

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3150310

Date: 09/06/2026

Subject Name: Biomedical Signals and Systems

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1** (a) For given signal $x(n) = \{1, -1, 2, -2, 3, -3, 4, -4\}$ **03**
 $\uparrow$
 Sketch following signal (i) $x(n)$ (ii) $x(n+2)$ (iii) $x(n-1)$
- (b) Give classification of following (i) Bio Signals (ii) Biological Systems **04**
- (c) Define Signal and explain briefly various types of signals. **07**
- Q.2** (a) Write down the application of performing correlation operation for biomedical signals. **03**
- (b) Define Discrete Time System, and enlist the classification of discrete time systems. **04**
- (c) Perform linear convolution between given two sequences using mathematical method: **07**
 $x(n) = \{2, 1, 2, 1, 3\}$ and $y(n) = \{1, 2, 3\}$
- OR
- Q.2** (c) Compute the cross correlation between given two sequences **07**
 $x(n) = \{2, -1, 3, 1, 2\}$ and $y(n) = \{1, 2, 0, -1, 1\}$
- Q.3** (a) Discuss how the stability of IIR and FIR systems is determined on the basis on zero pole plot or on the basis of location of zeroes and poles. **03**
- (b) Define and explain briefly Recursive system and Non Recursive system. **04**
- (c) Explain in detail Direct form realization for IIR system with neat diagram and giving suitable example. **07**
- OR
- Q.3** (a) Write down the computational complexity required in terms of adders, multiplier etc. to implement Direct – I IIR system. **03**
- (b) State the difference between FIR systems and IIR systems. **04**
- (c) Discuss in detail the implementation of cascade combination of second order IIR system with neat diagram. **07**
- Q.4** (a) Explain purpose of performing Z – Transform for any system. **03**
- (b) Compute Z transform of following signal and determines its ROC: **04**
 $x(n) = \delta(n)$
- (c) Explain with proof and necessary equations any two properties of Z – Transform. **07**
- OR

- Q.4**
- (a) Discuss briefly the mapping of s-plane of Laplace transform and Z-plane of Z Transform. **03**
 - (b) Compute Z transform of following signal and determines its ROC: **04**

$$x(n) = u(n)$$
 - (c) Enlist methods for computing Inverse Z – transform. Enlist and explain steps of any one method. **07**
- Q.5**
- (a) Compute DFT of of unit impulse signal **03**

$$x(n) = \delta(n)$$
 - (b) Explain with steps how linear convolution can be computed using DFT. **04**
 - (c) Explain in detail Radix – 2 DIT – FFT algorithm for computation of FFT. **07**
- OR
- Q.5**
- (a) State and prove periodicity property of DFT. **03**
 - (b) Explain briefly the purpose of performing frequency domain analysis for any signal of biomedical origin. **04**
 - (c) Determine 4 point DFT of following sequence **07**

$$x(n) = \{-2, 1, 3, 5\}$$
