

Version 3.1	Course Academic Plan	Course Code and Name: Random Signal Analysis
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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 strengthen the foundations of probability
2	To teach continuous and discrete random variables.
3	To explain statistical behaviour of one dimensional and two-dimensional random variables
4	To describe the concept of random process which is essential for random signals and systems encountered in communications and statistical learning
5	To develop problem solving skills and explain how to make the transition from a real-world problem to a probabilistic model. To develop a thorough understanding of DFT and FFT and their applications.

1.b Course Outcome (CO) Mapping with Modules

Sr No	Cos	Related Module/s
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CO1	Apply theory of probability in identifying and solving relevant problems.	Module 1
CO2	Differentiate continuous and discrete random variables and their distributions	Module 2
CO3	Analyse mean, variance, and distribution function of random variables and functions of random variables.	Module 3
CO4	Characterize probability models and function of multiple random variables	Module 4
CO5	Define a random process, determine the type of the process and find the response of LTI system for WSS process	Module 5
CO6	Explain linear regression algorithms and apply for predictive applications.	Module 6

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

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	√							√		√		√
CO 2					√				√	√		√
CO 3		√	√						√	√		√
CO 4		√	√		√					√		√
CO 5	√		√					√	√	√		√
CO 6	√			√	√	√	√	√		√	√	√

1.d Mapping of COs with PSOs

	PSO 1	PSO 2	PSO 3	PSO 4
CO 1			√	
CO 2		√		
CO 3		√		
CO 4		√		
CO 5		√	√	
CO 6	√	√	√	√

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 (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECC504	Random Signal Analysis	03	--	01	03	--	01	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Exam Duration (Hrs.)	Term Work	Practical and Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test2	Avg.					
ECC504	Random Signal Analysis	20	20	20	80	03	25	--	125

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	Basic Concepts in Probability	5	12.5
2	Introduction to Random Variables	8	20
3	Operations on One Random Variable	8	20
4	Multiple Random Variables and Convergence	8	20
5	Random Processes	6	15
6	Introduction to Statistical Learning and Applications	5	12.5

2.c Prerequisite Courses

Sr. No.	Semester	Name of the course	Topics covered
1	IV	Engineering Mathematics IV	Complex Integration, Statistical Techniques
2	IV	Signals and Systems	Linear Time Invariant System

2.d Relevance to Future Courses

Sr. No.	Semester	Name of the course
1	NA	NA

2.e Industry Application of the course

Sr. No	Application
1	
2	
3	
4	
5	DSP in RADAR Signal Monitoring

3.a Past Results –

	Division A	Division B
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Year	Initials of Teacher	% Result	Initials of Teacher	% Result
2016 Dec	Pooja Shukre	100 %	Pooja Shukre	69.77%
2017 Dec	Pooja Shukre		NA	NA

Topics which affect results negatively	Module Number	Recommendations to overcome these issues & improve result in future
Multiple Random Variables, Random Processes	4, 5	More problem solving

4.a Learning Resources – Books and E-Resources

4.b List of Text Books

Sr. No.	Text book titles	Authors	Publisher	Edition	Module No
1	Probability, Statistics and Random Process	T. Veerarajan	Tata McGraw Hill Education	Third Edition	1, 2, 3, 4, 5
2	Probability, Statistics, and Random Processes for Engineers	Henry Stark & John Woods	Pearson Education	Fourth Edition	1, 2, 3, 4, 5
3	Introduction to linear regression Analysis	Douglas C. Montgomery, Elizabeth A. Peck and G. Geoffrey Vining,	Wiley publications.	Student Edition	6

4.c List of Reference Books

Sr. No.	Referencebook titles	Authors	Publisher	Edition	Module No
1	Probability and Random Processes with Applications to Signal Processing and Communications	Scott Miller and Donald Childers	Elsevier Publication	-	-
2	Theory and Problems of Probability	Hwei Hsu	Schaum's Outline Series, McGraw Hill	-	-
3	Probability Theory and Random Process	P. Ramesh Babu	Tata McGraw Hill Education		

4.dList of E – Books

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

4.e Web 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.

1	Stochastics- An International Journal of Probability and Stochastic Processes	https://www.tandfonline.com/loi/gssr20	All Modules
2	Stochastic Processes and their Applications	https://www.journals.elsevier.com/stochastic-processes-and-their-applications	All Modules

5. Concept Inventory

Sr. No.	Chapter	Concepts	Text Book	Start Page	End Page	No. of Pages	App. Effort in Min
1	Basic Concepts in Probability	Definitions of probability, , Bayes' theorem, independence of events,	B1	39	54	16	30
		Joint, conditional, and total probability	B1	64	68	5	30
		Bayes' Rule	B1	69	70	2	30
		Independence of events	B1	70	76	7	60
		binary symmetric communication channel analysis using Bayes' theorem	B1	76	80	5	60
2	Introduction to Random Variables	Continuous, discrete, and mixed random variables,	B1	135	142	8	120
		Probability density function	B1	142	152	11	120
		Probability distribution function	B1	154	158	5	120
		Probability mass function	B1	158	160	2	60
		Properties of PDF and CDF Distribution and density functions of R.V	B1	161	164	5	120
		Binomial, Poisson, Uniform, Gaussian and Rayleigh Distributions	B1	226	232	7	60
		Mean, variance and moments of random variables	B1	237	240	4	60
3	Operations on One Random Variable	Function of a random variable and their distribution and density functions.	B1	207	211	5	60
		Expectation, variance, moments, and characteristic function of random variable.	B1	213	216	4	60
		Transformation of a random variable, Markov and Chebyshev inequality	B1	217	223	7	60
		Characteristic functions, moment theorem.	B1	223	225	3	60

