AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Approved By AICTE, Permanently Affiliated to JNT University, Kakinada, Tamaram, Makavarapalem, Narsipatnam(R D), Visakhapatnam Dist-531113

Additional Information / Evidences sharing the procedure adopted for effective curriculum delivery in the Institute

CONTENTS

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Directorate of Academic Planning

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA-533003, Andhra Pradesh, INDIA
(Established by AP Government Act No. 30 of 2008)

Lr. No. 01-08/ JNTUK/DAP/AC/B. Tech-B. Pharmacy/II-III-IV Year/2020-21 *Date: 29-12-2020*

Dr. R. Srinivasa Rao,
Director, Academic Planning
JNTUK, Kakinada

To
All the Principals of Affiliated Colleges,
JNTUK, Kakinada.

Academic Calendar for II, III and IV - B. Tech & B. Pharmacy
Academic year 2020-21

I SEMESTER			
Description	**From**	**To**	**Weeks**
Commencement of Class Work	02.11.2020		
I Unit of Instruction	02.11.2020	19.12.2020	7W
II Unit of Instructions	21.12.2020	23.01.2021	5W
I Mid Examinations	25.01.2021	30.01.2021	1W
II Unit of Instructions(Continued)	01.02.2021	20.02.2021	3W
II Mid Examinations	22.02.2021	27.02.2021	1W
Preparation & Practicals	01.03.2021	06.03.2021	1W
End Examinations	08.03.2021	20.03.2021	2W
Commencement of II Semester Class Work	22.03.2021		
II SEMESTER			
I Unit of Instructions	22.03.2021	08.05.2021	7W
I Mid Examinations	10.05.2021	12.05.2021	1/2W
II Unit of Instructions	13.05.2021	30.06.2021	7W
II Mid Examinations	01.07.2021	03.07.2021	1/2W
Preparation & Practicals	05.07.2021	10.07.2021	1W
End Examinations	12.07.2021	24.07.2021	2W
Commencement of next Year Class Work			
Note: Calendar is prepared with 8 hrs/day hence 7 weeks per instruction period			

R. Srinivasa Rao
Director Academic Planning
Director
Academic Planning
JNTUK Kakinada

Copy to the Secretary to the Hon'ble Vice Chancellor, JNTUK
Copy to Rector, JNTUK
Copy to Registrar, JNTUK
Copy to Director Academic Audit, JNTUK
Copy to Director of Evaluation, JNTUK

Principal
Avanthi Institute of Engg. & Technology
Tamaram, Makavarapalem Md.,
Visakhapatnam District., Pin: 531113

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

TAMARAM(V), MAKAVARAPALEM (M)
VISAKHAPATNAM-531113

ACADEMIC CALANDER

Commencement of Class Work for II B.Tech- I Sem: 02.11.2020

Description	From	To	Weeks
I Unit of Instructions	02.11.2020	19.12.2020	7W
I Mid Examinations	25.01.2021	30.01.2021	1W
II Unit of Instructions	21.12.2020	23.01.2021	5W
II Mid Examinations	22.02.2021	27.02.2021	1W
Preparation & Practicals	01.03.2021	06.03.2021	1W
End Examinations	08.03.2021	20.03.2021	2W

*Mid Examinations are to be conducted without effecting the regular class work

Week No	Date		No. of Working Days	Reports to be Submitted	Target Date
	From	To			
1	02.11.2020	07.11.2020	06	Monthly Attendance and Syllabus Completion report up to 28.11.2020 and student Counseling	On or before 30.11.2020
2	09.11.2020	14.11.2020	05		
3	14.11.2020	21.11.2020	06		
4	23.11.2020	28.11.2020	06		
5	30.11.2020	05.12.2020	05	Monthly Attendance and Syllabus Completion report up to 19.12.2020 and student Counseling	On or before 22.12.2020
6	07.12.2020	12.12.2020	06		
7	14.12.2020	19.12.2020	06		
8	25.01.2021	30.01.2021	I- Mid & Online Examinations	Submission of Absentee Statement and Result Analysis	On or before 02.02.2020
9	21.12.2020	26.12.2020	05	Monthly Attendance and Syllabus Completion report up to 16.01.2021 and student Counseling	On or before 19.01.2021
10	28.12.2020	02.01.2021	06		
11	04.01.2022	09.01.2021	06		
12	11.01.2022	16.01.2021	02		
13	18.01.2021	23.01.2021	06	Monthly Attendance and Syllabus Completion report up to 23.01.2021 and student Counseling	On or before 25.01.2021
14	22.02.2021	27.02.2021	II- Mid & Online Examinations	Submission of Absentee Statement and Result Analysis	On or before 01.03.2021
Submission of all Academic Documents Maintained by Faculty					11.03.2021

Total No. of Working Days: 65

Expected Total No. of Periods per Subject: 75

Events to be organized

S. No	Name of the Event	Event Date
1	Induction Meet	1st Week of Aug'2020
2	Industrial Visit	Last Week of Feb'2021

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AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

TAMARAM(V), MAKAVARAPALEM (M)
VISAKHAPATNAM-531113

ACADEMIC CALANDER

Commencement of Class Work for II B.Tech- II Sem: 22.03.2021

Description	From	To	Weeks
I Unit of Instructions	22.03.2021	08.05.2021	7W
I Mid Examinations	10.05.2021	12.05.2021	1/2W
II Unit of Instructions	13.05.2021	30.06.2021	7W
II Mid Examinations	01.07.2021	03.07.2021	1/2W
Preparation & Practicals	05.07.2021	10.07.2021	1W
End Examinations	12.07.2021	24.07.2021	2W

*Mid Examinations are to be conducted without effecting the regular class work

Week No	Date From	Date To	No. of Working Days	Reports to be Submitted	Target Date
1	22.03.2021	27.03.2021	06	Monthly Attendance and Syllabus Completion report up to 17.04.2021 and student Counseling	On or before 20.04.2021
2	29.03.2021	03.04.2021	04		
3	05.04.2021	10.04.2021	05		
4	12.04.2021	17.04.2021	04		
5	19.04.2021	24.04.2021	05	Monthly Attendance and Syllabus Completion report up to 08.05.2021 and student Counseling	On or before 11.05.2021
6	26.04.2021	01.05.2021	05		
7	03.05.2021	08.05.2021	06		
8	10.05.2021	12.05.2021	I- Mid & Online Examinations	Submission of Absentee Statement and Result Analysis	On or before 15.05.2021
10	13.05.2021	22.05.2021	07	Monthly Attendance and Syllabus Completion report up to 12.06.2021 and student Counseling	On or before 15.06.2021
11	24.05.2021	29.05.2021	05		
12	31.05.2021	05.06.2021	04		
13	07.06.2021	12.06.2021	06		
14	14.06.2021	19.06.2021	06	Monthly Attendance and Syllabus Completion report up to 30.06.2021 and student Counseling	On or before 02.07.2021
15	21.06.2021	26.06.2021	06		
16	28.06.2021	30.06.2021	03		
17	01.07.2021	03.07.2021	II- Mid & Online Examinations	Submission of Absentee Statement and Result Analysis	On or before 06.07.2021
Submission of all Academic Documents Maintained by Faculty					17.07.2021

Total No. of. Working Days: 72

Expected Total No. of Periods per Subject: 78

Events to be organized

S. No	Name of the Event	Event Date
1	Industrial Visit	Last Week of March
2	2 Day Technical Meet	2nd Week of April'2021
3	National symposium	3rd Week of June'2021

Principal

Principal
Avanthi Institute of Engg. & Technology
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Visakhapatnam District, Pin. 531113

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

TAMARAM, MAKAVARAPALEM

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING ENGINEERING

II B.TECH - I SEMESTER(R19) ECE BRANCH TIME TABLE FOR THE ACADEMIC YEAR 2020-2021

W.E.F: 17 08 2020

DAY	1	2	3	12.30 - 02:00	4	5
	09:30-10:30	10:30-11:30	11:30-12:30		02:00-03:00	03:00-04:00
MON	SS	RVSP	EDC	BREAK	MEFA	STLD(T)
TUE	EDC	SS	RVSP		STLD	JAVA(T)
WED	MEFA	RVSP	EDC		STLD	JAVA
THU	SS	EDC	STLD		COUNSELLING/ REMIDIAL CLASSES	MEFA(T)
FRI	JAVA	RVSP	MEFA		SS	EDC(T)
SAT	STLD	DEPARTMENT ASSOC. MEETING			SS	LIBRARY/INTERNET

Electronic Devices & Circuits(EDC)	E Govinda	Object Oriented Programming Through Java(JAVA)	P M Manohar
Switching Theory & Logic Design(STLD)	P Sanyasi	Managerial Economics & Financial Analysis(MEFA)	P Ganesh
Signals & Systems(SS)	K Dhilli		
Random Variables & Stochastic Processes(RVSP)	R Prasad Rao		

