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Name:	
Roll No.:	A Dear of Exercising and Exercise
Invigilator's Signature:	

#### CS/M.Tech(ECE)/SEM-1/MCE-103/2012-13 2012

#### ADVANCED DIGITAL SIGNAL PROCESSING

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

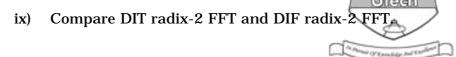
Candidates are required to give their answers in their own words as far as practicable.

# **GROUP - A**( Objective Type Questions )

- 1. Answer any *ten* of the following :
- $10 \times 1 = 10$
- i) What is linear time invariant system?
- ii) Write short notes on system and signals.
- iii) Distinguish between a causal and non-causal system.
- iv) Define even and odd signals.
- v) State sampling theorem.
- vi) Distinguish between deterministic and random signals.
- vii) Define DFT and IDFT.
- viii) Find the values of  $W_N^k$ , when N=8, for k=2,3.

41153 Turn over

#### CS/M.Tech(ECE)/SEM-1/MCE-103/2012-13



- x) Differentiate IIR filters and FIR filters.
- xi) Write the characteristics features of Hanning window.
- xii) Define pre-warping effect. Why is it employed?

## GROUP - B ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$ 

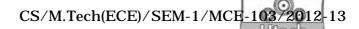
Explain the concept of energy and power signals. Also check whether the following signals are energy or power signals.

$$x(n) = [1/3]^n u(n), (b) x(n) = \sin[1/4]^n$$

- 3. Determine the *z*-transform of x [n] = -(0.5) u [-n-1] and the region of convergence.
- 4. State and prove shifting property of DFT.
- 5. Describe bilinear transformation mapping for designing IIR filter.
- 6. Write the expression for Kaiser window function. Write the characteristics features of rectangular window.

2

41153



### **GROUP - C** ( Long Answer Type Questions )

Answer any three of the following.



- 7. a) Check the following system for linearity, time invariance, causulity and stability.
  - i)  $y(n) = e^{x(n)}$
  - ii) y(n) = x(-n+2).
  - b) Find the z-transform of  $x_1$  ( n ) = { 3, 5, 7 } and  $x_2$  ( n ) = { 3, 0.5.0.7 }. What is the relation between  $X_1$  ( z ) and  $X_2$  ( z )?
- 8. a) Compute 4-point DFT of a causal three sample sequence is given by,

$$x(n) = 1/3, 0 \le n \le 2$$

$$= 0$$
, else  $10$ 

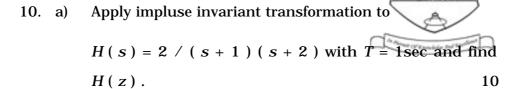
- b) State and prove shifting property, of DFT.
- 5
- 9. a) Determine the inverse of z-transform of causal

$$X(z) = \frac{4 - 8z^{-1} + 6z^{-2}}{(1 - 2z^{-1})^2 (1 - z^{-1})}.$$

Using partial fraction expansion.

b) State and prove that the product of the two sequences  $x_1(n)$  and  $x_2(n)$  is equivalent to the convolution of their respective z-transforms. i.e.  $X_1(z) * X_2(z)$ .

#### CS/M.Tech(ECE)/SEM-1/MCE-103/2012-13



- b) Describe bilinear transformation mapping for designing IIR filter. 5
- 11. Write short notes on any *three* of the following :  $3 \times 5$

4

- a) Kalman Filter
- b) Power Spectrum analysis using DFT
- c) Wavelet Transform
- d) DFT
- e) FFT.

41153