LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr.M.S.Giridhar
Course Name & Code : Power System Protection (17EE21) Credits : 3
L-T-P Structure : 3-0-0 A.Y : 2022-23
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Sections- A

PRE-REQUISITE: Electrical Power Transmission

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the student to

- Understand the working and operation of different types of circuit breakers, electro-magnetic and electro-static relays.
- Identify different protection schemes for different electrical equipment in the power system.
- Introduce the concepts of microprocessor based protective relaying schemes.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Illustrate different types and functions of protective relays of power systems.
CO 2	Analyze the operation and working of electromechanical, static and numerical relays.
CO 3	Design relevant protection schemes for the main elements of power system.
CO 4	Illustrate fundamental concepts and types of circuit breakers.

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2									1			
CO2	3	3	1	2									2	1		
CO3	3	3	2	2	3		2	1			2	2	2	2		
CO4	3	2	1	2									2	1		

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

T1 Badri Ram, D.N.Vishwakarma, „Power System Protection and Switchgear" TMH publications 2nd Edition, 2011.

T2 T.S.Madhava Rao, „Power system protection –Static relays with microprocessor applications" TMH publications 2nd Edition,2008.

REFERENCE BOOKS:

R1 C.R.Mason, „Art and scince of protective relaying" Wiley publications, 1956

R2 C.L.Wadhwa, "Electrical Power Systems", New Age international(P)Limited, Third Edition, 2004.

R3 Sunil S. Rao, Switchgear Protection and Power Systems: Theory, Practice and Solved Problems – 11th Edition, Khanna Publishers, 1999.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: General Introduction to Power system protection

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Power System Protection	2	12-07-2022 13-07-2022		TLM1	
2.	Overview of Power System Protection	2	15-07-2022 16-07-2022		TLM1	
3.	Need for power system protection , Nature and causes of faults	2	19-07-2022 20-07-2022		TLM1	
4.	Power system protective components	1	22-07-2022		TLM1	
5.	Types of faults and their effects	1	23-07-2022		TLM2	
6.	Evolution of protective relaying, Zones of protection	1	26-07-2022		TLM1	
7.	Primary and Backup protection	1	27-07-2022		TLM1	
8.	Essential qualities of protection	1	29-07-2022		TLM1	
9.	Classification of protective relays based on technology and functions	1	30-07-2022		TLM1	
10.	Classification of protective schemes	1	02-08-2022		TLM2	
No. of classes required to complete UNIT-I: 13				No. of classes taken:		

UNIT-II: Operating Principles and Relay Construction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Electromagnetic relays – attracted armature, Induction disc.	2	03-08-2022 05-08-2022		TLM1	
2.	Induction cup, permanent magnet type of relays Moving coil electromagnetic relay	2	06-08-2022 10-08-2022		TLM1	
3.	Moving iron electromagnetic relay	2	12-08-2022 13-08-2022		TLM1	
4.	Balanced beam relay	1	16-08-2022		TLM1	
5.	Auxiliary relay. Thermal relays	1	17-08-2022		TLM1	
6.	Merits and demerits of static relays	1	20-08-2022		TLM1	
7.	Comparators-amplitude and phase duality between amplitude and	1	23-08-2022		TLM1	
8.	Phase comparators, Types of amplitude and phase comparators	1	24-08-2022		TLM1	
9.	Micro processor based protective relays.	1	26-08-2022		**TLM2**	
No. of classes required to complete UNIT-II: 12				No. of classes taken:		

UNIT-III: Protective Schemes

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	**Over current protection:** Time-Current characteristics	2	27-08-2022 02-09-2022		TLM1	
2.	Current and time settings Protection Schemes	2	30-08-2022 03-09-2022		TLM1	
3.	Reverse power or directional relay, protection of feeders, ring mains	1	27-09-2022		TLM1	
4.	Earth fault and phase fault protection.	2	28-09-2022 30-09-2022		TLM1	
5.	Distance protection: Impedance, reactance and MHO relays	2	01-10-2022 04-10-2022		TLM1	

6.	Effect of arc resistance, power surges or power swings and line length on the performance of distance relays	2	07-10-2022 08-10-2022		TLM1	
7.	Selection of distance relays, distance relay characteristics	1	11-10-2022		TLM1	
8.	Choice of characteristics for different zones of protection.	1	12-10-2022		**TLM2**	
9.	Generator protection – protection against stator, Generator rotor faults and protection	1	14-10-2022		**TLM2**	
10.	Abnormal operating conditions such as unbalanced loading, loss of excitation, over speeding	1	15-10-2022		**TLM2**	
11.	Transformer unit protection.	1	18-10-2022		**TLM2**	
12.	Star-delta, delta-star, delta-delta and star-star transformers connected with C.Ts	1	19-10-2022		**TLM2**	
13.	Transformer- over current protection	1	21-10-2022		**TLM2**	
14.	Transformer - differential protection	1	22-10-2022		**TLM2**	
No. of classes required to complete UNIT-III: 19				No. of classes taken:		

UNIT-IV: Microprocessor Based Protective Relays

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Microprocessor based Over current relay.	1	25-10-2022		TLM1	
2.	Microprocessor based Distance (Impedance) relays	1	26-10-2022		TLM1	
3.	Microprocessor based Distance (Reactance) relays	1	28-10-2022		TLM1	
4.	Flow chart for over current relay, impedance and reactance relay	1	29-10-2022		TLM2	
5.	Microprocessor based Directional Relays , Flow chart for directional relay	1	01-11-2022		TLM2	
6.	Generalized mathematical expression for distance relays	1	02-11-2022		TLM1	
7.	Block diagram explanation of Distance relays	2	04-11-2022 05-11-2022		TLM1	
8.	Protection against high resistance ground faults	2	08-11-2022 09-11-2022		TLM1	
9.	Inter-turn faults - Bucholz relay	1	11-11-2022		TLM1	
No. of classes required to complete UNIT-IV: 11				No. of classes taken:		

UNIT-V: Circuit Breakers

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Arc voltage Arc	2	12-11-2022 15-11-2022		TLM1	
2.	Interruption theories	2	16-11-2022 18-11-2022		TLM1	
3.	Re-striking and recovery voltages	1	19-11-2022		TLM1	
4.	Resistance switching,	1	29-11-2022		TLM1	
5.	Current chopping in circuit breakers	2	30-11-2022 02-12-2022		TLM1	
6.	interruption of capacitive currents	1	03-12-2022		TLM1	
7.	Oil Circuit breaker	1	06-12-2022		**TLM2**	
8.	Air blast and Air break Circuit breaker	1	07-12-2022		**TLM2**	

9.	SF6 breaker operating mechanism	1	09-12-2022		**TLM2**	
10.	Selection of circuit breakers, high voltage DC circuit breakers	1	10-12-2022			
11.	Ratings & Testing of Circuit Breakers	1	13-12-2022			
No. of classes required to complete UNIT-V: 14				No. of classes taken:		

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
1.	Numerical Over current Relays	1	14-12-2022		TLM1	CO1, CO2	T2,R3	
2.	Communication in Power system protection	1	16-12-2022		TLM1	CO2, CO3	T2,R3	
3.	HV circuit breakers	1	17-12-2022		TLM1	CO4	T2,R3	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO 2	Design and analyze electrical machines, modern drive and lighting systems
PSO 3	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO 4	Design controllers for electrical and electronic systems to improve their performance

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr.M.S.Giridhar	Dr.M.S.Giridhar	Dr.M.S.Giridhar	Dr.J.Sivavaraprasad

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr.M.S.Giridhar
Course Name & Code : Power System Protection (17EE21) Credits : 3
L-T-P Structure : 3-0-0 A.Y : 2022-23
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Sections- B

PRE-REQUISITE: Electrical Power Transmission

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the student to

- Understand the working and operation of different types of circuit breakers, electro-magnetic and electro-static relays.
- Identify different protection schemes for different electrical equipment in the power system.
- Introduce the concepts of microprocessor based protective relaying schemes.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Illustrate different types and functions of protective relays of power systems.
CO 2	Analyze the operation and working of electromechanical, static and numerical relays.
CO 3	Design relevant protection schemes for the main elements of power system.
CO 4	Illustrate fundamental concepts and types of circuit breakers.

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2									1			
CO2	3	3	1	2									2	1		
CO3	3	3	2	2	3		2	1			2	2	2	2		
CO4	3	2	1	2									2	1		

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

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REFERENCE BOOKS:

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PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: General Introduction to Power system protection

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Power System Protection	2	11-07-2022 12-07-2022		TLM1	
2.	Overview of Power System Protection	2	14-07-2022 15-07-2022		TLM1	
3.	Need for power system protection , Nature and causes of faults	2	18-07-2022 19-07-2022		TLM1	
4.	Power system protective components	1	21-07-2022		TLM1	
5.	Types of faults and their effects	1	22-07-2022		TLM2	
6.	Evolution of protective relaying, Zones of protection	1	25-07-2022		TLM1	
7.	Primary and Backup protection	1	26-07-2022		TLM1	
8.	Essential qualities of protection	1	28-07-2022		TLM1	
9.	Classification of protective relays based on technology and functions	1	29-07-2022		TLM1	
10.	Classification of protective schemes	1	01-08-2022		TLM2	
No. of classes required to complete UNIT-I: 13				No. of classes taken:		

UNIT-II: Operating Principles and Relay Construction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Electromagnetic relays – attracted armature, Induction disc.	2	02-08-2022 04-08-2022		TLM1	
2.	Induction cup, permanent magnet type of relays Moving coil electromagnetic relay	2	05-08-2022 08-08-2022		TLM1	
3.	Moving iron electromagnetic relay	2	11-08-2022 12-08-2022		TLM1	
4.	Balanced beam relay	1	16-08-2022		TLM1	
5.	Auxiliary relay. Thermal relays	1	18-08-2022		TLM1	
6.	Merits and demerits of static relays	1	22-08-2022		TLM1	
7.	Comparators-amplitude and phase duality between amplitude and	1	23-08-2022		TLM1	
8.	Phase comparators, Types of amplitude and phase comparators	1	25-08-2022		TLM1	
9.	Micro processor based protective relays.	1	26-08-2022		**TLM2**	
No. of classes required to complete UNIT-II: 12				No. of classes taken:		

UNIT-III: Protective Schemes

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	**Over current protection:** Time-Current characteristics	2	29-08-2022 30-08-2022		TLM1	
2.	Current and time settings Protection Schemes	2	01-09-2022 02-09-2022		TLM1	
3.	Reverse power or directional relay, protection of feeders, ring mains	1	26-09-2022		TLM1	
4.	Earth fault and phase fault protection.	2	27-09-2022 29-09-2022		TLM1	
5.	Distance protection: Impedance, reactance and MHO relays	2	30-09-2022 04-10-2022		TLM1	