HOD, ECE

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Avanthi Institute of Engg. & Technology
Tamaram, Makavarapalem Md
Visakhapatnam District, Pin-S. 1123

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
TAMARAM (VILL.), MAKAVARAPALEM (M.O), VISAKHAPATNAM (DIST).
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MICRO LESSON PLAN FOR THE COURSE : RANDOM VARIABLES AND STOCHASTIC PROCESS

NAME OF THE STAFF : R.PRASAD RAO		YEAR/SEM	: 2/1
DESIGNATION : ASSOCIATE PROFESSOR		BRANCH&SECTION	: ECE
DEPARTMENT : ELECTRONICS AND COMMUNICATION ENGINEERING		ACADEMIC YEAR.	: 2020-21

SI No	Unit No.	Topics to be covered	Cumulative hours	Proposed date of completion	Reference Material	Teaching Methodologies
		THE RANDOM VARIABLE				
1		Review of probability theory, Definition of a Random Variable	1	02-11-20	T3	Video,PPT,Chalk&Talk
2		Conditions for a Function to be a Random Variable	3	04-11-20	T3	PPT,Chalk&Talk
3		Discrete, Continuous and Mixed Random Variables	5	06-11-20	T2	PPT,Chalk&Talk
4	1	Distribution and Density functions	6	07-11-20	T1	PPT,Chalk&Talk
5		Properties of Binomial, Poisson, Uniform, Gaussian	8	09-11-20	T1	PPT,Chalk&Talk
6		Properties Exponential, Rayleigh	10	11-11-20	T1	PPT,Chalk&Talk
7		Properties Conditional Distribution, Conditional Density	11	13-11-20	T1	PPT,Chalk&Talk
11		REVISION	12	14-11-20	T1	PPT,Chalk&Talk
12						
13		**OPERATION ON ONE RANDOM VARIABLE - EXPECTATIONS:**	13	16-11-20	T2	PPT,Chalk&Talk
14		Introduction, Expected Value of a Random Variable	15	18-11-20	T1	PPT,Chalk&Talk
15		Function of a Random Variable, Moments about the Origin	17	20-11-20	T1	Chalk&Talk
16		Central Moments, Variance and Skew	18	21-11-20	T1	Chalk&Talk
17	2	Chebychev's Inequality, Characteristic Function	19	23-11-20	T1	Chalk&Talk
18		Moment Generating Function, Transformations of a Random Variable	21	25-11-20	T1	Chalk&Talk
19		Non-Monotonic Transformations for a Continuous Random Variable	23	28-11-20	T1	Chalk&Talk
20		REVISION	24	30-11-20	T1	Chalk&Talk
21		**MULTIPLE RANDOM VARIABLES**	25	01-12-20	T1	
22		Vector Random Variables, Joint Distribution Function Properties of Joint Distribution, Marginal Distribution Functions	26	02-12-20	T1	PPT,Chalk&Talk
23		Conditional Distribution and Density, Statistical Independence,Sum of Two Random Variables, Sum of Several Random Variables	28	05-12-20	T1	PPT,Chalk&Talk
24	3	**OPERATIONS ON MULTIPLE RANDOM VARIABLES:**	29	08-12-20	T1	PPT,Chalk&Talk
25		Joint Moments about the Origin,Joint Central Moments, Joint Characteristic Functions	30	10-12-20	T1	PPT,Chalk&Talk
26		Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case	32	12-12-20	T1	Video,PPT,Chalk&Talk
27		Properties, Transformations of Multiple Random Variables	34	14-12-20	T1	PPT,Chalk&Talk
28		Linear Transformations of Gaussian Random Variables.	35	17-12-20	T1	Video,PPT,Chalk&Talk
29		**RANDOM PROCESSES– TEMPORAL CHARACTERISTICS:**	37	19-12-20	T2	PPT,Chalk&Talk
30		The RandomProcess Concept, Classification of Processes	38	22-12-20	T2	PPT,Chalk&Talk
32		Deterministic and Nondeterministic Processes, Distribution and Density Functions	40	26-12-20	T2	PPT,Chalk&Talk
33		Concept of Stationarity and Statistical Independence,	41	28-12-20	T2	PPT,Chalk&Talk
34		First-Order Stationary Processes, Second-order and Wide-Sense Stationarity	42	30-12-20	T2	PPT,Chalk&Talk
35		Nth-order and Strict-SenseStationarity, Time Averages and Ergodicity	43	02-01-21	T2	Video,PPT,Chalk&Talk
36	4	Autocorrelation Function and its Properties, CrossCorrelation Function and its Properties,	44	04-01-21	T2	PPT,Chalk&Talk
37		Poisson Random Process.	46	06-01-21	T1	PPT,Chalk&Talk
38		**RANDOM PROCESSES - SPECTRAL CHARACTERISTICS:**	48	09-01-21	T2	PPT,Chalk&Talk
39		The PowerDensity Spectrum: Properties	50	11-01-21	T2	PPT,Chalk&Talk
40		Relationship between Power Density Spectrum and Autocorrelation Function	53	13-01-21	T2	PPT,Chalk&Talk
41		The Cross-Power Density Spectrum, Properties	55	16-01-21	T2	PPT,Chalk&Talk
42		Relationship between Cross-Power Density Spectrum and Cross-Correlation Function.	57	17-01-21	T2	PPT,Chalk&Talk

43	5	**LINEAR SYSTEMS WITH RANDOM INPUTS:**	58	18-01-21	T2	Video,PPT,Chalk&Talk
44		Random Signal Response of Linear Systems	60	19-01-21	T2	PPT,Chalk&Talk
45		System Response – Convolution, Mean and Mean-squared Value of System Response	61	20-01-21	T2	PPT,Chalk&Talk
46		Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output	63	21-01-21		PPT,Chalk&Talk
47		Spectral Characteristics of System Response: Power Density Spectrum of Response	64	23-01-21	T2	PPT,Chalk&Talk
48		CrossPower Density Spectra of Input and Output	66	22-02-21	T2	PPT,Chalk&Talk
49		Band pass, Band-Limited and Narrowband Processes	67	23-02-21	T2	Video,PPT,Chalk&Talk
50		Properties.	68	25-02-21	T2	PPT,Chalk&Talk
51		**REVISION**	70	27-02-21		PPT,Chalk&Talk
52						

54 T1,T2,T3

1.Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles,TMH, 4th Edition,2001.
2.Probability, Random Variables and Stochastic Processes, Athanasios Papou lisand
S.Unnikrisha, PHI, 4th Edition,2002.
3.Probability and Random Processes with Applications to Signal Processing, HenryStark and John W. Woods, Pearson Education, 3rdEdition,2001.

HOD

PRINCIPAL

Avanthi Institute of Engg. & Technology
Tamaram, Makavarapalem Md
Visakhapatnam District, Pin-531113

COURSE FILE REQUIREMENTS

PART I	
S.NO	CONTENT
1	Department Vision
2	Department Mission
3	Program Educational Objectives
4	Program Outcomes
5	Syllabus
6	Course Objectives, Course Outcomes
7	Course Information Sheet
8	Mapping Onto PEO And PO
9	Lecture Notes
10	Model Lesson Plan
11	OHP/LCD Sheets/CDS
12	University Question Papers
13	Internal Question Paper With Key
14	Assignment Topics
15	Tutorial Sheets
16	Unit Wise Question Bank
17	Gaps & Plans For Add On Programs
18	Topics Beyond Syllabus- References
19	Result Analysis, Remedial/Corrective Action
20	Learning Outcomes Assessment, Mapping Onto Po
	PART II
S.NO	CONTENT
21	Lesson Plan
22	Teaching Log Book/ Attendance Register
23	Daily Delivery Recording
24	Continuous Evaluation- Marks(Tests, Assignment, Etc)
25	Sample Answer Sheets(Of Test Papers)
26	Sample Assignment Sheets
27	Record Of Tutorial Classes
28	Record Of Remedial Classes
29	Make – Up Tests
30	Guest Lectures Conducted
31	Details Of Add-On Programs
32	List Of Advance Learners List
33	List Of Weak Students

FACULTY

HOD

Department vision

We envision the department to make an impact on, and lead in the field of Electronics communications engineering through its education and research agenda

DEPARTMENT MISSION

"To produce highly competent electronics and communications engineers to suite global needs.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

2020-21

II B.Tech. I Sem.

RANDOM VARIABLES & STOCHASTIC PROCESSES

UNIT I:

THE RANDOM VARIABLE : Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.

UNIT II:

OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.

