POORNIMA
COLLEGE OF ENGINEERING

COURSE FILE

Name of faculty	**Dr. Jyoti Shukla**
Class	**Vth Sem Sec A**
Branch	**Electrical Engineering**
Course Code	**5EE4-03**
Course Name	**Control System**
Session	**2021-22**

Dr. Mahesh Bundele
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DEPARTMENT OF ELECTRICAL ENGINEERING

VISION

To be a model of excellence in Professional Education and Research by creating electrical engineers who are prepared for lifelong engagement in the rapidly changing fields and technologies with the ability to work in team.

MISSION

- ✓ To provide a dynamic environment of technical education wherein students learn in collaboration with others to develop knowledge of basic and engineering sciences.
- ✓ To identify and strengthen current thrust areas based upon informed perception of global societal issues in the electrical and allied branches.
- ✓ To develop human potential with intellectual capability who can become a good professional, researcher and lifelong learner.

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PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

PEO 1: Graduates will have the ability to formulate, analyze and apply design process using the basic knowledge of engineering and sciences to solve complex electrical engineering problems.

PEO 2: Graduates will exhibit quality of leadership, teamwork, time management, with a commitment towards addressing societal issues of equity, public and environmental safety using modern engineering tools.

PEO 3: Graduates will possess dynamic communication and have successful transition into a broad range of multi-disciplinary career options in industry, government and research as lifelong learner.

PROGRAM OUTCOMES (PO's)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
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.
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.
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.

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8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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 (PSO's)

PSO1: Graduate possesses the ability to apply fundamental knowledge of basic sciences, mathematics and computation to solve the problems in the field of electrical engineering for the benefit of society.

PSO2: Graduate possesses the ability to professionally communicate and ethically solve complex electrical engineering problems using modern engineering tools.

PSO3: Graduate possesses sound fundamental knowledge to be either employable or develop entrepreneurship in the emerging areas of renewable and green energy, electric and hybrid vehicles and smart grids and shall be susceptive to life- long learning.

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MAPPING OF KEY PHRASES OF THE INSTITUTES MISSION STATEMENT WITH THE KEY PHRASES OF INSTITUTES VISION STATEMENT

(Institution Mission Vs Institute Vision)

Key Phrases of the Mission Statement of the Institute	**Key Phrases of the Vision Statement of the Institute**		
	IV_1: To create knowledge based society with scientific temper	**IV_2:** Team spirit	**IV_3:** To face the global competitive challenges
IM_1: Skill based systems for effective delivery of knowledge	√		√
IM_2: To equip young professionals with dedication		√	√
IM_3: Excellence in all spheres of life	√		√

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MAPPING OF KEY PHRASES OF THE DEPARTMENTS VISION STATEMENT WITH THE KEY PHRASES OF INSTITUTES MISSION STATEMENT

(Department Vision Vs Institution Mission)

Key Phrases of the Vision Statement of the Department	**Key Phrases of the Mission Statement of the Institute**		
	IM_1: Skill based systems for effective delivery of knowledge	**IM_2:**To equip young professionals with dedication	**IM_3:** Excellence in all spheres of life
DV_1: To be a model of excellence in Professional Education	√	√	√
DV_2: Lifelong engagement in the rapidly changing fields	√		√
DV_3: The ability to work in team		√	√

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MAPPING OF KEY PHRASES OF THE DEPARTMENTS MISSION STATEMENT WITH THE KEY PHRASES OF DEPARTMENTS VISION STATEMENT

(Department Mission Vs Department Vision)

Key Phrases of the Mission Statement of the Department	**Key Phrases of the Vision Statement of the Department**		
	DV_1: To be a model of excellence in Professional Education	**DV_2:** Lifelong engagement in the rapidly changing fields	**DV_3:** The ability to work in team
DM_1: **D**ynamic environment of Technical Education, Collaborative learning	√	√	√
DM_2: Current thrust areas based on global societal needs	√	√	
DM_3: Good professional, researcher and lifelong learner	√	√	

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MAPPING OF PEOS WITH KEY PHRASES OF DEPARTMENTS MISSION STATEMENT

(PEO Vs Department Mission)

PEO Statements	Key Phrases of the Mission of the Department		
	DM1: Dynamic environment of Technical Education, Collaborative learning	**DM2:** Current thrust areas based on global societal needs	**DM3:** Good professional, researcher and lifelong learner
Graduates will have the ability to formulate, analyze and apply design process using the basic knowledge of engineering and sciences to solve complex electrical engineering problems.	√		√
Graduates will exhibit quality of leadership, teamwork, time management, with a commitment towards addressing societal issues of equity, public and environmental safety using modern engineering tools.	√	√	√
Graduates will possess dynamic communication and have successful transition into a broad range of multi-disciplinary career options in industry, government and research as lifelong learner.		√	√

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MAPPING OF PSO WITH KEY PHRASES OF DEPARTMENTS MISSION STATEMENT

(PSO Vs Department Mission)

PSO Statements	Key Phrases of the Mission of the Department		
	DM1: Dynamic environment of Technical Education, Collaborative learning	**DM2:** Current thrust areas based on global societal needs	**DM3:** Good professional, researcher and lifelong learner
PSO1: Graduate possesses the ability to apply fundamental knowledge of basic sciences, mathematics and computation to solve the problems in the field of electrical engineering for the benefit of society.	√	√	
PSO2: Graduate possesses the ability to professionally communicate and ethically solve complex electrical engineering problems using modern engineering tools.		√	√
PSO3: Graduate possesses sound fundamental knowledge to be either employable or develop entrepreneurship in the emerging areas of renewable and green energy, electric and hybrid vehicles and smart grids and shall be susceptive to life- long learning.	√	√	√

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MAPPING OF PEO WITH KEY PHRASES OF PO

(PEO Vs PO)

PO/PEO	1. Engineering knowledge:	2. Problem analysis:	3. Design/development of solutions:	4. Conduct investigations of complex problems:	5. Modern tool usage:	6. The engineer and society:	7. Environment and sustainability:	8. Ethics:	9. Individual and team work:	10. Communication:	11. Project management and finance:	12. Life-long learning:
PEO 1: Graduates will have the ability to formulate, analyze and apply design process using the basic knowledge of engineering and sciences to solve complex electrical engineering problems.	**3**	**3**	**3**	**2**								**2**
PEO 2: Graduates will exhibit quality of leadership, teamwork, time management, with a commitment towards addressing societal issues of equity, public and environmental safety using modern engineering tools.					**3**	**3**	**3**	**2**	**3**		**3**	**2**
PEO 3: Graduates will possess dynamic communication and have successful transition into a broad range of multi-disciplinary career options in industry, government and research as lifelong learner.									**2**	**3**	**2**	**3**

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MAPPING OF PSO WITH PEO

(PSO Vs PEO)

PSO/PEO	PSO1: Graduate possesses the ability to apply fundamental knowledge of basic sciences, mathematics and computation to solve the problems in the field of electrical engineering for the benefit of society.	PSO2: Graduate possesses the ability to professionally communicate and ethically solve complex electrical engineering problems using modern engineering tools.	PSO3: Graduate possesses sound fundamental knowledge to be either employable or develop entrepreneurship in the emerging areas of renewable and green energy, electric and hybrid vehicles and smart grids and shall be susceptive to life- long learning.
PEO 1: Graduates will have the ability to formulate, analyze and apply design process using the basic knowledge of engineering and sciences to solve complex electrical engineering problems.	**3**		**2**
PEO 2: Graduates will exhibit quality of leadership, teamwork, time management, with a commitment towards addressing societal issues of equity, public and environmental safety using modern engineering tools.		**3**	**1**
PEO 3: Graduates will possess dynamic communication and have successful transition into a broad range of multi-disciplinary career options in industry, government and research as lifelong learner.		**3**	**2**

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Control System (5EE4-03)
Course Outcomes

After completion of course,

CO1: Explain the fundamentals of open and closed loop control systems along with applications.

CO2: Solve analytical and design problems in time and frequency domain.

CO3: Examine the stability using Routh-Hurwitz criteria, Root-Locus, Nyquist stability criteria, Bode plot, polar plot

CO4: Analyze the response and state equation for stabilizing the analog and digital control systems.

CO5: Design the stable closed loop control systems using different stability condition.

Mapping of CO with PO

CO	Course Outcome	PO											
		1	2	3	4	5	6	7	8	9	10	11	12
CO 1	Explain the fundamentals of open and closed loop control systems along with applications.	3	2	-									
CO 2	Solve analytical and design problems in time and frequency domain.	3	3	-									
CO 3	Examine the stability using Routh-Hurwitz criteria, Root-Locus, Nyquist stability criteria, Bode plot, polar plot	3	3	3									
CO 4	Analyze the response and state equation for stabilizing the analog and digital control systems.	3	3	-									
CO 5	Design the stable closed loop control systems using different stability condition.	3	3	-									

Mapping of CO with PSO

CO	Course Outcome	PSO1	PSO2	PSO3
1	Explain the fundamentals of open and closed loop control systems along with applications.	2	1	-
2	Solve analytical and design problems in time and frequency domain.	2	1	-
3	Examine the stability using Routh-Hurwitz criteria, Root-Locus, Nyquist stability criteria, Bode plot, polar plot	2	1	1
4	Analyze the response and state equation for stabilizing the analog and digital control systems	2	1	-
5	Design the stable closed loop control systems using different stability condition.	2	1	-

1- Low, 2- Moderate, 3-Strong

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PO's Strongly Mapped:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: 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.

PO3: 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's Moderately Mapped:

PO2: 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.

PSO's Strongly Mapped:

Nil

PSO's Moderately Mapped:

PSO1: Graduate possesses the ability to apply fundamental knowledge of basic sciences, mathematics and computation to solve the problems in the field of electrical engineering for the benefit of society.

PSO's Low Mapped:

PSO2: Graduate possesses the ability to professionally communicate and ethically solve complex electrical engineering problems using modern engineering tools.

PSO3: Graduate possesses sound fundamental knowledge to be either employable or develop entrepreneurship in the emerging areas of renewable and green energy, electric and hybrid vehicles and smart grids and shall be susceptive to life- long learning.

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Time Table

Poornima College of Engineering								
Department of Electrical Engineering								
Dr. Jyoti Shukla								
Day/Time	**8:30-9:30**	**9:30-10:30**	**10:30-11:30**	**11:30-12:10**	**12:10-1:10**	**1:10-2:10**	**2:10-3:10**	**3:10-4:00**
Monday	OE	ACS LAB, A2, 7EE4-22, JS, AT-20B		L U N C H		ACS LAB, A1, 7EE4-22, JS, AT-20B		Project, 7EEPR ,IV-A
Tuesday	OE	ACS LAB, A2, 7EE4-22, JS, AT-20A				CS,5EE4-03, JS		
Wednesday	OE	CS,5EE4-03, JS			CS,5EE4-03, JS	ACS LAB, A1, 7EE4-22, JS, AT-20A		
Thursday		SP LAB, 5EE4-24, JS, A2, AT-20A			SP LAB, 5EE4-24, JS, A1, AT-20A			
Friday		SP LAB, 5EE4-24, JS, A3, AT-20A						
Saturday								

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RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year - V Semester: B.Tech. (Electrical Engineering)

5EE4-03: CONTROL SYSTEM

Credit: 3 Max. Marks: 150(IA:30, ETE:120)

3L+0T+0P End Term Exam: 3 Hours

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction to control problem** Industrial Control examples. Mathematical models of physical sys- tems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra	4
3	**Time Response Analysis:** Standard test signals. Time response of first and second order sys- tems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.	9
4	**Frequency-response analysis** Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.	6
5	**Introduction to Controller Design** Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers	10
6	**State variable Analysis** Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems	06
7	**Introduction to Optimal Control and Nonlinear Control** Performance Indices. Regulator problem, Tracking Problem. Nonlinearsystem–Basic concepts and analysis	05
	TOTAL	41

ABC Analysis
5EE4-03: Control System

Credit: 3
3L+0T+0P

Max. Marks: 150(IA:30, ETE:120)
End Term Exam:3Hours

S. No.	Category A	Category B	Category C
1	Objective, scope and outcome of the course.		
2	Block diagram algebra	Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback.	Industrial Control examples. Mathematical models of physical systems. Control hardware and their models.
3	Design specifications for second-order systems based on the time-response. Root-Locus technique. Construction of Root-loci.	Standard test signals. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis.	Time response of first and second order systems for standard test inputs. Application of initial and final value theorem.
4	Bode plots. Nyquist stability criterion.	Relationship between time and frequency response, Polar plots,	Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.
5	Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Analog and Digital implementation of controllers	Stability, steady-state accuracy, transient accuracy	Disturbance rejection, insensitivity and robustness of control systems. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs.
6	Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models oflinear discrete-time systems. Stability of linear discrete-time systems	Concepts of state variables. Eigenvalues and Stability Analysis. Concept of controllability and observability.	State space model. Diagonalization of State Matrix. Solution of state equations.
7	Tracking Problem. Nonlinear system–Basic concepts and analysis		Performance Indices. Regulator problem,

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SYLLABUS DEPLOYMENT

Campus: PCE **Course: B. Tech** **Class/Section: V Sem A** **Date: 9-12-2021**
Name of Faculty: Dr. Jyoti Shukla **Name of Subject: Control System** **Code: 5EE4-03**

S.No.	Lecture No.	Topics, Problems, Applications	CO/LO	Target Date of Coverage	Actual Date of Coverage	Ref. / Text Book With Page No.
1		**Introduction**				
	1	Objective, scope and outcome of the course		6/10/21	6/10/21	T1
2		**Introduction to control problem**				
	2	Lecture Introduction 2.1 Element of control system 2.1.1 Historical Background 2.1.2 Industrial Control system examples 2.1.3 Terminology Lecture Conclusion	1	8/10/21	8/10/21	T1
	3	Lecture Introduction 2.2 Mathematical models of physical systems 2.2.2 Mechanical systems 2.2.3 Electrical systems 2.2.3 Electronic systems 2.2.4 Thermal systems 2.2.5 Hydraulic systems 2.2.6 Chemical systems 2.2.7 Numerical Problems Lecture Conclusion	1	12/10/21	12/10/21	T1
	4	Lecture Introduction 2.3 Control hardware and their models.	4	15/10/21	15/10/21	T1