6.	Effect of arc resistance, power surges or power swings and line length on the performance of distance relays	2	06-10-2022 07-10-2022		TLM1	
7.	Selection of distance relays, distance relay characteristics	1	10-10-2022		TLM1	
8.	Choice of characteristics for different zones of protection.	1	11-10-2022		**TLM2**	
9.	Generator protection – protection against stator, Generator rotor faults and protection	1	13-10-2022		**TLM2**	
10.	Abnormal operating conditions such as unbalanced loading, loss of excitation, over speeding	2	14-10-2022 17-10-2022		**TLM2**	
11.	Transformer unit protection.	1	18-10-2022		**TLM2**	
12.	Star-delta, delta-star, delta-delta and star-star transformers connected with C.Ts	1	19-10-2022		**TLM2**	
13.	Transformer- over current protection	1	20-10-2022		**TLM2**	
14.	Transformer - differential protection	1	21-10-2022		**TLM2**	
No. of classes required to complete UNIT-III: 20				No. of classes taken:		

UNIT-IV: Microprocessor Based Protective Relays

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Microprocessor based Over current relay.	1	25-10-2022		TLM1	
2.	Microprocessor based Distance (Impedance) relays	1	27-10-2022		TLM1	
3.	Microprocessor based Distance (Reactance) relays	1	28-10-2022		TLM1	
4.	Flow chart for over current relay, impedance and reactance relay	1	31-10-2022		TLM2	
5.	Microprocessor based Directional Relays , Flow chart for directional relay	1	01-11-2022		TLM2	
6.	Generalized mathematical expression for distance relays	1	03-11-2022		TLM1	
7.	Block diagram explanation of Distance relays	2	04-11-2022 07-11-2022		TLM1	
8.	Protection against high resistance ground faults	2	08-11-2022 10-11-2022		TLM1	
9.	Inter-turn faults - Bucholz relay	1	11-11-2022		TLM1	
No. of classes required to complete UNIT-IV: 11				No. of classes taken:		

UNIT-V: Circuit Breakers

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Arc voltage Arc	2	14-11-2022 15-11-2022		TLM1	
2.	Interruption theories	2	17-11-2022 18-11-2022		TLM1	
3.	Re-striking and recovery voltages	1	19-11-2022		TLM1	
4.	Resistance switching,	1	28-11-2022		TLM1	
5.	Current chopping in circuit breakers	2	29-11-2022 01-12-2022		TLM1	
6.	Interruption of capacitive currents	1	02-12-2022		TLM1	
7.	Oil Circuit breaker	1	05-12-2022		**TLM2**	
8.	Air blast and Air break Circuit breaker	1	06-12-2022		**TLM2**	
9.	SF6 breaker operating mechanism	1	08-12-2022		**TLM2**	

10.	Selection of circuit breakers, high voltage DC circuit breakers	1	09-12-2022			
11.	Ratings & Testing of Circuit Breakers	1	12-12-2022			
No. of classes required to complete UNIT-V: 14				No. of classes taken:		

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
1.	Numerical Over current Relays	1	13-12-2022		TLM1	CO1, CO2	T2,R3	
2.	Communication in Power system protection	1	15-12-2022		TLM1	CO2, CO3	T2,R3	
3.	HV circuit breakers	1	16-12-2022		TLM1	CO4	T2,R3	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO 2	Design and analyze electrical machines, modern drive and lighting systems
PSO 3	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO 4	Design controllers for electrical and electronic systems to improve their performance

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr.M.S.Giridhar	Dr.M.S.Giridhar	Dr.M.S.Giridhar	Dr.J.Sivavaraprasad

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF Electrical and Electronics Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr.P.Sobha Rani
Course Name & Code : Power System operation and Control 17EE22
L-T-P Structure : 2-1-0 Credits : 3
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Section- A A.Y : 2022-23

PRE-REQUISITE : Power System Analysis

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the student to

- Familiarize economic operation of power system
- Introduce emphasizes on single area and two area load frequency control
- Understand reactive power control methods

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Illustrate the fundamental concepts of economic operation of power
CO 2	Realize the operations of AGC and reactive power control
CO 3	Outline the concepts of deregulation

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1								1	2			
CO2	3	3		3	3								2	1		2
CO3	3	3		3	3								2	2		2

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

T1 W D Stevenson Jr., "Power System Analysis", T M H, 4th edition,1982.
T2 PSR Murthy, "Operation and control in power system" , BS publications, second edition,2009

REFERENCE BOOKS:

R1 O.I.Elgerd, "Electric Energy systems theory: An introduction", TMH, 2nd edition 2017.
R2 A.J.Wood and B.F.Wallenberg, "Power Generation, operation and Control", John Wiley&sons publications, 2nd edition 2010.
R3 Hadi Saadat, "Power System Analysis"– TMH , 3rd Edition, 2011.
R4 Dr. Shailendra Jain, "Modelling and simulation using MATLAB-Simulink", Wiley Publication, II Edition., 2011.
R5 Dr.Vikramaditya Dave, "Electric power transmission and Distribution system with PSCAD (Basics)", Himanshu Publication, 2017.
R6 Atosua Yazdani, "Modern distribution systems with PSCAD analysis", CRC press, I Edition., 2018.
R7 Tharangika Bambaravanage, "Modelling, simulation and control of a medium scale power system", Springer, I Edition., 2017.
R8 Operating procedures for national grid, NLDC Power system operation corporation Ltd, July 2013

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):A/S

UNIT-I: ECONOMIC OPERATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, Course outcomes	1	12-07-2022		TLM2	
2.	Optimal operation of generators in thermal stations	1	13-07-2022		TLM2	
3.	Heat rate curve, cost curve, incremental fuel and production costs	1	14-07-2022		TLM2	
4.	Input-output characteristics	1	15-07-2022		TLM2	
5.	Input-output characteristics	1	16-07-2022		TLM2	
6.	Tutorial	1	19-07-2022		TLM3	
7.	Optimum generation allocation including effect of transmission line losses	2	20-07-2022 21-07-2022		TLM2	
8.	Loss coefficients	1	22-07-2022		TLM2	
9.	Loss coefficients	1	23-07-2022		TLM2	
10.	Tutorial	1	26-07-2022		TLM3	
11.	General transmission line loss formula	1	27-07-2022		TLM2	
No. of classes required to complete UNIT-I: 13				No. of classes taken:		

UNIT-II: UNIT COMMITMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Unit commitment problem	1	28-07-2022		TLM2	
2.	Unit commitment problem	1	29-07-2022		TLM2	
3.	Priority order scheduling	1	30-07-2022		TLM2	
4.	Tutorial	1	02-08-2022		TLM3	
5.	Priority order scheduling	1	03-08-2022		TLM2	
6.	Dynamic programming approach to Unit commitment problem	2	04-08-2022 05-08-2022		TLM2	
7.	Dynamic programming approach to Unit commitment problem	1	06-08-2022		TLM2	
8.	Hydro-Thermal coordination	2	10-08-2022 11-08-2022		TLM2	
9.	Hydro-Thermal coordination	1	12-08-2022		TLM2	
No. of classes required to complete UNIT-II:11				No. of classes taken:		

UNIT-III: AUTOMATIC GENERATION CONTROL(AGC)

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Generator-steady state and transient models	2	16-08-2022 17-08-2022		TLM2	

2.	Description of simplified network model of a synchronous machine	2	18-08-2022 20-08-2022		TLM2	
3.	Tutorial	1	23-08-2022		TLM3	
4.	Load, prime mover and governor models	2	24-08-2022 25-08-2022		TLM2	
5.	Steady state performance of speed governing system	2	26-08-2022 27-08-2022		TLM2	
6.	Tutorial	1	30-08-2022		TLM3	
7.	Restricted mode of governing mode of operation	1	01-09-2022		TLM2	
8.	Primary load frequency loop	2	02-09-2022 03-09-2022		TLM2	
9.	CRT Classes		05-09-2022 To 17-09-2022			
10.	I Mid Examinations		20-09-2022 To 24-09-2022			
11.	Steady state response with and without integral control loop	1	27-09-2022		TLM2	
12.	dynamic response with and without integral control loop	2	28-09-2022 29-09-2022		TLM2	
13.	Modeling and Performance of secondary load frequency loop	1	30-09-2022		TLM2	
14.	Extension to two area system	1	01-10-2022		TLM2	
15.	tie line power flow model	1	06-10-2022		TLM2	
16.	Interfacing AGC with economic dispatch	1	07-10-2022		TLM2	
No. of classes required to complete UNIT-III:20				No. of classes taken:		

UNIT-IV : REACTIVE POWER CONROL AND VOLTAGE STABILITY

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Reactive power flow and voltage collapse	1	11-10-2022		TLM2	
2.	V-Q sensitivity analysis	2	12-10-2022 13-10-2022		TLM2	
3.	Reactive power compensation in transmission system	1	14-10-2022		TLM2	
4.	Advantages and disadvantages of different types of compensating equipment for transmission system	1	15-10-2022		TLM2	
5.	Tutorial	1	18-10-2022		TLM3	
6.	Load compensation	1	19-10-2022		TLM2	
7.	Specifications of load compensator	1	20-10-2022		TLM2	
8.	Uncompensated and compensated transmission lines				TLM2	
9.	**Shunt and series compensation**	2	21-10-2022 22-10-2022		TLM2	
10.	Tutorial	1	25-10-2022		TLM3	
11.	FACTS devices (elementary treatment)	3	26-10-2022 27-10-2022 28-10-22		TLM2	
No. of classes required to complete UNIT-IV:14				No. of classes taken:		

UNIT-V : DEREGULATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction of market structure	2	29-10-2022 01-11-2022		TLM2	
2.	Spot market	1	02-11-2022		TLM2	
3.	Forward markets and settlements	1	03-11-2022		TLM2	
4.	pricing	1	04-11-2022		TLM2	
5.	Location marginal prices(LMP)	1	05-11-2022		TLM2	
6.	Location marginal prices(LMP)	1	09-11-2022		TLM2	
7.	Tutorial	1	10-11-2022		TLM3	
8.	Transmission pricing	2	11-11-2022 16-11-2022		TLM2	
9.	Tutorial	1	15-11-2022		TLM3	
10.	Introduction to financial rights	1	17-11-2022		TLM2	
11.	revision	2	18-11-2022 19-11-2022		TLM1	
12.	II Mid		22-11-2022 to 26-11-2022			
No. of classes required to complete UNIT-V:14				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5

Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO 2	Design and analyze electrical machines, modern drive and lighting systems
PSO 3	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO4	Design controllers for electrical and electronic systems to improve their performance

Course Instructor Course Coordinator Module Coordinator HOD

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DEPARTMENT OF Electrical and Electronics Engineering

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr.P.Sobha Rani
Course Name & Code : Power System operation and Control 17EE22
L-T-P Structure : 2-1-0 Credits : 3
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Section- B A.Y : 2021-22

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COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the student to

- Familiarize economic operation of power system
- Introduce emphasizes on single area and two area load frequency control
- Understand reactive power control methods

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Illustrate the fundamental concepts of economic operation of power
CO 2	Realize the operations of AGC and reactive power control
CO 3	Outline the concepts of deregulation

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1								1	2			
CO2	3	3		3	3								2	1		2
CO3	3	3		3	3								2	2		2

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
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R7 Tharangika Bambaravanage, "Modelling, simulation and control of a medium scale power system", Springer, I Edition., 2017.

