programme**
**Continuous Assessment Test (OBT) - 2015/2016**
**Pure Mathematics - Level 04**
**PUU2140/PUE4140– Sequences and Series**
**Duration: - One hour**

---

**Date: - 19-04-2016** **Time: - 4:15pm – 5.15pm.**

---

01. (i) Find two sequences $\langle x_n \rangle, \langle y_n \rangle$ such that $\langle x_n + y_n \rangle = \langle 1 \rangle$ and $\langle x_n y_n \rangle = \langle 0 \rangle$.

(ii) Find two unbounded sequences $\langle x_n \rangle, \langle y_n \rangle$ such that $\langle x_n + y_n \rangle$ is bounded.

(iii) Find two sequences $\langle x_n \rangle, \langle y_n \rangle$ such that both $\langle x_n \rangle, \langle y_n \rangle$ converge to $0$ and for each $n \in \mathbb{N}$, $x_n < y_n$.

(iv) Let $x$ be a positive real number. Prove that $\left\langle \left(1+\frac{x}{n}\right)^n \right\rangle$ is strictly increasing.

02. (i) Use $\varepsilon$ - definition of limit to prove that $\lim_n \frac{n+1}{2n+3} = \frac{1}{2}$.

(ii) Suppose $\langle x_n \rangle$ is a sequence such that for each $\varepsilon > 0$, $\{n \in \mathbb{N} : |x_n - x| \geq \varepsilon\}$ is a finite set. Does it follow that $\langle x_n \rangle$ converge to $x$ ?. Justify your answer.

(iii) Use the definition of limit to prove that $\lim_n \frac{n^2+2}{n+1} = \infty$.