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		2.3.1 Explanation 2.3.2 Mathematical Model 2.3.3 Examples Lecture Conclusion				
	5	Lecture Introduction 2.4 Transfer function models of linear time-invariant systems. 2.4.1 Explanation 2.4.2 Study of examples 2.4.3 Scope of applicability Lecture Conclusion	2	19/10/21	19/10/21	T1
	6	Lecture Introduction 2.5 Open Loop System and Closed Loop System 2.5.1 Explanation 2.5.2 Applications 2.5.3 Examples 2.5.4 Advantages & Disadvantages 2.5.5 Open loop vs close loop system Lecture Conclusion	1	22/10/21	22/10/21	T1
	7	Lecture Introduction 2.6 Block Diagram 2.6.1 Block Diagram Reduction Techniques 2.6.2 Steps for drawing Block diagrams 2.6.2 Examples Lecture Conclusion	1	28/10/21	28/10/21	T1
3		**Time Response Analysis:**				
	9	Lecture Introduction 3.1.1 Standard test signals. 3.1.2 order and type of the system 3.1.3 Response of First order system with test signals Lecture Conclusion	3	9/11/21	9/11/21	T1
	10	Lecture Introduction 3.2.1 Response of Second order system with test signals 3.2.2 Time Response specifications Lecture Conclusion	2	10/11/21	10/11/21	T1

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	11	Lecture Introduction 3.3.1 Final and initial value theorem 3.3.2 Design Specification for second order system Lecture Conclusion	2	10/11/21	10/11/21	T1
	12	Lecture Introduction 3.4 BIBO Stability 3.4.1 Explanation 3.4.2 Significance 3.4.3 Rouths Hurwitz Criterion Lecture Conclusion	1	16/11/21	16/11/21	T1
	13	Lecture Introduction 3.5.1 Rouths Hurwitz Criterion with special cases 3.5.2 Absolute and Relative stability analysis 3.5.3 Significance Lecture Conclusion	3	18/11/21	18/11/21	T1
	14	Lecture Introduction 3.6 Root locus 3.6.1 Explanation 3.6.2 Rules to plot the root locus 3.6.3 Implementation of Root loci in designing	5	18/11/21	18/11/21	T1
	15	OBT		19/11/21	19/11/21	
4		**Frequency-response analysis**				
	16	Lecture Introduction 4.1.1 Introduction of Frequency response 4.1.2 Difference between time response and frequency response 4.3.3 Relationship between time and frequency response Lecture Conclusion	2	24/11/22	24/11/22	T1
	17	Lecture Introduction 4.2.1 Derivation of Resonant frequency, peak and Bandwidth 4.2.2 Polar plots Lecture Conclusion	3	29/11/21	29/11/21	T1

	18	Lecture Introduction 4.3 Bode plots Introduction 4.3.1 Procedure 4.3.2 Phase Margin & Gain Margin 4.3.3 Examples Lecture Conclusion	3	30/11/21	30/11/21	T1
	19	4.4 Nyquist stability criterion 4.4.1 Introduction & Definition 4.4.2 Procedure 4.4.3 Phase Margin & Gain Margin using Nyquist criterion 4.4.4 Examples	4	3/12/21	3/12/21	T1
	20	Lecture Introduction 4.5 Closed Loop Frequency Response 4.5.1 M Circles 4.5.2 N Circles Lecture Conclusion	4	7/12/21	7/12/21	T1
	21	Class Test		10/12/21	10/12/21	T1
5		**Introduction to Controller Design**				
	22	Lecture Introduction 5.1 steady-state accuracy, transient accuracy. 5.1.1 Static Error Coefficient 5.1.2 Static Position Error coefficient 5.1.3 Static Velocity Error coefficient 5.1.4 Static Acceleration Error coefficient 5.1.5 Dynamic Error Coefficient Lecture Conclusion	2	13/12/21	13/12/21	T1

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	23	Lecture Introduction 5.2 disturbance rejection, insensitivity, and robustness of control systems 5.2.1 Explanation 5.2.2 Transfer function Model with disturbance 5.2.3 Sensitivity analysis with respect to various parameters Lecture Conclusion	2	14/12/21	14/12/21	T1
	24	Lecture Introduction 5.3 Root-loci method of feedback controller design. 5.3.1 Explanation 5.3.2 Design problems Lecture Conclusion	2	15/12/21	15/12/21	T1
	25	Lecture Introduction 5.4 Design specifications in frequency-domain. Frequency-domain methods of design. 5.4.1 Explanation 5.4.2 Mathematical Expression Lecture Conclusion	2	15/12/21	15/12/21	T1
	26	Lecture Introduction 5.5 compensation 5.5.1 Arrangement 5.5.2 Types 5.5.2.1 Lag Compensator 5.5.3.2 Lead Compensator 5.5.2.3 Lag Lead Compensator Lecture Conclusion	2	20/12/21	20/12/21	T1
	27	Lecture Introduction 5.6 Controllers 5.6.1 Explanation 5.6.2 Proportional Controller 5.6.2.1 Statement 5.6.2.2 Advantages 5.6.2.3 Disadvantages 5.6.2.4 Application Lecture Conclusion	2	20/12/21	20/12/21	T1

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	28	Lecture Introduction 5.7 Integral Controller 5.7.1 Statement 5.7.2 Advantages 5.7.3 Disadvantages 5.7.4 Application Lecture Conclusion		21/12/21	21/12/21	T2
	29	Lecture Introduction 5.8 Derivative Controller 5.8.1 Statement 5.8.2 Advantages 5.8.3 Disadvantages 5.8.4 Application Lecture Conclusion	4	22/12/21	22/12/21	T2
	30	Lecture Introduction 5.9 PI, PD and PID Controller 5.9.1 Statement 5.9.2 Advantages 5.9.3 Disadvantages 5.9.4 Application Lecture Conclusion	5	22/12/21	22/12/21	T2
	31	Lecture Introduction 5.10 Analog and Digital implementation of controllers Lecture Conclusion	5	24/12/21	24/12/21	T2
	32	Quiz		24/12/21	24/12/21	
6		**State variable Analysis**				
	33	Lecture Introduction 6.1 Concepts of state variables analysis 6.1.1 Concepts of state variables. 6.1.2 State space model. 6.1.3 Writing state space equations of mechanical Lecture Conclusion	4	27/12/21	27/12/21	T1
	34	Lecture Introduction 6.2 State Space Representation using physical and phase variables 6.2.1 Comparison form of system representation 6.2.2 Block diagram	4	28/12/21	28/12/21	T1

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		representation of state model. 6.2.3 State space representation using canonical variables Lecture Conclusion				
	34	Lecture Introduction 6.3 Solution of state equations 6.3.1 Explanation 6.3.2 Mathematical Expression 6.3.3 Derivation of transfer function from state-model.	4	29/12/21	29/12/21	T1
	35	Lecture Introduction 6.4 Solution of State Equations 6.4.1 Diagonalization, 6.4.2 Eigenvalues and eigen vectors Lecture Conclusion	4	29/12/21	29/12/21	T1
	36	Lecture Introduction 6.5 Matrix exponential, State transition matrix 6.5.1 Properties of state transition matrix. 6.5.2 Computation of State Lecture Conclusion	1	4/1/22	4/1/22	T1
	37	Lecture Introduction 6.6 transition matrix concepts of controllability &observability 6.6.1 Explanation 6.6.2 Examples Lecture Conclusion	3	5/1/22	5/1/22	T1
	38	Lecture Introduction 6.7.1 transition matrix 6.7.2 concepts of controllability &observability 6.6.3 Examples Lecture Conclusion	3	11/1/22	11/1/22	T1
	39	Lecture Introduction 6.8.1 Pole placement by state feedback, 6.8.2 Ackerman's formula Lecture Conclusion	3	12/1/22	12/1/22	T1

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	40	Introduction 6.9 Discrete-time systems. 6.9.1 State-space models of linear discrete-time systems 6.9.2 Stability of linear discrete-time systems Lecture Conclusion		12/1/22	12/1/22	T1
7		**Introduction to Optimal Control and Nonlinear Control**				
	41	Lecture Introduction 7.1 Performance Indices. 7.1.1 Linear Performance index 7.1.2 Quadratic Performance index Lecture Conclusion	4	18/1/22	18/1/22	T2
	42	Lecture Introduction 7.2 Regulator problem 7.2.1 Explanation 7.2.2 Analysis Lecture Conclusion	4	19/1/22	19/1/22	T2
	43	Lecture Introduction 7.3 Tracking Problem. 7.3.1 Explanation 7.3.2 Analysis Lecture Conclusion	5	21/1/22	21/1/22	T2
	44	Lecture Introduction 7.4 Nonlinear system 7.4.1 Basic Concept 7.4.2 Analysis Lecture Conclusion	5	21/1/22	21/1/22	T2

- **T1:** Control System Engineering by I.J Nagrath and M.Gopal
- **T2:** Modern Control Engineering by Katsuhik Ogata,Pearson Education

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Session: 2021 -22(Odd Sem.)

COURSE: B.TECH **CLASS/SECTION: III YEAR /A**
NAME OF FACULTY: DR. JYOTI SHUKLA **BRANCH: ELECTRICAL ENGINEERING**

Zero Lecture

1) Name of Subject with Code : **Control System (5EE4-03)**
Course Nature (Compulsory/Elective): Compulsory

2). Self-Introduction:

a). Name: Dr. Jyoti Shukla
b). Qualification: B.Tech, M.Tech, PhD
c). Designation: Associate Professor
d). Research Area: *Renewable Energy, Power system*
e). E-mail Id: jyoti.shukla@poornima.org
f). Other details:

1. Areas of proficiency/expertise:
    1.1 Subjects taken:
        1.1.1 Power System
        1.1.2 Transmission and Distribution
        1.1.3 Soft Computing
        1.1.4 Control System
    1.2Laboratories Taken
        1.2.1 Electrical Machine Lab
        1.2.2 Electrical Circuit Lab

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1.2.3 Power system Lab

1.2.4 Power modeling and simulation Lab

1.3 Member of Professional Body

1.3.1 None

1.4Academic Proficiency

1.4.1 English

1.4.2 Hindi

1.5 Book Authored

None

1.6 Papers published in National/ International Conferences/ Journals

1.6.1 Published a paper on "**Power quality disturbances classification based on Gramian Angular Summation Field method and convolutional neural networks**", International Transactions on Electrical Energy Systems, 2021.

1.6.2 Published a paper on "**A comprehensive Review on Intelligent islanding detection techniques for renewable energy integrated power system**", International Journal of Energy Research, 2021.

1.6.3 Published a paper on "**Stochastic reconfiguration of distribution system considering stability correlated loads and renewable energy based DGs with varying penetration**", Sustainable Energy, Grids and Networks, vol. 23, Sep. 2020.

1.6.4 Published a paper on "**Stability constrained optimal distribution system reconfiguration considering uncertainties in correlated loads and distributed generations**", International Journal of Electrical Power & Energy Systems, vol. 99, Pages 121-133, Jan. 2018.

1.6.5 Published a paper on **"Consideration of small signal stability in multi-objective DS reconfiguration in the presence of distributed generation**," IET Generation, Transmission & Distribution, vol.11, no.1, pp.236-245, 2017.

1.6.6 Presented a paper on **"An analytical approach for optimal size of distributed generation unit**", at International Conference on Recent Advances and Innovations in Engineering (ICRAIE-2014), Jaipur, India, 2014.

3).Introduction of Students:

a) Students will be asked to introduce them covering the following points:

- Name
- Place to which he/she belongs
- Academic merit
- Percentage of marks in XII
- Merit in AIEEE
- Co-curricular activity
- Day scholar/Hosteller
- Medium in class XII: English/Hindi

b*). Records of students in 12th*

Sr. No.	Average	Name of student scored	Marks 60% above	Marks between 40%-60% (No. of	English Medium Students	Hindi Medium	No. of Hostellers	No. of Day Scholar

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	result of 12th	highest marks	(No. of students)	students)	(No.)	Students (No.)		

d). Methods of Evaluation

(i) I & II Mid-Term Examination.
(ii) Assignment / Tutorials / Lab Records.
(iii) Quiz (Objective) / Viva-Voce
(iv) OBT
(v) Class Test

4). A) Course Outcomes

CO1: Students will be able to classify types of electric drive systems based on nature of loads, control objectives, performance and reliability.

CO2: Students will be able to use power electronic techniques to control DC motor drive.

CO3: Students will be able to apply vector control technique to specify three phase induction motor characteristics.

CO4: Students will be able to design and develop power electronic based circuits for control strategy of slip ring motor.

B) Program Outcomes

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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.

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.

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.
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.

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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.

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.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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.

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.

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.

C) CO-PO Mapping

Mapping of CO with PO

CO	Course Outcome	PO											
		1	2	3	4	5	6	7	8	9	10	11	12
1	explain the fundamentals of open and closed loop control systems along with applications.	3	2										
2	solve analytical and design problems in time and frequency domain.	3	3										
3	examine the stability using Routh-Hurwitz criteria, Root-Locus, Nyquist stability criteria, Bode plot, polar plot	3	3	3									
4	analyze the response and state equation for stabilizing the analog and digital control systems.	3	3										

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5	design the stable closed loop control systems using different stability condition.	3												

Mapping of CO with PSO

CO	Course Outcome	PSO1	PSO2	PSO3
1	Explain the fundamentals of open and closed loop control systems along with applications.	2	1	-
2	Solve analytical and design problems in time and frequency domain.	2	1	-
3	Examine the stability using Routh-Hurwitz criteria, Root-Locus, Nyquist stability criteria, Bode plot, polar plot	2	1	1
4	Analyze the response and state equation for stabilizing the analog and digital control systems.	2	1	-
5	Design the stable closed loop control systems using different stability condition.	2	1	-

2- Low, 2- Moderate, 3-Strong

5). Instructional Language: - 100 % English

6). Introduction to subject: -Electrical engineering is considered to deal with the problems associated with large-scale electrical systems such as power transmission and motor control, whereas electric drive and machine engineering deals with the study of large-scale electronic systems including machine and integrated circuits. Alternatively, electric drive engineering are usually concerned with using electricity to transmit energy and analysis of DC, Induction and synchronize drive system.

a). Relevance to Branch:

Electrical Drives and Control is a branch of electrical engineering that deals with the control of electrical drives and machine. The objective of a control scheme is to keep the electrical machine operation in stable, desirable condition. By knowing the characteristics of the machine we can say that which machine is suitable for which operation.

b). Relevance to Society:

Today's industrial and domestic loads demands precise and smooth variable speed control. The development of compact thyristor power converters has made this possible by smooth speed control of both AC and DC motors which are employed for several applications such as DC/AC drives, Vehicles and renewable energy. So we can say that it is directly relevant to the society.

c). Relevance to Self:

This course enables to develop the basics of electric drives and maintain different types of DC in industries. The competency in this area is highly required in engineering graduates working in most of the industries since these industries employ large number of motors and drives and their smooth operation and maintenance requires lot of competent man power. Thus this course is must for students who want to work in industries.

