Assignment

Q1. State and prove the following DFT properties.

- **Time reversal**
- **Frequency shifting**
- **Complex conjugate**
- **Multiplication**
- **Symmetry properties**
- **Parseval's relation**

Q2. Prove the identity: $\sum_{l=-\infty}^{\infty} \delta[n + lN] = \frac{1}{N} \sum_{k=0}^{N-1} e^{j\frac{2\pi}{N}kn}$

Q3. Let $x[n] = \{\underset{\uparrow}{1}, \ 2, 3, 6\}$ then

- Compute 6-point DFT of $x[n]$ and is represented as $X(k)$. Comment on the relation between $X(1)$ and $X(5)$; $X(2)$ and $X(4)$
- Compute 6-point DFT of $x[n-10]$ and is represented as $Y(k)$; What is relation between $Y(k)$ and $X(k)$;
- Obtain $y[n]$ by computing IDFT of $Y(k)$; What is the relation between $y[n]$ and $x[n]$?
- Find DFT of $x[n]\cos\left(\frac{2\pi k_0 n}{N}\right)$ in terms of $X(k)$; here k_0 is an integer constant.

Q4. $X(k)$ is DFT of $x[n]$, whose values are non-zero $0 \leq n \leq N-1$ else zero. Let $Y(k) = X(k), 0 \leq k \leq L, N-L \leq k \leq N-1$ and zero $L < k < N-L$; $y[n]$ is IDFT of $Y(k)$ then how $y[n]$ can be obtained directly from $x[n]$, explain it clearly.

Q5. Let $x[n]$ values are non-zero $0 \leq n \leq N-1$ else zero, $y[n] = x[n] + x\left[n + \frac{N}{2}\right], 0 \leq n \leq N-1$ else zero and $Y(k)$ is $\frac{N}{2}$ point DFT of $y[n]$ then what is the relation between $Y(k)$ and $X(k)$?