Version 3.1	Course Academic Plan	Course Code and Name: ECC404 Signals and Systems

The academic resources available in PHCET, Rasayani

PHCET AMS	Evaluation and Assessment	PHCET Library	Value added courses and MOOC courses
Institute & Department Vision and Mission	Former IA question papers and solutions (prepared by faculty)	Former IA question papers solutions - hardcopy	Value Added Courses (VAC) are conducted throughout the semester & in the semester break -
Lesson Plan, Practical plan, Content delivery (Planned and Actual)	MU end semester examination question papers and solutions (prepared by faculty)	MU end semester exam question paper & solutions by faculty, hardcopy	Online courses from NPTEL, Coursera etc. Are pursued throughout the semester
Student attendance and performance	Class notes and Digital Content for the subject	All text books, reference books, e -books mentioned in the syllabus & AAP	Video recording of Lectures captured in Light board studio at PHCET is made available.
Student details	Comprehensive question bank, MCQ, GA, PPT, Class Test papers	Technical journals and magazines for reference	Interactive smart board facility is available and lectures are recorded.
Departmental Academic plan	Academic Administration Plan &Beyond Syllabus Activity report	PHCET library is member of IIT Bombay Library	Expert lectures by Industry/Academia

1.a Course Objectives (As per Blooms Taxonomy)

Sr No	Course Objectives
1.	To introduce students the concept and theory of signals and systems needed in electronics and telecommunication engineering fields.
2.	To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domain.

1.b Course Outcome (CO) Mapping with Modules

Sr. No	COs	Related Module/s
CO1	Students will be able to understand the basic concepts of signals and systems.	1
CO2	Students will be able to understand about various types of signals and systems, classify them, analyse them and perform various operations on them.	1, 2
CO3	Students will be able to understand use of transforms in analysis of signals and system in continuous and discrete time domain.	3,4

CO4	Students will able to observe the effect of various properties and operations of signals and systems.	3,4
CO5	Students will be able to evaluate the time and frequency response of Continuous and Discrete time systems.	3,4,5
CO6	Students will be able to understand the behaviour of electronic circuits and communication systems.	5,6

1.c Mapping of COs with POs (mark 3: Strong, 2: Moderate, 1: Weak,)

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	1	2	1	1	2	2	2
CO2	3	2	1	2	2	2	1	2	2	1	1	1
CO3	3	2	2	1	3	2	2	2	2	1	1	2
CO4	3	3	2	3	1	2	2	3	2	1	2	2
CO5	2	2	2	2	1	2	2	2	2	2	2	1
CO6	2	1	1	1	2	1	1	1	1	1	2	1

1.d Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	2
CO2	2	2	2	2
CO3	2	2	3	2
CO4	2	3	2	3
CO5	3	2	2	2
CO6	2	2	2	2

1.e Core Competency of the course

Categories	Mathematics	Basic Science & General Engg	Humanities & Soft Skill	Core Engg./ Technology – Design & Analysis	Multidisciplinary
Tick where applicable	√	√	√	√	√

2.a Teaching Scheme (As specified by the University)

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract	Tut	Theory	Pract	TW	Total
ECC404	Signals and Systems	4	-	2	4	-	1	5

2.b Module Wise Teaching Hours and % Weightage in University Question Paper

Module No.	Module Title and Brief Details	Teaching Hrs. for each module	% Weightage in University Question Papers
1	Introduction to signals and systems	8	13
2	Time domain analysis of continuous time and discrete time systems	8	13
3	Frequency domain analysis of continuous and discrete signals	10	18
4	Z-Transform	8	13
5	State Space Analysis and Realization Structures.	8	13
6	Applications of Signals and Systems	6	10

2.c Prerequisite Courses

Sr. No.	Semester	Name of the course	Topics covered
1	1,2,3	AM-I,II,III	Transforms, integration and differentiation.

2.d Relevance to Future Courses

Sr. No.	Semester	Name of the course
1	5	Discrete Time Signal Processing

2.e Industry Application of the course

Sr. No	Application
1	Communication system
2	Robotics
3	Medical image processing

3.a Past Results –

	Division A		Division B		Division C	
Year	Initials of Teacher	% Result	Initials of Teacher	% Result	Initials of Teacher	% Result
MAY 2018	VG	66.67	-	-	-	-
MAY 2019	SR	62.50	-	-	-	-

Topics which affect results negatively	Module Number	Recommendations to overcome these issues & improve result in future
Frequency domain analysis of continuous and discrete signals	3,4	Students need to clear maths concepts.

