COURSE MODULE FOR THE AY- 2025-26 ODD sem

Course Syllabi with CO's

Department: **Electronics and Communication Engineering**							
Course Coordinator: Prof. Manjunath k & Prof. Anupama Shetter							
Course Code	**Course Title**	**Core/Elective**	**Prerequisite**	**Contact Hours**			**Total Hrs/ Sessions**
				L	**T**	**P**	
BEC502	**Digital Signal Processing**	Core_ IPCC	Signals and Systems, Laplace and Z transforms, frequency response, convolution , filtering and sampling.	3	-	2	40
Objectives	Course objectives: 1. Preparation: To prepare students with fundamental knowledge/ overview in the field of Digital Signal Processing 2. Core Competence: To equip students with a basic foundation of Signal Processing by delivering the basics of Discrete Fourier Transforms, their properties, efficient computations & the design of digital filters.						

Topics to be Covered as per the VTU Syllabus

Module-1

Introduction: Signals, Systems and Signal Processing, Classification of Signals, The Concept of Frequency in Continuous Time and Discrete Time Sinusoidal Signals. [Text1: 1.1, 1.2, 1.3: 1.3.1, 1.3.2]

Discrete Time Signals and Systems: Discrete Time Signals, Discrete Time Systems, Analysis of Discrete Time Linear Time Invariant Systems.

[Text 1: 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.3.3, 2.3.5]

Module-2

Z-Transforms: The z-Transform, Properties of the z-Transform (Statements only), The System Function of a Linear Time Invariant system. Text1:3.1, 3.2, 3.3.3.

The Discrete Fourier Transform: Frequency Domain sampling and Reconstruction of Discrete Time Signals, The DFT, The DFT as Linear Transformation. Properties of DFT: Periodicity, Linearity and Symmetry for real valued sequence, Multiplication of two DFTs and Circular Convolution.

[Text1: 7.1.1, 7.1.2, 7.1.3, 7.2: 7.2.1, 7.2.2]

Module-3

DFT Properties: Time reversal of a sequence, Circular Time shift of a sequence, Circular frequency shift, Complex conjugate property, Multiplication of two sequences, Perceval's theorem. Linear Filtering Methods based on the DFT. (Text 1: 7.3].

Efficient Computation of the DFT- FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: computation of DFT and IDFT in decimation in time.

[Text1: 8.1: 8.1.1, 8.1.3].

Module-4

Design of FIR Filters: Characteristics of practical frequency-selective filters, Symmetric and Antisymmetric FIR filters, Design of Linear-phase FIR (low pass and High pass) filters using windows - Rectangular, Bartlett, Hanning, Hamming and Blackman windows. Structure for FIR Systems: Direct form and Cascade form.

[Text1: 10.1.2, 10.2.1, 10.2.2]

Module-5

IIR Filter Design: Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Low pass prototype transformation, Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design (Lowpass and Highpass) using BLT. Realization of IIR Filters in Direct form I and II.
[Text2: 8.1, 8.2, 8.3 (Butterworth filter design), 8.8.1]

List of Text Books

1. Proakis & Manolakis, "Digital Signal Processing - Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9.
2. Li Tan, Jean Jiang, "Digital Signal processing - Fundamentals and Applications", Academic Press, 2013, ISBN: 978-0-12-415893.
3. Vinay K. Ingle, John G Proakis , "Digital Signal Processing Using MATLAB, A problem Solving Companion", Cengage Learning, 2018, ISBN: 93-86668-11-4

List of Reference Books

1. Simon Haykin and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN9971-51- 239
2. Sanjit K Mitra, "Digital Signal Processing, A Computer Based Approach", 4th Edition, McGraw Hill Education, 2017. ISBN:978-1-25-909858
3. Oppenheim & Schaffer, "Discrete Time Signal Processing", PHI, 2003.
4. D Ganesh Rao and Vineeth P Gejji, "Digital Signal Processing" Cengage India Private Limited, 2017, ISBN: 9386858231

List of URLs, Text Books, Notes, Multimedia Content, etc

1. Digital Signal processing, https://nptel.ac.in/courses/117102060 By Prof. S. C. Dutta Roy, IIT Delhi
2. https://nptel.ac.in/courses/117102060
3. https://www.youtube.com/watch?v=6dFnpz_AEyA

Course Outcomes

At the end of the course the student will be able to:
1. Analyse the different types of signals and systems used in digital signal processing.
2. Compute the response of an LTI system using time and frequency domain techniques.
3. Develop algorithms for the efficient computations of DFT and IDFT.
4. Design of digital FIR filters for the given specifications using different window methods.
5. Design of digital IIR digital filters using bilinear transformation method.

Internal Assessment Marks: 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in 22OB4.2.Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Subject Code:	IPCC BEC502	Title: DIGITAL SIGNAL PROCESSING												
List of Course Outcomes	Program Outcomes												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	1	2	2	-	-	-	-	-	-	2	2	2
CO-2	3	2	1	-	2	-	-	-	-	-	-	2	2	2
CO-3	2	2	1	2	2	-	-	-	-	-	-	2	2	2
CO-4	2	3	2	-	2	-	-	-	-	-	-	2	2	2
CO-5	2	3	2	2	2	-	-	-	-	-	-	2	2	2

Note: 3 = Strong Contribution 2= Average Contribution 1 = Weak Contribution -= No Contribution