UNIT III:

MULTIPLE RANDOM VARIABLES : Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions. OPERATIONS ON MULTIPLE RANDOM VARIABLES: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT IV:

RANDOM PROCESSES – TEMPORAL CHARACTERISTICS: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second Order and Wide-Sense Stationarity, Nth -order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

UNIT V:

RANDOM PROCESSES – SPECTRAL CHARACTERISTICS: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

LINEAR SYSTEMS WITH RANDOM INPUTS : Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Band pass, BandLimited and Narrowband Processes, Properties, Modeling of Noise Sources: Resistive (Thermal) Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Average Noise Figure, Average Noise Figure of cascaded networks

TEXTBOOKS:

1. Probability, Random Variables & Random SignalPrinciples, Peyton Z.Peebles, TMH, 4 thEdition, 2001.

2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI,4th Edition, 2002.

3. Probability and Random Processes with Applications to Signal Processing, Henry Starkand John W.Woods, Pearson Education, 3 rdEdition, 2001.

REFERENCE BOOKS:

1. Schaum's Outline of Probability, Random Variables, and Random Processes, 1997.

2. An Introduction to Random Signals and Communication Theory, B.P.Lathi, International Textbook, 1968.

3. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill,2015.

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

TAMARAM, MAKAVARAPALEM,NARSIPATNAM

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

-

Subject: RANDAM VARIABLES & STOCHASTIC PROCESSES

Branch: ECE II year I sem.

COURSE OBJECTIVE

1	To give students an introduction to elementary probability theory, in preparation to learn the concepts of statistical analysis, random variables and stochastic processes
2	To mathematically model theory and phenomena with the help of probability theory Concepts
3	To introduce the important concepts of random variables and stochastic processes.
4	To analyze the LTI systems with stationary random process as input.

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

TAMARAM, MAKAVARAPALEM, NARSIPATNAM

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Subject: RANDAM VARIABLES & STOCHASTIC PROCESSES

Branch: ECE II year I sem.

COURSE OUTCOMES

SNO	DESCRIPTION
1	Mathematically model theory and phenomena and solve simple probabilistic problems.
2	Identify different types of random variables and compute statist cal averages of the serandom variables.
3	Characterize the random processes in the time and frequency domains.
4	Analyze the LTI systems with random inputs.

COURSE INFORMATION SHEET

PROGRAMME: B.TECH ECE Academic Year :2020-21	DEGREE: B.TECH II-I
COURSE: RANDOM VARIABLES & STOCHASTIC PROCESSES	SEMESTER: I CREDITS: 3
COURSE CODE: REGULATION:R19	COURSE TYPE: CORE
COURSE AREA/DOMAIN: RANDOM VARIABLES & STOCHASTIC PROCESSES	CONTACT HOURS: 3+1 (Tutorial) hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): No	LAB COURSE NAME: No

SYLLABUS:

UNIT	DETAILS	HOURS
I	**THE RANDOM VARIABLE :** Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.	12
II	**OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS** : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.	12
III	**MULTIPLE RANDOM VARIABLES :** Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions. **OPERATIONS ON MULTIPLE RANDOM VARIABLES:** Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random	11

	Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.	
IV	**RANDOM PROCESSES – TEMPORAL CHARACTERISTICS:** The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.	11
V	**RANDOM PROCESSES – SPECTRAL CHARACTERISTICS:** The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. **LINEAR SYSTEMS WITH RANDOM INPUTS :** Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Band pass, Band- Limited and Narrowband Processes, Properties.	11 13
	TOTAL HOURS	**70**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
1	Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4th Edition, 2001.
2	Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI, 4th Edition, 2002.
3	Probability Theory and Stochastic Processes – B. Prabhakara Rao, Oxford University Press
4	Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W.Woods, Pearson Education, 3rd Edition.
5	Probabilistic Methods of Signal & System Analysis, George R. Cooper, Clave D. Mc Gillem, Oxford, 3rd Edition, 1999.
6	Statistical Theory of Communication, S.P.Eugene Xavier, New Age Publications, 2003
7	Signals, Systems & Communications, B.P. Lathi, B.S. Publications, 2003
8	Probability and Random Processes, An Introduction for Applied Scientists and Engineers, Davenport W.B, McGraw-Hill, 1970.
9	Introduction to Random Processes with Applications to Signals and Systems, Gardener W.A, McGraw-Hill, 2nd Edition
10	Schaum's Outline of Probability, Random Variables, and Random Processes.
11	An Introduction to Random Signals and Communication Theory, B.P. Lathi, International Textbook, 1968.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
	Mathematics I&II	Basic concepts about mathematics	I-I
	P&S	Probability and statistics	

COURSE OBJECTIVES:

1	To give students an introduction to elementary probability theory, in preparation to learn the concepts of statistical analysis, random variables and stochastic processes
2	To mathematically model theory and phenomena with the help of probability theory Concepts
3	To introduce the important concepts of random variables and stochastic processes.
4	To analyze the LTI systems with stationary random process as input.

COURSE OUTCOMES:

SNO	DESCRIPTION
1	Mathematically model theory and phenomena and solve simple probabilistic problems.
2	Identify different types of random variables and compute statistical averages of the serandom variables.
3	Characterize the random processes in the time and frequency domains.
4	Analyze the LTI systems with random inputs.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS
1	Probability theory	GUEST LECTURER
2	Rectangular destructive functions	NPTEL LECTURES
3	Applications of RVSP in signal processing and communication systems	Nptel lectures
4	Some other topics in noise like addition of noise due to several amplifiers, equivalent noise temperature of cascaded stages.	GUEST LECTURER

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

1	Applications of PTSP in signal processing and communication systems
2	Rectangular destructive functions

WEB SOURCE REFERENCES:

1	http://www.math.uiuc.edu/
2	http:// *nptel.iitm.ac.in/...random.../NPT39*

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ CHALK & TALK	✓ STUD. ASSIGNMENT	✓ WEB RESOURCES	
✓ LCD/SMART BOARDS	✓ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

✓ ASSIGNMENTS	✓ STUD.SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	✓ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES			☐ OTHERS

ASSESSMENT METHODOLOGIES-INDIRECT

✓ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

TAMARAM, MAKAVARAPALEM, NARSIPATNAM

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Subject: RANDAM VARIABLES & STOCHASTIC PROCESSES

Branch: ECE II year I sem.

PEO'S AND PO'S MAPPING

SNO	DESCRIPTION	PEO'S MAPPING	PO'S MAPPING
1	Simple probabilities using an appropriate sample space.	PEO1,PEO2,PEO3,PEO4	a,c,d
2	Simple probabilities and expectations from probability density functions (pdfs)	PEO1,PEO2,PEO3,PEO4	a,c,d
3	Likelihood ratio tests from pdfs for statistical engineering problems.	PEO1,PEO2,PEO3,PEO4	a,c,d,e
4	Least – square & maximum likelihood estimators for engineering problems.	PEO1,PEO2,PEO3,PEO4	a,c,d,e
5	Mean and covariance functions for simple random process s.	PEO1,PEO2,PEO3,PEO4	a,c,d

Code No: R1921044 **R19** **SET - 1**

II B. Tech I Semester Regular Examinations, March - 2021
RANDOM VARIABLES AND STOCHASTIC PROCESSES
(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 75

Answer any FIVE Questions each Question from each unit
All Questions carry Equal Marks

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1 a) Define conditional probability distribution function and write he properties [8M]

b) A random variable X is defined by [7M]

$$X(i)=\begin{cases}-2 & i\le -2\\ i & -2<i\le 1\\ 1 & 1<i\le 4\\ 6 & 4<i\end{cases}$$

Show, by a sketch, the value x into which the values of i are mapped by x. What type of random variable is X?

Or

2 a) Given that a random variable X has the following possible values, state if X is discrete, continuous or mixed [8M]

i. {-20<x<-5}
ii. {10,12<x<=14,15,17)
iii. {-10 for s>2 and 5 for s<=2, where 1<s<=6}
iv. {4,3.1,1, -2}

b) Suppose height to the bottom of clouds is a Gaussian random variable for which ax=4000m and σx=1000m. A person bets that cloud height tomorrow will fall in the set A={1000m<X≤3000m} while a second person bets that height will be satisfied by B={2000m<X≤4200m}.A third person bets they are both correct. Find the probability that each person will win the bet. [7M]

3 a) The random variable X has characteristics function $\phi_X(w)=[a/a-jw]^N$ for a>0 and N=1,2,3..... Show that $\bar{X}=N/a$, $\bar{X}^2N(N+1)/a^2$, and $\sigma_x^2=N/a^2$. [8M]

b) Find mean and variance of Gaussian random variable? [7M]

Or

4 a) A random variable X is uniformly distributed on the interval (-5,15).Another random variable $Y=e^{(-\frac{X}{5})}$ is formed. Find E[Y]. [8M]

b) A Gaussian voltage random variable X has a mean value ax=0 and $\sigma^2x=9$. The voltage X is applied to a square-law, full wave diode detector with a transfer characteristics $Y=5X^2$. Find the mean value of the output voltage Y. [7M]

5 a) Random variable X and Y have the joint density [8M]

$F_{X,Y}(x,y)=\{$ 1/24 0<x<6 and 0<y<4
0 elsewhere.