Presently this is the sector which is touching sky-heights and this subject deals with power electronics technology. There are many projects in which students can work based on the concepts learnt in this subject.

d). Relation with lab:

The best way of learning things include the collaboration of theoretical and practical knowledge. The labs will prove to be helpful in correlating the theoretical fundamentals learnt in the class with the practical performed in the labs providing crystal clear concepts. This subject is directly connected with electric drive and control lab in this semester.

e).Pre- Requisites (Connection with previous year): -

1. Mathematics
2. Circuit & Analysis

As in previous semester, the concepts learnt in Engineering Mathematics- I and Engineering Mathematics- II were related to build the basics of the students. This subject is the basic building block of electrical engineering enabling students in easy grasping of various electrical concepts. Now we'll study further Moderm Control theory.

7). Syllabus of Rajasthan Technical University, Kota

SN	CONTENTS	HOURS
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction to control problem** Industrial Control examples. Mathematical models of physical sys- tems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra	4

3	**Time Response Analysis:** Standard test signals. Time response of first and second order sys- tems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.	**9**
4	**Frequency-response analysis** Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.	**6**
5	**Introduction to Controller Design** Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Leadand Lag compensation in designs. Analog and Digital implementation of controllers	**10**
6	**State variable Analysis** Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models oflinear discrete-time systems. Stability of linear discrete-time systems	**06**
7	**Introduction to Optimal Control and Nonlinear Control** Performance Indices. Regulator problem, Tracking Problem. Nonlinearsystem–Basic concepts and analysis	**05**
	TOTAL	**41**

8). Books/ Website/Journals & Handbooks/ Association & Institution:

a). Recommended Text & Reference Books and Websites:

S. No.	Title of Book	Authors	Publisher	No. of books in Library
T1	Control System	Barapate	Tech Max publications	
T2	Modern Control Engineering	Ogata K	Prentice Hall	
T3	Control System with Matlab	Hasan Saeed	S.K. Kataria & Sons	

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R1	Automatic Control Systems	S.N.Verma, B.S.Manke	Khanna publisher	
R2	Control System Engineering	I.J.Nagrath, M.Gopal	New age international	

b). Journals & Handbooks: -

1. Journal of Scientific and Industrial Research
2. Indian Journal of Engineering and Material Science
3. Green Energy
4. Science Competition Vision
5. Electrical India

c). Associations and Institutions:

1. Department Of Science and Technology(DST)
2. IEEE
3. MNIT & IIT

d). ***Websites related to subject:-***

1. www.nptel.iitm.ac.in
2. www.4shared.com
3. www.mit.com
4. www.electrical4u.com/electrical-drives/

9). Syllabus Deployment: -

a). Total weeks available for academics (excluding exams/ holidays) as per PGC calendar-

SEMESTER	IV
No. of Working Days Available (Approx.)	70
No. of Weeks(Approx.)	14

- Total weeks available for covering RTU syllabus- 11-12weeks (Approx.)
- Total weeks available for special activities (as mentioned below)- 02 weeks (Approx.)

b). Course Assesment Methods (Special Activities):

- Open Book Test
- Quiz (50% Technical & 50% Aptitude)- Once in a semester
- Special Lectures (SPL)- 10% of total no. of lectures including following
    i. One PPT by the faculty, who is teaching the subject
    ii. SPL by expert faculty at PGC level
    iii. SPL by expert from industry/academia (other institution)
- Revision classes:- 1 to 3 turn at the end of semester (Before II Mid Term Exam)
- Solving Important Question Bank- 1 Turn before I& II Mid Term Exam (each) - Total Two turn.
- I and II Midterms

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- RTU University Examinations

c). Lecture schedule per week/ Contact Hours:

i). University scheme (L+T+P) = 3+1+0
ii). PGC scheme (L+T+P) = 5+0+0

d). Introduction & Conclusion: Each subject, unit and topic shall start with introduction & close with conclusion. In case of the subject, it is Zero lecture.

e). Time Distribution in lecture class: - Time allotted: 60 min.

i. First 5 min. should be utilized for paying attention towards students who were absent for last lecture or continuously absent for many days + taking attendance by calling the names of the students and also sharing any new/relevant information.
ii. Actual lecture delivery should be of 50 min.
iii. Last 5 min. should be utilized by recapping/ conclusion of the topic. Providing brief introduction of the coming up lecture and suggesting portion to read.
iv. After completion of any Unit/Chapter a short quiz should be organized.
v. During lecture student should be encouraged to ask the question**.**

10). Home assignment: - An essential component of Teaching- Learning process in Professional Education.

Home assignment shall comprise of two parts:

Part (i) Minimum essential questions, which are to be solved and submitted by all with in specified due date.

Part (ii) Other important questions, which may also be solved and submitted for examining and guidance by teacher.

11). Examination System:

Sr. No.	Name of the Exam	Max. Marks	% of passing marks	Nature of paper Theory + Numerical	Syllabus coverage (in %)	Conducted by
1.	Ist Mid Term Exam	60	21	T+N	60%	PCE
2.	IInd Mid Term Exam	60	21	T+N	40%	PCE
3.	University (End) Term Exam	120		T+N	100%	RTU

Place: **Jaipur**
Date: **09/12/2021**

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BLOWN UP SYLLABUS

BLOWN UP SYLLABUS

Campus: PCE	**Course: B.TECH**	**Class/Section: III Year**	**Date: 9-12-2021**
Name of Faculty: Dr. Jyoti Shukla		**Name of Subject: Control System**	**Code: 5EE3-03**

Unit no	Topic as per Syllabus	BLOWN UP TOPICS (Upto 10 TIMES SYLLABUS)
1	**Introduction** Objective, scope and outcome of the course	
2.	**Introduction to control problem**	
	2.1 Introduction	2.1.1 The Control System 2.1.2 Historical Background
	2.2 Mathematical models of physical systems	2.2.1 Terminology 2.2.2 Mechanical systems

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		2.2.2 Electrical systems 2.2.3 Electronic systems 2.2.4 Thermal systems 2.2.5 Hydraulic systems 2.2.6 Chemical systems
	2.3 Control hardware and their models.	2.3.1 Explanation 2.3.2 Mathematical Model 2.3.3 Examples
	2.4 Transfer function models of linear time-invariant systems.	2.4.1 Explanation 2.4.2 Study of examples 2.4.3 Scope of applicability
	2.5 Open Loop System and Closed Loop System	2.5.1 Explanation 2.5.2 Applications 2.5.3 Examples 2.5.4 Advantages & Disadvantages 2.5.5 Open loop vs close loop system
	2.7 Block Diagram & Signal Flow Graph	2.6.1 Block Diagram Reduction Techniques 2.6.2 Steps for drawing Block diagrams 2.6.3 Problems 2.6.4 Signal Flow Graph Reduction Techniques & Rules 2.6.5 Important Terms
3.	**Time Response Analysis:**	
	3.1 Input Test Signals	3.1.1 Introduction. 3.1.2 Step Input 3.1.3 Ramp Input 3.1.4 Parabolic Input 3.1.5 Impulse Input
	3.2 Time Response analysis	3.2.1 Introduction. 3.2.2 Transient & Steady State Response 3.2.3 order and type of the system 3.2.4 Response of First order system with test signals 3.2.5 Response of Second order system with test signals
	3.3 Design Specification for second order system	3.3.1 Peak time 3.3.2 Rise time 3.3.3 Delay time

		3.3.4 Peak overshoot 3.3.5 Settling Time
	3.4 BIBO Stability	3.4.1 Introduction 3.4.2 Relative and absolute Stability 3.4.3 Significance
	3.5 Routh's Hurwitz Criterion	3.5.1 Introduction. 3.5.2 Routh's Hurwitz Criterion with special cases 3.5.3 Examples
	3.6 Root locus	3.6.1 Introduction 3.6.2 Rules to plot the root locus 3.6.3 Examples
4	**Frequency-response analysis**	
	4.1 Introduction	4.1.1 Introduction of Frequency response 4.1.2 Difference between time response and frequency response 4.3.3 Relationship between time and frequency response 4.3.4 Derivation of Resonant frequency, peak and Bandwidth
	4.2 Polar plots	4.2.1 Introduction 4.2.2 Procedure 4.2.3 Examples
	4.3 Bode plots	4.3.1 Introduction 4.3.1 Procedure 4.3.2 Phase Margin & Gain Margin 4.3.3 Examples
	4.4 Nyquist stability criterion	4.4.1 Introduction & Definition 4.4.2 Procedure 4.4.3 Phase Margin & Gain Margin using Nyquist criterion 4.4.4 Examples
	4.5 Closed Loop Frequency Response	4.5.1 M Circles 4.5.2 N Circles
5	**Introduction to Controller Design**	

	5.1 steady-state accuracy, transient accuracy.	5.1.1 Static Error Coefficient 5.1.2 Static Position Error coefficient 5.1.3 Static Velocity Error coefficient 5.1.4 Static Acceleration Error coefficient 5.1.5 Dynamic Error Coefficient
	5.2 disturbance rejection, insensitivity, and robustness of control systems	5.2.1 Explanation 5.2.2 Transfer function Model with disturbance 5.2.3 Sensitivity analysis with respect to various parameters
	5.3 Root-loci method of feedback controller design.	5.3.1 Explanation 5.3.2 Design problems
	5.4 Design specifications in frequency-domain. Frequency-domain methods of design.	5.4.1 Explanation 5.4.2 Mathematical Expression
	5.5 compensation	5.5.1 Arrangement 5.5.2 Types 5.5.2.1 Lag Compensator 5.5.3.2 Lead Compensator 5.5.2.3 Lag Lead Compensator
	5.6 Controllers	5.6.1 Explanation 5.6.2 Proportional Controller 5.6.2.1 Statement 5.6.2.2 Advantages 5.6.2.3 Disadvantages 5.6.2.4 Application 5.6.3 Integral Controller 5.6.3.1 Statement 5.6.3.2 Advantages 5.6.3.3 Disadvantages 5.6.3.4 Application 5.6.4 Derivative Controller 5.6.4.1 Statement 5.6.4.2 Advantages 5.6.4.3 Disadvantages 5.6.4.4 Application 5.6.5 PI, PD and PID Controller 5.6.5.1 Statement 5.6.5.2 Advantages 5.6.5.3 Disadvantages 5.6.5.4 Application

	5.7 Analog and Digital implementation of controllers	5.7.1 Explanation 5.7.2 Examples
6	**State variable Analysis**	
	6.1 Concepts of state variables analysis Lecture Conclusion	6.1.1 Concepts of state variables. 6.1.2 State space model. 6.1.3 Writing state space equations of mechanical
	6.2 State Space Representation using physical and phase variables	6.2.1 Comparison form of system representation 6.2.2 Block diagram representation of state model. 6.2.3 State space representation using canonical variables
	6.3 Solution of state equations	6.3.1 Explanation 6.3.2 Mathematical Expression 6.3.3 Derivation of transfer function from state-model.
	6.4 Solution of State Equations	6.4.1 Diagonalization, 6.4.2 Eigenvalues and eigen vectors
	6.5 Matrix exponential, State transition matrix	6.5.1 Properties of state transition matrix. 6.5.2 Computation of State
	6.6 transition matrix concepts of controllability &observability	6.6.1 Explanation of transition matrix 6.6.2 concepts of controllability & observability 6.6.3 Examples
	6.7 Pole placement by state feedback,	6.7.1 Explanation 6.7.2 Ackerman's formula
7	**Introduction to Optimal Control and Nonlinear Control**	
	7.1 Performance Indices.	7.1.1 Linear Performance index 7.1.2 Quadratic Performance index
	7.2 Regulator problem	7.2.1 Explanation 7.2.2 Analysis
	7.3 Tracking Problem.	7.3.1 Explanation

	7.4 Nonlinear system	7.3.2 Analysis 7.4.1 Basic Concept 7.4.2 Analysis

Place: **Jaipur**
Date: **09/12/2021**

Dr. Jyoti Shukla
(Associate Professor)

RULES FOR CO/LO ATTAINMENT LEVELS: (TARGETS)

Course Name	Level 3	Level 2	Level 1
Control System	**60 % of students getting > 60% marks**	**50-60 % of students getting > 60% marks**	**40-50 % of students getting > 60% marks**

END TERM RTU COMPONENT: CO ATTAINMENT LEVELS

Course Name	Level 3	Level 2	Level 1
Control System	**50 % of students getting > 60% marks**	**40-50 % of students getting > 60% marks**	**30-40 % of students getting > 60% marks**

S. No.	Course Type	Attainment Level=1	Attainment Level=2	Attainment Level=3
1	Mid Semester Exams	CO1, CO2, CO3, CO4, CO5	CO1, CO2, CO3, CO4, CO5	CO1, CO2, CO3, CO4, CO5