R8 Operating procedures for national grid, NLDC Power system operation corporation Ltd, July 2013

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):B/S

UNIT-I: ECONOMIC OPERATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, Course outcomes	1	11-7-2022		TLM2	
2.	Optimal operation of generators in thermal stations	1	12-7-2022		TLM2	
3.	Heat rate curve, cost curve, incremental fuel and production costs	1	13-7-2022		TLM2	
4.	Input-output characteristics	1	14-7-2022		TLM2	
5.	Input-output characteristics	1	15-7-2022		TLM2	
6.	Optimum generation allocation without line losses	1	18-7-2022		TLM2	
7.	Tutorial	1	19-7-2022		TLM3	
8.	Optimum generation allocation including effect of transmission line losses	2	20-7-2022 21-7-2022		TLM2	
9.	Loss coefficients	1	22-7-2022		TLM2	
10.	Loss coefficients	1	25-7-2022		TLM2	
11.	Tutorial	1	26-7-2022		TLM3	
12.	General transmission line loss formula	1	27-7-2022		TLM2	
No. of classes required to complete UNIT-I: 13				No. of classes taken:		

UNIT-II: UNIT COMMITMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Unit commitment problem	1	28-7-2022		TLM2	
2.	Unit commitment problem	2	29-7-2022 01-8-2022		TLM2	
3.	Priority order scheduling	1	02-8-2022		TLM2	
4.	Tutorial-1	1	03-8-2022		TLM2	
5.	Dynamic programming approach to Unit commitment problem	2	04-8-2022 05-8-2022		TLM2	
6.	Dynamic programming approach to Unit commitment problem	1	08-8-2022		TLM2	
7.	Hydro-Thermal coordination	2	10-8-2022 11-8-2022		TLM2	
8.	Hydro-Thermal coordination	1	12-8-2022		TLM2	
No. of classes required to complete UNIT-II:11				No. of classes taken:		

UNIT-III: AUTOMATIC GENERATION CONTROL(AGC)

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Generator-steady state and transient models	2	16-8-2022 17-8-2022		TLM2	

2.	Description of simplified network model of a synchronous machine	2	18-8-2022 22-8-2022		TLM2	
3.	Tutorial	1	23-8-2022		TLM3	
4.	Load, prime mover and governor models	2	24-8-2022 25-8-2022		TLM2	
5.	Steady state performance of speed governing system	2	26-8-2022 29-8-2022		TLM2	
6.	Tutorial	1	30-8-2022		TLM3	
7.	Restricted mode of governing mode of operation	2	1-9-2022 2-9-2022		TLM2	
8.	CRT classes		5-9-2022 to 17-9-2022			
9.	I Mid Examinations		19-9-2022 to 23-9-2022			
10.	Primary load frequency loop	1	26-9-2022		TLM2	
11.	Tutorial	1	27-9-2022		TLM3	
12.	Steady state with and without integral control loop	1	28-9-2022		TLM2	
13.	dynamic response with and without integral control loop	1	29-9-2022		TLM2	
14.	Modeling and Performance of secondary load frequency loop	1	30-9-2022		TLM2	
15.	Extension to two area system	1	6-10-2022		TLM2	
16.	tie line power flow model	1	7-10-2022		TLM2	
17.	Interfacing AGC with economic dispatch	1	10-10-2022		TLM2	
No. of classes required to complete UNIT-III:20				No. of classes taken:		

UNIT-IV : REACTIVE POWER CONROL AND VOLTAGE STABILITY

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Reactive power flow and voltage collapse	1	11-10-2022		TLM2	
2.	V-Q sensitivity analysis	1	12-10-2022		TLM2	
3.	Reactive power compensation in transmission system	1	13-10-2022		TLM2	
4.	Advantages and disadvantages of different types of compensating equipment for transmission system	1	14-10-2022		TLM2	
5.	Load compensation	1	17-10-2022		TLM2	
6.	Tutorial	1	18-10-2022		TLM3	
7.	Specifications of load compensator	2	19-10-2022 20-10-2022		TLM2	
8.	Uncompensated and compensated transmission lines				TLM2	
9.	Shunt and series compensation	2	21-10-2022 26-10-2022		TLM2	
10.	Tutorial	1	25-10-2022		TLM3	
11.	FACTS devices (elementary treatment)	3	27-10-2022 28-10-2022 31-10-2022		TLM2	
No. of classes required to complete UNIT-IV:14				No. of classes taken:		

UNIT-V : DEREGULATION

S.No.	Topics to be covered	No. of Classes	Tentative Date of	Actual Date of	Teaching Learning	HOD Sign

		Required	Completion	Completion	Methods	Weekly
1.	Introduction of market structure	2	01-11-2022 02-11-2022		TLM2	
2.	Spot market	1	03-11-2022		TLM2	
3.	Forward markets and settlements	2	04-11-2022 07-11-2022		TLM2	
4.	pricing	2	09-11-2022 10-11-2022		TLM2	
5.	Location marginal prices(LMP)	2	11-11-2022 14-11-2022		TLM2	
6.	Tutorial	1	15-11-2022		TLM3	
7.	Transmission Pricing	1	16-11-2022		TLM2	
8.	Introduction to financial rights	1	17-11-2022		TLM2	
9.	revision	1	18-11-2022		TLM1	
10.	II Mid		21-11-2022 to 25-11-2022			
No. of classes required to complete UNIT-V:13				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO 2	Design and analyze electrical machines, modern drive and lighting systems
PSO 3	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO4	Design controllers for electrical and electronic systems to improve their performance

Course Instructor Course Coordinator Module Coordinator HOD

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L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

COURSE HANDOUT

PROGRAM : B.Tech., VII-Sem., EEE , A-Sec

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : **Solid State Drives** - 17EE23

L-T-P STRUCTURE : **2**-2-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : **P.Deepak Reddy**

COURSE COORDINATOR : **P.Deepak Reddy**

PRE-REQUISITE: Power Electronics, Electrical Machines-I & Electrical Machines-II.

COURSE OBJECTIVE : This course enables the student to

- Know the operation of various converter controlled dc and ac motor drives
- Provide the controlling of dc motor drives with single phase/ three phase converters and choppers
- Understand AC motor drive control with variable frequency and variable voltage

COURSE OUTCOMES(COs)

After completion of the course, the student will be able to

CO1: Interpret various operating regions of electrical drives.
CO2: Analyze suitable controllers for DC Drives.
CO3: Analyze suitable controllers for AC Drives.

COURSE ARTICULATION MATRIX (Correlation between COs&POs,PSOs):

COs	POa	POb	POc	POd	POe	POf	POg	POh	POi	POj	POk	POl	PSOa	PSOb	PSOc	PSOd
CO1	3	3	-	-	3	-	-	-	-	-	-	1	-	3		-
CO2	3	3	-	3	3	-	-	-	-	-	-	-	-	3		2
CO3	3	3	-	3	3	-	-	-	-	-	-	-	-	3		2

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

BOS APPROVED TEXT BOOKS:

T1 G.K.Dubey, "Power Semi Conductor Dives", Narosa Publications.

T2 B.K.Bose, "Modern Power Electronics and AC drives", PHI.

BOS APPROVED REFERENCE BOOKS:

R1 Vedam Subramanyam, "Thyristor control of Electric Drives" Tata McGraw Hill Publications.

R2 S K Pillai, "A first course on Electrical Drives", New age International(P) ltd. 3rd Edition.

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I : RECTIFIER CONTROLLED DC MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction to Subject & Course Outcomes	1	11-07-2022		**TLM1**	CO1,2	1	
2.	UNIT-I, Significance of variable speed drives	1	12-07-2022		**TLM1**	CO1,2	1	
3.	Single-phase fully controlled rectifier fed separately excited DC motor	1	13-07-2022		**TLM1**	CO1,2	1	
4.	Single-phase semi controlled rectifier fed separately excited DC motor	1	14-07-2022		**TLM1**	CO1,2	1	
5.	Three-phase, fully controlled rectifier fed separately excited DC motor	1	16-07-2022		**TLM1**	CO1,2	1	
6.	Three-phase, semi controlled rectifier fed separately excited DC motor	1	18-07-2022		**TLM1**	CO1,2	1	
7.	TUTORIAL-1	1	19-07-2022		**TLM3**	CO1,2	1	
8.	Single-phase fully controlled rectifier fed DC series motor	1	20-07-2022		**TLM1**	CO1,2	1	
9.	Single-phase semi controlled rectifier fed DC series motor	1	21-07-2022		**TLM1**	CO1,2	1	
10.	Three-phase, fully controlled rectifier fed DC series motor	1	23-07-2022		**TLM1**	CO1,2	1	
11.	Three-phase, semi controlled rectifier fed DC series motor	1	25-07-2022		**TLM1**	CO1,2	1	
12.	TUTORIAL-2	1	26-07-2022		**TLM3**	CO1,2	1	
13.	Problems	1	27-07-2022		**TLM1**	CO1,2	1	
14.	Assignment/Quiz-1	1	28-07-2022		**TLM6**	CO1,2	1	
No. of classes required to complete UNIT-I		15			No. of classes taken:			

UNIT-II : CHOPPER CONTROLLED DC MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
15.	Principle of operation and control techniques	1	30-07-2022		**TLM1**	CO1,2	1	
16.	motoring operation of separately excited dc motor	1	1-08-2022		**TLM1**	CO1,2	1	
17.	TUTORIAL-3	1	2-08-2022		**TLM3**	CO1,2	1	
18.	motoring operation of dc series motor	1	3-08-2022		**TLM1**	CO1,2	1	
19.	regenerative braking of separately excited dc motor and dc series motor	1	4-08-2022		**TLM1**	CO1,2	1	

