126 TE-sem-VI - CBGS-EXTC-DTSP 16/5/16

QP Code : 31652

(3 Hours) [Total Marks :80

N.B. : (1) Question no. **1** is **compulsory.**
(2) Solve any **three** questions from remaining **five questions.**
(3) In all **four** questions to be attempted.
(4) **Figures** to the **right** indicate **full** marks.

1. (a) Explain multirate signal processing with applications. 20
(b) If h(n) = {1, 2, 3,4 } is impulse response of FIR Filter, Realize the filter in direct form.
(c) State and prove Parseval's Theorem.
(d) State advantage and disadvantage of digital filters.

2. (a) (i) x(n) = {1, 2, 3, 4} find DFT of x(n) 10
(ii) Using results obtained in part (i) and otherwise find DFT of following sequences
a(n = { 4, 1, 2, 3} b(n) = {2, 3, 4, 1} c(n) = {3, 4, 1, 2}
d(n) = {4, 6, 4, 6}
(b) A digital filter is describe by the following differential equation 10
y(n) = 0.9 y(n-1) + bx(n)
(i) Determine **b** such that |**H** (0)|= 1
(ii) Determine the frequency at which $|H(w)| = \frac{1}{\sqrt{2}}$
(iii) Identify the filter type based on the passband.

3. (a) If x(n) = {1 2 3 4 5 6 7 8}, Find X(k) using DITFFT. Compare computational complexity of above algorithm with DFT. 10
(b) Show the mapping from S plane to Z plane using Impulse Invariant Method and explain its limitation. Using this method, determine H(Z) if 10

$$H(s) = \frac{3}{(s+2)(s+3)} \text{ if } T = 0.1 \text{ sec}$$

4. (a) Design a Linear Phase FIR Low Pass filter of Length 7 and cut off frequency 1 rad/sec using rectangular window. 10
(b) If x(n) = {1, 2, 3, 2} and h(n) = {1, 0, 2, 0} 10
(i) Find circular convolution using time domain method.
(ii) Find linear convolution using circular convolution.

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5. (a) Design a digital Butterworth filter for following specifications using Bilinear transformation technique 10
   Attenuation in Pass band = 1.93dB,
   Pass band Edge frequency= 0.2π,
   Attenuation in Stop band = 13.97dB,
   Stop band Edge frequency= 0.6π.
   (b) With a suitable block diagram describe sub-band coding of speech signals. 10

6. Attempt the following :-
   (a) Short note on dval tone multifreqrency detection using Goertzel's algorithm 8
   (b) Compare FIR and IIR filters. 6
   (c) Finite word length effect in digital filters. 6