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

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 ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

"To produce Electrical and Electronics Engineers through quality education with exposure to state of art technology and innovation with ethical values"

MISSION

- M1 : Empowering students and professionals with state-of-art knowledge and Technological skills.
- M2 : To prepare students for higher studies and entrepreneurship.
- M3 : To impart essential skills of leadership, teamwork, communication and ethics among the students.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- **PEO 1:**
  Domain Knowledge:
  Graduates will have knowledge in basic science, mathematical tools and fundamental engineering stream with contemporary problem solving, critical analysis in Electrical and Electronics Engineering and its allied areas.

- **PEO 2:**
  Communication Skills & Employability:
  Graduates will have careers in the diversified sectors of electrical power industry, software industries and also encouraged for higher education and research.

- **PEO 3:**
  Life Long Learning & Social Concern:
  Graduates will be able to communicate effectively, adopt lifelong learning act with integrity and have inter personal skills needed to engage in, lead and nurture diverse teams with commitment to their ethical and social responsibilities.

MAPPING OF MISSION STATEMENTS WITH PEOs

MS/PEO	PEO 1	PEO 2	PEO 3
M1	3	3	2
M2	2	2	3
M3	2	3	2

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

PROGRAMME 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 modelling 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: On successful completion of the B. Tech. (EEE) Program, the graduates will be able to apply technical knowledge and usage of modern hardware & software tools related to Electrical and Electronics Engineering for solving real world problems.

PSO 2: On successful completion of the B. Tech. (EEE) Program, the graduates will be able to analyse, comprehend, design & develop Electrical subsystems/systems for a variety of engineering applications and thus demonstrating professional ethics and concern for societal wellbeing.

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	3									3	3
PEO 2						3	3	3	3	3	3		2	2
PEO 3									3	3		3	2	2

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

2302105 - CONTROL SYSTEMS

(Only for EEE)

Programme & Branch	B.Tech & EEE	Sem	Category	L	T	P	Credit
Prerequisites	Electrical Circuit Analysis-II	**4**	**PC**	**3**	**0**	**0**	**3**

Course Objectives:

1. To obtain the mathematical models of physical systems and derive transfer function.
2. To determine the time response of systems and analyze system stability.
3. To analyze system stability using frequency response methods.
4. To analyze controllers and compensators.
5. To obtain mathematical models of physical systems using state space approach and determine the response.

Preamble:	To provide an introduction and practice of control systems engineering. The knowledge emphasizes the practical application of the subject to the analysis and design of feedback control systems, various controllers and compensators.

Course Contents:

Unit-1	Mathematical Modelling of Control Systems	Contact Hours: 9

Classification of control systems - open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks- translational and rotational mechanical systems- block diagram reduction techniques – representation by signal flow graph – reduction using Mason's gain formula.

Unit-2	Time Response Analysis & Stability and Root Locus Technique	Contact Hours: 9

Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants.

The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function.

Unit-3	Frequency Response Analysis	Contact Hours: 9

Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram –Polar plots, Nyquist stability criterion- stability analysis using Bode plots (phase margin and gain margin).

Unit-4	Controllers and Compensators	Contact Hours: 9

Controllers: Introduction to controllers (P, PI, PID), Effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) proportional integral derivative (PID) systems.

Compensators: Introduction to Compensators, Lag, lead, lag-lead compensators - physical realization

Unit-5	State Space Analysis of LTI Systems	Contact Hours: 9

Concepts of state - state variables and state model - state space representation of transfer function: Controllable Canonical Form - Observable Canonical Form - Diagonal Canonical Form - diagonalization using linear transformation - solving the time invariant state equations State Transition Matrix and its properties- concepts of controllability and observability.

Total Hours: 45

Text Books:	
1	Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India, 5th edition, 2015.
2	Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 9th Edition,2014.
Reference Books:	
1	Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage International Publications, 7th Edition,2021.
2	Control Systems Engineering by Norman S. Nise, Wiley Publications, 7th edition.
Web References :	
1	https://archive.nptel.ac.in/courses/107/106/107106081/
2	https://archive.nptel.ac.in/courses/108/106/108106098/
3	https://nptelvideos.com/video.php?id=1423&c=14

COURSE OUTCOMES: Upon completion of the course, students shall have ability to		**BT Mapped** (Highest Level)
CO 1	Derive the transfer function of physical systems and determine overall transfer function using block diagram algebra and signal flow graphs.	3
CO 2	Obtain the time response of first and specifications of second order systems and determine error constants. Analyze the absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.	3
CO 3	Analyze the stability of LTI systems using frequency response methods.	3
CO 4	Analyze the effect of PID controllers and Lag, Lead, Lag-Lead compensators on system performance.	3
CO 5	Apply state space analysis concepts to represent physical systems as state models, derive transfer function and determine the response. Understand the concepts of controllability and observability	3

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	2	3	1										3	1
CO 2	2	3	1										3	1
CO 3	2	3	1										3	1
CO 4	2	3	3										3	1
CO 5	2	3	1										3	1
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

Assessment Pattern – Theory							
TEST	Remembering (K1)%	Understanding (K2)%	Applying (K3)%	Analyzing (K4)%	Evaluating (K5)%	Creating (K6)%	Total%
Mid-1	6	9	85				100
Mid-2	6	9	85				100
SEE	10	10	80				100
*± 3% may be varied							