What is the expected value of the function $g(X,Y)=(XY)^2$?

b) Two statistically independent random variable X and Y have mean values $\bar{X}$ =E[X]=2 and E[Y]=4. They have second moments $\bar{X}^2$=E[X^2]=8 and E[Y^2]=25. Find i) the mean value ii) the second moment iii) the variance of the random variable W=3X-Y. [7M]

Or
~~~~~~~~~~~~~~~~~~~~~~~~~

Code No: R1921044 **R19** **SET - 1**

6 a) For the two random variable X and Y: [8M]

$F_{X,Y}(x,y)=0.15\delta(x+1)\delta(y)+0.1\delta(x)\delta(y)+0.1\delta(x)\delta(y-2)+0.4\delta(x-1)\delta(y+2)$
$+0.2\delta(x-1)\delta(y-1)+0.5\delta(x-1)\delta(y-3)$

Find: i) the correlation, ii) the covariance, iii) the correlation coefficient of X and Y and iv) are X and Y either uncorrelated or orthogonal?

b) Gaussian random variable X_1 and X_2 for which $\bar{X}_1=2, \sigma_{X1}^2=9, \bar{X}_2=-1, \sigma_X^2=4$ and $C_{X1X2}=-3$ are transformed to new random variable Y_1 and Y_2 according to $Y_1=-X_1+X_2, Y_2=-2X_1-3X_2$. Find [7M]
i)σ_{Y1}^2 ii)σ_{Y2}^2 iii) C_{Y1Y2}.

7 a) Let X (t) be a stationary continuous random process that is differentiable. Denote its time derivative by $\dot{X}(t)$. Show that $E\left[\dot{X}(t)\right]=0$. [8M]

b) Given the random process by $X(t)=A\cos(w_0t)+B\sin(w_0t)$ [7M]
Where w_0 is a constant, and A and B are uncorrelated zero mean random variables having different density functions but the same variance ,show that X(t) is wide sense stationary but not strictly stationary.

Or

8 a) A random process is defined by $X(t) = A$, where A is a continuous random variable uniformly distributed on (0, 1). Determine the form of the sample functions, classify the process [8M]

b) Define ergodic random proven? Explain with example. [7M]

9 a) Drive the Wiener-Khintchine relation. [10M]

b) What is Mean value of System Response for Random Signal Response of Linear Systems. [5M]

Or

10 A Random signal X(t) of PSD of $\frac{N_0}{2}$ is applied on an LTI system having impulse response $h(t)$. If $Y(t)$is output, find (i) $E[Y^2(t)]$ (ii) $R_{XY}(\tau)$ (iii) $R_{YX}(\tau)$ (iv) $R_{YY}(\tau)$. [15M]

Code No: R1621045 **R16** **SET - 2**

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
RANDOM VARIABLES & STOCHASTIC PROCESSES
(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (Part-A and Part-B)
2. Answer ALL the question in Part-A
3. Answer any FOUR Questions from Part-B

PART –A

1. a) What are the Conditions for a Function to be a Random Variable? (2M)
   b) Define Variance. (2M)
   c) Write properties of Joint Density Function. (2M)
   d) Define Deterministic Nondeterministic Processes with example. (3M)
   e) Determine whether the below function is be valid power density spectrum? Why? (2M)

$$\frac{\cos(3\omega)}{1+\omega^2}$$

   f) What is Mean-squared value of System Response? (3M)

PART -B

2. a) Define conditional probability distribution function and write the properties. (7M)
   b) A random current is described by the sample space. A random variable X is defined by (7M)

$$X(i)=\begin{cases}-2 & i\le -2\\ i & -2<i\le 1\\ 1 & 1<i\le 4\\ 6 & 4<i\end{cases}$$

Show, by a sketch, the value x into which the values of i are mapped by x. What type of random variable is X?

3. a) Find mean and variance of Gaussian random variable? (7M)
   b) Explain about Transformation of random variable. (7M)

4. a) Define Marginal density function? Find the Marginal density functions of below joint density function, (7M)

$$f_{XY}=\frac{1}{12}u(x)u(y)e^{-x/3}e^{-y/4}$$

   b) Find the density function of W=X+Y, where the densities of X and Y are assumed to be: $f_x(x)=4u(x)e^{-4x}$; $f_y(y)=5u(y)e^{-5y}$. (7M)

Code No: R1621045

R16

SET - 2

5. a) let two random processes X(t) and Y(t) be defined by (9M)

$$X(t) = A\cos\omega_0 t + B\sin\omega_0 t$$
$$Y(t) = B\cos\omega_0 t - A\sin\omega_0 t$$

Where A and B are random variables and ω_0 is a constant. Assume A and B are uncorrelated, zero mean random variables with same variance. Find the cross correlation function $R_{XY}(t,t+\tau)$.

b) Write the properties of Cross correlation Function of Random Process (5M)

6. a) Write the properties of power density spectrum (7M)

b) If X(t) is a stationary process, find the power spectrum of $Y(t) = A_0 + B_0 X(t)$ (7M)
in term of the power spectrum of X(t) if A_0 and B_0 are real constants

7. a) The bandwidth of a system is 10MHz. Find the thermal noise voltage across an 800Ω resistor at room temperature. (7M)

b) If X(t) is band limited process such that $S_{xx}(\omega) = 0, when\ |\omega| > \sigma$, prove that $2[R_{xx}(0) - R_{xx}(\tau)] \leq \sigma^2\tau^2 R_{xx}(0)$ (7M)

Code No: RT22042 **R13** SET - 1

II B. Tech II Semester Regular Examinations, April/May - 2016
RANDOM VARIABLES AND STOCHASTIC PROCESSES
(Electronics and Communications Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Define probability mass function and list its properties. (3M)
   b) Show that the first central moment is zero. (4M)
   c) Define central limit theorem. (4M)
   d) Distinguish between deterministic and non-deterministic random processes. (3M)
   e) Show that $S_{XX}(-\omega) = S_{XX}(\omega)$. (4M)
   f) A WSS random process $X(t)$ is applied to the input of an LTI system with transfer function $H(\omega) = \frac{3}{2+j\omega}$. Find the mean of the output $Y(t)$ of the system if $E[X(t)] = 2$. (4M)

PART -B

2. a) Two dice are thrown. The square of the sum of the points appearing on the two dice is a random variable X. Determine the values taken by X, and the corresponding probabilities. (8M)
   b) State and prove the properties of probability density function. (8M)

3. a) Let $Y = 2X + 3$. If the random variable X is uniformly distributed over [-1, 2], determine $f_Y(y)$. (8M)
   b) Find the second central moment of a random variable with PDF $f_X(x) = ae^{-ax}u(x)$ (8M)

4. a) State central limit theorem for the following cases: (8M)
      i) Equal distributions ii) Unequal distributions
   b) Determine $f_Z(z)$ in terms of $f_X(x)$and $f_Y(y)$, if $Z = X + Y$. (8M)

5. a) Give the classification of random processes. (8M)
   b) A random process is given by $X(t) = A\cos(\omega_c t + \Theta)$, where$\omega_c$ is a constant and A and Θ are independent random variables uniformly distributed in the ranges (-1, 1) and (0, 2 π), respectively. Determine$R_{XX}(t_1, t_2)$. (8M)

6. a) For each of the following functions, state whether it can be valid PSD of a real random process: i) $\frac{(2\pi f)^2}{(2\pi f)^2+16}$ ii) $j[\delta(f+f_o) + \delta(f-f_o)]$ (8M)
   b) State and prove the properties of power spectral density. (8M)

7. a) Let $Y(t)$ be the output of an LTI system with impulse response $h(t)$. Find the cross-correlation between the input $X(t)$ and output $Y(t)$. (8M)
   b) Write notes on the following terms: i) Thermal noise ii) Narrowband noise (8M)
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AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
TAMARAM, MAKVARAPALEM MANDAL, VISAKHAPATNAM DIST.

II B. Tech I Sem – ECE SUBJECTIVE TEST – I

SUBJECT: Random Variables and Stochastic Processes (R19)

Date : 30 01 2021 **Time: 90 Min.** **Max. Marks: 20**

Answer All the following questions

01. a. State the properties of Cumulative distribution function. [03 Marks]

b. A Gaussian random variable X has $m_x=2$ and $\sigma x=2$
i. find P{x>1.0} ii. find P{X≤-1.0} [03 Marks]

02. a. State and prove the properties of variance.[03 Marks]

