Registration No : | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech.**
PEE5I103

5th Semester Regular Examination 2017-18
Digital Signal Processing
BRANCH: ELECTRICAL
Time: 3 Hours
Max Marks: 100
Q.CODE: B362

Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions: *multiple type or dash fill up type*** **(2 x 10)**

a) (ROC) Region of convergence of $x(n) = \delta(n)$ is _____.
b) If $Z[x(n)] = X(z)$, then $Z[a^n x(n)]$ =_____.
c) The number of arithmetic operations (multiplications and additions) required to compute the output of a system is called _____ of that system.
d) _____ filters are prefered in filtering problems where there is a requirement of linear phase charactereistics in the passband of filter.
e) IIR filter has lower_____ in the stopband than FIR filter having same number of parameters.
f) To compute N point DFT, it requires _____ complex multiplications and _____ complex additions.
g) FFT is an efficient way of finding _____.
h) Adaptive filter is an example of _____ system. (open loop/ closed loop)
i) _____band lies in between passband & stopbad of the filter characteristics.
j) In an adaptive filter , _____ of the filter are made to adapt to signal statistics.

Q2 **Answer the following questions : Short answer type** **(2 x 10)**

a) What is the condition on the ROC of the system function for stability of an LTI system?
b) What do you understand by a causal LTI sytem?
c) The first five points of the eight-point DFT of a real valued sequence are {0.25, 0.125-j0.3018, 0, 0.125-j0.0518, 0 }. Determine the remaining three points.
d) Give the difference equation and system function expression for an FIR system.
e) Draw a direct form realisation for the filter with impulse response:
$h(n)$ = {1,2,3,4,3,2,1}
f) State the *Time Reversal Property* in DFT .
g) What is N in N-point DFT ?
h) What do you understand by radix of an FFT algorithm ?
i) What is meant by linear phase characteristic of an filter?
j) What is BIBO in reference to stability of a system ?

Q3 **a)** Determine the inverse z-transform of $X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}}$, when **(10)**
ROC: $|z| > 1$
ROC: $|z| < 0.5$

b) An LTI system is characterised by the system function $(z) = \frac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}}$. **(5)**
Specify the ROC of $H(z)$, when the system is:
Stable
Causal
Anticausal

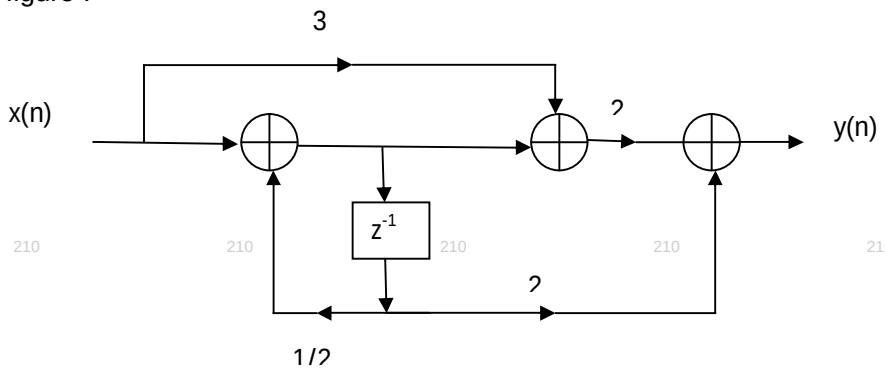
Q4 **a)** Prove that the multiplication of two DFTs is equivalent to circular convolution of their respective time domain sequences. **(10)**

b) Perform the circular convolution of the followig two sequences: $x_1(n)$ = {2, 1,2,1 } & $x_2(n)$ = {1, 2,3,4 } using the time domain formula. **(5)**

Q5 **a)** Obtain the direct form-I, direct form II, cascade and parallel structures for the system represented by the difference equation: **(10)**

$$y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x(n-1)$$

b) Determine the system function and impulse response of the system shown in the figure : **(5)**



Q6 **a)** Compute the eight point DFT of the sequence $x(n)$ = {0.5,0.5,0.5,0.5,0,0,0,0} using the in-place radix-2 decimation in time algorithm. **(10)**

b) Give the expressions for directly calculating the DFT and IDFT. What are the *symmetry property* and *periodicity property* of phase factor W_N in context to finding DFT. Discuss the need and feasibility of efficient algorithms for finding DFT. **(5)**

Q7 **a)** With supporting block diagram and mathematical expressions, explain what is channel equalisation and how it can be realised with adaptive filters. **(10)**

b) Explain LMS algorithm in terms of gradient descent and recursion with supporting mathematical expressions. **(5)**

Q8 **a)** Derive the *Wiener Hopf* equation based on minimum mean square error. **(10)**

b) State the orthogonality principle in mean-sqaure estimation? Give the mathematical expression and emphasise its significance. **(5)**

Q9 **a)** Compute the convolution of the following signals by means of z-transform: **(10)**

$$x_1(n) = \begin{cases} \left(\frac{1}{3}\right)^n, n \geq 0 \\ \left(\frac{1}{2}\right)^n, n < 0 \end{cases}$$

$$x_2(n) = \left(\frac{1}{2}\right)^n u(n)$$

b) Use the convolution property to express the z-transform of : **(5)**

$$y(n) = \sum_{k=-\infty}^{n} x(k)$$