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2	University Exam			
4	OBT	CO1, CO2, CO3, CO4, CO5	CO1, CO2, CO3, CO4, CO5	CO1, CO2, CO3, CO4, CO5
5	Class Test	CO1, CO2, CO3, CO4, CO5	CO1, CO2, CO3, CO4, CO5	CO1, CO2, CO3, CO4, CO5
6	Quiz	CO4	CO4	CO4

CO WISE ASSESSMENT ACTIVITIES (AS MENTIONED IN SESSION PLAN)

CO	Class Test	Quiz 1	OBT	Mid Term Exam 1	Mid Term Exam 2
CO1	Y		Y	Y	
CO2	Y		Y	Y	
CO3	Y		Y	Y	Y
CO4	Y	Y	Y		Y
CO5	Y		Y		Y

CO-PO/PSO MAPPING AND TARGETS

CO	PO												Avg.	PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	CO Targets	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	**2.5**	2	1	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	**3**	2	1	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	**3**	2	1	1
CO4	3	3	-	-	-	-	-	-	-	-	-	-	**3**	2	1	-

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CO5	3	3	-	-	-	-	-	-	-	-	-	-	**3**	2	1	-

ACTIVITY WISE ASSESSMENT TOOLS

Sr. No.	Activity	Assessment Method	Tools	Weightage Marks	Recommendation
1.	**Class Test**	**Direct**	**Marks**	**50**	**ForCO1-CO5**
2.	**Open Book Test**	**Direct**	**Marks**	**25**	**ForCO1-CO5**
3.	**Quiz**	**Direct**	**Marks**	**10**	**ForCO4**
4.	**MidTerm1**	**Direct**	**Marks**	**60**	**ForCO1-CO3**
5.	**MidTerm2**	**Direct**	**Marks**	**60**	**ForCO3-CO5**

Poornima College of Engineering

Department of Electrical Engineering

Subject Name: Control System **Subject Code: 5EE4 - 03**

Quiz

1. Assertion (A): All the systems which exhibit overshoot in transient response will also exhibit resonance peak in frequency response.
   Reason (R): Large resonance peak in frequency response corresponds to a large overshoot in transient response.
   a) Both A and R are true and R is the correct explanation of A
   b) Both A and R are true and R is not the correct explanation of A
   c) A is true but R is false
   d) A is false but R is true
2. The phase angle of the system G(s) =s+5/s^2+4s+9; varies between
   a) 0° and 90°
   b) 0° and -90°
   c) 0° and -180°
   d) -90° and -180°

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3. The open loop transfer function of a system is :
   $G(s)\,H(s) = K/(1+s)(1+2s)(1+3s)$
   The phase crossover frequency wpc is:
   a) $\sqrt{2}$
   b) 1
   c) Zero
   d) $\sqrt{3}$
4. Scientist Bode have contribution in :
   a) Asymptotic plots
   b) Polar plots
   c) Root locus technique
   d) Constant M and n circle
5. For a stable closed loop system, the gain at phase crossover frequency should always be:
   a) < 20 dB
   b) < 6 dB
   c) > 6 dB
   d) > 0 Db
6. Which one of the following methods can determine the closed loop system resonance frequency operation?
   a) Root locus method
   b) Nyquist method
   c) Bode plot
   d) M and N circle
7. Which one of the following statements is correct?
   Nichol's chart is useful for the detailed study of:
   a) Closed loop frequency response
   b) Open loop frequency response
   c) Close loop and open loop frequency responses
   d) None of the mentioned
8. The forward path transfer function of a unity feedback system is given by $G(s) = 100/(s^2+10s+100)$. The frequency response of this system will exhibit the resonance peak at:
   a) 10 rad/sec
   b) 8.66 rad/sec
   c) 7.07 rad/sec
   d) 5rad/sec
9. Which one of the following statements is correct for gain margin and phase margin of two closed-loop systems having loop functions G(s) H(s) and exp(-s) G(s) H(s)?
   a) Both gain and phase margins of the two systems will be identical
   b) Both gain and phase margins of G(s) H(s) will be more
   c) Gain margins of the two systems are the same but phase margins of G(s) H(s) will be more
   d) Phase margins of the two systems are the same but gain margin of G(s) H(s) will be less

10. The loop transfer function of a system is given by G(s) H(s) =$10e^{-Ls}/s$. The phase crossover frequency is 5rad/s. The value of the dead time L is
    a) π/20
    b) π/10
    c) -π/20
    d) Zero

ANSWER KEY

1. A
2. B
3. B
4. A
5. D
6. D
7. A
8. C
9. C
10. B

III B.TECH. (V Sem.)

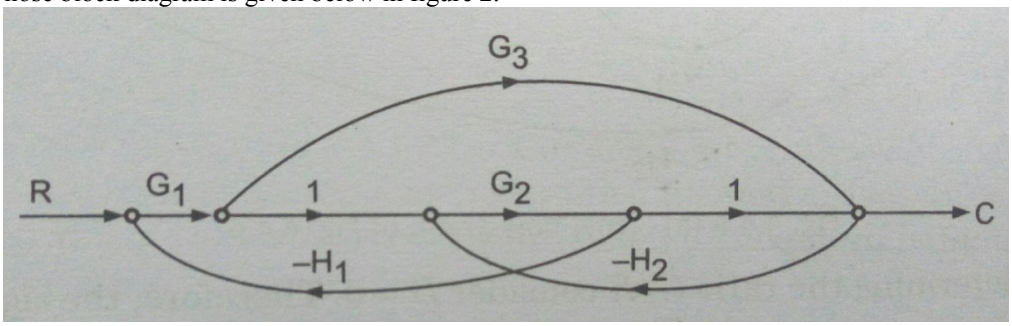
CLASS TEST 2021-22
Code: 5EE4-03 Category: PCC Subject Name–Control System
(BRANCH –ELECTRICAL ENGINEERING)

Max. Time: 2 hrs. **Max. Marks: 50**

All questions carry equal marks

NOTE:-

Q.1 **CO1** Obtain the overall transfer function using signal flow graph representation for a system whose block diagram is given below in figure 2.



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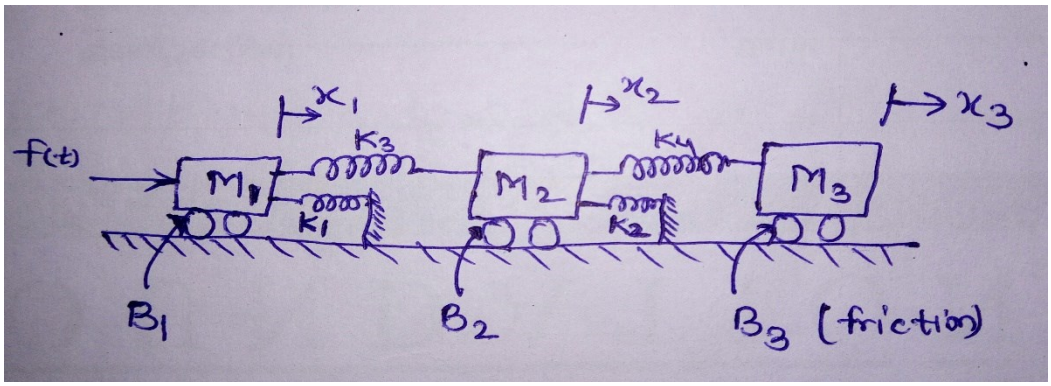
Q.2 **CO2** Draw the mechanical circuit diagram for the system as given below in figure 3 and write the system equations for F-V and F-I analogy. Also draw the F-V and F-I analogy circuit.



Q.3 **CO3** Construct the Bode plot on a semi-log graph-sheet for a unity feedback system whose open loop transfer function is given by $G(s) = \dfrac{50}{s(1+s)(1+0.5s)}$. From the Bode plot check the stability of the closed loop system.

Q.4 **CO4** Verify whether the following system is controllable.

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$

Q.5 **CO5** Write the necessary and sufficient condition for the stability in Routh Stability criterion.

Assignment-I

Q.1: Explain open and closed loop system in details?

Q.2: Explain different type of control system?

Q.3: Explain unit ramp and unit impulse response in details?

Q.4: Explain second order system with an example?

Q.5: Give an idea about transient system specification?

Q.6: Give the Nyquist stability criterion in detail?

Q.7: Give a relation between poles and stability?

Q.8 List the several methods to determine the stability of control system?

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FIRST MID TERM EXAMINATION 2021-22

Code: 5EE4-03 Category: PCC Subject Name– Control System

(BRANCH – ELECTRICAL ENGINEERING)

Max. Time: 2 hrs. **Max. Marks: 60**

	PART - A: (All questions are compulsory) Max. Marks (10)				
		Marks	**CO**	**BL**	**PO**
Q.1	Write Masons Gain formula.	**2**	1	1	1

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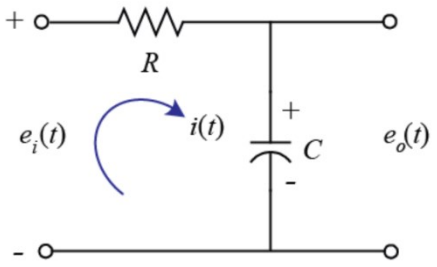
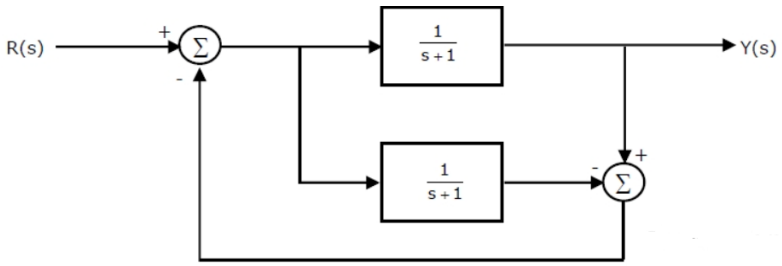
Q.2	Define order of a system.	**2**	1	2	1
Q.3	What are transient and steady state response of a control system?	**2**	2	2	2
Q.4	Name the bounded test signals used for stability in control system.	**2**	3	3	3
Q.5	What are the elements of block diagram?	**2**	1	1	1
	PART - B: (Attempt 4 questions out of 6) Max. Marks (20)				
Q.6	Give the comparison between open loop and closed loop system.	**5**	1	2	1
Q.7	How is a control system classified depending on the value of damping?	**5**	2	1	2
Q.8	What is the basis for framing the rules of block diagram reduction technique?	**5**	1	1	1
Q.9	Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system.	**5**	1	2	1
Q.10	Write the necessary and sufficient condition for the stability in Routh Stability criterion.	**5**	3	1	3
Q.11	Find the transfer function of a given linear system. 	**5**	1	5	1
	PART - C: (Attempt 3 questions out of 4) Max. Marks (30)				
Q.12	Simplify the block diagram and obtain the transfer function 	**10**	1	5	1

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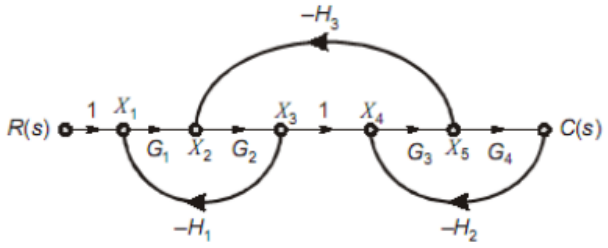
Q.13	Perform time response analysis of the first order system with impulse input.	**10**	2	4	2
Q.14	Determine the stability of given system using Routh Hurwitz criterion. $Q(s)=s^4+8s^3+18s^2+16s+5$	**10**	3	4	3
Q. 15	Obtain the closed loop transfer function of the systems, by using Mason's gain formula. 	**10**	1	5	1

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SECOND MID TERM EXAMINATION 2021-22
Code: 5EE4-03 Category: PCC Subject Name–CONTROL SYSTEM
(BRANCH –ELECTRICAL ENGINEERING)

Course Credit: 03
Max. Time: 2 hrs. **Max.Marks: 60**

	PART - A: (All questions are compulsory) Max. Marks (10)				
		Marks	**CO**	**BL**	**PO**
Q.1	What will be the Stability of the system when the roots of characteristic equation are lying on right half of the S- plane?	**2**	3	2	1
Q.2	What are the main advantages of Bode plot?	**2**	3	2	1,2

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Q.3	Define Corner frequency?	**2**	3	1	2
Q.4	What is a compensator?	**2**	5	1	1
Q.5	What are the frequency domain specifications?	**2**	3	1	1
	PART - B: (Attempt 4 questions out of 6) Max. Marks (20)				
Q.6	How are phase margin and gain margin determined using bode plot?	**5**	3	3	1
Q.7	Differentiate lag and lead compensator.	**5**	4	4	2
Q.8	Write down short notes on: (i) Derivative Controllers (ii) Proportional Controllers	**5**	4	1	1
Q.9	A system has $G(s)=20/(s^2+5s+5)$ with unity feedback. Find $\square_n$, $\square_d$, M_p and M_r.	**5**	3	5	1
Q.10	Draw the polar plot for the transfer function $G(s)H(s)=1/s(s+1)$	**5**	3	5	3
Q.11	Explain the Nyquist stability criterion.	**5**	3	2	1
	PART - C: (Attempt 3 questions out of 4) Max. Marks (30)				
Q.12	Consider a unity feedback system whose open loop system is $$G(S)\,H(S) = \frac{K}{S(Ts+1)}$$ Determine whether the closed loop system is stable or not using Nyquist criterion	**10**	3	4	1
Q.13	The open loop transfer function of a unity feedback control is given by $$G(s) = \frac{k}{s(1+0.2s)}$$ Design a suitable compensator such that the system have $K_r=10$ ans P.M.=50^o	**10**	5	5	2
Q.14	Write down the procedure steps for plotting root locus.	**10**	3	1	3
Q. 15	Derive the expression of Resonant Peak and resonant frequency.	**10**	4	3	1

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DEPARTMENT OF ELECTRICAL ENGINEERING
OPEN BOOK TEST
Session 2021-2022
B.Tech. III year V Sem Section:
Code: 5EE4-03 Subject Name– Control System

Max. Time: 1 hr. **Max. Marks: 25**

Note: Attempt all questions.

