SYMBIOSIS INSTITUTE OF TECHNOLOGY (SIT)

Constituent of Symbiosis International (Deemed University), Pune

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Tutorial -6

Subject Name: Mathematics-III

Q. 1: Find the Z-transforms of the following discrete functions/sequences:

(i). $u_n = 3(2^n) - 4(3^n)$, (ii) $u_n = \cos(3n+2)$, (iii). $u_n = \cos^2\frac{n\pi}{6}$ (iv). $u_n = n(n-1)2^n$

(v). $u_n = \frac{c^n}{n},\ n \geq 1,\ c > 0$ (vi). $u_n = \frac{a^n}{n!}$ (vii). $u_n = \sinh\frac{n\pi}{2}$

Q. 2: Find the inverse Z-transforms of the following functions:

(i). $U(z) = \frac{2}{(z-2)^2}$, (ii). $U(z) = \frac{z}{z-1}$, (iii). $U(z) = \frac{z}{(z-2)^3}$,

(iv). $U(z) = \frac{2z^2 - 5z}{(z-2)(z-3)}$, (v). $U(z) = \frac{z}{(z-1)(z-2)}$.

Q. 3: Find the inverse Z-transforms of $U(z) = \frac{1}{(z-2)(z-3)}$:

(i) $|z| < 2$ (ii). $|z| > 3$ (iii). $2 < |z| < 3$

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Answers

Q.1: **(i)** $\frac{3z}{z-2} - \frac{4z}{z-3}$. **(ii)** $\frac{z(z\cos 2 - \cos 1)}{z^2 - 2z\cos 3 + 1}$. **(iii)** $\frac{4z^3 - 5z^2 + 3z}{4(z-1)(z^2 - z + 1)}$. **(iv)** $\frac{8z}{(z-2)^3}$.

(v) $-\log\left(1 - \frac{c}{z}\right)$. **(vi)** $e^{\frac{a}{z}}$. **(vii)** $\frac{z\sinh\frac{\pi}{2}}{z^2 - 2z\cosh\frac{\pi}{2} + 1}$.

Q.2: **(i)** $(n-1)2^{n-1}$, **(ii)** 1, **(iii)** $(2)^{n-3}\,n(n-1),\ n \geq 2$. **(iv)** $(2)^n + (3)^n$. **(v)** $(2)^n - 1$.

Q.3: **(i)** $(2)^{n-1} - (3)^{n-1}, n \leq 0$ **(ii)** $(3)^{n-1} - (2)^{n-1}, n \geq 1$.. **(iii)** $u_n = \begin{cases} -(2)^{n-1}, & n \geq 1 \\ -(3)^{n-1}, & n \leq 0 \end{cases}$.