C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 55B04

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Fifth Semester

Biomedical Engineering

15UBM504 - PRINCIPLES OF DIGITAL SIGNAL PROCESSING

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. In radix 2 FFT the total number of complex multiplications are CO1- R

   (a) $(N/2)\log_2 N$ (b) $N \log_2 N$ (c) $(N*N)\log_2 N$ (d) $\log_2(N/2)$

2. The poles of the Chebyshev filter lie on a CO2- R

   (a) Circle (b) Ellipse (c)Parabola (d) Hyperbola

3. In linear phase realization, equal valued coefficients are taken common for reducing the requisite number of _____. CO3- R

   (a) Adders (b) Subtractors (c) Multipliers (d) Dividers

4. The error in the filter output that results from rounding or truncating calculations within the filter is called CO4- R

   (a) Coefficient quantization error (b) Adder overflow limit cycle

   (c) Round off noise (d) Limit cycles

5. In Barlett window, the triangular function resembles the tapering of rectangular window sequence _____ from the middle to the ends. CO5- R

   (a) Linearly (b) Elliptically (c) Hyperbolically (d) Parabolically

PART – B (5 x 3= 15Marks)

6. Find DFT of the sequence x(n)={1,2,3,0} using DIF algorithm CO1-U

7. Determine order of the Butterworth filter for the given specification. Pass band attenuation is -4db with frequency 10rad/sec and stop band attenuation is -20db with frequency 30rad/sec. CO2-App

8. What are the desirable and undesirable features of FIR filters CO3-U

9. The filter coefficient H=-0.673 is represented by sign magnitude fixed point arithmetic. If the word length is 6 bits, compute the quantization error due to truncation. CO4-App

10. Estimate the power density Spectrum of x (n) = {1, 2, 4} using autocorrelation CO5-U

PART – C (5 x 16= 80Marks)

11. (a) Find the DFT of the Sequence CO1- App (16)

$$X(n)=\begin{cases} 1 & for\ 0 \le n \le 2 \\ 0 & otherwise \end{cases}$$

For N=4 then plot Magnitude and angle of X(K)

Or

(b) Determine the IDFT of the following sequence using DIT-FFT method. CO1- App (16)

X(K)={0,-√2+j(2+√2),0,√2-j(2-√2),8,√2+j(2-√2),0,-√2-j(2+√2)}

12. (a) Design a Chebyshev filter for the following specification using bilinear transformation and impulse invariance method CO2- App (16)

$$\begin{cases} 0.8 \le H(ejw) \le 1 \ \ for\ 0 \le w \le 0.2\pi \\ H(ejw) \le 0.2\ for\ 0.6\pi \le w \le \pi \end{cases}$$

Or

(b) For the given specification, design a Butterworth high pass filter α_p=3db, α_s=15db, Ω_p=1000 rad/sec and Ω_s=500 rad/sec. Convert the analog transfer function to digital using bilinear transformation. CO2- App (16)

13. (a) Design a FIR filter using hanning window for the specification given CO3- App (16)

$$H_d e^{(jw)} = \begin{cases} 1 & for -\pi/4 \le w \le \pi \\ 0 & for\ w \le \pi/4 \end{cases}$$

Or

(b) Determine the filter coefficients h(n) obtained by sampling CO3- App (16)

$$H_d e^{(jw)} = \begin{cases} e^{-j(N-1)w/2} & for 0 \le w \le \pi/2 \\ 0 & for\ \pi/2 \le w \le \pi \end{cases}$$

14.	(a)	Explain the quantization process and errors introduced due to quantization?	CO4-U	(16)
		Or		
	(b)	Discuss the effects of finite word length in FIR digital filters	CO4- U	(16)
15.	(a)	Derive the expression for discrete wavelet transform.	CO5- U	(16)
		Or		
	(b)	Explain in detail about different types of non-parametric estimation of power spectrum density.	CO5- U	(16)