Q.1	**CO 5**	Explain in detail the state-space models of linear discrete-time system.	**(5)**
Q.2	**CO 3**	Design the phase lead compensator. Also draw the Bode plot and pole-zero plot for the lead compensator.	**(5)**

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Q.3	**CO 2**	Obtain the state transition matrix in the form e^{At} and determine the time response for the system, $\dot{x} = Ax$, Where $A = \begin{bmatrix} 0 & 1 \\ -2 & 0 \end{bmatrix}$ and $x_1(0) = 1$, $x_2(0) = 1$.	**(5)**
Q.4	**CO1**	Draw the state-space block diagram for the transfer function given below and obtain state equations using cascade decomposition. $\frac{Y(s)}{U(s)} = \frac{1}{s^3 + 9s^2 + 26s + 24}$	**(5)**
Q.5	**CO 4**	A unit feedback system has a loop transfer function $G(s) = \frac{s+2}{(s+1)(s-1)}$. Use Nyquist criteria to determine the system stability in the closed loop configuration.	**(5)**

References:

1. Control System, Barapate, Tech Max publications
2. Modern Control Engineering, Ogata K, Prentice Hall
3. Control System with Matlab, Hasan Saeed, S.K. Kataria & Sons
4. Control System Engineering, I.J.Nagrath, M.Gopal, New age international
5. Automatic Control Systems, S.N.Verma, B.S.Manke, Khanna publisher

OBT: Attainment Table

S. No	Student Name	Total Marks	CO Attainment																		PO Attainment								
			CO1	Prev. CO1	CO1 Cum.	CO2	Prev. CO2	CO2 Cum.	CO3	Prev. CO3	CO3 Cum.	CO4	Prev. CO4	CO4 Cum.	CO5	Prev. CO5	CO5 Cum.	Overall CO	Prev. Overall	Cum. Overall	PO1	Prev. PO1	Cum. PO1	PO2	Prev. PO2	Cum. PO2	PO3	Prev. PO3	Cum. PO3
		25	Level of Attainment																										
1	AARAV BHARADWAJ																												
2	ABHISHEK JANGID	25	3			3			3			3			3			3			3			3			3		
3	ACHAL SINGHAL	20	3			3			3			3			3			3			3			3			3		
4	AJAY YADAV	21	3			3			3			3			3			3			3			3			3		
5	AMIT KUMAR	22	3			3			3			3			3			3			3			3			3		
6	AMIT SHARMA																												
7	ANKIT KUSHWAHA																												
8	ANKIT MAAN	21	3			3			3			3			3			3			3			3			3		
9	ANKIT MALI	17	3			3			3			3			3			3			3			3			3		
10	ASHISH MEENA	20	3			3			3			3			3			3			3			3			3		
11	AVINASH SHARMA																												
12	AYUSH GUPTA	23	3			3			3			3			3			3			3			3			3		
13	BHUVANESH CHAUDHARY	18	3			3			3			3			3			3			3			3			3		
14	CHAUDHARY HARIOM LAKSHMIKANT	18	3			3			3			3			3			3			3			3			3		
15	DEEPAK MOURYA																												
16	DIPESH SAINI	20	3			3			3			3			3			3			3			3			3		
17	DIVYANSH SHARMA	20	3			3			3			3			3			3			3			3			3		
18	GARVIT JANGID	19	3			3			3			3			3			3			3			3			3		
19	GARVIT KHANDELWAL	22	3			3			3			3			3			3			3			3			3		
20	HARDIK BHASKAR	23	3			3			3			3			3			3			3			3			3		
21	HARSHIT KUMAR MEHARCHANDANI	20	3			3			3			3			3			3			3			3			3		
22	HARSHVARDHAN SHRINGI	22	3			3			3			3			3			3			3			3			3		

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23	HEMANT KUMAR SHARMA	19	3			3			3			3			3			3			3			3			3			
24	IRFAN ALAM	16	3			3			3			3			3			3			3			3			3			
25	JATIN AGARWAL	15	3			3			3			3			3			3			3			2			2			
26	KANAK PAREEK	21	3			3			3			3			3			3			3			3			3			
27	KARAN JANGID	18	3			3			3			3			3			3			3			3			3			
28	KESHAV KUMAR SHARMA	20	3			3			3			3			3			3			3			3			3			
29	KHUSHI VERMA	23	3			3			3			3			3			3			3			3			3			
30	KULDEEP CHOUDHARY																												
31	KUNAL JAIN	19	3			3			3			3			3			3			3			3			3			
32	MAHENDRA BAIRWA	17	3			3			3			3			3			3			3			3			3			
33	MANISH BAIRWA	20	3			3			3			3			3			3			3			3			3			
34	MANISH MEENA	21	3			3			3			3			3			3			3			3			3			
35	MANOJ SAINI	21	3			3			3			3			3			3			3			3			3			
36	MANSI BARDAWAT	17	3			3			3			3			3			3			3			3			3			
37	MAYANK YADAV	17	3			3			3			3			3			3			3			3			3			
38	MD ANAS ZAIM KHAN	21	3			3			3			3			3			3			3			3			3			
39	MD SAJID	19	3			3			3			3			3			3			3			3			3			
40	MEENAKSHI RATNAWAT	18	3			3			3			3			3			3			3			3			3			
41	MOHIT JOSHI	17	3			3			3			3			3			3			3			3			3			
42	NAVNEET KUMAR SAINI	23	3			3			3			3			3			3			3			3			3			
43	NIDHI SINGH BUNKER	20	3			3			3			3			3			3			3			3			3			
44	PRETISH GARG	20	3			3			3			3			3			3			3			3			3			
45	PRIYA KANWAR	19	3			3			3			3			3			3			3			3			3			
46	SANEY THAKUR	22	3			3			3			3			3			3			3			3			3			
47	SATYAM KUMAR SHUKLA	23	3			3			3			3			3			3			3			3			3			
48	SHAHNAWAZ ALAM	19	3			3			3			3			3			3			3			3			3			
49	SUNIL MEENA	19	3			3			3			3			3			3			3			3			3			
50	VISHNU MAHAWAR	19	3			3			3			3			3			3			3			3			3			
51	VISHVENDRA PALIWAL	20	3			3			3			3			3			3			3			3			3			

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52	VIVEK YADAV	21	3			3			3			3			3			3			3			3			3			
53	YASH KUMAR KATARA	20	3			3			3			3			3			3			3			3			3			
54	YASHSHVI MEENA	20	3			3			3			3			3			3			3			3			3			
55	YUVRAJ SINGH	18	3			3			3			3			3			3			3			3			3			
56	ANIL KUMAR (PMSSS)	21	3			3			3			3			3			3			3			3			3			
57	ARUN ISHER (PMSSS)	21	3			3			3			3			3			3			3			3			3			
58	PRAVEEN SINGH (PMSSS)	20	3			3			3			3			3			3			3			3			3			
59	ABHISHEK DUBEY	20	3			3			3			3			3			3			3			3			3			
60	ABHISHEK KUMAR	21	3			3			3			3			3			3			3			3			3			
61	AMRIT KUMAR																												
62	KANHAIYA LAL	20	3			3			3			3			3			3			3			3			3			
63	KIRAN BALA																												
64	MOHAMMAD RIZWAN	17	3			3			3			3			3			3			3			3			3			
65	RAJVEER SAINI	23	3			3			3			3			3			3			3			3			3			
66	SURENDER KUMAR	19	3			3			3			3			3			3			3			3			3			
	No. of Students attained level 3= 57																% of Students Attained Level 3= 100%												
	No. of Students attained level 2= 0																% of Students Attained Level 2= 0%												
	No. of Students attained level 1= 0																% of Students Attained Level 1= 0%												
	Target Achieved= Yes																												
	Mark X for absent- (Take avg. of all present)= 0																												

	CO						PO											
Overall CO Attainments for PO	CO1	CO2	CO3	CO4	CO5	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Targets	2.5	3.00	3	3.00	3	2.93	3	2.8	3									
Attainment	2.5	3.00	3	3.00	3	2.93	3	2.78	3.00									
Previous Attainment																		
Cumulative																		

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Gap	**0**	**0**	**0**	**0**		**0**	**0**	**0.0161**	**0**									

Gaps Identified:
1. Some students showed less interest in application-based engineering because of a lack of imagination.
2. Problem-solving capability of students is not up to the Mark.

Activities decided to Bridge the Gap:
1. Extra lectures on different types of problem analysis techniques need to be taken for improvement.
2. Practical will be performed on analysis-based topics.

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ATTAINMENT FOR MIDTERM-I EXAM

S. No	Student Name	Total Marks	CO Attainment																		PO Attainment									
			CO1	Prev. CO1	CO1 Cum.	CO2	Prev. CO2	CO2 Cum.	CO3	Prev. CO3	CO3 Cum.	CO4	Prev. CO4	CO4 Cum.	CO5	Prev. CO5	CO5 Cum.	Overall CO	Prev. Overall	Cum. Overall	PO1	Prev. PO1	Cum. PO1	PO2	Prev. PO2	Cum. PO2	PO3	Prev. PO3	Cum. PO3
		60	Level of Attainment																											
1	AARAV BHARADWAJ																													
2	ABHISHEK JANGID	4	1	3	2		3	3		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
3	ACHAL SINGHAL	52	3	3	3	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	AJAY YADAV	21	1	3	2	1	3	2	1	3	2		3	3		3	3	1	3	2	1	3	2	1	3	2	1	3	2
5	AMIT KUMAR	22	2	3	2.5	1	3	2	2	3	2.5		3	3		3	3	2	3	2.5	2	3	2.5	1	3	2	2	3	2.5
6	AMIT SHARMA																													
7	ANKIT KUSHWAHA																													
8	ANKIT MAAN	7	1	3	2		3	3		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
9	ANKIT MALI	35	3	3	3	2	3	2.5	2	3	2.5		3	3		3	3	2	3	2.5	2	3	2.5	2	3	2.5	2	3	2.5
10	ASHISH MEENA	21	1	3	2	3	3	3	1	3	2		3	3		3	3	2	3	2.5	2	3	2.5	1	3	2	1	3	2
11	AVINASH SHARMA																													
12	AYUSH GUPTA	15	2	3	2.5	3	3	3		3	3		3	3		3	3	3	3	3	3	3	3	3	3	3		3	3
13	BHUVANESH CHAUDHARY	10	1	3	2	1	3	2		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
14	CHAUDHARY HARIOM LAKSHMIKANT	10	1	3	2		3	3	2	3	2.5		3	3		3	3	2	3	2.5	2	3	2.5	1	3	2	2	3	2.5
15	DEEPAK MOURYA																													
16	DIPESH SAINI	19	3	3	3	3	3	3		3	3		3	3		3	3	3	3	3	3	3	3	3	3	3		3	3
17	DIVYANSH SHARMA	5	2	3	2.5	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3
18	GARVIT JANGID	13	3	3	3	1	3	2	1	3	2		3	3		3	3	2	3	2.5	2	3	2.5	1	3	2	1	3	2
19	GARVIT KHANDELWAL	7	1	3	2	3	3	3		3	3		3	3		3	3	3	3	3	3	3	3	3	3	3		3	3
20	HARDIK BHASKAR	39	3	3	3	2	3	2.5	1	3	2		3	3		3	3	2	3	2.5	2	3	2.5	2	3	2.5	1	3	2
21	HARSHIT KUMAR MEHARCHANDANI	2	1	3	2		3	3		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
22	HARSHVARDHAN SHRINGI	35	3	3	3	3	3	3	2	3	2.5		3	3		3	3	3	3	3	3	3	3	3	3	3	2	3	2.5

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23	HEMANT KUMAR SHARMA	6	1	3	2		3	3	1	3	2		3	3		3	3	1	3	2	1	3	2	1	3	2	1	3	2
24	IRFAN ALAM	18	1	3	2	1	3	2	3	3	3		3	3		3	3	2	3	2.5	2	3	2.5	2	3	2.5	3	3	3
25	JATIN AGARWAL	24	2	3	2.5	1	3	2	1	3	2		3	3		3	3	1	3	2	1	3	2	1	2	1.5	1	2	1.5
26	KANAK PAREEK	11	2	3	2.5		3	3		3	3		3	3		3	3	2	3	2.5	2	3	2.5	1	3	2		3	3
27	KARAN JANGID	24	1	3	2	3	3	3	2	3	2.5		3	3		3	3	2	3	2.5	2	3	2.5	2	3	2.5	2	3	2.5
28	KESHAV KUMAR SHARMA	3	1	3	2	1	3	2		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
29	KHUSHI VERMA	34	3	3	3	3	3	3	1	3	2		3	3		3	3	2	3	2.5	2	3	2.5	2	3	2.5	1	3	2
30	KULDEEP CHOUDHARY																												
31	KUNAL JAIN	12	1	3	2	1	3	2		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
32	MAHENDRA BAIRWA	32	3	3	3	1	3	2		3	3		3	3		3	3	2	3	2.5	2	3	2.5	1	3	2		3	3
33	MANISH BAIRWA	33	3	3	3	1	3	2	3	3	3		3	3		3	3	3	3	3	3	3	3	2	3	2.5	3	3	3
34	MANISH MEENA	5	1	3	2		3	3		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
35	MANOJ SAINI	4	1	3	2		3	3		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
36	MANSI BARDAWAT	24	2	3	2.5	1	3	2		3	3		3	3		3	3	2	3	2.5	2	3	2.5	1	3	2		3	3
37	MAYANK YADAV	25	2	3	2.5	3	3	3		3	3		3	3		3	3	3	3	3	3	3	3	3	3	3		3	3
38	MD ANAS ZAIM KHAN	9	1	3	2		3	3		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
39	MD SAJID			3	3		3	3		3	3		3	3		3	3		3	3		3	3		3	3		3	3
40	MEENAKSHI RATNAWAT	29	3	3	3	3	3	3		3	3		3	3		3	3	3	3	3	3	3	3	3	3	3		3	3
41	MOHIT JOSHI	32	2	3	2.5	1	3	2	3	3	3		3	3		3	3	2	3	2.5	2	3	2.5	2	3	2.5	3	3	3
42	NAVNEET KUMAR SAINI	26	3	3	3	2	3	2.5	1	3	2		3	3		3	3	2	3	2.5	2	3	2.5	1	3	2	1	3	2
43	NIDHI SINGH BUNKER	32	3	3	3	1	3	2	2	3	3		3	3		3	3	2	3	2.5	2	3	2.5	2	3	2.5	2	3	2.5
44	PRETISH GARG	29	2	3	2.5	2	3	2.5	2	3	2.5		3	3		3	3	2	3	2.5	2	3	2.5	2	3	2.5	2	3	2.5
45	PRIYA KANWAR	20	1	3	2	2	3	2.5	3	3	3		3	3		3	3	2	3	2.5	3	3	3	2	3	2.5	3	3	3
46	SANEY THAKUR	24	2	3	2.5	2	3	2.5	3	3	3		3	3		3	3	3	3	3	3	3	3	2	3	2.5	3	3	3
47	SATYAM KUMAR SHUKLA	36	3	3	3	1	3	2	3	3	3		3	3		3	3	3	3	3	3	3	3	2	3	2.5	3	3	3
48	SHAHNAWAZ ALAM	52	3	3	3	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3

