CLASS: MTECH / PRE-PHD   SEMESTER : I
BRANCH: EE   SESSION : MO/2022

SUBJECT: EE501 ADVANCED DIGITAL SIGNAL PROCESSING

TIME: 03 Hours   FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

----

Q.1(a) A system has an impulse response of $h(n) = \{1,\ 2,\ 3\}$ and output response $y(n) = \{1,\ 1,\ 2,\ -1,\ 3\}$. [2]
Determine the input sequence $x(n)$.   **(CO1, CO3, PO1)**

Q.1(b) Obtain the direct form I and II structure for the following system: [3]
$y(n) = 3b^5 \cos \omega_0 y(n-1) - 2b^2 y(n-2) + 2x(n) - 4b \cos \omega_0 x(n-1)$ **(CO2, CO4, PO1)**

Q.1(c) Derive and explain N-point radix-2 DIT-FFT algorithm. For N=8 draw the signal flow graph. [5]
(CO3, CO4, PO1)

Q.2(a) Write the frequency transformation formula for the impulse invariant and bilinear transformation. What [2]
is warping effect?   **(CO2, CO3, PO2)**

Q.2(b) The system function of the analog filter is given as [3]
$$H(s) = \frac{2}{(S+1)(S+2)}$$
Obtain the system function and realization of the IIR digital filter by using bilinear transformation.
(CO2, CO3, PO2)

Q.2(c) Design a linear phase FIR lowpass filter using rectangular window by taking 7 samples of window **[5]**
sequence and with a cutoff frequency of 1 rad/sample.   **(CO3, CO4, PO3)**

Q.3(a) What is interpolator? Draw the symbolic representation of an interpolator. Write the expression for [2]
output spectrum, $Y(e^{jw})$ of interpolator in terms of input spectrum, $X(e^{jw})$.   **(CO2, CO4, PO2)**

Q.3(b) Derive the expression for output spectrum, $Y(e^{jw})$ of decimator in terms of input spectrum, $X(e^{jw})$. [3]
(CO2, CO5, PO3)

Q.3(c) Considered a spectrum of input signal $X(e^{jw})$ with bandwidth of – pi/2 to + pi/2 [5]
as shown in fig. Sketch the spectrum of
a down sampled signal for sampling rate reduction factor D=2 and D=3.
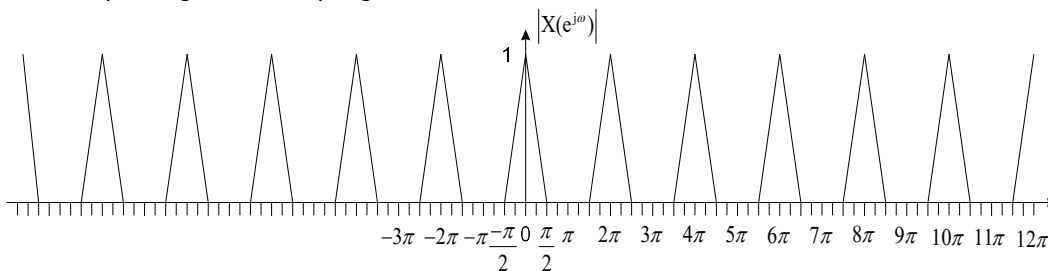
(CO4, CO5, PO3)

Q.4(a) Explain adaptive system. What are characteristics of adaptive system. How intelligent systems differ [2]
from adaptive system?   **(CO3, CO4, PO3)**

Q.4(b) Explain adaptive system. What are characteristics of adaptive system. How intelligent systems differ [3]
from adaptive system?   **(CO3, CO4, PO3)**

Q.4(c) Write short notes on (i) noise-cancelation (ii) identification of unknown nonlinear plant using adaptive [5]
system.   **(CO3, CO4, PO4)**

Q.5(a) Discuss the various hardware required in digital signal processors.   **(CO1, CO3, PO4)** [2]

Q.5(b) Draw the simplified architecture of TMS320C5x processor and explain.   **(CO1, CO3, PO4)** [3]

Q.5(c) Write the basic steps in finding linear and circular convolution of two signals. Write the basic [5]
instructions of TMS320Cx processor that are suitable for this signal processing application.
(CO4, CO5, PO3)