RAGHU ENGINEERING COLLEGE (Autonomous)

(Approved by AICTE, New Delhi & Permanently Affiliated to JNTUGV, Vizianagaram)
NBA and NAAC 'A+' grade accredited Institute.
Dakamarri, Bheemili Mandal, Visakhapatnam – 531162, A.P.
Phone: 08922-248001 / 221122/9963981111, www.raghuenggcollege.com

INSTITUTE VISION

Envisioning to be a world class technical institution by synergizing quality education with ethical values.

INSTITUTE MISSION

- To encourage training and research in cutting-edge technologies.
- To develop and strengthen strategic links with the industry.
- To kindle the zeal among the students and promote their quest for academic excellence.
- To encourage extra-curricular activities along with good communication skills.

QUALITY POLICY

RAGHU Engineering College underscores ethical values along with innovative teaching through an interactive, activity-based pedagogy; establishes the best of infrastructural facilities, inculcates engineering temper among the students through the use of the latest Information and Communication Technologies, and strives for an efficient, responsive and transparent administration in all areas.

Department of Electronics and Communication Engineering

VISION

To grow into a premier engineering department with excellence in teaching, research, and innovation in the field of electronics and communication engineering at par with the global industrial standards catering to the needs of the stakeholders while keeping up with the advancing technology.

MISSION

- M1: To provide excellence in education, research and public services.
- M2: To provide a creative environment through structured teaching and learning process.
- M3:To impart employability-focused education while imbibing the spirit of entrepreneurship.
- M4: To inculcate self-learning attitude, management skills and professional ethics.

PROGRAMME EDUCTIONAL OBJECTIVES (PEOs)
● **PEO 1: Domain Knowledge: -** To have the knowledge and technical skills required to remain productive. ● **PEO 2: Communication Skills & Employability: -** To apply technical knowledge and skills as electronics and communication engineers to provide practical solutions in industrial and governmental organizations. ● **PEO 3: Life Long Learning & Social Concern: -** To achieve success with awareness of entrepreneurship skills and have the ability for lifelong learning by pursuing professional development to meet the emerging and evolving demands for a successful career.

MAPPING OF MISSION STATEMENTS WITH PEOs

MS/PEOs	PEO 1	PEO 2	PEO 3
MS 1	3	2	2
MS 2	3	3	2
MS 3	3	2	3
MS 4	2	3	3

1-Slight , **2**- Moderate, **3**- Substantial

PROGRAM OUTCOMES	
Graduates of Electrical and Electronics Engineering Will:	
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PROGRAM SPECIFIC OUTCOMES (PSOs)	
PSO 1: Understand and apply the fundamental concepts of Basic and Engineering Sciences for appropriate up-skilling in the fast-emerging fields of Signal Processing, Image Processing, Communication, Networking, VLSI, Embedded Systems, Analog and Digital Technologies to meet the futuristic industrial achievements.	
PSO 2: Apply latest hardware and software tools to solve complex electronics and communication engineering problems along with analytical skills to derive appropriate solutions in the real time applications across varied business and administrative functions.	

Mapping of PEOs with POs and PSOs

PEO/PO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
PEO 1	3	3	3	2	2						1	1	3	1
PEO 2	2	3	3	2			2	2		3			3	3
PEO 3						1	1	1	1	2	1	3	3	1

1-Slight **, 2-** Moderate**, 3-** Substantial

23ES108– Probability Theory and Stochastic Processes							
Programme &Branch	**B.Tech & ECE**	**Sem**	**Category**	**L**	**T**	**P**	**Credits**
Prerequisites	**Linear Algebra and Calculus, Differential Equations & Vector Calculus**	**3**	**Engineering Science**	**2**	**0**	**0**	**2**

Course Objectives:

1. To provide mathematical background of probability and basic understanding of random variables.
2. To study the operations on random variables.
3. To explain the concepts of multiple random variables and operations that may be performed on multiple random variables.
4. To understand the concepts of stochastic process and its temporal & spectral characteristics
5. To know the concepts of Noise in Communication systems.

Preamble:	This course provides the fundamental tools and concepts that support many advanced topics in the field, including signal processing, communications, control systems, and machine learning. Probability theory forms the mathematical foundation for modeling and analyzing systems affected by randomness. Stochastic processes extend these ideas to model sequences of random events, offering a framework for understanding phenomena that evolve over time.

Course Contents:

Unit-1	**Probability & Random Variable**	Contact Hours: 8

Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events. Random Variable: Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable.

Unit-2	**Distribution & Density Functions and Operation on One Random Variable**	Contact Hours: 9

Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

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 and Non-monotonic Transformations.

Unit-3	Multiple Random Variables and Operations	Contact Hours: 9

Multiple Random Variables: Joint Distribution and density Functions and their Properties, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density, Statistical Independence. Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem (proof not required)

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables, properties.

Unit-4	Stochastic Processes	Contact Hours: 9

Temporal Characteristics: The Stochastic 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.

Spectral Characteristics: Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties.

Unit-5	Noise Sources	Contact Hours: 8

Introduction, Classification, White noise or White Gaussian noise, Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow band noise and its properties.

Total Hours: 43

Text Books:

1	Probability, Random Variables & Random Signal Principles – Peyton Z. Peebles, Tata McGraw Hill, Fourth Edition, 2001.
2	Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S.Unnikrishnan, Prentice Hall of India, Fourth Edition, 2002.
3	Probability theory and stochastic process – Y. Mallikarjuna Reddy, Universities Press, Fourth edition.

Reference Books:

1	Probability Theory and Stochastic Processes – B. Prabhakara Rao, BS Publications.
2	Probability and Random Processes with Applications to Signal Processing – Henry Stark and John W. Woods, Pearson Education, Third Edition.
3	Probability Theory and Random Processes – P. Ramesh Babu, McGraw Hill, 2015.

Web References:

1	https://onlinecourses.nptel.ac.in/noc21_ma66/preview
2	https://ocw.mit.edu/courses/res-6-012-introduction-to-probability-spring-2018/resources/stochastic-processes/
3	https://www.youtube.com/watch?v=zqLjwDAXiKE&list=PLBH9ZHwfJyk_bTAEyAxnn9m8uMSjtFfyY

COURSE OUTCOMES: Upon completion of the course, students shall have ability to		**BT Mapped** (Highest Level)
CO 1	Compute simple probabilities using an appropriate sample space.	L3
CO 2	Compute probabilities and expectations from probability density functions.	L3
CO 3	Translate one random variable to multiple random variables	L2
CO 4	Determine the Spectral and temporal characteristics of Stochastic processes	L3
CO 5	Understand the concepts of Noise in Communication systems.	L2

Mapping of Cos with POs and PSOs:

COs/POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO 1	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO 2	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO 3	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO 4	3	3	1		-	-	-	-	-	-	-	-	2	-
CO 5	2	2	-		-	-	-	-	-	-	-	-	1	-
1 – Slight, 2 – Moderate, 3 – Substantial														

ASSESSMENT PATERN - THEORY							
TEST	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total%**
MID-1	20	40	40				**100**
MID-2	10	10	40	40			**100**
SEE	15	15	30	40			**100**
***± 3% may be varied**							