20.	dynamic braking of separately excited dc motor and dc series motor	1	6-08-2022		**TLM1**	CO1,2	1	
21.	plugging of separately excited dc motor and dc series motor	1	8-08-2022		**TLM1**	CO1,2	1	
22.	multi quadrant control of chopper fed dc motors	1	10-08-2022		**TLM1**	CO1,2	1	
23.	Problems	1	11-08-2022		**TLM3**	CO1,2	1	
24.	Repetition	1	13-08-2022		**TLM2**	CO1,2	1	
25.	TUTORIAL-4	1	16-08-2022		**TLM3**	CO1,2	1	
26.	Assignment/Quiz-2	1	17-08-2022		**TLM6**	CO1,2	1	
No. of classes required to complete UNIT-II		13			No. of classes taken:			
I-MID EXAMINATIONS(19/09/2022 TO 24/09/2022)								

UNIT-III : CONTROL OF INDUCTION MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
27.	Stator voltage control of Induction Motor	1	18-08-2022		**TLM1**	CO3	2	
28.	Stator frequency control-Open loop V/f control of Induction Motor	1	20-08-2022		**TLM1**	CO3	2	
29.	Control of Induction motor by ac voltage controller	1	22-08-2022		**TLM1**	CO3	2	
30.	TUTORIAL-5	1	23-08-2022		**TLM3**	CO3	2	
31.	Control of induction motor by voltage source Inverter	1	24-08-2022		**TLM1**	CO3	2	
32.	Control of induction motor by current source Inverter	1	25-08-2022		**TLM1**	CO3	2	
33.	Control of induction motor by cyclo converter	1	27-08-2022		**TLM1**	CO3	2	
34.	Comparison of voltage source and current source inverter drives	1	29-08-2022		**TLM1**	CO3	2	
35.	TUTORIAL-6	1	30-08-2022		**TLM3**	CO3	2	
36.	problems	1	01-09-2022		**TLM1**	CO3	2	
37.	problems	1	03-09-2022		**TLM1**	CO3	2	
38.	Demonstration	1	26-09-2022		**TLM4**	CO3	2	
39.	TUTORIAL-7	1	27-09-2022		**TLM3**	CO3	2	
40.	Assignment/Quiz-3	1	28-09-2022		**TLM6**	CO3	2	
41.	Repetition		29-09-2022		**TLM2**	CO3	2	
No. of classes required to complete UNIT-III		15			No. of classes taken:			

UNIT-IV : SLIP POWER CONTROLLED WOUND ROTOR INDUCTION MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
42.	Static rotor resistance control	1	01-10-2022		**TLM1**	CO3	1	
43.	TUTORIAL-8	1	04-10-2022		**TLM3**	CO3	1	
44.	Slip-power recovery schemes	1	06-10-2022		**TLM3**	CO3	1	
45.	Static Scherbius, Phasor diagram	1	08-10-2022		**TLM1**	CO3	1	
46.	Static Kramer drive, Phasor diagram	1	10-10-2022		**TLM1**	CO3	1	
47.	TUTORIAL-9	1	11-10-2022		**TLM3**	CO3	1	
48.	Closed loop speed control of Static Scherbius drive	1	12-10-2022		**TLM3**	CO3	1	
49.	Modes of operation of Static Scherbius	1	13-10-2022		**TLM1**	CO3	1	
50.	Problems, Applications	1	15-10-2022		**TLM1**	CO3	1	
51.	Problems	1	17-10-2022		**TLM1**	CO3	1	
52.	TUTORIAL-10	1	18-10-2022		**TLM3**	CO3	1	
53.	Demonstration	1	19-10-2022		**TLM4**	CO3	1	
54.	Repetition	1	20-10-2022		**TLM2**	CO3	1	
55.	Assignment/Quiz-4	1	22-10-2022		**TLM6**	CO3	1	
56.	TUTORIAL-11	1	25-10-2022		**TLM3**	CO3	1	
No. of classes required to complete UNIT-IV		15			No. of classes taken:			

UNIT-V : CONTROL OF SYNCHRONOUS MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
57.	Synchronous motors- variable frequency control	1	26-10-2022		**TLM1**	CO3	1	
58.	Operation of self controlled Synchronous motors-by VSI.	1	27-10-2022		**TLM1**	CO3	1	
59.	Operation of self controlled Synchronous motors-by CSI.	1	29-10-2022		**TLM1**	CO3	1	
60.	Operation of self controlled Synchronous motors-by Cyclo converters	1	31-10-2022		**TLM1**	CO3	1	
61.	TUTORIAL-12	1	1-11-2022		**TLM3**	CO3	1	
62.	Load commutated CSI fed Synchronous Motor	1	2-11-2022		**TLM3**	CO3	1	

63.	Closed Loop control operation of synchronous motor drives (Block Diagram Only)	1	3-11-2022		**TLM1**	CO3	1	
64.	problems	1	5-11-2022		**TLM3**	CO3	1	
65.	Demonstration	1	7-11-2022		**TLM4**	CO3	1	
66.	Assignment/Quiz-5	1	9-11-2022		**TLM6**	CO3	1	
67.	Repitition	1	10-11-2022		**TLM2**	CO3	1	
68.	Repitition	1	12-11-2022		**TLM2**	CO3	1	
69.	Repitition	1	14-11-2022		**TLM2**	CO3	1	
70.	TUTORIAL-13	1	15-11-2022		**TLM3**	CO3	1	
71.	Repitition	1	16-11-2022		**TLM2**	CO3	1	
72.	Repitition	1	17-11-2022		**TLM2**	CO3	1	
73.	Repitition	1	19-11-2022		**TLM2**	CO3	1	
74.	No. of classes required to complete UNIT-V	17			No. of classes taken:			
II-MID EXAMINATIONS(21/11/2022 to 26/11/2022)								

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
75.								
76.								
77.								

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM2	PPT	**TLM6**	Assignment or Quiz
TLM3	Tutorial	**TLM7**	Group Discussion/Project
TLM4	Demonstration (Lab/Field Visit)		

Part - C

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1,2	A1=5
Assignment/Quiz – 2	1,2	A2=5
I-Mid Examination	1,2	B1=20
Online Quiz Examination-1	1,2	C1=10
Assignment/Quiz – 3	3	A3=5
Assignment/Quiz – 4	3	A4=5
Assignment/Quiz – 5	3	A5=5
II-Mid Examination	3	B2=20
Online Quiz Examination-2	3	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3	A=5
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3	B=20
Evaluation of Online Quiz Examination: C=75% of Max(C1,C2)+25% of Min(C1,C2)	1,2,3	C=10
Attendance	1,2,3	D=5
Cumulative Internal Examination : A+B+C+D	**1,2,3**	**A+B=40**
Semester End Examinations	**1,2,3**	**C=60**
Total Marks: A+B+C	**1,2,3**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)
PROGRAMME OUTCOMES (POs)
PSOs

P.Deepak Reddy	P.Deepak Reddy	Dr.J.S.V.Prasad	Dr.J.S.V.Prasad
Course Instructor	Course Coordinator	Module Coordinator	HOD

LAKKIREDDY BALI REDDY COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
(Autonomous & Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi, NAAC Accredited with 'A' grade, Accredited by NBA, Certified by ISO 9001:2015)
L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

COURSE HANDOUT

PROGRAM : B.Tech., VII-Sem., EEE , B-Sec

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : **Solid State Drives** - 17EE23

L-T-P STRUCTURE : **2**-2-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : **P.Deepak Reddy**

COURSE COORDINATOR : **P.Deepak Reddy**

PRE-REQUISITE: Power Electronics, Electrical Machines-I & Electrical Machines-II.

COURSE OBJECTIVE : This course enables the student to

- Know the operation of various converter controlled dc and ac motor drives
- Provide the controlling of dc motor drives with single phase/ three phase converters and choppers
- Understand AC motor drive control with variable frequency and variable voltage

COURSE OUTCOMES(COs)

After completion of the course, the student will be able to

CO1: Interpret various operating regions of electrical drives.
CO2: Analyze suitable controllers for DC Drives.
CO3: Analyze suitable controllers for AC Drives.

COURSE ARTICULATION MATRIX (Correlation between COs&POs,PSOs):

COs	POa	POb	POc	POd	POe	POf	POg	POh	POi	POj	POk	POl	PSOa	PSOb	PSOc	PSOd
CO1	3	3	-	-	3	-	-	-	-	-	-	1	-	3		-
CO2	3	3	-	3	3	-	-	-	-	-	-	-	-	3		2
CO3	3	3	-	3	3	-	-	-	-	-	-	-	-	3		2

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

BOS APPROVED TEXT BOOKS:

T1 G.K.Dubey, "Power Semi Conductor Dives", Narosa Publications.

T2 B.K.Bose, "Modern Power Electronics and AC drives", PHI.

BOS APPROVED REFERENCE BOOKS:

R1 Vedam Subramanyam, "Thyristor control of Electric Drives" Tata McGraw Hill Publications.

R2 S K Pillai, "A first course on Electrical Drives", New age International(P) ltd. 3rd Edition.

