SEMESTER S5

SIGNALS AND SYSTEMS

Course Code	**PCEET503**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Mathematics for Electrical Science	**Course Type**	Theory

Course Objectives:

1. To introduce time domain and frequency domain representation of continuous and discrete time signals and perform various mathematical operations
2. To introduce various types of signals and systems
3. To introduce time domain and frequency domain representation of continuous and discrete time systems.
4. To familiarize mathematical modelling of dynamic systems and analyze it's stability

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to Signals and Systems:** Elementary Signals, Classification and representation of continuous time and discrete time signals, Signal operations. (3 hours) Concept of system: Continuous time and discrete time systems; Properties of systems: Time invariance, Linearity, Causality, Systems with and without memory, Stability. (3 hours) Convolution Integral and sum. (2 hours) Impulse and step response. (1 hour)	9

2	**Frequency domain characterization of Signals and Systems:** *Fourier transform:* Existence - Properties of Continuous time Fourier transform; Concept of Frequency response; Significance of Fourier transform and difference from Fourier series. (3 hours) Review of Laplace Transforms. *Characterization of LTI systems:* Differential equation representation of continuous time LTI systems. Transfer function representation of differential equation in Laplace domain. (2 hours) *Modeling of LTI systems:* Electrical, translational and rotational mechanical systems, DC servo-motor; Force voltage, Force current analogy. (4 hours)	**9**
3	**Sampled Data Systems and Z-Transform:** Sampling process - Impulse train sampling-sampling theorem- Aliasing effect. (2 hour) Zero-order and First-order hold circuits - Signal reconstruction. (2 hours) *Z-Transform:* Region of convergence- Properties of Z-Transform Inverse Z-Transform. Pulse transfer function. Difference equations representation using Z-transform and it's solution using inverse Z-Transform. (3 hours) Impulse and step response of discrete-time systems. (3 hours)	**10**
4	**Dynamic System Representation and Stability:** Open loop and closed loop systems. Effect of feedback in systems. Block diagram representation - block diagram reduction. Signal flow graph - Mason's gain formula. (5 hours) Type and Order of the systems - Pole-Zero representation of systems. Characteristic equation. Routh stability criterion. (3 hours)	**8**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	To represent continuous and discrete time signals in time domain and perform various mathematical operations	**K2**
CO2	To represent continuous time signals and systems in frequency domain	**K3**
CO3	To represent discrete time signals and systems in Z-domain.	**K3**
CO4	To analyse the stability of continuous time dynamical systems	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	1	3	3	3			3	2
CO2	3	3	2	2	2	3	3	3			3	2
CO3	3	3	2	2	2	3	3	3			3	2
CO4	3	3	2	2	2	3	3	3			3	2
CO5												

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Signals and Systems	Simon Haykin, Barry Van Veen	Wiley	2nd Edition, 2007
2	Discrete Time Control Systems	Katsuhiko Ogata	Pearson	2nd Edition, 2006
3	Control Systems Engineering	Norman S. Nise	Wiley	5th Edition, 2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Signals and Systems	Oppenheim A.V., Willsky A.S. & Nawab S.H.	Prentice Hall	2nd Edition, 2015
2	Modern Control Systems	Dorf R. C., Bishop R. H	Pearson Education India	12th Edition, 2013
3	Digital Signal Processing Principles	John G. Proakis& Dimitris G.Manolakis	Prentice Hall	4th Edition, 2007