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49	SUNIL MEENA	30	3	3	3	3	3	3		3	3		3	3		3	3	3	3	3	3	3	3	3	3	3		3	3
50	VISHNU MAHAWAR	35	3	3	3		3	3		3	3		3	3		3	3	3	3	3	3	3	3	2	3	2.5		3	3
51	VISHVENDRA PALIWAL	25	1	3	2	3	3	3	1	3	2		3	3		3	3	2	3	2.5	2	3	2.5	2	3	2.5	1	3	2
52	VIVEK YADAV	56	3	3	3	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3
53	YASH KUMAR KATARA	24	2	3	2.5	1	3	2	3	3	3		3	3		3	3	3	3	3	3	3	3	2	3	2.5	3	3	3
54	YASHSHVI MEENA	48	3	3	3	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3
55	YUVRAJ SINGH	10	1	3	2		3	3	2	3	2.5		3	3		3	3	1	3	2	1	3	2	1	3	2	2	3	2.5
56	ANIL KUMAR (PMSSS)	40	3	3	3	2	3	2.5	3	3	3		3	3		3	3	3	3	3	3	3	3	2	3	2.5	3	3	3
57	ARUN ISHER (PMSSS)	5	1	3	2		3	3		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
58	PRAVEEN SINGH (PMSSS)	36	2	3	2.5	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3
59	ABHISHEK DUBEY	54	3	3	3	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3
60	ABHISHEK KUMAR	53	3	3	3	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3
61	AMRIT KUMAR																												
62	KANHAIYA LAL	51	3	3	3	3	3	3	1	3	2		3	3		3	3	3	3	3	3	3	3	2	3	2.5	1	3	2
63	KIRAN BALA																												
64	MOHAMMAD RIZWAN	19	2	3	2.5	1	3	2		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
65	RAJVEER SAINI	3	1	3	2	1	3	2		3	3		3	3		3	3	1	3	2	1	3	2	1	3	2		3	3
66	SURENDER KUMAR	56	3	3	3	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3

	No. of Students attained level 3= 46	% of Students Attained Level =79.68%
	No. of Students attained level 2= 12	% of Students Attained Level 2= 20.07%
	No. of Students attained level 1= 0	% of Students Attained Level 1= 0%
	Target Achieved= yes	

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	CO						PO											
Overall CO Attainments for PO	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Targets	**2.5**	**3.00**	**3**	**3.00**	**3.00**	**2.93**	**3**	**2.8**	**3.00**									
Attainment	**1.6959**	**2.0889**	**2.2**			**2.052**	**2.1404**	**1.7357**	**2.2**									
Previous Attainment	**2.5**	**3.00**	**3**	**3.00**	**3.00**	**2.93**	**3**	**2.78**	**3.00**									
Cumulative	**2.10**	**2.54**	**2.60**	**3.00**	**3.00**	**2.08**	**2.57**	**2.26**	**2.60**									
Gap	**0.40**	**0.46**	**0.40**	**0.00**	**0.00**	**0.00**	**0.43**	**0.54**	**0.40**									

Gaps for CO attainment through Mid term 1:
1. Problem-solving capability of students is not up to the Mark
2. Lack of thorough approach of analysis observed.
3. Students did not realize the importance of the environment and its sustainability for the future generation.

Action to be taken:
1. Theory teaching will be focused more on complex problems.
2. Workshop and training programs will be arranged to improve the contribution of engineers to society.
3. Students were encouraged to actively participate in webinars, NPTEL online course.

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CLASS TEST: Attainment Table

S. No	Student Name	Total Marks	CO Attainment																		PO Attainment								
			CO1	Prev. CO1	CO1 Cum.	CO2	Prev. CO2	CO2 Cum.	CO3	Prev. CO3	CO3 Cum.	CO4	Prev. CO4	CO4 Cum.	CO5	Prev. CO5	CO5 Cum.	Overall CO	Prev. Overall	Cum. Overall	PO1	Prev. PO1	Cum. PO1	PO2	Prev. PO2	Cum. PO2	PO3	Prev. PO3	Cum. PO3
		50	Level of Attainment																										
1	AARAV BHARADWAJ																												
2	ABHISHEK JANGID	46	3	2	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	3	3
3	ACHAL SINGHAL	37	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	AJAY YADAV	37	3	2	2.5	3	2	2.5	3	2	2.5	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	2	2.5
5	AMIT KUMAR	37	3	2.5	2.75	3	2	2.5	3	2.5	2.75	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2	2.5	3	2.5	2.75
6	AMIT SHARMA																												
7	ANKIT KUSHWAHA																												
8	ANKIT MAAN	37	3	2	2.5	3	3	3	1	3	2	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	1	3	2
9	ANKIT MALI	45	3	3	3	3	2.5	2.75	3	2.5	2.75	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75
10	ASHISH MEENA	34	3	2	2.5	2	3	2.5	3	2	2.5	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2	2.5	3	2	2.5
11	AVINASH SHARMA																												
12	AYUSH GUPTA	48	3	2.5	2.75	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
13	BHUVANESH CHAUDHARY	39	3	2	2.5	3	2	2.5	3	3	3	3	3	3	2	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	3	3
14	CHAUDHARY HARIOM LAKSHMIKANT	35	3	2	2.5	3	3	3	3	2.5	2.75	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2	2.5	3	2.5	2.75
15	DEEPAK MOURYA																												
16	DIPESH SAINI	39	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
17	DIVYANSH SHARMA	41	3	2.5	2.75	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
18	GARVIT JANGID	40	3	3	3	3	2	2.5	3	2	2.5	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2	2.5	3	2	2.5
19	GARVIT KHANDELWAL	33	3	2	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20	HARDIK BHASKAR	44	3	3	3	3	2.5	2.75	3	2	2.5	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75	3	2	2.5
21	HARSHIT KUMAR MEHARCHANDANI	40	3	2	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	3	3
22	HARSHVARDHAN SHRINGI	45	3	3	3	3	3	3	3	2.5	2.75	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.5	2.75
23	HEMANT KUMAR SHARMA	46	3	2	2.5	3	3	3	3	2	2.5	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	2	2.5

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24	IRFAN ALAM	40	2	2	2	3	2	2.5	3	3	3	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75	3	3	3
25	JATIN AGARWAL	36	3	2.5	2.75	3	2	2.5	3	2	2.5	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	1.5	2.25	3	1.5	2.25
26	KANAK PAREEK	35	3	2.5	2.75	3	3	3	3	3	3	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2	2.5	3	3	3
27	KARAN JANGID	43	3	2	2.5	3	3	3	3	2.5	2.75	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75
28	KESHAV KUMAR SHARMA	39	3	2	2.5	3	2	2.5	3	3	3	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	3	3
29	KHUSHI VERMA	34	3	3	3	3	3	3	3	2	2.5	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75	3	2	2.5
30	KULDEEP CHOUDHARY																													
31	KUNAL JAIN	36	3	2	2.5	3	2	2.5	3	3	3	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	3	3
32	MAHENDRA BAIRWA	41	3	3	3	3	2	2.5	3	3	3	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2	2.5	3	3	3
33	MANISH BAIRWA	38	3	3	3	3	2	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.5	2.75	3	3	3
34	MANISH MEENA	38	3	2	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	3	3
35	MANOJ SAINI	41	3	2	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	3	3
36	MANSI BARDAWAT	41	3	2.5	2.75	3	2	2.5	3	3	3	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2	2.5	3	3	3
37	MAYANK YADAV	36	3	2.5	2.75	3	3	3	3	3	3	2	3	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
38	MD ANAS ZAIM KHAN	43	3	2	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2.5	3	2	2.5	3	2	2.5	3	3	3
39	MD SAJID	37	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
40	MEENAKSHI RATNAWAT	40	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
41	MOHIT JOSHI	39	3	2.5	2.75	3	2	2.5	3	3	3	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75	3	3	3
42	NAVNEET KUMAR SAINI	42	3	3	3	3	2.5	2.75	3	2	2.5	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2	2.5	3	2	2.5
43	NIDHI SINGH BUNKER	37	3	3	3	3	2	2.5	2	3	2.5	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75	2	2.5	2.25
44	PRETISH GARG	44	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75	3	3	3	3	3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75
45	PRIYA KANWAR	38	3	2	2.5	3	2.5	2.75	3	3	3	3	3	3	3	3	3	3	2.5	2.75	3	3	3	3	2.5	2.75	3	3	3
46	SANEY THAKUR	35	3	2.5	2.75	3	2.5	2.75	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.5	2.75	3	3	3
47	SATYAM KUMAR SHUKLA	42	3	3	3	3	2	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.5	2.75	3	3	3
48	SHAHNAWAZ ALAM	39	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
49	SUNIL MEENA	38	3	3	3	3	3	3	3	3	3	1	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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50	VISHNU MAHAWAR	**35**	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	2.5	2.75	**3**	3	3
51	VISHVENDRA PALIWAL	**41**	**3**	2	2.5	**3**	3	3	**3**	2	2.5	**3**	3	3	**3**	3	3	**3**	2.5	2.75	**3**	2.5	2.75	**3**	2.5	2.75	**3**	2	2.5
52	VIVEK YADAV	**38**	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3
53	YASH KUMAR KATARA	**41**	**3**	2.5	2.75	**3**	2	2.5	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	2.5	2.75	**3**	3	3
54	YASHSHVI MEENA	**43**	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3
55	YUVRAJ SINGH	**44**	**3**	2	2.5	**3**	3	3	**3**	2.5	2.75	**3**	3	3	**3**	3	3	**3**	2	2.5	**3**	2	2.5	**3**	2	2.5	**3**	2.5	2.75
56	ANIL KUMAR (PMSSS)	**43**	**3**	3	3	**3**	2.5	2.75	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	2.5	2.75	**3**	3	3
57	ARUN ISHER (PMSSS)	**40**	**3**	2	2.5	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	2	2.5	**3**	2	2.5	**3**	2	2.5	**3**	3	3
58	PRAVEEN SINGH (PMSSS)	**34**	**3**	2.5	2.75	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3
59	ABHISHEK DUBEY	**42**	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3
60	ABHISHEK KUMAR	**41**	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3
61	AMRIT KUMAR																												
62	KANHAIYA LAL	**42**	**3**	3	3	**3**	3	3	**3**	2	2.5	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	2.5	2.75	**3**	2	2.5
63	KIRAN BALA																												
64	MOHAMMAD RIZWAN	**43**	**3**	2.5	2.75	**3**	2	2.5	**3**	3	3	**3**	3	3	**3**	3	3	**3**	2	2.5	**3**	2	2.5	**3**	2	2.5	**3**	3	3
65	RAJVEER SAINI	**38**	**3**	2	2.5	**3**	2	2.5	**3**	3	3	**3**	3	3	**3**	3	3	**3**	2	2.5	**3**	2	2.5	**3**	2	2.5	**3**	3	3
66	SURENDER KUMAR	**38**	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3	**3**	3	3

	No. of Students attained level 3= 57	**% of Students Attained Level 3= 100%**
	No. of Students attained level 2= 0	**% of Students Attained Level 2= 0%**
	No. of Students attained level 1= 0	**% of Students Attained Level 1= 0%**
	Target Achieved= 3	**Gap= 0**
	Mark X for absent- (Take avg. of all present)=	

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	CO						PO											
Overall CO Attainments for PO	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Targets	**2.5**	**3**	**3**	**3**	**3**	**2.9333**	**3**	**2.8**	**3**									
Attainment	**2.4856**	**2.9828**	**2.9483**	**2.9483**	**2.9828**	**2.9333**	**3**	**2.8**	**2.9483**									
Previous Attainment	**2.098**	**2.5444**	**2.6**	**3**	**3**	**2.08**	**2.5702**	**2.2598**	**2.6**									
Cumulative	**2.2918**	**2.7636**	**2.7741**	**2.9741**	**2.9914**	**2.5067**	**2.7851**	**2.5299**	**2.7741**									
Gap	**0.2082**	**0.2364**	**0.2259**	**0.0259**	**0.0086**	**0**	**0.2149**	**0.2701**	**0.2259**									

Gaps Identified:

1. Unable to relate theory to real-life problems.
2. Lack of awareness to the real-time problems of industry and process to design and develop the solution, considering public health & safety and cultural, societal and environmental considerations

Activities decided to Bridge the Gap:

1. Online course materials and lectures regarding modern tools will be focused on.
2. Interaction with professional bodies is to be increased.