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

UNIT-I : RECTIFIER CONTROLLED DC MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction to Subject & Course Outcomes	1	12-07-2022		**TLM1**	CO1,2	1	
2.	UNIT-I, Significance of variable speed drives	1	13-07-2022		**TLM1**	CO1,2	1	
3.	Single-phase fully controlled rectifier fed separately excited DC motor	1	14-07-2022		**TLM1**	CO1,2	1	
4.	Single-phase semi controlled rectifier fed separately excited DC motor	1	15-07-2022		**TLM1**	CO1,2	1	
5.	Three-phase, fully controlled rectifier fed separately excited DC motor	1	16-07-2022		**TLM1**	CO1,2	1	
6.	Three-phase, semi controlled rectifier fed separately excited DC motor	1	19-07-2022		**TLM1**	CO1,2	1	
7.	Single-phase fully controlled rectifier fed DC series motor	1	20-07-2022		**TLM1**	CO1,2	1	
8.	TUTORIAL-1	1	21-07-2022		**TLM3**	CO1,2	1	
9.	Single-phase semi controlled rectifier fed DC series motor	1	22-07-2022		**TLM1**	CO1,2	1	
10.	Three-phase, fully controlled rectifier fed DC series motor	1	23-07-2022		**TLM1**	CO1,2	1	
11.	Three-phase, semi controlled rectifier fed DC series motor	1	26-07-2022		**TLM1**	CO1,2	1	
12.	Problems	1	27-07-2022		**TLM1**	CO1,2	1	
13.	TUTORIAL-2	1	28-07-2022		**TLM3**	CO1,2	1	
14.	Assignment/Quiz-1	1	29-07-2022		**TLM6**	CO1,2	1	
No. of classes required to complete UNIT-I		14			No. of classes taken:			

UNIT-II : CHOPPER CONTROLLED DC MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
15.	Principle of operation and control techniques	1	30-07-2022		**TLM1**	CO1,2	1	
16.	motoring operation of separately excited dc motor	1	2-08-2022		**TLM1**	CO1,2	1	
17.	motoring operation of dc series motor		3-08-2022		**TLM1**	CO1,2	1	
18.	TUTORIAL-3	1	4-08-2022		**TLM3**	CO1,2	1	
19.	regenerative braking of separately excited dc motor and dc series motor	1	5-08-2022		**TLM1**	CO1,2	1	

20.	dynamic braking of separately excited dc motor and dc series motor	1	6-08-2022		**TLM1**	CO1,2	1	
21.	plugging of separately excited dc motor and dc series motor	1	10-08-2022		**TLM1**	CO1,2	1	
22.	TUTORIAL-4	1	11-08-2022		**TLM3**	CO1,2	1	
23.	multi quadrant control of chopper fed dc motors	1	12-08-2022		**TLM1**	CO1,2	1	
24.	Problems	1	13-08-2022		**TLM1**	CO1,2	1	
25.	Repetition	1	16-08-2022		**TLM2**	CO1,2	1	
26.	Assignment/Quiz-2	1	17-08-2022		**TLM6**	CO1,2	1	
27.	TUTORIAL-5	1	18-08-2022		**TLM3**	CO1,2	1	
No. of classes required to complete UNIT-II		13			No. of classes taken:			
I-MID EXAMINATIONS(19/09/2022 TO 24/09/2022)								

UNIT-III : CONTROL OF INDUCTION MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
28.	Stator voltage control of Induction Motor	1	20-08-2022		**TLM1**	CO3	2	
29.	Stator frequency control-Open loop V/f control of Induction Motor	1	23-08-2022		**TLM1**	CO3	2	
30.	Control of Induction motor by ac voltage controller	1	24-08-2022		**TLM1**	CO3	2	
31.	TUTORIAL-6	1	25-08-2022		**TLM3**	CO3	2	
32.	Control of induction motor by voltage source Inverter	1	26-08-2022		**TLM1**	CO3	2	
33.	Control of induction motor by current source Inverter	1	27-08-2022		**TLM1**	CO3	2	
34.	Control of induction motor by cyclo converter	1	30-08-2022		**TLM1**	CO3	2	
35.	TUTORIAL-7	1	01-09-2022		**TLM3**	CO3	2	
36.	Comparison of voltage source and current source inverter drives	1	02-09-2022		**TLM1**	CO3	2	
37.	problems	1	03-09-2022		**TLM1**	CO3	2	
38.	problems	1	27-09-2022		**TLM1**	CO3	2	
39.	Demonstration	1	28-09-2022		**TLM4**	CO3	2	
40.	TUTORIAL-8	1	29-09-2022		**TLM3**	CO3	2	
41.	Assignment/Quiz-3	1	30-09-2022		**TLM6**	CO3	2	
42.	Repetition	1	01-10-2022		**TLM2**	CO3	2	
No. of classes required to complete UNIT-III		15			No. of classes taken:			

UNIT-IV : SLIP POWER CONTROLLED WOUND ROTOR INDUCTION MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
43.	Static rotor resistance control	1	04-10-2022		**TLM1**	CO3	1	
44.	TUTORIAL-9	1	06-10-2022		**TLM3**	CO3	1	
45.	Slip-power recovery schemes	1	07-10-2022		**TLM1**	CO3	1	
46.	Static Scherbius, Phasor diagram	1	08-10-2022		**TLM1**	CO3	1	
47.	Static Kramer drive, Phasor diagram	1	11-10-2022		**TLM1**	CO3	1	
48.	Closed loop speed control of Static Scherbius drive	1	12-10-2022		**TLM1**	CO3	1	
49.	TUTORIAL-10	1	13-10-2022		**TLM3**	CO3	1	
50.	Modes of operation of Static Scherbius	1	14-10-2022		**TLM1**	CO3	1	
51.	Problems, Applications	1	18-10-2022		**TLM1**	CO3	1	
52.	Problems	1	19-10-2022		**TLM1**	CO3	1	
53.	TUTORIAL-11	1	20-10-2022		**TLM3**	CO3	1	
54.	Demonstration	1	21-10-2022		**TLM4**	CO3	1	
55.	Repetition	1	22-10-2022		**TLM2**	CO3	1	
56.	Assignment/Quiz-4	1	25-10-2022		**TLM6**	CO3	1	
57.	Problems	1	26-10-2022		**TLM1**	CO3	1	
58.	TUTORIAL-12	1	27-10-2022		**TLM3**	CO3	1	
No. of classes required to complete UNIT-IV		16			No. of classes taken:			

UNIT-V : CONTROL OF SYNCHRONOUS MOTOR DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
59.	Synchronous motors- variable frequency control	1	28-10-2022		**TLM1**	CO3	1	
60.	Operation of self controlled Synchronous motors-by VSI.	1	29-10-2022		**TLM1**	CO3	1	
61.	Operation of self controlled Synchronous motors-by CSI.	1	01-11-2022		**TLM1**	CO3	1	
62.	Operation of self controlled Synchronous motors-by Cyclo converters	1	02-11-2022		**TLM1**	CO3	1	
63.	TUTORIAL-13	1	03-11-2022		**TLM3**	CO3	1	
64.	Load commutated CSI fed Synchronous Motor	1	04-11-2022		**TLM1**	CO3	1	
65.	Closed Loop control operation of synchronous motor drives (Block Diagram Only)	1	05-11-2022		**TLM1**	CO3	1	

66.	TUTORIAL-14	1	10-11-2022		**TLM3**	CO3	1	
67.	Demonstration	1	11-11-2022		**TLM4**	CO3	1	
68.	Assignment/Quiz-5	1	12-11-2022		**TLM6**	CO3	1	
69.	Repitition	1	15-11-2022		**TLM2**	CO3	1	
70.	Repitition	1	16-11-2022		**TLM2**	CO3	1	
71.	TUTORIAL-15	1	17-11-2022		**TLM3**	CO3	1	
72.	Repitition	1	18-11-2022		**TLM2**	CO3	1	
73.	Repitition	1	19-11-2022		**TLM2**	CO3	1	
74.	No. of classes required to complete UNIT-V	15			No. of classes taken:			
II-MID EXAMINATIONS(21/11/2022 to 26/11/2022)								

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
75.								
76.								
77.								

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM2	PPT	**TLM6**	Assignment or Quiz
TLM3	Tutorial	**TLM7**	Group Discussion/Project
TLM4	Demonstration (Lab/Field Visit)		

Part - C

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1,2	A1=5
Assignment/Quiz – 2	1,2	A2=5
I-Mid Examination	1,2	B1=20
Online Quiz Examination-1	1,2	C1=10
Assignment/Quiz – 3	3	A3=5
Assignment/Quiz – 4	3	A4=5
Assignment/Quiz – 5	3	A5=5
II-Mid Examination	3	B2=20
Online Quiz Examination-2	3	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3	A=5
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3	B=20
Evaluation of Online Quiz Examination: C=75% of Max(C1,C2)+25% of Min(C1,C2)	1,2,3	C=10
Attendance	1,2,3	D=5
Cumulative Internal Examination : A+B+C+D	**1,2,3**	**A+B=40**
Semester End Examinations	**1,2,3**	**C=60**
Total Marks: A+B+C	**1,2,3**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)
PROGRAMME OUTCOMES (POs)
PSOs

P.Deepak Reddy	P.Deepak Reddy	Dr.J.S.V.Prasad	Dr.J.S.V.Prasad
Course Instructor	Course Coordinator	Module Coordinator	HOD

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.G.Tabita
Course Name & Code : Advanced control systems & 17EE26
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Section- A A.Y : 2022-23
Pre requisite: Control Systems (17EE06)

Course Educational Objective: This course enables the student to

- Provide knowledge on design in state variable form
- Provide knowledge in phase plane analysis.
- Give basic knowledge in describing function analysis.
- Design the optimal controller.
- Learn about the adaptive and robust controllers

Course Outcomes: At the end of the course, students are able to

CO1. Apply the state space modelling concepts to a given system
CO2. Design state observer and controller
CO3. Analyze the non linear systems for stability studies
CO4. Illustrate the adaptive and robust controllers

COURSE ARTICULATION MATRIX (Correlation between Cos & POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3										1	1		3
CO2	3	3	3	2									1			3
CO3	3	3	2													3
CO4	1															1

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

BOS APPROVED TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 6th Edition, 2007.

2. Ashish Tewari, "Modern control Design with Matlab and Simulink" , John Wiley, 1st edition , New Delhi, 2002.

BOS APPROVED REFERENCE BOOKS:

1. Jinzhi Wang, Zhisheng Duan, Ying Yang, Lin Huang, "Analysis and Control of Nonlinear Systems with Stationary sets-Time domain and

Frequency domain methods", World Science publishing co.Pvt Ltd, 1st edition, 2009.
2. George J. Thaler, "Automatic Control Systems", Jaico Publishers, 1st edition, 2006**.**
3. M.Gopal, "Modern control system theory", New Age International Publishers, 9th edition 2014.
4. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, " Feedback Control of Dynamic Systems", Fourth edition, Pearson Education, Low price edition, 2014.
5. Zhou, J.C. Doyle, K. Glover : "Robust and Optimal Control", Prentice Hall, 1st edition, 1996.
6. J. Astrom and B. Wittenmark, "Adaptive Control", Addison-Wesley, 2nd Edition, 2008.

