(f) Compute N point DFT of
$x(n) = \{1, 1, 2, 2, 3, 3\}$
and compute the corresponding amplitude and phase spectrum.

2 Answer any four parts of the following : **5×4**

(a) State the relationship between DTFT and DFT.

(b) Determine the DFT of the sequence :

$$x[n]=\begin{cases}\frac{1}{5}, & \text{for } -1 \le n \le 1\\ 0, & \text{otherwise}\end{cases}$$

(c) Determine the IDFT of X[k] = [3, (2+j), 1, (2 – j)].

(d) Draw the butterfly line diagram for 8 point IFFT calculation and brifly explain.

(e) Given x[n] = {0, 1, 2, 3, 4, 5, 6, 7} and N = 8, find X[k] using DIT FFT algorithm.

(f) Given $x[n] = 2^n$ and N = 8 find X[k] using DIF FFT algorithm.

3 Answer any two parts of the following : **10×2**

(a) Develop a canonic direct form realisation IIR transfer function

$$H[z]=\frac{3+5z^{-1}-8z^{-2}+4z^{-5}}{2+3z^{-1}+6z^{-3}}$$

And then determine its transpose configuration.

(b) Draw the structures of cascade and parallel realization of

$$H[z]=\frac{\left(1-z^{-1}\right)^3}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{8}z^{-1}\right)}$$

(c) What are linear phase FIR filter? How can the symmetry of these filter help to simplify the network structure? Realize the following causal linear phase FIR system function
$H(z) = 1 + 2.88\, z^{-1} + 3.404\, z^{-2} + 1.742\, z^{-3} + 0.4\, z^{-4}$

4 Answer any two parts of the following : **10×2**

(a) What do you mean by frequency warping? Convert the analog filter with system function

$$H[s]=\frac{(s+0.1)}{(s-0.1)^2+9}$$

Into a digital IIR filter using bilinear transformation. The digital filter should have a resonant frequency of $w_r = \pi/4$

(b) A low pass filter is to be designed with the following desired frequency response

$$H_d\left(e^{iw}\right)=\begin{cases}e^{-j2w}, & for - \ \pi/4 \le w \le \pi/4\\ 0, & \pi/4 \le w \le \pi\end{cases}$$

Determine the filter coefficient $h_d(n)$ if the window function is defined as

$$w(n)=\begin{cases}1, & for \ \ 0 \le n \le 4\\ 0, & \text{otherwise}\end{cases}$$