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QUIZ : Attainment Table

S. No	Student Name	Total Marks	CO Attainment																		PO Attainment									
			CO1	Prev. CO1	CO1 Cum.	CO2	Prev. CO2	CO2 Cum.	CO3	Prev. CO3	CO3 Cum.	CO4	Prev. CO4	CO4 Cum.	CO5	Prev. CO5	CO5 Cum.	Overall CO	Prev. Overall	Cum. Overall	PO1	Prev. PO1	Cum. PO1	PO2	Prev. PO2	Cum. PO2	PO3	Prev. PO3	Cum. PO3
		10	Level of Attainment																											
1	AARAV BHARADWAJ																													
2	ABHISHEK JANGID	8		2.5	2.5		3	3		3	3	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		3	3
3	ACHAL SINGHAL	6		3	3		3	3		3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3		3	3	3
4	AJAY YADAV	8		2.5	2.5		2.5	2.5		2.5	2.5	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		2.5	2.5
5	AMIT KUMAR	9		2.75	2.75		2.5	2.5		2.75	2.75	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.5	2.75		2.75	2.75
6	AMIT SHARMA																													
7	ANKIT KUSHWAHA																													
8	ANKIT MAAN	10		2.5	2.5		3	3		2	2	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		2	2
9	ANKIT MALI	6		3	3		2.75	2.75		2.75	2.75	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.75	2.88		2.75	2.75
10	ASHISH MEENA	9		2.5	2.5		2.5	2.5		2.5	2.5	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.5	2.75		2.5	2.5
11	AVINASH SHARMA																													
12	AYUSH GUPTA	7		2.75	2.75		3	3		3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3		3	3	3
13	BHUVANESH CHAUDHARY	9		2.5	2.5		2.5	2.5		3	3	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		3	3
14	CHAUDHARY HARIOM LAKSHMIKANT	7		2.5	2.5		3	3		2.75	2.75	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.5	2.75		2.75	2.75
15	DEEPAK MOURYA																													
16	DIPESH SAINI	6		3	3		3	3		3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3		3	3	3
17	DIVYANSH SHARMA	6		2.75	2.75		3	3		3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3		3	3	3
18	GARVIT JANGID	9		3	3		2.5	2.5		2.5	2.5	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.5	2.75		2.5	2.5
19	GARVIT KHANDELWAL	10		2.5	2.5		3	3		3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3		3	3	3
20	HARDIK BHASKAR	9		3	3		2.75	2.75		2.5	2.5	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.75	2.88		2.5	2.5
21	HARSHIT KUMAR MEHARCHANDANI	6		2.5	2.5		3	3		3	3	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		3	3
2	HARSHVARDHAN SHRINGI	7		3	3		3	3		2.7	2.7	3	3	3		3	3	3	3	3	3	3	3	3	3	3		2.7	2.7

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2										5	5																	5	5
23	HEMANT KUMAR SHARMA	9		2.5	2.5		3	3		2.5	2.5	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		2.5	2.5
24	IRFAN ALAM	6		2	2		2.5	2.5		3	3	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.75	2.88		3	3
25	JATIN AGARWAL	8		2.75	2.75		2.5	2.5		2.5	2.5	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.25	2.63		2.25	2.25
26	KANAK PAREEK	10		2.75	2.75		3	3		3	3	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.5	2.75		3	3
27	KARAN JANGID	8		2.5	2.5		3	3		2.75	2.75	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.75	2.88		2.75	2.75
28	KESHAV KUMAR SHARMA	8		2.5	2.5		2.5	2.5		3	3	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		3	3
29	KHUSHI VERMA	10		3	3		3	3		2.5	2.5	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.75	2.88		2.5	2.5
30	KULDEEP CHOUDHARY																												
31	KUNAL JAIN	4		2.5	2.5		2.5	2.5		3	3	2	3	2.5		3	3	2	2.5	2.25	2	2.5	2.25	2	2.5	2.25		3	3
32	MAHENDRA BAIRWA	6		3	3		2.5	2.5		3	3	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.5	2.75		3	3
33	MANISH BAIRWA	9		3	3		2.5	2.5		3	3	3	3	3		3	3	3	3	3	3	3	3	3	2.75	2.88		3	3
34	MANISH MEENA	7		2.5	2.5		3	3		3	3	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		3	3
35	MANOJ SAINI	6		2.5	2.5		3	3		3	3	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		3	3
36	MANSI BARDAWAT	8		2.75	2.75		2.5	2.5		3	3	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.5	2.75		3	3
37	MAYANK YADAV	6		2.75	2.75		3	3		3	3	3	2.5	2.75		3	3	3	3	3	3	3	3	3	3	3		3	3
38	MD ANAS ZAIM KHAN	8		2.5	2.5		3	3		3	3	3	3	3		3	3	3	2.5	2.75	3	2.5	2.75	3	2.5	2.75		3	3
39	MD SAJID	10		3	3		3	3		3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3		3	3
40	MEENAKSHI RATNAWAT	9		3	3		3	3		3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3		3	3
41	MOHIT JOSHI	7		2.75	2.75		2.5	2.5		3	3	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.75	2.88		3	3
42	NAVNEET KUMAR SAINI	6		3	3		2.75	2.75		2.5	2.5	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.5	2.75		2.5	2.5
43	NIDHI SINGH BUNKER	6		3	3		2.5	2.5		2.5	2.5	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.75	2.88		2.25	2.25
44	PRETISH GARG	6		2.75	2.75		2.75	2.75		2.75	2.75	3	3	3		3	3	3	2.75	2.88	3	2.75	2.88	3	2.75	2.88		2.75	2.75
45	PRIYA KANWAR	9		2.5	2.5		2.75	2.75		3	3	3	3	3		3	3	3	2.75	2.88	3	3	3	3	2.75	2.88		3	3
46	SANEY THAKUR	10		2.75	2.75		2.75	2.75		3	3	3	3	3		3	3	3	3	3	3	3	3	3	2.75	2.88		3	3

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47	SATYAM KUMAR SHUKLA	**3**		3	3		2.5	2.5		3	3	**1**	3	2		3	3	**1**	3	2	**1**	3	2	**1**	2.75	1.88		3	3
48	SHAHNAWAZ ALAM	**9**		3	3		3	3		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	3	3		3	3
49	SUNIL MEENA	**9**		3	3		3	3		3	3	**3**	2	2.5		3	3	**3**	3	3	**3**	3	3	**3**	3	3		3	3
50	VISHNU MAHAWAR	**8**		3	3		3	3		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	2.75	2.88		3	3
51	VISHVENDRA PALIWAL	**8**		2.5	2.5		3	3		2.5	2.5	**3**	3	3		3	3	**3**	2.75	2.88	**3**	2.75	2.88	**3**	2.75	2.88		2.5	2.5
52	VIVEK YADAV	**7**		3	3		3	3		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	3	3		3	3
53	YASH KUMAR KATARA	**9**		2.75	2.75		2.5	2.5		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	2.75	2.88		3	3
54	YASHSHVI MEENA	**10**		3	3		3	3		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	3	3		3	3
55	YUVRAJ SINGH	**10**		2.5	2.5		3	3		2.75	2.75	**3**	3	3		3	3	**3**	2.5	2.75	**3**	2.5	2.75	**3**	2.5	2.75		2.75	2.75
56	ANIL KUMAR (PMSSS)	**6**		3	3		2.75	2.75		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	2.75	2.88		3	3
57	ARUN ISHER (PMSSS)	**6**		2.5	2.5		3	3		3	3	**3**	3	3		3	3	**3**	2.5	2.75	**3**	2.5	2.75	**3**	2.5	2.75		3	3
58	PRAVEEN SINGH (PMSSS)	**8**		2.75	2.75		3	3		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	3	3		3	3
59	ABHISHEK DUBEY	**8**		3	3		3	3		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	3	3		3	3
60	ABHISHEK KUMAR	**10**		3	3		3	3		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	3	3		3	3
61	AMRIT KUMAR																													
62	KANHAIYA LAL	**10**		3	3		3	3		2.5	2.5	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	2.75	2.88		2.5	2.5
63	KIRAN BALA																													
64	MOHAMMAD RIZWAN	**8**		2.75	2.75		2.5	2.5		3	3	**3**	3	3		3	3	**3**	2.5	2.75	**3**	2.5	2.75	**3**	2.5	2.75		3	3
65	RAJVEER SAINI	**8**		2.5	2.5		2.5	2.5		3	3	**3**	3	3		3	3	**3**	2.5	2.75	**3**	2.5	2.75	**3**	2.5	2.75		3	3
66	SURENDER KUMAR	**6**		3	3		3	3		3	3	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	3	3		3	3

	No. of Students attained level 3= 56	**% of Students Attained Level 3= 98.24%**
	No. of Students attained level 2= 1	**% of Students Attained Level 2= 1.75%**
	No. of Students attained level 1= 0	**% of Students Attained Level 1= 0%**
	Target Achieved= 3	

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	CO						PO											
Overall CO Attainments for PO	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Targets	**2.5**	**3**	**3**	**3**	**3**	**2.9333**	**3**	**2.8**	**3**									
Attainment				**2.9483**		**2.8828**	**2.9483**	**2.7517**										
Previous Attainment	**2.4856**	**2.9828**	**2.9483**	**2.9483**	**2.9828**	**2.9333**	**3**	**2.8**	**2.9483**									
Cumulative	**2.49**	**2.98**	**2.95**	**2.95**	**2.98**	**2.91**	**2.97**	**2.78**	**2.95**									
Gap	**0.01**	**0.02**	**0.05**	**0.05**	**0.02**	**0.03**	**0.03**	**0.02**	**0.05**									

Gaps Identified:
1. Some students showed less interest in application-based engineering because of a lack of imagination.
2. Problem-solving capability of students is not up to the Mark

Activities decided to Bridge the Gap:
1. Extra lectures on different types of problem analysis techniques need to be taken for improvement.
2. Practical will be performed on analysis-based topics.

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ATTAINMENT FOR MIDTERM-II EXA

S. No	Student Name	Total Marks	CO Attainment																		PO Attainment								
			CO1	Prev. CO1	CO1 Cum.	CO2	Prev. CO2	CO2 Cum.	CO3	Prev. CO3	CO3 Cum.	CO4	Prev. CO4	CO4 Cum.	CO5	Prev. CO5	CO5 Cum.	Overall CO	Prev. Overall	Cum. Overall	PO1	Prev. PO1	Cum. PO1	PO2	Prev. PO2	Cum. PO2	PO3	Prev. PO3	Cum. PO3
		60	Level of Attainment																										
1	AARAV BHARADWAJ																												
2	ABHISHEK JANGID	25		2.5	2.5		3	3	2	3	2.5		3	3	3	3	3	2	2.75	2.375	3	2.75	2.875	3	2.75	2.875	2	3	2.5
3	ACHAL SINGHAL	56		3	3		3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	AJAY YADAV	24		2.5	2.5		2.5	2.5	2	2.5	2.25		3	3	1	3	2	1	2.75	1.875	1	2.75	1.875	1	2.75	1.875	2	2.5	2.25
5	AMIT KUMAR	28		2.75	2.75		2.5	2.5	3	2.75	2.875	3	3	3	1	3	2	2	2.875	2.4375	3	2.875	2.9375	3	2.75	2.875	3	2.75	2.875
6	AMIT SHARMA																												
7	ANKIT KUSHWAHA																												
8	ANKIT MAAN	23		2.5	2.5		3	3	1	2	1.5		3	3		3	3	1	2.75	1.875	1	2.75	1.875	1	2.75	1.875	1	2	1.5
9	ANKIT MALI	45		3	3		2.75	2.75	3	2.75	2.875		3	3	2	3	2.5	2	2.875	2.4375	3	2.875	2.9375	3	2.875	2.9375	3	2.75	2.875
10	ASHISH MEENA	26		2.5	2.5		2.5	2.5	2	2.5	2.25	3	3	3	2	3	2.5	3	2.875	2.9375	3	2.875	2.9375	3	2.75	2.875	2	2.5	2.25
11	AVINASH SHARMA																												
12	AYUSH GUPTA	24		2.75	2.75		3	3	2	3	2.5	3	3	3	1	3	2	2	3	2.5	2	3	2.5	2	3	2.5	2	3	2.5
13	BHUVANESH CHAUDHARY	29		2.5	2.5		2.5	2.5	2	3	2.5		3	3	3	3	3	2	2.75	2.375	3	2.75	2.875	3	2.75		2	3	
14	CHAUDHARY HARIOM LAKSHMIKANT	8		2.5	2.5		3	3	1	2.75	1.875		3	3		3	3	1	2.875	1.9375	1	2.875	1.9375	1	2.75		1	2.75	
15	DEEPAK MOURYA																												
16	DIPESH SAINI	24		3	3		3	3	3	3	3		3	3		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
17	DIVYANSH SHARMA	9		2.75	2.75		3	3	1	3	2		3	3		3	3	3	3	3	1	3	2	1	3	2	1	3	2
18	GARVIT JANGID	12		3	3		2.5	2.5	1	2.5	1.75		3	3	2	3	2.5	2	2.875	2.4375	1	2.875	1.9375	1	2.75	1.875	1	2.5	1.75
19	GARVIT KHANDELWAL	10		2.5	2.5		3	3	1	3	2	3	3	3		3	3	3	3	3	3	3	3	3	3	3	1	3	2
20	HARDIK BHASKAR	7		3	3		2.75	2.75	1	2.5	1.75	1	3	3	2	3	2.5	2	2.875	2.4375	1	2.875	1.9375	1	2.875	1.9375	1	2.5	1.75
21	HARSHIT KUMAR MEHARCHANDANI	16		2.5	2.5		3	3	2	3	2.5		3	3	2	3	2.5	1	2.75	1.875	2	2.75	2.375	2	2.75	2.375	2	3	2.5
22	HARSHVARDHAN SHRINGI	37		3	3		3	3	3	2.75	2.875	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.75	2.875
23	HEMANT KUMAR SHARMA	5		2.5	2.5		3	3		2.5	2.5	2	3	2.5	2	3	2.5	1	2.75	1.875	2	2.75	2.375	2	2.75	2.375		2.5	2.5
24	IRFAN ALAM	3		2	2		2.5	2.5		3	3	1	3	2		3	3	2	2.875	2.4375	1	2.875	1.9375	1	2.875	1.9375		3	3
25	JATIN AGARWAL	22		2.75	2.75		2.5	2.5	1	2.5	1.75	1	3	2	2	3	2.5	1	2.75	1.875	2	2.75	2.375	2	2.625	2.3125	1	2.25	1.625
26	KANAK PAREEK	15		2.75	2.75		3	3	1	3	2	3	3	3	2	3	2.5	2	2.875	2.4375	3	2.875	2.9375	3	2.75	2.875	1	3	2

