Exam No: _____

GANPAT UNIVERSITY

B. TECH SEM- V (BM&I) REGULAR EXAMINATION– NOV-DEC 2016

2BM504 : Biological Digital Signal Processing

TIME: 3 HRS

TOTAL MARKS: 60

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.

SECTION: I

Que. 01 **Answer the following questions.** [10]

a) Explain following operations upon signal. 5
1. Time delay & time advance
2. Folding & shifting
3. Time scaling

b) What is aliasing? Explain with the help of suitable example. How to overcome with it? 5

OR

Que. 01 **Answer the following questions.** [10]

a) Prove and explain graphically the difference between the relations: 4
1. $x[n]\ \delta[n - n_0] = x[n_0]$
2. $x[n] * \delta[n - n_0] = x[n_0]$

b) Enlist and explain the advantages of Digital Signal Processing over Analog Signal Processing. 4

c) List the applications of DSP in telecommunication and biomedical engineering. 2

Que. 02 **Answer the following questions.** [10]

a) Perform convolution of two finite duration sequences, using graphical and tabular method. 6

$x[n] = \begin{cases} 1 & for -1 \le n \le 1 \\ 0 & otherwise \end{cases}$ and $h[n] = \begin{cases} 1 & for -1 \le n \le 1 \\ 0 & otherwise \end{cases}$

b) Enlist the methods used to design IIR filter. Explain Bilinear Transformation method for IIR filter design in detail. 4

OR

Que. 02 **Answer the following questions.** [10]

a) What is the significance of Convolution sum in the analysis of LTI system? 6
Compute convolution of the following signal.
$x[n] = u[n + 1] - u[n - 4] - \delta[n - 5]$, $h[n] = [u[n + 2] - u[n - 3]]\ [3 - n]$

b) Write short note on: Impulse invariance transformation of IIR filter design. 4

Que. 03 **Answer the following questions.** [10]

a) Give the difference between cross correlation and auto-correlation. Perform auto-correlation of sequence, $x[n] = \{-3, -2, 1, \underset{\uparrow}{4}, 8, -3\}$ 4

b) Determine the Z-transform and sketch the ROC of the following finite duration sequences. 6
$x_1[n] = \{\underset{\uparrow}{1}, 2, 4, 5, 0, 7\}$ $x_2[n] = \{1, 2, \underset{\uparrow}{4}, 5, 0, 7\}$ $x_3[n] = \{1, 2, \underset{\uparrow}{4}, 5, 0, 7\}$

SECTION: II

Que. 04 **Answer the following questions :** [10]

a) For given x (n) = {1, 0, 0, 1} 5

Compute 4 – point DFT mathematically also validate your answer using matrix method.

b) Derive the mathematical equation for frequency and magnitude response of FIR Rectangular window filter. 5

OR

Que. 04 **Answer the following questions :** [10]

a) The first five points of 8 – point DFT of a real valued sequence are 4
x (n) = {0.25, 0.125 – j0.3018, 0, 0.125 – j0.00518, 0}.

Determine the remaining three points using property of DFT.

b) Obtain co-efficient of FIR high pass filter with given specifications using hanning window function. Passband edge frequency = 70Hz, Transition width = 5Hz, Stopband Attenuation = 750dB and Sampling frequency = 8kHz. 6

Que. 05 **Answer the following questions :** [10]

a) What is superposition theorem? Enlist the necessary steps to check the linearity of any system. Also check whether given systems are linear or not: 4

1. $y(n) = |x(n)|$
2. $y(n) = x(n) + nx(n+1) + 2x(n-2)$

b) Differentiate between following: 4

(1) Microprocessor & Digital signal processors

(2) Recursive filter & Non – Recursive filter

c) Describe briefly lossy & lossless data compression technique? Which one is more suitable for biomedical data processing? 2

OR

Que. 05 **Answer the following questions :** [10]

a) Explain briefly the classification of systems. 4

b) Determine the response for given FIR filter using DFT technique. 6
x (n) = {1, 2, 0, 0} & h(n) = {2, 2, 0, 0}

Que. 06 **Answer the following questions :** [10]

a) What is butterfly structure? Derive the stage wise diagram to compute 8 – point DFT using DITFFT algorithm using N/2 radix approach. 4

b) Attempt any two from following: 6

(1) Short note on generalized block diagram of signal processing application for biomedical data.

(2) Explain briefly classification of filters.

(3) How digital signal processing can contribute in diagnosis of neurological disorders? Explain briefly the signal processing techniques to classify alpha & beta waves from EEG waveform.

----------END OF PAPER----------