4.a Learning Resources – Books and E-Resources

PowerPoint presentations
Signal Processing Toolbox of Matlab

4.b List of Text Books

Sr. No.	Text book titles	Authors	Publisher	Edition	Module No
B1	Signals and Systems	Nagoor Kani	Tata McGraw Hil	3rd	1, 2, 5
B2	Signals and Systems	Simon Haykin and Barry Van Yeen	John Wiley and Sons	2nd	3, 4, 6

4.c List of Reference Books

Sr. No.	Reference book titles	Authors	Publisher	Edition	Module No
1	Advance microprocessors	Alan V Oppenheim, Alan S Willsky and S Hamid Nawab	PHI	2nd	1 to 6

4.d List of E – Books

Sr. No.	E book titles	Authors	Publisher	Edition	Module No

4.eWeb Links and Names of Magazines, Journals, E-journals

Sr. No.	Web-Links and Names of Journals and E-Journals Recommended	Web-Links and Names of Magazines Recommended	Module Nos.

5. Concept Inventory

Sr. No.	Chapter	Specific Concepts Covered in this Topic	Recommended Text Book for this Topic	Starting Page	Ending Page	No. of Pages	App. Effort in Min	Approximate Weightage (Marks)
1	1	Introduction to signals and systems	B1	1.1	1.4	4	8	13
2	1	Sampling theorem	B1	6.6	6.10	5		
3	1	Classification of signals	B2	16	53	37		
4	1	Classification of systems	B1	2.43	2.59	16		
5	2	Representation of systems using differential equation.	B1	2.29	2.43	15	8	13
6	2	Convolution integral and convolution sum for analysis of LTI system	B1	2.59	2.65	7		
7	2	Correlation and spectral density	1	312	314	3		
8	3	Trigonometric and exponential Fourier series representation of signals	B1	4.1	4.19	19	10	18
9	3	Gibbs phenomenon	1	200	201	2		
10	3	Fourier transform: CTFT	1	284	317	34		
11	3	DTFT	1	358	382	25		
12	3	Laplace transform	B2	482	523	41		
13	4	Z transform: need and definition	B2	553	553	1	8	13
14	4	Properties of Z transform	B2	566	571	6		
15	4	Region of convergence (ROC)	B2	556	566	11		
16	4	Analysis of DT LTI system using Z transform	B2	579	594	16		
17	4	Inverse Z transform	B2	572	579	8		
18	4	Relationship between LT & ZT and between DTFT & ZT.	B1	7.56	7.58	3		
19	5	Notation of state	B1	11.1	11.5	5	8	13
20	5	Systematic procedure for determining state equations	B1	11.5	11.6	2		
21	5	Solution of state equations using Laplace transform	B1	11.5	11.8	4		
22	5	Time domain solution of state equations	B1	11.8	11.14	7		
23	5	Recursive and non-recursive DT system	B2	79	80	2		
24	5	Realisation structures: direct form I, direct form II, transpose, cascade and parallel forms	B2	594	600	7		
25	6	Signal processing applications: speech and audio processing	B2	737	739	3	6	10
26	6	Multimedia processing, biological signal analysis	B1	1.7	1.8	2		
27	6	Communication and control system applications	B1	1.7	1.8	2		

6.0 Web Links for Online Notes/YouTube/ Digital Content/Lecture Capture/NPTEL Videos

Sr. No.	Websites/ Links	Module No

7. Recommended MOOC Courses like Coursera / NPTEL / Swayam/ edX etc.

Sr. No.	MOOC course link	Resource Person	Course duration	Certificate (Y/N)
1	https://nptel.ac.in/courses/108/104/108104100	Prof. Aditya K. Jagannatham	12 Weeks	N