		Two functions of two random variables	B1	240	247	8	60
		Joint characteristic function	B1	251	253	3	60
		Covariance and correlation-independent, uncorrelated and orthogonal random variables	B1	249	250	2	120
4	Multiple Random Variables and Convergence	Pairs of random variables, joint CDF and joint PDF	B1	293	293	1	30
		One function of two random variables; joint moments, covariance and correlation independent, uncorrelated and orthogonal random variables	B1	293	295	3	30
		Central limit theorem and its significance	B1	296	304	9	60
5	Random Process	Random process: Definition, realizations, sample paths	B1	346	349	4	30
		Discrete and continuous time processes	B1	354	366	13	30
		Probabilistic structure of a Random process; mean, correlation and covariance functions	B1	350	351	2	60
		Stationarity of random process	B1	372	382	11	120
		Ergodicity	B1,B2	394, 511	397, 518	4	120
		Transmission of WSS random process through LTI system	B1	374	375	2	30
		Introduction to Markov Process	B1	419	427	9	30
6	Introduction to Statistical Learning and Applications	Regression and model building	B1	475	479	5	30
		Simple linear regression	B1	480	482	3	30
		Multiple linear regression	B1	484	492	9	30
		least square estimation of the coefficients	B1	493	495	9	30
		Residual calculations	B1	492	493	2	30
		Applications of simple linear regression in prediction of new observations.	B1	515	517	3	30

6.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)
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1	https://onlinecourses.nptel.ac.in/noc21_ma01/preview	Prof. G. Srinivasan		
2	https://onlinecourses.swamyam2.ac.in/cec21_ma02/preview	Dr P. Nagesh		

8. Study Material Distributed among Students

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

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	Definitions of probability independence of events,		CO 1		
	2	1	Joint, conditional, and total probability		CO 1		
	3	1	Bayes' Rule		CO 1		
	4	1	Independence of events		CO 1		
	5	1	binary symmetric communication channel analysis using Bayes' theorem		CO 1		
	6	2	Continuous, discrete, and mixed random variables,		CO 2		
	7	2	Probability density function		CO 2		
	8	2	Probability distribution function		CO 2		
	9	2	Probability mass function		CO 2		
	10	2	Properties of PDF and CDF Distribution and density functions of R.V		CO 2		
	11	2	Binomial, Poisson, Uniform, Gaussian and Rayleigh Distributions		CO 2		
	12	2	Mean, variance and moments of random variables		CO 2		

	13	2	Mean, variance and moments of random variables		CO 2		
	14	3	Function of a random variable		CO 3		
	15	3	Distribution and density functions.		CO 3		
	16	3	Distribution and density functions.		CO 3		
	17	3	Expectation, variance,		CO 3		
	18	3	Expectation, variance,		CO 3		
	19	3	Moments and characteristic function of random variable.		CO 3		
	20	3	Transformation of a random variable		CO 3		
	21	3	Markov and Chebyshev inequality		CO 3		
	22	4	Pairs of random variables, joint CDF		CO 4		
	23	4	Joint PDF		CO 4		
	24	4	One function of two random variables		CO 4		
	25	4	Joint moments		CO 4		
	26	4	covariance and correlation independent, uncorrelated and orthogonal random variables		CO 4		
	27	4	Central limit theorem and its significance		CO 4		
	28	5	Random process: Definition, realizations, sample paths		CO 5		
	29	5	Discrete and continuous time processes		CO 5		
	30	5	Probabilistic structure of a Random process; mean, correlation and covariance functions		CO 5		
	31	5	Stationarity of random process		CO 5		
	32	5	Ergodicity		CO 5		
	33	5	Transmission of WSS random process through LTI system		CO 5		
	34	5	Introduction to Markov Process		CO 5		
	35	6	Regression and model building		CO 6		
	36	6	Simple linear regression		CO 6		
	37	6	Multiple linear regression		CO 6		

	38	6	least square estimation of the coefficients		CO6		
	39	6	Residual calculations		CO 6		
	40	6	Applications of simple linear regression in prediction of new observations.		CO 6		

10. Rubric for Grading and Marking of Term Work

Lecture + Practical (% Attendance) & Marks	Assignments	Tutorial	Lab / Practical Performance	Lab Journal Assessment	Mooc Course	Total
5	-	20	NA	NA	-	25

11. Practical/Assignment Plan

Tutorial	Module no.	Title of experiment/assignment/ Tutorial	Mapping with Cos
1	1	Tutorial No.1	CO 1
2	2	Tutorial No.2	CO 2
3	3	Tutorial No.3	CO 3
4	3	Tutorial No.4	CO 3
5	4	Tutorial No.5	CO 4
6	4	Tutorial No.6	CO 4
7	5	Tutorial No.7	CO 5
8	5	Tutorial No.8	CO 5
9	All	Tutorial No.9	CO1, CO2, CO3, CO4, CO5, CO6
10	All	Tutorial No.10	CO1, CO2, CO3, CO4, CO5, CO6

12. Beyond Syllabus Activities for Gap Mitigation

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

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Academic Plan prepared by

Name of Faculty: Pooja Shukre
Sign:

Domain Co-ordinator	SIG Coordinator	HOD