PARUL UNIVERSITY - Faculty of Engineering and Technology

Department of Computer Science & Engineering

SYLLABUS FOR 4th Sem BTech PROGRAMME

Signals and Systems (203105257)

Type of Course: BTech

Prerequisite: Inclination to learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks

Rationale: The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The students will learn basic continuous time and discrete time signals and systems. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time. Students will also explore to power and energy signals and spectrum.

Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		T	P	T	CE	P	
3	0	0	3	60	-	20	20	-	100

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Unit - 1**: Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.	10%	4
2	**Unit - 2**: Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.	15%	5
3	**Unit - 3**: Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.	15%	8

4	**Unit - 4**: The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior.	15%	8
5	**Unit - 5**: The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.	25%	12
6	**Unit - 6**: State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.	20%	8

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

Reference Books:

1. Signals And Systems (TextBook)
   Alan V. Oppenheim; Pearson Education
2. Signals and Systems
   Simon Haykin; Wiley Publication
3. Signals and Systems
   K. Gopalan; Cengage Learning (India Edition)
4. Signals and Systems
   Michal J. Roberts and Govind Sharma; Tata Mc-Graw Hill Publications
5. Linear Systems and Signals
   B.P.Lathi; Oxford University Press

Course Outcome:

After Learning the course the students shall be able to:

1. Analyze different types of signals.
2. Represent continuous and discrete systems in time and frequency domain using different transforms.
3. Investigate whether the system is stable.
4. Sampling and reconstruction of a signal.