8. Study Material Distributed among Students

GA	Notes (Hand Written)	Digital content	PPT	MCQ	Other
	Yes	Yes	Yes		

9. Lesson Plan

Week	Lecture no.	Module No.	Lecture Topics / IA 1 and IA 2 / BSA planned to be covered	Actual date of Completion	Mapping with COs	Recommended Prior Viewing / Reading	
						Lecture No. (on LMS)	Chapter No. / Page Nos./ Books/ Web Site
1	1	1	Introduction to signals: Definition, sampling theorem		1,2		
	2		Sampling of continuous time signals, elementary signals				
	3		Classification of signals: Continuous and discrete time, deterministic and non-deterministic, periodic and aperiodic, symmetric (even) and asymmetric (odd)				
	4		Energy and power, causal and anti-causal signal, Case study of different signals from communication and biomedical field				
	5		Introduction to systems: Definition,				

			Classification of systems				
2	6		Stable and unstable systems., communication and control system as examples				
	7	2	Representation of systems using differential /difference equation, Impulse, step and exponential response, system stability		2		
	8		Use of convolution integral for analysis of LTI systems				
	9		Use of convolution sum for analysis of LTI systems				
	10		Properties of convolution integral sum				
3	11		Impulse response of interconnected systems				
	12		Auto-correlation, cross correlation				
	13		Analogy between correlation and convolution				
	14		Energy spectral density, power spectral density, relation of ESD,PSD with auto-correlation				
	15	3	Trigonometric Fourier series representation of signals		3,4,5		

4	16		Exponential Fourier series representation of signals				
	17		Gibbs phenomenon				
	18		Discrete Time Fourier Series				
	19		Discrete Time Fourier Series properties				
	20		Analogy between Continuous Time Fourier Series (CTFS) and Discrete Time Fourier Series (DTFS)				
5	21		Fourier Transform on periodic and non-periodic signals				
	22		Inverse Fourier Transform on periodic and non-periodic signals				
	23		Limitations of CT/DT Fourier Transform and need for Laplace/Z Transform.				
	24		Need of Laplace Transform, review of unilateral and bilateral Laplace Transform				
	25		Laplace Transform properties				
6	26		Inverse of Laplace Transform, concept of Region of Convergence (ROC)				
	27		Poles and zeros				
	28		Relation between				

			continuous time Fourier Transform and Laplace Transform.				
	29	4	Need of Z-Transform, definition of unilateral and bilateral Z Transform		3,4,5		
	30		Z-Transform of finite and infinite duration sequences				
7	31		Properties of Z-Transform				
	32		Inverse Z-Transform				
	33		Relation between discrete time Fourier Transform and Z-Transform				
	34		Z-Transform of standard signals				
	35		ROC for ZT, plotting poles and zeros of transfer function.				
8	36		Analysis of discrete time LTI systems using Z-Transform: Transfer Function				
	37		Causality and stability of systems, frequency response (impulse and step)				
	38		Relation between Laplace Transform and Z-Transform.				
	39	5	Introduction to the notion of ‘state’,		5,6		

			systematic procedure for determining state equations				
	40		Solution of state equations using Laplace transform				
9	41		Definition of exp(A) where A is a matrix				
	42		Time domain solution of state equations				
	43		Systems with finite duration and infinite duration, impulse response				
	44		Recursive and non-recursive discrete time system				
	45		Realization structures: direct form-I, direct form-II				
10	46		Realization structures: Transpose, cascade, and parallel forms				
	47	6	Signal Processing Applications: Speech and Audio Processing		6		
	48		Signal Processing Applications: Multimedia (image & video) processing, Underwater acoustic signal processing				
	49		Signal Processing Applications: Biological signal analysis				

	50		Communication and Control System Application				

10. Rubric for Grading and Marking of Term Work

Lecture + Practical (% Attendance) & Marks	Assignments	Tutorial	Lab / Practical Performance	Lab Journal Assessment	Mooc Course	Total
15		10				25

11. Practical/Assignment Plan

Practical/Assignment No.	Module no.	Title of experiment/assignment	Mapping with COs					
			CO1	CO2	CO3	CO4	CO5	CO6
1	1	Tutorial no.-1	√	√				
2	2	Tutorial no.-2		√				
3	3	Tutorial no.-3			√	√	√	
4	4	Tutorial no.-4			√	√	√	
5	5	Tutorial no.-5					√	√
6	6	Tutorial no.-6						√

12. Beyond Syllabus Activities for Gap Mitigation

No	Type of the Activity	Activities	Details – no of attendees, guest, feedback, mark sheet, report

Academic Plan prepared by

Name of Faculty: Prof. Shashikant T. Renushe
Sign:

Domain Co-ordinator	SIG Coordinator	HOD