b. The probabilities of getting 0,1,2,3,4,5 heads in five flips a balanced coin are 1/32, 5/32, 10/32, 10/32, 5/32, 1/32 find the mean and variance of this probability of this distribution. [03 Marks]

03. a. Given the function : [04 Marks]

$$f_{xy}(x,y)\begin{cases} = b(x+y)^2 & -2<x<2 \text{ and } -3<Y<3 \\ 0 & \text{elsewhere} \end{cases}$$

i. find the constant 'b' such that this is a valid joint density function

ii. Determine the marginal density function $f_x(x)$ and $f_y(y)$

b. The probability density function of a random variable X is given as $f(x)=ae^{-b|x|}$ where a and b are real constants, find the
i. Moment generating function
(ii) Mean [04 Marks]

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY
TAMARAM, MAKVARAPALEM MANDAL, VISAKHAPATNAM DIST.

II B. Tech I Sem – ECE SUBJECTIVE TEST – I

SUBJECT: Random Variables and Stochastic Processes (R19)

Date : 30 01 2021 Time: 90 Min. Max. Marks: 20

Answer All the following questions

01. a. State the properties of Cumulative distribution function. [03 Marks]

b. A Gaussian random variable X has $m_x=2$ and $\sigma x=2$
i. find P{x>1.0} ii. find P{X≤-1.0} [03 Marks]

02. a. State and prove the properties of variance.[03 Marks]

b. The probabilities of getting 0,1,2,3,4,5 heads in five flips a balanced coin are 1/32, 5/32, 10/32, 10/32, 5/32, 1/32 find the mean and variance of this probability of this distribution. [03 Marks]

03. a. Given the function : [04 Marks]

$$f_{xy}(x,y)\begin{cases} = b(x+y)^2 & -2<x<2 \text{ and } -3<Y<3 \\ 0 & \text{elsewhere} \end{cases}$$

i. find the constant 'b' such that this is a valid joint density function

ii. Determine the marginal density function $f_x(x)$ and $f_y(y)$

b. The probability density function of a random variable X is given as $f(x)=ae^{-b|x|}$ where a and b are real constants, find the
i. Moment generating function
(ii) Mean [04 Marks]

II ECE-I & II

RVSP

(1)

(a) State the properties of probability Density function and probability distribution function.

(b) Consider the experiment of tossing four fair coins. The Random Variable X is associated with the no. of tails showing. Compute and sketch the cumulative distribution function of X.

(2)

(a) State and prove the properties of Variance.

(b) Consider a Random Variable X with $E[X] = 5$ and $\sigma_X^2 = 2.9$. Another Random Variable is given as $Y = -8X + 10$. find $E[XY]$, $E[X^2]$, $E[Y^2]$, σ_Y

(3)

(a) The probability density function of a Random Variable X is given as $f_X(x) = ae^{-bx}$ for $x \geq$

find (i) $M_X(v)$
(ii) $E[X]$
(iii) $E[X^2]$

(b) The Joint pdf of Two Random Variables X and Y is given by. $f_{XY}(x,y) = \begin{cases} 10e^{-2x} \cdot e^{-3y} & \text{for } 0 \leq y \leq \infty \\ 0 & \text{elsewhere} \end{cases}$

find. $f_{x}(x/y)$, and $f_{y}(y/x)$.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ECE

ASSIGNMENT QUESTIONS

SUB: RVSP
ASSIGNMENT: 1

1. What are the conditions for a function to be random variable?

2. Define probability mass function and list its properties.

3. Define the conditional density and distribution functions and list all the properties?

4. If the probability density function of a random variable is give by

$$f_x(x)=\begin{cases} c\exp\left(-\frac{x}{4}\right) & \text{for } 0 \le x \le 1 \\ 0 & otherwise \end{cases}$$

Find the value of 'c' .evaluate $F_x(0.5)$?

5. Let x be a continuous random variable with density function

$$f_x(x)=\begin{cases} \frac{x}{a}+k & \text{for } 0 \le x \le 6 \\ 0 & otherwise \end{cases}$$

i) Find the value of 'k'.

ii) Find P {2 <= x <= 5}

ASSIGNMENT -2

1. Show that f [X+Y]= f [X]+f [Y]

2. Define characteristic function and list its properties?

3. if k is a constant, then for a random variable x, prove that var(kx)=k^2var(x)?

4. Prove that the zeroth central moment is always one?

5. Show that first central moment is zero mathematically the n^{th} moment about its mean is defined as

6. Sate and prove the chebychev's inequality.

ASSIGNMENT -3

1. state and prove central limit theorem?

2.Define joint probability lensity lensity function list all properties?

3.prove that the sum of two statistically independent random variables is equal to the convolution of their individual density functions?

4. Define marginal distribution and density functions?

5.the joint PDF of two continous random variables is given by

$$f_{xy}(x,y)= xye^{-x2}.e^{-y2/2u(x)u(y)}$$

are x and y are independent?

6.show that E[X+Y]=E[X]+E[Y]?

7.when the two random variables X and Y are said to be jointly guassian ?

ASSIGNMENT:4

1.If x, y and z are three random variables then the cov(x+y,z)=cov (x,y)+cov (y,z)

2. show that for two random variable X and Y var[aX+bY]=a^2 var (X)+ b^2 var (Y)+2ab cov (X,Y) where a,b are real constants.

3.two random variables x and y have joint characterstic function Øxy (w_1,w_2)=exp(-2w_1^2-8w_2^2)

i) Show that x and y are zero mean random variables.
ii) Are x and y ar correlated.

4. explain joint central moments.

5. for two random variables x and y then

Var [X+Y]=var[X]+var[Y]+2 cov (X,Y)

And var [X-Y]=var[X]+var[Y]-2 cov (X,Y)

ASSIGNMENT -5

1. Define power density spectrum and write its properties?

2. Show that $S_{XY}(-w)=S_{XY}(w)$

3. Derive the relationship between cross power spectrum and cross correlation function?

4. Show that $S_{xy}(w)=S^{*}_{yx}(w)$?

ASSIGNMENT -6

1.State stable systems.

2.Write the properties of Band limited Random process.

3. A network has the transfer function.

$$H(w)= \frac{8.e^{\frac{jw}{20}}}{(10+jw)^3}$$

Determine the impulse response.

4.A wss Random process X(t) with a mean values and power spectrum of $50\,\pi\,\delta(w)+\frac{3}{1+(\frac{w}{2})^2}$ is applied to network with a impulse response $h(t)=4e^{-4|t|}$

i) find H(w) of the network

ii) Find the power spectrum density of the response Y(t)

5.State and explain transfer function of LTI systems.

6. Relation between auto correlation and cross correlation.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ECE

TUTORIAL QUESTIONS

SUB: RVSP

TUTORIAL: 1

1. The random variable x has the discrete variable in the set{-1, 0.5, 0.7,1,5,3}, the corresponding probabilities are assumed to be {0.1,0.2,0.1,0.4,0.2} plot its distribution function?
2. If the probability density of a random variable is given by

$$f_x(x)=\begin{cases} c.\exp\left(-\frac{x}{4}\right) & \text{for } 0 < x < 1 \\ 0 & otherwise \end{cases}$$

Find the value of 'c' evaluate $F_x(0.5)$?

3. Two dies are thrown. the square of the sum of the points appearing on the two dies is a random variable X. determine the values taken by X_1 and the corresponding probabilities?

4. State and prove the properties of probability density function?

5. Explain about the distribution and density functions of Rayleigh random variable with neat sketches?

TUTORIAL -2

1. A random variable X has a PDF

$$F_x(x) = \begin{cases} \frac{1}{2}\cos x & \text{for } -\pi/2 < x < \pi/2 \\ 0 & \text{Otherwise} \end{cases}$$

Find the mean value of the function $g(x) = 4x^2$?

2. If x is a discrete random variable with probability mass function given as below table

x	-2	-1	0	1	2
P(X)	1/5	2/5	1/10	1/10	1/5

Find 1) E[x] 2) $E[X^2]$ 3) E [2X+3] 4) $E[(2x+1)^2]$

3. State and prove properties of moment generating function?

4. Let Y=2x+3, if the random variable x is uniformly distributed over [-1, 2], determine $f_y(y)$?

5. Show that E[X+Y] =E[X] +E[Y]?

TUTORIAL -3

1. The joint density function for X and Y is

$$f_{xy}(X,Y) = \begin{cases} \frac{xy}{9} & \text{for } 0 < x < 2, 0 < y < 3 \\ 0 & otherwise \end{cases}$$

