CS/B.TECH(BME-OLD)/SEM-3/BME-301/2011-12

2011

BIOPHYSICAL SIGNALS AND SYSTEM SIMULATION

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 × 1 = 10

   A)   Choose the correct alternatives for the following :

      i)   Generally all periodic signals are

         a)   Energy signal

         b)   Power signal

         c)   Non-recognisable signal

         d)   None of these.

ii)   FFT means

a)   First Fourier Transform

b)   Finite Filtering Technique

c)   File For Transformation

d)   First Fourier Technique.

iii)   To reduce noise you should prefer

a)   positive feedback

b)   negative feedback

c)   open loop control system

d)   all of these.

iv)   In cardiovascular system the electrical equivalent of pressure drop across a blood vessel is

a)   Charge   b)   Voltage

c)   Current   d)   Capacitance.

v) The cut-off frequency of RC-passive high-pass filter is

a) $\dfrac{1}{2\pi\,RC}$ b) $\dfrac{R}{2\pi C}$

c) $\dfrac{1}{4\pi\,RC}$ d) $\dfrac{RC}{2\pi}$.

vi) The capacitor has

a) no memory b) memory

c) both (a) & (b) d) none of these.

B) Answer the following very briefly :

vii) Check whether the signal $x(n)=\cos\left(\dfrac{\pi\,30n}{105}\right)$

is periodic or not. Then find its fundamental period.

viii) Sketch the signal

$$x(n)=\begin{cases} 1+|n|/3, & -3\le n\le -1\\ 1, & 0\le n\le 3\\ 0, & \text{elsewhere}\end{cases}$$

ix) Determine whether the following signal is causal or not : $y(n)=x(2n)$.

x) Define DTFT.

xi) What do you mean by 'White Noise' ?

xii) What do you mean by the term 'Power of a Signal' ?

GROUP – B

(Short Answer Type Questions)

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

2. Determine whether the following systems are linear or non-linear : $2 \times 2\frac{1}{2}$
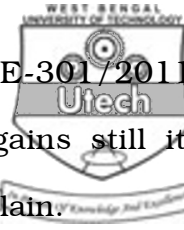
a) $y (n) = nx (n)$

b) $y (n) = x (n^2)$.

3. Determine whether or not the following signals are periodic. In case the signal is periodic, specify its fundamental period : $2 \times 2\frac{1}{2}$

a) $x (t) = 3 \cos \left(5 \theta + \frac{\pi}{6} \right)$

b) $x (t) = \sin (\sqrt{2}\ \pi t)$.

4. What do you mean by filtering ? Why is this technique used to measure the Biophysical signal ? $2 + 3$

5. Negative feedback amplifier reduces the gains still it is preferred over positive feedback system. Explain.

6. Briefly discuss the procedure for recording Nerve action with proper diagram.

GROUP – C

(Long Answer Type Questions)
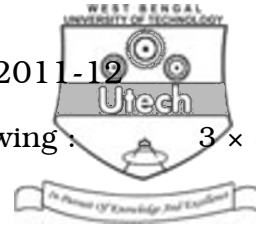
Answer any *three* of the following. 3 × 15 = 45

7. a) Define DTFS. Determine the Fourier series for the following discrete time sequence :

   $x (n) = \{ 1, 1, 0, 0 \}$ with a period of $N = 4$. 6

   b) What are the different kinds of Feedback amplifiers ? Explain how negative feedback affects the input and output impedance of an amplifier. 9

8. a) What are active filters ? Why are they preferred over passive filters ? 8

   b) Draw the block diagram of an active HPF and determine its cut-off frequency. 2 + 5

3015(O) 5 [Turn over

9. Write short notes on any *three* of the following : 3 × 5

    a) Causal and non-causal system.

    b) Distortion analysis by negative feedback.

    c) Time variant and time invariant system.

    d) Importance of physiological system modelling.

    e) Different sources and types of noise.

10. a) Describe the closed loop operation of the cardiovascular system representing the four chambers of the heart by block diagram. 5

    b) Describe the basic electrical model of arterial circulation process. 5

    c) Develop the equations governing the arterial pressure dynamic with its transfer function. 5

11. a) Draw and discuss an electrical equivalent model of nerve membrane. 5

 b) With schematic diagram describe the immune response to an infection. 5

 c) Represent the immune response by a single system with different system equations. 5

━━━━━━