

**GANPAT UNIVERSITY**  
**B. TECH. SEMESTER V BIOMEDICAL & INSTRUMENTATION ENGINEERING**  
**REGULAR EXAMINATION NOVEMBER/ DECEMBER- 2013**  
**2BM504:- BIOLOGICAL DIGITAL SIGNAL PROCESSING**

Time: 3 Hours

Total Marks: 70

**Instruction:**

1. All the questions are compulsory.
2. Answer of each section must be written in separate answer books.
3. Figure to the right indicates marks.
4. Assume data, if needed.
5. Conventional terms / notations are used.

**SECTION – I**

Que.-1

12

- (a) What information we should get from fourier analysis? Derive the coefficient  $a_n$  of trigonometric form of fourier series.
- (b) Define the inverse DFT. Derive the IDFT of the sequence  $X(k) = (3, 2+j, 1, 2-j)$ .

OR

Que.-1

12

- (a) Define the DFT of given sequence  $x(n)$  and explain under what condition it exists. How DFT is different from DTFT?
- (b) Derive the fourier components of the periodic waveform shown in Fig.1.

Que.-2

11

- (a) How many complex computations are involved in an N-point DFT? Using DIT Radix-2 FFT algorithm derive the first stage of decimation equation.
- (b) Let Analog filter  $H(s) = \frac{1}{(s+1)(s+2)}$ .  
 (1) Find corresponding  $H(z)$  using impulse invariant method.  
 (2) If  $f_s = 5$  Hz find  $H(z)$ .

OR

Que.-2

11

- (a) What is butter fly diagram? Derive the 8-point DFT of the sequence  $x(n) = (1, -1, 1, 0, 2, -1, 2, 1)$  using butter fly diagram.
- (b) Why IIR filters are design from analog filter? Enlist the different methods of IIR filter design. Explain the Impulse Invariant method in detail.

Que.-3 Answer the following questions (Any Three)

12

- (a) Write the equation describing the FIR filter. Give the FIR filter design steps with filter specification.
- (b) Derive the equation governing the circular convolution of DFT.
- (c) Prove that DFT and IDFT are periodic.
- (d) Write the equation of DFT and DTFT and give comparison. Also explain why the range of DFT is from  $0 \dots (N-1)$ ?



## SECTION – II

Que.-4

12

- (a) Define system. Give the Classification of system. Explain with examples.
- (b) What is Aliasing and sampling frequency? Explain with example

OR

Que.-4

12

- (a) Discuss various application of Adaptive filter.
- (b) Determine Inverse Z transform of  $X(z) = a/(z-a)$ ,  $|z| < |a|$  using power series method.

Que. 5

11

- (a) Draw the block diagram for Biomedical Digital signal processing and explain.
- (b) Explain following operations upon signal.
  1. Time delay & time advance
  2. Folding-shifting
  3. Time scaling

OR

Que.-5

11

- (a) Describe the differences and similarities between DSP and general purpose processor.
- (b) Find the following systems are Time variant or time invariant giving proof.
  - 1).  $Y[n] = X[2n]$
  - 2).  $Y[n] = X[n] \cos \omega_0 n$
  - 3).  $Y[n] = X[n] U[n]$

Que.-6 Answer the following questions (Any three)

12

- (a) What is finite precision effect? Represent the 0.5 in single precision format.
- (b) What is Data Compression? Why Data Compression? Discuss Lossless and Lossy Data Compression.
- (c) Prove that if z transform of  $x(n)$  is  $X(Z)$  then z transform of  $nx(n)$  is  $-[dX(Z)/dZ]$
- (d) Describe the superposition theorem & Determine whether the system is linear or non-linear:  $y(n) = x(n) \cos \omega_0 n$ ,  $y(n) = x[-n+2]$

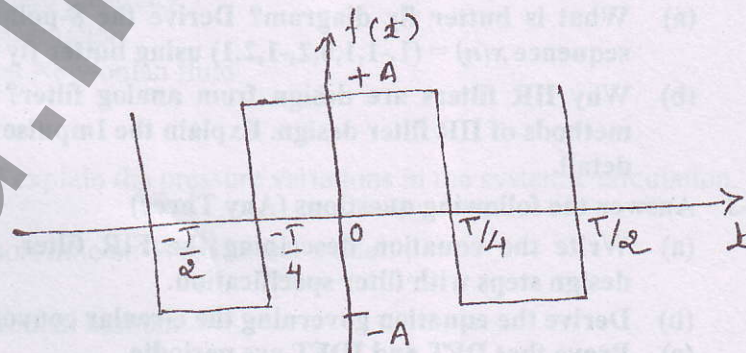


Fig. 1: OR Que. (1) (b)

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