Find the conditional density function?

2. The joint density function of X and Y is given by

$$f_{xy}(x,y) = \begin{cases} a\,x^2y & \text{for } 0 < x < y < 1 \\ 0 & elsewhere \end{cases}$$

1) find 'a' show that the function is a valid density function

2) find the marginal density functions?

3)the joint PDF of a bi-variable(x,y) is given by

$$f_{xy}(x,y) = \begin{cases} k.xy & \text{for } 0 < x < y < 1 \\ 0 & otherwise \end{cases}$$

where k is a constant

1)find the value of k 2)are X and Y are independent?

4)If X and Y are independent, then show E[XY]=E[X]E[Y]?

5)Let Z is the sum of the two independent random variables X and Y find the PDF of z?

TUTORIAL -4

1.consider a random process x(t)=A coswt, where w is a constant and A is a random variable uniformly distributed over(0,1).find the auto correlation and auto covariance of x(t)?

2.given E[x]=6 and $R_{xx}(t,t+\tau)=36+25\exp(-\tau)$ for a random process x(t).indicate which of the following statements are true.

1)is ergodic 2)is wide sense stationary?

3.derive an expression that relates autocorrelation function and auto covariance function?

4.what is auto correlation function,list out its properties?

5.show that $|R_{xx}(\tau)| \leq R_{xx}(0)$?

TUTORIAL -5

1.find whether given power spectrum $\cos 8w/2+w^4$ is valid or not?

2.show that $S_{xx}(-w)=S_{xx}(w)$?

3.power spectrum and auto correlation functions are a fourier transform pairs. prove this statement?

4.a wss random process x(t) which has the power spectral density

$$S_{xx}(w)=\frac{w^2}{w^4+10w^2+9}$$

Find the auto correlation function and mean square value of the process?

TUTORIAL -6

1. derive the expression for noise figure of two-stage cascaded network?

2. prove that $S_{yy}(\square)=|H(\square)|^2 S_{xx}(\square)$?

3. list the properties narrow band random process?

4. derive the relationsip between autocorrelation of output random process of an LTI system when the input is a WSS process?

5. Find the mean square value of the output response for a system having h (t) $=e^{-t}u(t)$ and input of white noise $N_0/2$?

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ECE

UNIT WISE QUESTIONS

SUB: RVSP UNIT: 1

1. Give example for continuous random variable and discrete random variable?
2. List any two properties of conditional density function?
3. A noisy transmission channel has a pre – digit error probability Pe=0.01. Calculate the probability of more than one error in 10 received digits?
4. Explain about the distribution and density function of exponential random variable with neat sketches?
5. If the probability density of a random variable is given by

$$f_x(X) = \begin{cases} x \; for \; 0 < x < 1 \\ (2 - x) \; for \; 1 < x < 2 \end{cases}$$

   Find 1) p {0.2<x<0.8}

   2) P {0.6<x<1.2}

6. Explain about distribution and density functions of a binomial random variable with neat sketches?
7. A binary source generates digits 0 & 1 randomly with probabilities 0.6 and 0.4 respectively. What is the probability that two 1's and three 0's will occur in a five-digit sequence?

   Hint: let x be the random variable denoting the number of 1's generated five-digit sequence.

UNIT- 2

1. State Chebyshev's inequality and prove it?
2. Find the relationship between fx(X) and fy(Y) if Y=ax+b?
3. State and prove the properties of the characteristic function of a random variable?
4. What is meant by expectation? State and prove its properties?
5. Find the second central moment of a random variable with PDF

FX(X) =aexp (-ax) u(x)?

6. Write notes on monotonic transformations for a continuous random variable.

7. Let Y= x^2 find FY(Y) if x=N (0, 1)?

UNIT-3

1. What is the probability density function of sum of two random variables?
2. Define correlation coefficient of joint random variable and marginal probability density functions?
3. Explain central limit theorem with equal and unequal distributions?
4. List all the properties of jointly Gaussian random variables?
5. Let X and Y be defined by $X=\cos\theta$ and $Y=\sin\theta$ where θ is a random variable uniformly distributed over $[0, 2\pi]$; show that X and Y are not independent?
6. Write notes on linear transformation of a Gaussian random variable.

UNIT-4

1. Explain stationary and ergodic random process?
2. What is auto correlation and cross correlation. List out its properties?
3. Give the classification of random process?
4. Given a random process x (t) =kt, where k is a random variable uniformly distributed over $(0,2\pi)$, show that x and y are not independent?
5. State the conditions for a wss random process?
6. A random process is described by $x(t)= A^2\cos^2(w_c t+\theta)$.A and w_c are constants and θ is a random variable uniformly distributed between $\pm\pi$. is x(t) a wide sense stationary?
7. Define 1) covariance – stationary random process?

   2) Auto correlation – stationary random process?

UNIT-5

1. If $R_{yy}(\square)=R_{xx}(\square)\cos(W_c\square)$,determine $S_{yy}(w)$?
2. Find whether given power spectrum, $S_{yy}(w)=\cos^2(w)\exp(-8w^2)$ is valid or not?
3. Define cross power density spectrum and list out its properties?
4. Consider the random process $x(t)=\cos(w_o t+\theta)$ is wss.if it is assumed that w_c is a constant and θ is uniformly distributed on the interval $(0,2\pi)$?
5. The PSD of x(t) is given by $s_{xx}(w)=\begin{cases}1+w^2 & \text{for } |w|<1\\ 0 & otherwise\end{cases}$

6.show that the power spectrum of a real random process x(t) is real?

7.state and prove wiener-khinchin relation?

1. List out the properties of band limited random process.

2. Find output response of cross correlation when random process x (t) is applied to a LTI system having input response h (t)?

3. Derive the expression for effective noise temperature of a cascaded system in terms of its individual input noise temperature?

4. Write short notes on the following: Also, draw its power spectrum.

   1) Band limited white noise

   2) Thermal noise.

5. Find output response of auto correlation when random process X (t) is applied to an LTI system having input response h (t)?

6. Define generalized nyquist theorem?

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

TAMARAM, MAKAVARAPALEM, NARSIPATNAM

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Subject: RANDAM VARIABLES & STOCHASTIC PROCESSES

Branch: ECE II year I sem.

CURRICULAR GAPS

Process:

The concerned faculty will verify the syllabus and suggest the missing contents and they will approach the senor faculties of the department to go through the syllabus prescribed the university in detail

Curricular gaps:

SNO	DESCRIPTION
1	Probability theory
2	Rectangular destructive functions
3	Applications of RVSP in signal processing and communication systems
4	Some other topics in noise like addition of noise due to several amplifiers, equivalent noise temperature of cascaded stages.

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Subject: RANDAM VARIABLES & STOCHASTIC PROCESSES

Branch: ECE II year II sem.

TOPICS BEYOND THE SYLLABUS

1	Applications of PTSP in signal processing and communication systems
2	Rectangular destructive functions

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY, TAMARAM, MAKAVARAPALEM MANDAL, VISAKHA DIST

II B.TECH (19 ADMITTED BATCH) I SEM RESULTS MARCH 2021

Branch	Appeared	Passed	Failed	Pass %
ECE-I	82	31	51	38
CSE-I	50	17	33	34
CSE-II	52	10	42	20
EEE	50	19	31	38
MEC-I	50	12	38	24
MEC-II	50	14	36	28
OVERALL PERCENTAGE	334	103	231	30.84

ECE - I		38%			
