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/ 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
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

2304106– Control Systems							
Programme &Branch	**B. Tech & ECE**	**Sem**	**Category**	**L**	**T**	**P**	**Credits**
Prerequisites	**Laplace Transforms, Differential Equations**	**4**	**Professional Core**	**3**	**0**	**0**	**3**

Course Objectives:

1. To introduce the concepts of open loop and closed loop systems, mathematical models of Mechanical and electrical systems and concepts of feedback.
2. To study the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system for necessary analysis.
3. To develop the acquaintance in analyzing the system response in time-domain and Frequency domain in terms of various performance indices.
4. To analyze the system in terms of absolute stability and relative stability by different approaches.
5. To design different control systems for different applications as per given specifications and introduce the concepts of state variable analysis and also the concepts of controllability and observability.

Preamble:	This course aims to develop the skills for mathematical modelling of various control systems and stability analysis using time domain and frequency domain approaches.

Course Contents:

Unit-1	**Introduction: Concepts of System, Control Systems**	Contact Hours: 8

Open Loop and closed loop control systems and their differences. Different examples of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models, Differential equations, Impulse Response and transfer functions. Translational and Rotational mechanical systems. Transfer Function of DC Servo motor - AC Servo Motor.

Unit-2	**Block diagram Algebra and Time Response Analysis**	Contact Hours: 10

Block diagram Algebra: Block diagram representation of systems considering electrical systems as examples -Block diagram algebra– Representation by Signal flow graph - Reduction using mason's gain formula.

Time Response Analysis: Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications –Steady state response - Steady state errors and error Constants**.**

Unit-3	**Stability Analysis**	Contact Hours: 9
The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability. Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.		
Unit-4	**Frequency response analysis**	Contact Hours: 9
Introduction, Correlation between time and frequency response, Polar Plots, Bode Plots, Nyquist Stability Criterion Compensation techniques – Lag, Lead, Lead-Lag Controllers design infrequency Domain, Basic Controllers – P, I, D, PI, PD, PID Controllers.		
Unit-5	**State Space Analysis**	Contact Hours: 9
State Space Analysis of Continuous Systems Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties –Concepts of Controllability and Observability.		
		Total Hours: 45

Text Books:	
1	Automatic Control Systems 8th edition – byB.C.Kuo – Johnwileyandson's,2003.
2	Control Systems Engineering– by I.J.Nagrathand M. Gopal, New Age International (P) Limited, Publishers, 2ndedition, 2007.
3	Modern Control Engineering – by Katsuhiko Ogata–Pearson Publications, 5th edition, 2015.
Reference Books:	
1	Control Systems by A. Nagoor kani, RBA publications, 3rd edition, 2017.
2	Control Systems by A. Anand kumar, PHI, 2nd Edition, 2014.
Web References:	
1	https://www.youtube.com/watch?v=HcLYoCmWOjI&list=PLBlnK6fEyqRhqzJT87LsdQKYZBC93ezDo
2	https://www.youtube.com/watch?v=5dJCEiGrJkE&list=PLBlnK6fEyqRhqzJT87LsdQKYZBC93ezDo&index=51
3	https://www.youtube.com/watch?v=j2QwTccMzto&list=PLBlnK6fEyqRhqzJT87LsdQKYZBC93ezDo&index=86

COURSE OUTCOMES: Upon completion of the course, students shall have ability to		**BT Mapped** (Highest Level)
CO 1	Understand the concepts of feedback and its advantages to various control system.	L2

CO 2	Understand the performance metrics to design the control system in time-domain and frequency domain.	L2
CO 3	Understand the Concept of stability and analyze Control systems for various applications using time-domain methods.	L2
CO 4	Analyze Control systems for various applications using frequency domain methods.	L4
CO 5	Analyze the control system using the state space approach and concepts of controllability, observability.	L4

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	2	-	-	-	-	-	-	-	-	-	-	3	-
CO 2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO 3	2	3	2	-	-	-	-	-	-	-	-	-	1	-
CO 4	2	3	1	-	-	-	-	-	-	-	-	-	2	-
CO 5	3	3	2	-	-	-	-	-	-	-	-	1	3	-
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	30	30	40				100
MID-2	20	20	30	30			100
SEE	10	10	80				100
*± 3% may be varied							