Part - B
COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: STATE VARIABLE ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	UNIT-I : STATE VARIABLE ANALYSIS- course objectives and outcomes	1	11-07-22		TLM1	
2.	Concept of state	1	12-07-22		TLM1	
3.	State Variable and State Model	1	13-07-22		TLM2	
4.	State models for linear and continuous time systems	1	14-07-22		TLM1	
5.	Solution of state and output equation- homogeneous systems	1	18-07-22		TLM1	
6.	numericals	1	19-07-22		TLM1	
7.	Solution of state and output equation-Non homogeneous systems	1	20-07-22		TLM2	
8.	controllability	1	21-07-22		TLM1	
9.	numericals	1	25-07-22		TLM1	
10.	Observability & numerical	1	26-07-22		TLM1	
11.	Pole Placement	1	27-07-22		TLM3	
12.	State observer Design of Control Systems with observers,	1	28-07-22		TLM5	
13.	numericals	1	01-08-22		TLM6	
14.	Assignment	1	02-08-22		TLM1	
No. of classes required to complete UNIT-I : 14			No. of classes taken :			

UNIT-II : PHASE PLANE ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly

15.	Features of linear and non-linear systems	1	03-08-22		TLM1	
16.	Common physical non-linearities	1	04-08-22		TLM1	
17.	Methods of linearising non-linear systems	1	08-08-22		TLM2	
18.	numericals	1	10-08-22		TLM1	
19.	Concept of phase portraits	1	11-08-22		TLM1	
20.	Singular points	1	16-08-22		TLM1	
21.	Limit cycles	1	17-08-22		TLM2	
22.	Construction of phase portraits	1	18-08-22		TLM1	
23.	numericals	1	22-08-22		TLM1	
24.	Phase plane analysis of linear systems	1	23-08-22		TLM5	
25.	Numericals	1	24-08-22		TLM2	
26.	Phase plane analysis of non-linear systems	1	25-08-22		TLM1	
27.	Isocline method.	1	29-08-22		TLM6	
28.	Delta method for constructing Trajectories	1	30-08-22		TLM1	
29.	Assignment-2	1	01-09-22		TLM1	
No. of classes required to complete UNIT- III :15				No. of classes taken :		

UNITIII: DESCRIBING FUNCTION ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
30.	Basic concepts of describing functions	1	26-09-22		TLM1	
31.	derivation of describing functions for common non-linearities	1	27-09-22		TLM2	
32.	Numerical on describing fumction	1	28-09-22		TLM1	
33.	Describing function analysis of non-linear systems	1	29-09-22		TLM1	
34.	Conditions for stability	1	06-10-22		TLM3	
35.	Numerical on stability	1	10-10-22		TLM1	
36.	Stability of oscillations.	1	11-10-22		TLM1	
37.	Analysis of stability of oscillations	1	12-10-22		TLM5	
38.	Numericals	1	13-10-22		TLM1	
39.	Assignment-3	1	17-10-22		TLM1	
No. of classes required to complete UNIT-III :10			No. of classes taken :			

UNIT IV: STABILITY ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40	Introduction to stability	1	18-10-22		TLM1	
41	Stability of equilibrium state Asymptotic stability	1	19-10-22		TLM1	
42	Graphical representation	1	20-10-22		TLM2	

43	Lyapunov stability theorem	1	25-10-22		TLM2	
44	The direct method of Lyapunov,	1	26-10-22		TLM2	
45	Numerical on Direct method of lyapunov	1	27-10-22		TLM2	
46	Stability analysis of linear and nonlinear systems	1	31-10-22		TLM2	
47	Methods of constructing Lyapunov Function for Non-linear Systems.	1	01-11-22		TLM2	
48	Construction of Lyapunov functions using variable gradient method	1	02-11-22		TLM6	
49	Assignment-4	1	03-11-22		TLM2	
No. of classes required to complete UNIT-IV: 10			No. of classes taken :			

UNIT V: OPTIMAL CONTROL

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
50.	Introduction of optimal control problems	1	07-11-22		TLM1	
51.	Concept of Decoupling	1	08-11-22		TLM2	
52.	Numericals on decupling	1	09-11-22		TLM2	
53.	Time varying optimal control	1	10-11-22		TLM2	
54.	LQR steady state optimal control	1	14-11-22		TLM1	
55.	Optimal estimation	1	15-11-22		TLM2	
56.	Introduction to adaptive controls.	1	16-11-22		TLM5	
57.	Introduction robust controls.	1	17-11-22		TLM6	
58.	Assignment-5	1	17-11-22		TLM1	
No. of classes required to complete UNIT-V : 09			No. of classes taken :			

CONTENTS BEYOND THE SYLLABUS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	four degree of freedom	1	30-08-22		TLM2	
2.	Kalman filter design	1	02-11-22		TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

Part - C

EVALUATION PROCESS: R-17 Regulation

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Mr. G.Tabita	Mr. G.Tabita	Dr. P. Sobha Rani	Dr.J.Siva Vara Prasad
Course Instructor	Course Coordinator	Module Coordinator	HOD

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.G.Tabita
Course Name & Code : Advanced control systems & 17EE26
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Section- B A.Y : 2022-23
Pre requisite: Control Systems (17EE06)

Course Educational Objective: This course enables the student to

- Provide knowledge on design in state variable form
- Provide knowledge in phase plane analysis.
- Give basic knowledge in describing function analysis.
- Design the optimal controller.
- Learn about the adaptive and robust controllers

Course Outcomes: At the end of the course, students are able to

CO1. Apply the state space modelling concepts to a given system
CO2. Design state observer and controller
CO3. Analyze the non linear systems for stability studies
CO4. Illustrate the adaptive and robust controllers

COURSE ARTICULATION MATRIX (Correlation between Cos & POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3										1	1		3
CO2	3	3	3	2									1			3
CO3	3	3	2													3
CO4	1															1

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
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3. M.Gopal, "Modern control system theory", New Age International Publishers, 9th edition 2014.
4. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, " Feedback Control of Dynamic Systems", Fourth edition, Pearson Education, Low price edition, 2014.
5. Zhou, J.C. Doyle, K. Glover : "Robust and Optimal Control", Prentice Hall, 1st edition, 1996.
6. J. Astrom and B. Wittenmark, "Adaptive Control", Addison-Wesley, 2nd Edition, 2008.

Part - B
COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: STATE VARIABLE ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	UNIT-I : STATE VARIABLE ANALYSIS- course objectives and outcomes	1	12-07-22		TLM1	
2.	Concept of state	1	14-07-22		TLM1	
3.	State Variable and State Model	1	15-07-22		TLM2	
4.	State models for linear and continuous time systems	1	16-07-22		TLM1	
5.	Solution of state and output equation- homogeneous systems	1	19-07-22		TLM1	
6.	numericals	1	21-07-22		TLM1	
7.	Solution of state and output equation-Non homogeneous systems	1	22-07-22		TLM2	
8.	controllability	1	23-07-22		TLM1	
9.	numericals	1	26-07-22		TLM1	
10	Observability & numerical	1	28-07-22		TLM1	
11	Pole Placement	1	2-07-22		TLM3	
12	State observer Design of Control Systems with observers,	1	29-07-22		TLM5	
13	numericals	1	30-07-22		TLM6	
14	numericals	1	02-08-22		TLM1	
15	Assignment	1	04-08-22			
No. of classes required to complete UNIT-I : 15			No. of classes taken :			

UNIT-II : PHASE PLANE ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
16	Features of linear and non-linear systems	1	05-08-22		TLM1	
17	Common physical non-linearities	1	06-08-22		TLM1	
18	Methods of linearising non-linear systems	1	11-08-22		TLM2	
19	numericals	1	12-08-22		TLM1	
20	Concept of phase portraits	1	16-08-22		TLM1	
21	Singular points	1	18-08-22		TLM1	
22	Limit cycles	1	20-08-22		TLM2	
23	Construction of phase portraits	1	23-08-22		TLM1	
24	Phase plane analysis of linear systems	1	25-08-22		TLM5	
25	Numericals	1	26-08-22		TLM2	
26	Phase plane analysis of non-linear systems	1	27-08-22		TLM1	
27	Isocline method.	1	30-08-22		TLM6	
28	Delta method for constructing Trajectories	1	01-09-22		TLM1	
29	Assignment-2	1	02-09-22		TLM1	
30	four degree of freedom	1	03-09-22			
No. of classes required to complete UNIT- III :15				No. of classes taken :		

UNITIII: DESCRIBING FUNCTION ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31	Basic concepts of describing functions	1	27-09-22		TLM1	
32	derivation of describing functions for common non-linearities	1	29-09-22		TLM2	
33	Numerical on describing fumction	1	30-09-22		TLM1	
34	Describing function analysis of non-linear systems	1	01-10-22		TLM1	
35	Conditions for stability	1	06-10-22		TLM3	
36	Numerical on stability	1	07-10-22		TLM1	
37	Stability of oscillations.	1	08-10-22		TLM1	
38	Analysis of stability of oscillations	1	11-10-22		TLM5	
39	Numericals	1	13-10-22		TLM1	
40	Assignment-3	1	14-10-22		TLM1	
No. of classes required to complete UNIT-III :10			No. of classes taken :			

UNIT IV: STABILITY ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
41	Introduction to stability	1	15-10-22		TLM1	
42	Stability of equilibrium state Asymptotic stability	1	18-10-22		TLM1	
43	Graphical representation	1	20-10-22		TLM2	
44	Lyapunov stability theorem	1	21-10-22		TLM2	
45	The direct method of Lyapunov,	1	22-10-22		TLM2	
46	Numerical on Direct method of lyapunov	1	25-10-22		TLM2	
47	Stability analysis of linear and nonlinear systems	1	27-10-22		TLM2	
48	Methods of constructing Lyapunov Function for Non-linear Systems.	1	28-10-22		TLM2	
49	Construction of Lyapunov functions using variable gradient method	1	29-10-22		TLM6	
50	Assignment-4	1	01-11-22		TLM2	
No. of classes required to complete UNIT-IV: 10			No. of classes taken :			

UNIT V: OPTIMAL CONTROL

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
51	Introduction of optimal control problems	1	03-11-22		TLM1	
52	Concept of Decoupling	1	04-11-22		TLM2	
53	Numericals on decupling	1	05-11-22		TLM2	
54	Time varying optimal control	1	08-11-22		TLM2	
55	LQR steady state optimal control	1	10-11-22		TLM1	
56	Optimal estimation	1	11-11-22		TLM2	
57	Introduction to adaptive controls.	1	12-11-22		TLM5	
58	Introduction robust controls.	1	15-11-22		TLM6	
59	revision	1	17-11-22		TLM1	
60	Kalman filter design	1	18-11-22			
61	Assignment-5	1	19-11-22			
No. of classes required to complete UNIT-V :11			No. of classes taken :			

CONTENTS BEYOND THE SYLLABUS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	four degree of freedom	1	03-09-22		TLM2	
2.	Kalman filter design	1	18-11-22		TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

Part - C

EVALUATION PROCESS: R-17 Regulation

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Mr. G.Tabita	Mr. G.Tabita	Dr. P. Sobha Rani	Dr.J.Siva Vara Prasad
Course Instructor	Course Coordinator	Module Coordinator	HOD

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

COURSE HANDOUT
PART-A

Name of Course Instructor : Dr.G.Nageswara Rao
Course Name & Code : **ENERGY CONSERVATION AND AUDIT** & 17EE28
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Sections- A A.Y : 2022-23

Pre-requisites : Electrical Power Transmission, Electrical Engineering Materials

Course Educational Objective: This course enables the student to

- Introduce the need of energy auditing and devise energy efficient control strategies.
- Learn reactive power management, energy efficient lighting schemes and energy conservation methods.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Illustrate the different parameters for energy auditing.
CO 2	Interpret the controlling of energy management and energy efficiency.
CO 3	Analyze the Reactive power management strategies.
CO 4	Analyze energy conservation measures for economic aspects.