Subject	Faculty	Appeared	Passed	Failed	Pass %
MEFA	P Ganesh	82	70	12	85
E&DC	E Govinda	82	61	21	74
STLD	Madhavai	82	58	24	71
S&S	K Dhilli	82	63	19	77
RVSP	R Prasad Rao	82	46	36	56
OOPS	Ch Dhanalakshmi	82	66	16	80

CSE-I		34%			
Subject	Faculty	Appeared	Passed	Failed	Pass %
MFCS	V Trinadh	50	29	21	58
SE	N V Ashok Kumar	50	40	10	80
PP	M Chiranjeevi	50	32	18	64
DS	Ch Dhanalakshmi	50	40	10	80
OOPS TH	B Ganesh	50	23	27	46
CO	K Varaprasad	50	29	21	58

CSE-II		20			
Subject	Faculty	Appeared	Passed	Failed	Pass %
MFCS	V Trinadh	50	21	29	42
SE	N V Ashok Kumar	50	31	19	62
PP	M Chiranjeevi	50	23	27	46
DS	Ch Dhanalakshmi	50	32	18	64
OOPS	B Ganesh	50	20	30	40
CO	K Varaprasad	50	22	28	44

EEE		38%			
Subject	Faculty	Appeared	Passed	Failed	Pass %
ECA-II	K Narayana Rao	50	35	15	70
EM-I	P anil Kumar	50	40	10	80
E&DC	K Dhilli	50	43	7	86
EMF	P Varahaladora	50	26	24	52
T&HPM	A N S S Surya Prakash	50	42	8	84
ME&FA	P Ganesh	50	43	7	86

MEC-I		24%			
Subject	Faculty	Appeared	Passed	Failed	Pass %
VC&FT	M Santhoshkumar	50	32	18	64
MOS	P Ramakrish	50	26	24	52
MS&M	Dr. Ch Suresh	50	35	15	70
PT	L Ramakrishna	50	30	20	60
TD	Y RK Prasanna	50	33	17	66
MD	J T Chinna Rao	50	35	15	70

MEC-II		28%			
Subject	Faculty	Appeared	Passed	Failed	Pass %
VC&FT	M Santhoshkumar	50	29	21	58
MOS	P Ramakrish	50	35	15	70
MS&M	Dr. Ch Suresh	50	33	17	66
PT	L Ramakrishna	50	31	19	62
TD	Y RK Prasanna	50	36	14	72
MD	J T Chinna Rao	50	36	14	72

PRINCIPAL

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

TAMARAM, MAKAVARAPALEM, VISAKHAPATNAM

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE LEARNING OUTCOMES – CORRECTIVE MEASURES

ACADEMIC YEAR: 2020-21

II B.TECH – I SEM ECE

S. No	Name of the Subject	Outcomes Assessment on 5 Point Scale	Corrective Measures
1.	Electronic Circuit Analysis	C6-4.06	
		C7-3.91	Practice on FET analysis circuits and problems
		C8-3.93	
		C9-3.94	
		C10-4.11	
2.	Management Science	Co11-3.92	
		C12-3.60	Assignments on concepts of operation and project management
		C13-3.92	
		C14-3.92	
		C15-4.13	
		C16-3.97	
3.	Random Variables & Stochastic Processes	C17-3.69	Problems practice on appropriate sample space in probabilities.
		C18-3.79	
		C19-3.79	
		C20-3.94	
		C21-3.92	
4.	Switching Theory & Logic Design	C22-3.97	
		C23-3.92	
		C24-3.94	
		C25-3.89	Assignments and practice of sequential circuits
5.	EM Waves and Transmission Lines	C26-3.97	
		C27-3.89	
		C28-3.79	
		C29-3.79	
		C30-3.75	Assignments on maxwell's equations
		C31-3.94	
7	Analog Communications	C32-4.04	
		C33-3.94	
		C34-3.92	Assignments on various analog and

			digital modulation techniques
		C35-3.97	
		C36-4.05	

In-Charge

HOD, ECE

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

LOG BOOK

me of the staff Member ...R...PRASADRAO.....Course.....ECE..... Subject .....R.V.S.P.....

Day & Date	No. of Periods	Cumulative No. of Periods	Topic (s) Covered in the Class
21/11	1	1 I UNIT	THE Random Variable: Introduction, Definition
23/11	1	2	& a R.V, Conditions for a function to be a R.V,
24/11	1	3	Discrete, Continuous and Mixed random Variable
28/11	1	4	Cumulative distribution and density functi
29/11	1	5	and its properties, solve problems in above topi
1/12	1	6	Explained Gaussian distribution and density function
2/12	1	7	Explained Binomial and poisson distributions
5/12	1	8	Explained uniform and exponential distribut
6/12	1	9	and density functions
8/12	1	10	Explained Rayleigh distribution and density funct
9/12	1	11	and density function
10/12	1	12	Explained conditional distribution and
10/12	1	13 II unit	density function and its properties, solve proble
13/12	1	14	solve previous paper problems in above topic
15/12	1	15	Solve previous paper problems in above top
16/12	1	16	Operation on one R.V- Expectations: Introduct
17/12	1	17	Expected value of a R.V, function of a R.V, and its
19/12	1	18	Explained Moments about origin and Central Moment
20/12	1	19	properties
20/12	1	20	Explained Variance and Skew, its properties
23/12	1	21	Explained chebychev's, chernoff's, Markov's
24/12	1	22	inequalit
24/12	1	23	Explained characteristic function and its properti
27/12	1	24	Explained Moment generating function and its
29/12	1	25 III unit	properties
30/12	1	26	Transformations of a R.V: Monotonic transfo
31/12	1	27	-mations for Continuous R.V, Non Monotonic transfo
2/1	1	28	& continuous R.V
3/1	1	29	Solve previous paper problems in above topi
5/1	1	30	Solve previous paper problems in above to
6/1	1	31	Solve previous paper problems in above t
7/1	1	32	Multiple R.V: Vector R.V, Joint distributio
9/1	1	33	and density function, and its properti
10/1	1	34	Marginal distribution, Conditional distribution
24/1	1	35	and density function, its properties, statistical
27/1	1	36	independen
28/1	1	37	Sum of Two R.V, Sum of Several R.V, Centra
28/1	1	38	limit Theorem: unequal and equal distributio
			solve problems in above topic
			Joint moments about origin, Joint Central momen
			Joint characteristic function, its properti
			Jointly Gaussian R.V: Two R.V case, N R.V
			Case, properties, Transformation & Multiple R.V
			Linear transformations & Gaussian R.V
			Solve previous paper problems in above
			Solve previous paper problems in above topics

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LOG BOOK

Name of the staff Member ..... Course..... Subject ..... ne

Day & Date	No. of Periods	Cumulative No. of Periods	Topic (s) Covered in the Class	Da & Dat
30/1	1	39	IV unit) Random Processes - Temporal characteristics:	
31/1	1	40	The R.P concept, classification & processes, Deterministic and non deterministic, Distribution and density functions	
2/2	1	41	Concept & stationarity and independence, First order, Second order, wide sense stationarity, Nth order and strict sense stationarity	
3/2	1	42		
4/2	1	43	Time averages and Ergodicity, problems	
6/2	1	44	Autocorrelation function and its properties	
7/2	1	45	Cross Correlation function and its properties	
9/2	1	46	Covariance function, Correlation coefficient	
10/2	1	47	Explained Gaussian and poisson R.P and its property	
11/2	1	48	solve problems in above topic	
13/2	1	49	Solve previous paper problems in above topic	
14/2	1	50	V unit) R.P - Spectral characteristics: Rayleigh theorem	
18/2	1	51	power density spectrum and its properties	
20/2	1	52	Relationship b/w power spectrum and Autocorrelation	
21/2	1	53	Cross power density spectrum and its properties	
22/2	1	54	Relationship b/w cross PSD and Cross Correlation	
23/2	1	55	Solve problems in above topic	
25/2	1	56	Solve previous paper problems in above topic	
27/2	1	57	VI unit) Linear systems with Random inputs: Response	
2/3	1	58	& linear system: System response, Mean and mean squared value & response,	
3/3	1	59	Autocorrelation & system response, Cross correlation & Input and output	
4/3	1	60	Spectral characteristics & Response: PSD	
8/3	1	61	& response, Cross PSD & input and output	
11/3	1	62	Band pass, band limited, Narrow band process	
13/3	1	63	classification & Noise and properties	
14/3	1	64	Explained Resistive (Thermal) Noise source	
15/3	1	65	Explained Noise power, Noise temperature,	
17/3	1	66	S/N ratio, power gain, Noise B.W, effective	
18/3	1	67	Explained Noise figure, Addition & input noise temperature	
21/3	1	68	Noise figure & Cascaded networks.	
22/3	1	69	Addition noise due to several Amp. temperature	
25/3	1	70	solve problems in above topic.	

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

Tamaram, Makavarapalem, Narsipatnam Revenue Division, Visakhapatnam Dist-531113.

Addl. Code No.

Total Marks: 13/20

MAIN ANSWER SHEET

