

GANPAT UNIVERSITY										
FACULTY OF ENGINEERING & TECHNOLOGY										
Programme		Bachelor of Technology				Branch/Spec.		Biomedical Engineering		
Semester		V				Version		2.0.0.1		
Effective from Academic Year				2024-25		Effective for the batch Admitted in				July 2022
Course Code		2BM5204		Course Name		Biological Digital Signal Processing				
Teaching scheme						Examination scheme (Marks)				
(Per week)		Lecture(DT)		Practical(Lab.)		Total				
		L	TU	P	TW			CE	SEE	Total
Credit		3	-	1	-	4	Theory	40	60	100
Hours		3	-	2	-	5	Practical	30	20	50
Pre-requisites										
Basic knowledge of Biological signal generation as well as discrete mathematics and analog filters design.										
Course Outcomes										
On successful completion of the course, the students will be able to:										
CO1	<b>Express</b> the continuous and discrete time signal mathematically and its properties.									
CO2	<b>Evaluate</b> the response of LSI system using various techniques.									
CO3	<b>Analyze</b> discrete-time systems using z-transform.									
CO4	<b>Understand</b> the Discrete-Fourier Transform (DFT) and the FFT algorithms.									
CO5	<b>Design</b> digital filters for various applications.									
CO6	<b>Apply</b> digital signal processing for the analysis of real-life signals.									
Theory syllabus										
Unit	Content								Hrs.	
1	<b>INTRODUCTION</b> Basic of DSP, Block Diagram of Digital System, Comparison between Digital Signal Processing and Analog Signal Processing, Applications and Advantages of Digital Signal Processing								2	
2	<b>DISCRETE TIME SIGNALS AND SYSTEMS</b> Introduction to signals, Sampling theorem, Representation and operation on discrete time signal, Discrete time system, Linear Shift Invariant (LSI) systems, LSI system representation by differential equation, correlation and its types, Examples on each techniques.								12	
3	<b>TRANSFORM DOMAIN TECHNIQUES</b> <b>Introduction to Z-transform:</b> properties, inverse Z transform, transfer function in Z domain, location of poles and zeroes of Z-domain. <b>Discrete Time Fourier Transform and its properties:</b> Discrete Fourier Transform (DFT): Definition and mathematical equation, relationship between DTFT and DFT. DFT computation using various techniques, DFT properties, Inverse DFT and its calculation. <b>Fast Fourier Transform (FFT):</b> Need of FFT, Radix-2 FFT algorithm, Radix-2 Decimation In Time algorithm, Butterfly diagram and construction of Butterfly diagram using Radix-2 Decimation In Time algorithm for 4 and 8 point DFT.								10	
4	<b>FILTER DESIGN</b> Basics of Digital Filters, <b>Infinite Impulse Response (IIR) Filters:</b> TF of IIR system, Impulse Response of Ideal Low Pass Filter, Design of IIR filters, Analog filters to design digital filters, Frequency transformations. <b>Finite Impulse Response (FIR) Filters:</b> TF of FIR system, Design of linear phase FIR filters, Design of FIR filters using window techniques, Gibb's phenomenon, Advantages and disadvantages of Window method, Comparison between IIR and FIR filters.								12	
5	Analysis of Finite Word length Effects and Introduction to DSP processor architecture and its Applications.								4	
6	<b>BIOLOGICAL SIGNAL ANALYSIS</b> <b>Cardio logical Signal Processing:</b> QRS detection, Rhythm analysis, Arrhythmia detection algorithms, Heart rate variability analysis. EEG and EMG signals analysis.								5	
Practical content										
Term Work and Practical shall be based on the above syllabus.										

Text Books	
1	Digital Signal Processing by N. G. Palan Pub.: Tech-Max Publication
2	Biomedical Signal Processing- Principles and Techniques by D. C. Reddy Pub.: TMH
Reference Books	
1	Biomedical Digital Signal Processing by Wills J. Tompkins Pub.: Prentice Hall of India Pvt. Ltd.
2	Digital Signal Processing by Oppenheim & Schafer Pub.: Prentice Hall
3	Digital Signal Processing by Sanjit K. Mitra Pub.: Tata McGraw-Hill Publishing Company Ltd.
4	Biomedical Signal Analysis by Rangaraj M. Rangayyan Pub.: IEEE Press
5	Digital Signal Processing by John G. Proakis, Dimitris G. Manolakis Pub.: Pearson Prentice Hall
ICT/MOOCs Reference	
1	<a href="https://nptel.ac.in/courses">https://nptel.ac.in/courses</a>
2	<a href="https://nptel.ac.in/courses">https://nptel.ac.in/courses</a>
3	<a href="https://www.ukessays.com/essays/biology/digital-signal-processing-in-fields-of-biomedical-sciences-biology-essay.php">ps://www.ukessays.com/essays/biology/digital-signal-processing-in-fields-of-biomedical-sciences-biology-essay.php</a>

Mapping of CO with PO and PSO:															
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	P S O 1	P S O 2	P S O 3
CO1	2	2	0	1	0	0	0	0	0	0	0	0	1	1	0
CO2	2	2	3	2	0	0	0	0	0	0	0	0	2	3	0
CO3	2	1	1	2	1	0	0	0	0	0	0	0	3	1	1
CO4	2	1	0	2	1	0	0	0	0	0	0	0	2	1	0
CO5	3	2	2	2	1	0	0	0	0	0	0	0	2	2	0
CO6	2	1	1	2	1	0	0	0	0	0	0	0	2	2	1