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

Cos	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO a	PSO b	PSO c	PSO d
CO1	3	3		2	2	1					1	1	3			
CO2	3	2		2	2						1	1	2			
CO3	3	2		2	3						1	1	3			
CO4	3	2		2	2						1	1	2	2		1

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

1. W.R. Murphy & G. Mckay Butter worth, "Energy Management", Elsevier publications. 2012
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd – 2nd Edition, 1995

REFERENCE BOOKS:

1. Energy management by Paulo' Callaghan, Mc – Graw Hill Book company – 1st edition, 1998
2. Energy management hand book by W.C. Turner, John wiley and son, 2001.
3. Energy management and good lighting practice: fuel efficiency booklet12 – EEO.
4. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing Company Ltd, New Delhi.
5. K.S.K.Weranga, SisilKumarawadu, D.P.Chandima-"Smart Metering Design and Applications", Springer Publications, 1st Edition, 2014.

Part - B
COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: BASIC PRINCIPLES OF ENERGY AUDIT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, course outcomes,	1	19/7/22			
2.	Energy audit- definitions, concept	1	20/7/22			
3.	Types of audit	1	21/7/22			
4.	Energy index, cost index	1	23/7/22			
5.	Pie charts, Sankey diagrams	1	26/7/22			
6.	Load profiles, Energy conservation schemes	1	27/7/22			
7.	Energy audit of industries	1	28/7/22			
8.	Energy saving potential	1	30/7/22			
9.	Energy audit of process industry	1	2/8/22			
10.	Thermal power station	1	4/8/22			
11.	Thermal power station	1	5/8/22			
12.	Building energy audit.	1	6/8/22			
13.	Smart Metering	1	10/8/22			
14.	Energy saving through smart metering	1	11/8/22			
No. of classes required to complete UNIT-I: 14					No. of classes taken:	

UNIT-II: ENERGY MANAGEMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Principles of energy management	1	13/8/22			
16.	Organizing energy management program	1	16/8/22			
17.	Initiating	1	17/8/22			
18.	Planning	1	18/8/22			
19.	Controlling	1	20/8/22			
20.	Promoting	1	23/8/22			
21.	Monitoring	1	24/8/22			

22.	Reporting, Energy manger	1	25/8/22			
23.	Qualities and functions of energy manager	1	27/8/22			
24.	Energy manager Language	1	30/8/22			
25.	Revision of unit 1	1	14/9/22			
26.	Revision of unit 2	1	30/8/22			
27.	MID-I					
28.	MID-I					
29.	MID-I					
30.	MID-I					
No. of classes required to complete UNIT-II: 12					No. of classes taken:	

UNIT-III: ENERGY EFFICIENT MOTORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Energy efficient motors	1	28/9/22		TLM2	
32.	Factors affecting efficiency	1	10/9/22		TLM2	
33.	Loss distribution	1	29/9/22		TLM2	
34.	Constructional details	1	6/10/22		TLM2	
35.	Characteristics, variable speed	1	8/10/22		TLM2	
36.	Variable duty cycle systems, RMS hp	1	11/10/22		TLM2	
37.	Voltage variation, voltage unbalance	1	12/10/22		TLM2	
38.	Over motoring, motor energy audit	1	13/10/22		TLM2	
No. of classes required to complete UNIT-III: 8					No. of classes taken:	

UNIT-IV: POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
39.	Power factor, methods of improvement, location of capacitors, Pf with nonlinear loads	1	15/10/22		TLM2	

40.	Effect of harmonics on power factor, power factor motor controllers	1	18/10/22		TLM2	
41.	Good lighting system design and practice	1	19/10/22		TLM2	
42.	Lighting control, lighting energy audit, Energy Instruments	1	20/10/22		TLM2	
43.	Wattmeter, data loggers	1	22/10/22		TLM2	
44.	Thermocouples, pyrometers	1	25/10/22		TLM2	
45.	Lux meters, tongue testers,	1	26/10/22		TLM2	
46.	Application of PLC's	1	27/10/22		TLM2	
No. of classes required to complete UNIT-IV: 8					No. of classes taken:	

UNIT-V: ECONOMIC ASPECTS AND ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Economics Analysis, Depreciation Methods, time value of money, rate of return,	1	29/10/22			
48.	Present worth method, replacement analysis	1	1/11/22			
49.	Life cycle costing analysis	1	2/11/22			
50.	Energy efficient motors	1	3/11/22			
51.	Calculation of simple payback method	1	5/11/22			
52.	Net present worth method	1	9/11/22			
53.	Power factor correction, lighting	1	10/11/22			
54.	Applications of life cycle costing analysis, return on investment	1	12/11/22			
55.	MID-II	1	15/11/22			
56.	MID-II	1	16/11/22			
57.	MID-II	1	17/11/22			
58.	MID-II	1	19/11/22			
No. of classes required to complete UNIT-V: 8					No. of classes taken:	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1.	Design and develop innovative products and services in the field of Electrical and Electronics Engineering and allied engineering disciplines.
PEO2.	Apply the knowledge of Electrical and Electronics Engineering to solve problems of social relevance, pursue higher education and research.
PEO3.	Work effectively as individuals and as team members in multidisciplinary projects.
PEO4.	Engage in lifelong learning, career enhancement and adapt to changing professional and societal needs.

PART-D

PROGRAMME OUTCOMES (POs):

PO a	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO b	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO c	**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 d	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO e	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO f	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO g	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO h	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO i	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO j	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO k	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO l	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO a	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO b	Design and analyze electrical machines, modern drive and lighting systems
PSO c	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO d	Design controllers for electrical and electronic systems to improve their performance.

Dr.G.Nageswara Rao	Dr.G.Nageswara Rao	Dr. M.S. Giridhar	Dr.J. Siva Vara Prasad
Course Instructor	Course Coordinator	Module Coordinator	HOD

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

COURSE HANDOUT
PART-A

Name of Course Instructor : Dr.G.Nageswara Rao
Course Name & Code : **ENERGY CONSERVATION AND AUDIT** & 17EE28
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Sections- B A.Y : 2022-23

Pre-requisites : Electrical Power Transmission, Electrical Engineering Materials

Course Educational Objective: This course enables the student to

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- Learn reactive power management, energy efficient lighting schemes and energy conservation methods.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Illustrate the different parameters for energy auditing.
CO 2	Interpret the controlling of energy management and energy efficiency.
CO 3	Analyze the Reactive power management strategies.
CO 4	Analyze energy conservation measures for economic aspects.

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

Cos	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO a	PSO b	PSO c	PSO d
CO1	3	3		2	2	1					1	1	3			
CO2	3	2		2	2						1	1	2			
CO3	3	2		2	3						1	1	3			
CO4	3	2		2	2						1	1	2	2		1

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

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5. K.S.K.Weranga, SisilKumarawadu, D.P.Chandima-"Smart Metering Design and Applications", Springer Publications, 1st Edition, 2014.

Part - B
COURSE DELIVERY PLAN (LESSON PLAN): Section-B

UNIT-I: BASIC PRINCIPLES OF ENERGY AUDIT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, course outcomes,	1	19/7/22			
2.	Energy audit- definitions, concept	1	21/7/22			
3.	Types of audit	1	22/7/22			
4.	Energy index, cost index	1	23/7/22			
5.	Pie charts, Sankey diagrams	1	26/7/22			
6.	Load profiles, Energy conservation schemes	1	28/7/22			
7.	Energy audit of industries	1	29/7/22			
8.	Energy saving potential	1	30/7/22			
9.	Energy audit of process industry	1	2/8/22			
10.	Thermal power station	1	4/8/22			
11.	Thermal power station	1	5/8/22			
12.	Building energy audit.	1	6/8/22			
13.	Smart Metering	1	10/8/22			
14.	Energy saving through smart metering	1	11/8/22			
No. of classes required to complete UNIT-I: 14					No. of classes taken:	

UNIT-II: ENERGY MANAGEMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Principles of energy management	1	13/8/22			
16.	Organizing energy management program	1	16/8/22			
17.	Initiating	1	17/8/22			
18.	Planning	1	18/8/22			
19.	Controlling	1	20/8/22			
20.	Promoting	1	23/8/22			
21.	Monitoring	1	24/8/22			

22.	Reporting, Energy manger	1	25/8/22			
23.	Qualities and functions of energy manager	1	27/8/22			
24.	Energy manager Language	1	30/8/22			
25.	Revision of unit 1	1	14/9/22			
26.	Revision of unit 2	1	30/8/22			
27.	MID-I					
28.	MID-I					
29.	MID-I					
30.	MID-I					
No. of classes required to complete UNIT-II: 12					No. of classes taken:	

UNIT-III: ENERGY EFFICIENT MOTORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Energy efficient motors	1	28/9/22		TLM2	
32.	Factors affecting efficiency	1	10/9/22		TLM2	
33.	Loss distribution	1	29/9/22		TLM2	
34.	Constructional details	1	6/10/22		TLM2	
35.	Characteristics, variable speed	1	8/10/22		TLM2	
36.	Variable duty cycle systems, RMS hp	1	11/10/22		TLM2	
37.	Voltage variation, voltage unbalance	1	12/10/22		TLM2	
38.	Over motoring, motor energy audit	1	13/10/22		TLM2	
No. of classes required to complete UNIT-III: 8					No. of classes taken:	

UNIT-IV: POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
39.	Power factor, methods of improvement, location of capacitors, Pf with nonlinear loads	1	15/10/22		TLM2	

40.	Effect of harmonics on power factor, power factor motor controllers	1	18/10/22		TLM2	
41.	Good lighting system design and practice	1	19/10/22		TLM2	
42.	Lighting control, lighting energy audit, Energy Instruments	1	20/10/22		TLM2	
43.	Wattmeter, data loggers	1	22/10/22		TLM2	
44.	Thermocouples, pyrometers	1	25/10/22		TLM2	
45.	Lux meters, tongue testers,	1	26/10/22		TLM2	
46.	Application of PLC's	1	27/10/22		TLM2	
No. of classes required to complete UNIT-IV: 8					No. of classes taken:	

UNIT-V: ECONOMIC ASPECTS AND ANALYSIS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Economics Analysis, Depreciation Methods, time value of money, rate of return,	1	29/10/22			
48.	Present worth method, replacement analysis	1	1/11/22			
49.	Life cycle costing analysis	1	2/11/22			
50.	Energy efficient motors	1	3/11/22			
51.	Calculation of simple payback method	1	5/11/22			
52.	Net present worth method	1	9/11/22			
53.	Power factor correction, lighting	1	10/11/22			
54.	Applications of life cycle costing analysis, return on investment	1	12/11/22			
55.	MID-II	1	15/11/22			
56.	MID-II	1	16/11/22			
57.	MID-II	1	17/11/22			
58.	MID-II	1	19/11/22			
No. of classes required to complete UNIT-V: 8					No. of classes taken:	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1.	Design and develop innovative products and services in the field of Electrical and Electronics Engineering and allied engineering disciplines.
PEO2.	Apply the knowledge of Electrical and Electronics Engineering to solve problems of social relevance, pursue higher education and research.
PEO3.	Work effectively as individuals and as team members in multidisciplinary projects.
PEO4.	Engage in lifelong learning, career enhancement and adapt to changing professional and societal needs.