MID EXAMINATION - I / II / III / IV Semester: I / II / III / IV / V

COURSES : B.Tech / MBA / M.Tech.

	Section A			Section B	
Q.No.	1	2	3	4	5
Marks					

Name: K. pavani Subject: RVSP Date: 30.10.2021

Year & Branch: 2nd E.C.E No. of Additionals: 1 Roll No. 208154041 7

Signature of the Invigilator: P. pavani 30/10/21

Ans (a) Cumulative Distribution function :-

If x is the random variable, then $P[X \leq x]$ it is the cumulative distribution function and x is denoted as $f_x(x)$.

$$f_x(x) = P[X \leq x]$$

properties of CDF :-

1. $f_x(x)$ is a non-decreasing function i.e $x_1 < x_2$ when $f_x(x_1) < f_x(x_2)$
2. $f_x(-\infty) = 0$
3. $f_x(+\infty) = 1$
4. $0 \leq F_x \leq 1$ since $f_x(x)$ is a probability function
5. If x is a discrete random variable taking the values $x_1, x_2 \ldots x_n$ where $x_1 < x_2 \ldots x_{i-1} < x_i \ldots x_n$
6. $P(x \geq x)$ i.e $f_x(x) = P[x \leq x]$
7. $P[x_1 < x \leq x_2]$ i.e $f_x(x_1) < P_x(x_2)$

AVANTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

Tamaram, Makavarapalem, Narsipatnam Revenue Division, Visakhapatnam Dist-531113.

Addl Code No

Total Marks 17/20

MAIN ANSWER SHEET

MID EXAMINATION - I / II / III / IV Semester: I / II / III / IV / V

COURSES : B.Tech / MBA / M.Tech.

	Section A			Section B	
Q.No.	1	2	3	4	5
Marks					

Name B. Leena Shri Subject: RVSP Date

Year & Branch ECE No. of Additionals Roll No. 20815A0407

Signature of the Invigilator :

Answers

16 Am

a) * properties of cumulative distribution function:

① x is a constant random variable

$$\frac{d}{dx} F_x(x) = f_x(x)$$

② $F_x(x)$ is a non-decreasing function of x

$x_1 < x_2$

$F_x(x_1) \leq F_x(x_2)$

③ $F_x(x) = -\alpha$

$F_x(-\alpha) = 0$

$P(x \leq -\alpha)$

④ $F_x(x) = +\alpha$

$F_x(+\alpha) = 1$

$\therefore P(S) = 1$

$P(x \leq +\alpha)$

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of ECE

Year & Semester – II & I

Subject – RVSP

List of Advanced Learners

S.NO	ROLL NO.	NAME OF THE STUDENT
1	19811A0412	C KUSUMA LATHA
2	19811A0450	T PAVANI
3	20815A0420	M DIVYA SREE
4	20815A0427	S KUSUMA KUMARI
5	19811A0402	ALLU ROOPA
6	19811A0406	B BHAVANA
7	19811A0407	B SAMU SRI
8	19811A0417	G DIVYA JYOTHI
9	19811A0420	G TEJASWI
10	19811A0423	K SAI SRI
11	19811A0426	K KRISHNA KUMAR
12	19811A0434	N MANASA
13	19811A0435	P DEVI
14	19811A0441	R HEERA VANI
15	20815A0422	R RAMYA RANI

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of ECE

Year & Semester – II & I

Subject – RVSP

List of Advanced Learners

S.NO	ROLL NO.	NAME OF THE STUDENT	Additional Content Delivered
1	ROLL NO.	NAME OF THE STUDENT	PROBABILITY THEORY
2	19811A0412	C KUSUMA LATHA	
3	19811A0450	T PAVANI	CONDITIONAL & JOINT PROBABILITY
4	20815A0420	M DIVYA SREE	
5	20815A0427	S KUSUMA KUMARI	TOTAL PROBABILITY AND BAYE'S THEOREM
6	19811A0402	ALLU ROOPA	
7	19811A0406	B BHAVANA	INDEPENDENDENT EVENTS, PERMUTATIONS
8	19811A0407	B SAMU SRI	COMBINATIONS, BERNOULLI TRAILS
9	19811A0417	G DIVYA JYOTHI	
10	19811A0420	G TEJASWI	CLASSIFICATION OF NOISE
11	19811A0423	K SAI SRI	OUTPUT NOISE POWER
12	19811A0426	K KRISHNA KUMAR	SYSTEM NOISE POWER
13	19811A0434	N MANASA	ADDITION OF NOISE DUE TO SEVERAL AMPLIFIERS IN CASCADE
14	19811A0435	P DEVI	EQUIVLALENT NOISE TEMPERATURE
15	19811A0441	R HEERA VANI	APPLICATION OF RVSP IN SP & CS
16	20815A0422	R RAMYA RANI	

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of ECE

Year & Semester – II & I

Subject – RVSP

List of Weak Students

S.NO	ROLL NO.	NAME OF THE STUDENT
1	19811A0408	B VINITH
2	19811A0410	C PRADEEP CHANDRA
3	19811A0413	C BALAJI
4	19811A0414	D SNEHA
5	19811A0415	D GOPAL RAJU
6	19811A0418	G BHARATH KUMAR
7	19811A0421	K PYDI RAJU
8	19811A0423	K SAI SHREE
9	19811A0424	K S K NAIDU
10	19811A0426	K KRISHNA KUMAR
11	19811A0432	N MAHALAXMI
12	19811A0433	N GANESH
13	19811A0440	P PAVAN KALYAN
14	19811A0447	T MOHAN VASANTH KUMAR
15	19811A0448	T NANI
16	19811A0449	T TARUN
17	19811A0452	V KIRAN
18	20815A0402	K DHARANI
19	20815A0409	G DEEPIKA
20	20815A0412	G POORNIMA
21	20815A0413	J VASAVI
22	20815A0414	K SONY
23	20815A0416	K DIVYA SREE
24	20815A0424	S MOUNIKA
25	20815A0425	SK MD ZUBAIR
26	20815A0429	V KIRAN KUMAR
27	20815A0430	K NOOKA RAJU
28	20815A0431	L GIRIDHAR

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of ECE

Year & Semester – II & I

Subject – RVSP

List of Weak Students

S.NO	ROLL NO.	NAME OF THE STUDENT	8/2/21	10/2/21	12/2/	15/2/	17/2/	19/2/	22/2/	24/2	26/2	1/3	5/3	10/3
1	19811A0408	B VINITH	1	2	3	4	5	A	6	7	8	9	10	11
2	19811A0410	C PRADEEP CHANDRA	1	2	3	A	4	5	6	7	8	9	10	11
3	19811A0413	C BALAJI	1	2	3	4	5	6	7	8	9	10	11	12
4	19811A0414	D SNEHA	1	2	3	4	5	6	7	A	8	9	10	11
5	19811A0415	D GOPAL RAJU	A	1	2	3	4	A	5	6	7	8	9	10
6	19811A0418	G BHARATH KUMAR	1	2	A	3	4	5	6	7	8	9	10	11
7	19811A0421	K PYDI RAJU	1	A	2	3	4	5	A	6	7	8	9	10
8	19811A0423	K SAI SHREE	1	2	3	4	5	6	7	8	9	10	11	12
9	19811A0424	K S K NAIDU	1	2	3	4	A	5	6	7	8	9	10	11
10	19811A0426	K KRISHNA KUMAR	1	2	3	4	5	6	7	8	9	10	A	A
11	19811A0432	N MAHALAXMI	1	2	3	A	4	5	6	7	8	9	10	11
12	19811A0433	N GANESH	1	2	3	4	5	6	7	8	9	10	11	12
13	19811A0440	P PAVAN KALYAN	1	2	3	4	5	6	A	7	8	9	10	11
14	19811A0447	T MOHAN VASANTH KUMAR	1	A	A	2	3	A	4	5	6	7	8	9
15	19811A0448	T NANI	1	2	3	4	5	6	7	8	9	10	11	12
16	19811A0449	T TARUN	1	2	3	4	5	6	7	8	9	10	11	A
17	19811A0452	V KIRAN	A	A	1	2	3	4	5	6	7	8	9	10
18	20815A0402	K DHARANI	1	2	3	A	4	5	6	7	8	9	10	11
19	20815A0409	G DEEPIKA	A	1	2	3	4	5	6	7	8	9	A	10
20	20815A0412	G POORNIMA	1	2	3	4	5	6	7	8	9	10	11	12
21	20815A0413	J VASAVI	1	2	A	3	4	5	6	7	8	9	10	11
22	20815A0414	K SONY	1	2	3	4	5	6	7	8	9	10	11	12
23	20815A0416	K DIVYA SREE	1	2	3	4	5	6	7	8	9	10	11	A
24	20815A0424	S MOUNIKA	1	2	3	4	5	6	7	8	9	10	11	12
25	20815A0425	SK MD ZUBAIR	1	2	3	4	5	6	7	8	9	10	11	12
26	20815A0429	V KIRAN KUMAR	1	2	3	A	4	5	6	7	8	9	10	11
27	20815A0430	K NOOKA RAJU	A	1	2	3	4	5	6	7	8	9	10	A
28	20815A0431	L GIRIDHAR	1	2	3	4	5	6	7	8	9	10	11	12

I Chapter : probability

1.1 Introduction: The formal study of the theory of probability began in the seventeenth century when two great french mathematicians, Blaise Pascal and Pierre de Fermat, corresponded over two problems in games of chance.

The theory of probability deals with averages of mass phenomena occuring sequentially or simultaneously : electron emission, telephone calls, radar detection, quality control, system failure, games of chance, statistical mechanics, turbulence, noise, birth and death rates, and queueing theory, among many others.

This chapter explains set theory and probability theory.

1.2 set theory :

(i) **Set** : A set is a collection of objects. The objects are called elements of the set. So a set can be represented by $A = \{x_1, x_2, x_3 \ldots x_n\}$, where A is a set, $x_1, x_2, x_3 \ldots x_n$ are elements. Thus, if x is an element of set A, then we write

$$x \in A \longrightarrow (1.1)$$

If x is not an element of A, we write

$$x \notin A \longrightarrow (1.2)$$

(ii) **Null set** : A set is said to be empty if it has no elements. The empty set is given the symbol ϕ and it is also called null set.

(iii) **Finite set** : A finite set has either empty or a finite number of elements. If the set has an infinite number of elements, it is called an infinite set.

(iv) **Subset** : If every element of a set A is also an element in another set B. A is said to be contained in B. A is known as a subset of B and we write

$$A \subseteq B \quad (1.3)$$

(v) **Disjoint sets** : Two sets A and B are said to be disjoint or mutually exclusive, if they have no common elements.

For example $A = \{1, 3, 5, 7\}$, $B = \{2, 4, 6, 8\}$ are disjoint sets.