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27	KARAN JANGID	**10**		2.5	2.5		3	3	**1**	2.75	1.875	3	3	3	1	3	2	**2**	2.875	2.4375	**1**	2.875	1.9375	**1**	2.875	1.9375	**1**	2.75	1.875
28	KESHAV KUMAR SHARMA	**28**		2.5	2.5		2.5	2.5	**2**	3	2.5	2	3	2.5		3	3	**1**	2.75	1.875	**2**	2.75	2.375	**2**	2.75	2.375	**2**	3	2.5
29	KHUSHI VERMA	**28**		3	3		3	3	**2**	2.5	2.25	3	3	3	2	3	2.5	**2**	2.875	2.4375	**2**	2.875	2.4375	**2**	2.875	2.4375	**2**	2.5	2.25
30	KULDEEP CHOUDHARY																												
31	KUNAL JAIN	**8**		2.5	2.5		2.5	2.5	**1**	3	2	1	2.5	1.75		3	3	**1**	2.25	1.625	**1**	2.25	1.625	**1**	2.25	1.625	**1**	3	2
32	MAHENDRA BAIRWA	**27**		3	3		2.5	2.5	**1**	3	2		3	3	2	3	2.5	**1**	2.875	1.9375	**1**	2.875	1.9375	**1**	2.75	1.875	**1**	3	2
33	MANISH BAIRWA	**8**		3	3		2.5	2.5	**1**	3	2	1	3	2		3	3	**2**	3	2.5	**1**	3	2	**1**	2.875	1.9375	**1**	3	2
34	MANISH MEENA	**24**		2.5	2.5		3	3	**1**	3	2	3	3	3	1	3	2	**1**	2.75	1.875	**1**	2.75	1.875	**1**	2.75	1.875	**1**	3	2
35	MANOJ SAINI			2.5	2.5		3	3	**1**	3	2		3	3	1	3	2	**1**	2.75	1.875	**1**	2.75	1.875	**1**	2.75	1.875	**1**	3	2
36	MANSI BARDAWAT	**2**		2.75	2.75		2.5	2.5	**1**	3	2		3	3	2	3	2.5	**1**	2.875	1.9375	**1**	2.875	1.9375	**1**	2.75	1.875	**1**	3	2
37	MAYANK YADAV	**15**		2.75	2.75		3	3	**2**	3	2.5		2.75	2.75	1	3	2	**2**	3	2.5	**1**	3	2	**1**	3	2	**2**	3	2.5
38	MD ANAS ZAIM KHAN	**26**		2.5	2.5		3	3	**2**	3	2.5	1	3	2	1	3	2	**1**	2.75	1.875	**1**	2.75	1.875	**1**	2.75	1.875	**2**	3	2.5
39	MD SAJID	**18**		3	3		3	3	**1**	3	2	3	3	3		3	3	**2**	3	2.5	**2**	3	2.5	**2**	3	2.5	**1**	3	2
40	MEENAKSHI RATNAWAT	**27**		3	3		3	3	**1**	3	2	2	3	2.5	1	3	2	**2**	3	2.5	**1**	3	2	**1**	3	2	**1**	3	2
41	MOHIT JOSHI	**28**		2.75	2.75		2.5	2.5	**2**	3	2.5	1	3	2		3	3	**2**	2.875	2.4375	**2**	2.875	2.4375	**2**	2.875	2.4375	**2**	3	2.5
42	NAVNEET KUMAR SAINI	**25**		3	3		2.75	2.75	**1**	2.5	1.75	1	3	2	1	3	2	**1**	2.875	1.9375	**1**	2.875	1.9375	**1**	2.75	1.875	**1**	2.5	1.75
43	NIDHI SINGH BUNKER	**41**		3	3		2.5	2.5	**3**	2.5	2.75	1	3	2	1	3	2	**2**	2.875	2.4375	**2**	2.875	2.4375	**2**	2.875	2.4375	**3**	2.25	2.625
44	PRETISH GARG	**29**		2.75	2.75		2.75	2.75	**1**	2.75	1.875	3	3	3	1	3	2	**2**	2.875	2.4375	**2**	2.875	2.4375	**2**	2.875	2.4375	**1**	2.75	1.875
45	PRIYA KANWAR	**31**		2.5	2.5		2.75	2.75	**2**	3	2.5	1	3	2		3	3	**2**	2.875	2.4375	**2**	3	2.5	**2**	2.875	2.4375	**2**	3	2.5
46	SANEY THAKUR	**25**		2.75	2.75		2.75	2.75	**1**	3	2	3	3	3	1	3	2	**2**	3	2.5	**1**	3	2	**1**	2.875	1.9375	**1**	3	2
47	SATYAM KUMAR SHUKLA	**30**		3	3		2.5	2.5	**2**	3	2.5	**2**	2	2	1	3	2	**2**	2	2	**1**	2	1.5	**1**	1.88	1.4375	**2**	3	2.5
48	SHAHNAWAZ ALAM	**34**		3	3		3	3	**3**	3	3	**1**	3	2	1	3	2	**2**	3	2.5	**1**	3	2	**1**	3	2	**3**	3	3
49	SUNIL MEENA	**17**		3	3		3	3	**1**	3	2	**2**	2.5	2.25	1	3	2	**2**	3	2.5	**1**	3	2	**1**	3	2	**1**	3	2
50	VISHNU MAHAWAR	**14**		3	3		3	3	**1**	3	2	**3**	3	3		3	3	**2**	3	2.5	**2**	3	2.5	**2**	2.88	2.4375	**1**	3	2
51	VISHVENDRA PALIWAL	**24**		2.5	2.5		3	3	**1**	2.5	1.75	**2**	3	2.5	1	3	2	**2**	2.88	2.4375	**1**	2.88	1.9375	**1**	2.88	1.9375	**1**	2.5	1.75
52	VIVEK YADAV	**47**		3	3		3	3	**3**	3	3	**3**	3	3	1	3	2	**3**	3	3	**2**	3	2.5	**2**	3	2.5	**3**	3	3
53	YASH KUMAR KATARA	**27**		2.75	2.75		2.5	2.5	**1**	3	2	**3**	3	3	1	3	2	**2**	3	2.5	**1**	3	2	**1**	2.88	1.9375	**1**	3	2
54	YASHSHVI MEENA	**24**		3	3		3	3	**1**	3	2	**2**	3	2.5	1	3	2	**2**	3	2.5	**1**	3	2	**1**	3	2	**1**	3	2
55	YUVRAJ SINGH	**5**		2.5	2.5		3	3	**1**	2.75	1.875	**1**	3	2	2	3	2.5	**1**	2.75	1.875	**1**	2.75	1.875	**1**	2.75	1.875	**1**	2.75	1.875

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56	ANIL KUMAR (PMSSS)	**16**		3	3		2.75	2.75	**1**	3	2	**1**	3	2	1	3	2	**2**	3	2.5	**1**	3	2	**1**	2.88	1.9375	**1**	3	2
57	ARUN ISHER (PMSSS)	**4**		2.5	2.5		3	3	**1**	3	2		3	3	1	3	2	**1**	2.75	1.875	**1**	2.75	1.875	**1**	2.75	1.875	**1**	3	2
58	PRAVEEN SINGH (PMSSS)	**29**		2.75	2.75		3	3	**2**	3	2.5	**3**	3	3		3	3	**3**	3	3	**3**	3	3	**3**	3	3	**2**	3	2.5
59	ABHISHEK DUBEY	**41**		3	3		3	3	**3**	3	3	**2**	3	2.5	1	3	2	**3**	3	3	**2**	3	2.5	**2**	3	2.5	**3**	3	3
60	ABHISHEK KUMAR	**55**		3	3		3	3	**3**	3	3	**3**	3	3	1	3	2	**3**	3	3	**2**	3	2.5	**2**	3	2.5	**3**	3	3
61	AMRIT KUMAR																												
62	KANHAIYA LAL	**49**		3	3		3	3	**3**	2.5	2.75	**3**	3	3	1	3	2	**2**	3	2.5	**2**	3	2.5	**2**	2.88	2.4375	**3**	2.5	2.75
63	KIRAN BALA																												
64	MOHAMMAD RIZWAN	**25**		2.75	2.75		2.5	2.5	**2**	3	2.5	**1**	3	2	1	3	2	**1**	2.75	1.875	**1**	2.75	1.875	**1**	2.75	1.875	**2**	3	2.5
65	RAJVEER SAINI	**25**		2.5	2.5		2.5	2.5	**1**	3	2		3	3	1	3	2	**1**	2.75	1.875	**1**	2.75	1.875	**1**	2.75	1.875	**1**	3	2
66	SURENDER KUMAR	**51**		3	3		3	3	**3**	3	3	**3**	3	3	1	3	2	**3**	3	3	**2**	3	2.5	**2**	3	2.5	**3**	3	3
	No. of Students attained level 3= 40																		**% of Students Attained Level 3= 70.17%**										
	No. of Students attained level 2= 18																		**% of Students Attained Level 2= 31.57%**										
	No. of Students attained level 1= 0																		**% of Students Attained Level 1= 0%**										
	Target Achieved= 3																												

	CO						**PO**											
Overall CO Attainments for PO	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Targets	**2.5**	**3**	**3**	**3**	**3**	**2.9333**	**3**	**2.8**	**3**									
Attainment			**1.6964**	**2.122**	**1.4545**	**1.8375**	**1.6724**	**1.5609**	**1.6964**									
Previous Attainment	**2.4856**	**2.9828**	**2.9483**	**2.94828**	**2.9828**	**2.90805**	**2.9741**	**2.7759**	**2.9483**									
Cumulative	**2.49**	**2.98**	**2.32**	**2.54**	**2.22**	**2.37**	**2.32**	**2.17**	**2.32**									
Gap	**0.01**	**0.02**	**0.68**	**0.46**	**0.78**	**0.56**	**0.68**	**0.63**	**0.68**									

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Gaps Identified:
1. Problem-solving capability of students is not up to the Mark
2. Unable to relate theory to real-life problems.

Activities decided to Bridge the Gap:
1. Extra lectures on different types of problem analysis techniques need to be taken for improvement.

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CO-GAP IDENTIFICATIONS

COs	CO 1	CO 2	CO 3	CO4	CO5
Target	**2.5**	**3**	**3**	**3**	**3**
Achieved	**2.485632**	**2.982759**	**2.965517**	**2.949153**	**2.982759**
Gap	**0.014368**	**0.017241**	**0.034483**	**0.050847**	**0.017241**

Gaps Identified:

1. Lack of basic engineering knowledge observed in students.
2. Inability to relate fundamental principles of engineering to the real problems
3. Technical communication was lacking among the students

OVERALL CO ATTAINMENT TABLE

COs	CO1	CO2	CO3	CO4	CO5
Attainment level as per rules	**2.485632**	**2.982759**	**2.965517**	**2.949153**	**2.982759**
Average CO attainment through internal assessment	**2.873163842**				

Activities Decided to Bridge the Gap:

1. **Imparting basic engineering knowledge through a practical approach needs to be focused more.**
2. **Video lectures and other resources for improving technical skills are to be shared on a common platform.**

ATTAINMENT OF POS & PSO

CO	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**
CO2	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**
CO3	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**1**
CO4	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**
CO5	**3**	**3**	**-**	**-**	**-**	**-**	**--**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**
Obtain Average-PO/PSO Targets	**3**	**2.8**	**3**										**2**	**1**	**1**

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PO GAP IDENTIFICATION

	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Targets	3	2.8	3										2	1	1
Achieved	2.966	2.768	2.966										1.356	0.333	0.333
Gap	0.034	0.032	0.034										0.644	0.667	0.667

Gaps Identified:

1. Some students showed less interest in application-based engineering because of a lack of imagination.
2. Problem-solving capability of students is not up to the Mark
3. Unable to relate theory to real-life problems.
4. Lack of awareness to the real-time problems of industry and process to design and develop the solution, considering public health & safety and cultural, societal and environmental considerations

Activities decided to Bridge the Gap:

1. Extra lectures on different types of problem analysis techniques need to be taken for improvement.
2. Practical will be performed on analysis-based topics.
3. Online course materials and lectures regarding modern tools will be focused on.
4. Interaction with professional bodies is to be increased.

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ATTAINMENT OF CO THROUGH MIDTERM -I COMPONENT

SEC A	
CO: 5EE4-03: Subject: Control System	
Target	2.9
Achieved	2.05
Gap	0.847

Gaps for CO attainment through MIDTERM-I Component:

1. Lack of basic engineering knowledge observed in students.
2. Inability to relate fundamental principles of engineering to the real problems

Action to be taken:

1. Imparting basic engineering knowledge through a practical approach needs to be focused more.

ATTAINMENT OF PO THROUGH CO (MIDTERM-I) COMPONENT

SEC A															
Attainment of PO through CO(MIDTERM-I) Component															
6EE4-05	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Targets	3	2.8	3										2	1	1
Achieved	2.14	1.74	2.20										0.96	0.33	0.33
Gap	0.86	1.06	0.80										1.04	0.67	0.67

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ATTAINMENT OF CO THROUGH MIDTERM -II COMPONENT

SEC A	
CO: 5EE4-03 : Subject: Control System	
Target	**2.99**
Achieved	**2.04**
Gap	**0.85**

Gaps for CO attainment through MIDTERM-II Component:

1. Problem-solving capability of students is not up to the Mark

2. Unable to relate theory to real-life problems.

Action to be taken:

1. Extra lectures on different types of problem analysis techniques need to be taken for improvement.

ATTAINMENT OF PO THROUGH CO (MIDTERM-II) COMPONENT

SEC A															
Attainment of PO through CO(MIDTERM-II) Component															
6EE4-05	**PO**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Targets	**3**	**2.8**	**3**										**2**	**1**	**1**
Achieved	**2.52**	**1.681**	**1.696**										**0.881**	**0.336**	**0.3333**
Gap	**0.48**	**1.119**	**1.304**										**1.118**	**0.663**	**0.6667**

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