PART-D

PROGRAMME OUTCOMES (POs):

PO a	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO b	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO c	**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 d	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO e	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO f	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO g	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO h	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO i	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO j	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO k	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO l	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO a	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO b	Design and analyze electrical machines, modern drive and lighting systems
PSO c	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO d	Design controllers for electrical and electronic systems to improve their performance.

Dr.G.Nageswara Rao	Dr.G.Nageswara Rao	Dr. M.S. Giridhar	Dr.J. Siva Vara Prasad
Course Instructor	Course Coordinator	Module Coordinator	HOD

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L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.

http://cse.lbrce.ac.in, cselbreddy@gmail.com, Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE HANDOUT

PROGRAM : EEE-VII-Sem-A Sec

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : **JAVA PROGRAMMING & 17CS80**

L-T-P STRUCTURE : 3-0-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : **Mr.P.Nagababu**

COURSE COORDINATOR : **Mr.P.Nagababu**

1. Pre-requisites:

- C , C++ Programming
- Need to know basics of programming language, data types and using loops instructions
- Basic need of Java for quick learning and understanding is Knowledge of basic programming like C/C++

2. Course Educational Objectives (CEOs):

- Concentrates on the methodological and technical aspects of software design and Programming based on OOP.
- Acquire the basic knowledge and skills necessary to implement object-oriented Programming techniques in software development through JAVA.
- Know about the importance of GUI based applications and the development of those Applications through JAVA.
- Get sufficient knowledge to enter the job market related to Web development.

3. Course Outcomes (COs): At the end of the course, the student will be able to:

CO1: Identify Object Oriented concepts through constructs of JAVA.

CO2: Understand the importance of Packages, Interfaces and implement Exception Handling Mechanism.

CO3: Explore the concepts of Exception Handling,Multi-threading

CO4: Design GUI based applications using Applet class and explore the concept of Event Handling using JAVA.

CO5: Design some examples of GUI based applications using AWT controls and Swings.

4. Course Articulation Matrix (Correlation between COs&POs,PSOs):

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	2-	-	-	-	-	-	-	-	-	1	3	-	1	-
CO2	2	3	2	-	1	-	-	-	-	-	-	1	3	-	1	-
CO3	3	2	3	-	1	-	-	-	-	-	-	1	3	-	1	-
CO4	3	2	3	-	1	-	-	-	-	-	-	1	3	-	1	-
CO5	3	2	2	-	1	-	-	-	-	-	-	1	3	3	1	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

SYLLABUS

UNIT – I

Introduction: Drawbacks of POP, Object Oriented paradigm, OOP concepts.

Java Language: History of Java, Java Buzzwords, The Byte code, Simple types, Arrays, Type conversion and casting, simple java programs.

Introducing classes: Class fundamentals, declaring objects, access control and recursion, Constructors, garbage collection, Simple example programs of String and StringBuffer classes, Wrapper classes.

UNIT – II

Inheritance &Polymorphism: Inheritance basics, using super keyword, multilevel hierarchy, Method overloading, Method overriding, Dynamic method dispatch, abstract class, Object class and final keyword.

Packages: Defining a package, Accessing a Package, Understanding CLASSPATH, importing packages, exploring java.util package (StringTokenizer, date classes).

Interfaces: Defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Differences between classes and interfaces.

UNIT – III

Exception Handling: Exception handling fundamentals, exception types, usage of try& catch, throw, throws and finally, Java Built-in Exceptions.

Multithreading: Differences between multi-threading and multitasking, java thread model, Creating thread, multiple threads and synchronizing threads.

UNIT – IV

Applet Class: Concepts of Applets, differences between applets and applications, applet architecture, skeleton, creating applets, passing parameters to applets, working with Graphicsclass.

Event Handling: Events handling mechanisms, Events, Event sources, Event classes, Event Listeners interfaces, Delegation event model, handling mouse and keyboard events, Adapterclasses, Inner classes.

UNIT – V

AWT controls: label, button, scrollbars, text components, check box, check box groups, Choices controls, lists, scrollbar, text field, layout managers – border, grid, flow.

Introducing Swing:– Introduction, key features of swings, limitations of AWT, components &containers, swing packages, creating swing applet- JApplet class, JComponents- Labels, text fields, buttons – The JButton class, Tabbed Panes, Scroll Panes, Tables.

TEXT BOOKS

Herbert Schildt, ―Java: The complete reference‖, TMH Publications, 7th edition, 2006.

REFERENCES

1.Dr.R.NageswaraRao,―Core JAVA: An Integrated Approach‖, Dreamtech Press, 1st Edition, 2008.

2.E.Balaguruswamy,―Programming with JAVA‖, TMH Publications, 2ndEdition, 2000.

3.Patrick Niemeyer & Jonathan Knudsen, ―Learning Java‖, O'REILLY Publications, 3rd Edition, 2005.

4.Benjamin J Evans & David Flanagan,―Java–in a Nutshell – A desktop quick reference, O'REILLY Publications, 6th Edition, 2014.

5.David Flanagan, ―Java Examples In a nutshell – A Tutorial companion to java in a nutshell, O'REILLY Publications, 3rd Edition, 2004.

Course Delivery Plan

UNIT-I: Introduction to Java, Introduction to classes

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	Introduction to OOPS ,Course Outcomes Types of Languages	1	11-07-2022		TLM1	CO1	
2.	OOPS concepts	1	13-07-2022		TLM1	CO1	
3.	Introduction to Java, History of Java collection	1	14-07-2022		TLM1	CO1	
4.	Features of Java	1	16-07-2022		TLM1	CO1	
5.	JVM, Garbage, Identifiers and Keywords, Data types, Programming concepts of basic java	2	18-07-2022 & 20-07-2022		TLM1	CO1	
6.	Expressions in Java, Control structures	2	21-07-2022 & 23-07-2022		TLM1	CO1	
7.	Decision making statements **Tutorial-1**	1	25-07-2022		TLM1	CO1	
8.	Arrays Introduction and types Recursion and Wrapper classes	2	27-07-2022 & 28-07-2022		TLM1	CO1	
9.	String ,String Buffer class, **Tutorial-2**	1	30-07-2022		TLM1	CO1	
10	Class Fundamentals Declaring objects, Constructors, Access Control,	1	01-08-2022		TLM1	CO1	
	No. of classes required to complete UNIT-I	**13**			**No. of classes taken:**		

Unit-II: Polymorphism, Inheritance and Packages

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
11.	Method Overloading & Method Overriding	1	03-08-2022		TLM1	CO2	
12.	Finalization, this, Super keywords **Tutorial-3**	1	04-08-2022		TLM1	CO2	
13.	Subclasses (Inheritance), and types	2	06-08-2022 & 08-08-2022		TLM1	CO2	
14.	Static data, Static methods, Static blocks, class modifiers	1	10-08-2022		TLM1	CO2	
15.	Abstract Classes	1	11-08-2022		TLM1	CO2	
16.	Interfaces, Inner classes Implementing and extending interfaces	2	13-08-2022 & 17-08-2022		TLM1	CO2	
17.	Packages, Package access Importing packages and classes, User defined packages, Class-path.	2	18-08-2022 & 20-08-2022		TLM1	CO2	
18.	final with inheritance, Dynamic method dispatch	1	22-08-2022		TLM1	CO2	
19.	**Tutorial-4** Util package	1	24-08-2022		TLM1	CO2	
20.	Revision of unit-1	2	27-08-2022		TLM1	CO2	
21.	Revision of unit-2	2	03-09-2022		TLM1	CO2	
22.	Mid-I Exams		**19-09-2022**				
23.	Mid-I Exams		20-09-2022				
24.	Mid-I Exams		**24-09-2022**				
	No. of classes required to complete UNIT-II	**14**			**No. of classes taken:**		

UNIT-III: Exception Handling and Multi Threading

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
25.	Types of Exceptions, try, catch, finally, throw keywords	2	26-09-2022 & 29-09-2022		TLM1	CO3	
26.	Handling User defined Exceptions	1	6-10-2022		TLM1	CO3	
27.	Nested Try Statement and multiple catch blocks, **Tutorial- 5**	1	8-10-2022		TLM1	CO3	
28.	Processes and threads, Thread states, D/B multi-threading and multitasking	2	10-10-2022 & 12-10-2022		TLM1	CO3	
29.	Thread life cycle	2	13-10-2022 &15-10-2022		TLM1	CO3	
30.	Creating threads, Interrupting threads Synchronizing threads **Tutorial- 6**	2	17-10-2022 & 19-10-2022		TLM1	CO3	
	No. of classes required to complete UNIT-III	**10**			**No. of classes taken:**		

UNIT-IV: Applet Class, Event Handling

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
31.	Applet definition and Types of Applets,	2	20-10-2022 &22-10-2022		TLM1	CO4	
32.	Applet life cycle	1	26-10-2022		TLM1	CO4	
33.	Parameter Passing to an Applet Graphics class, **Tutorial- 7**	2	27-10-2022 & 29-10-2022		TLM1	CO4	

34.	Event handling mechanism, Events	1	31-10-2022		TLM1	CO4	
35.	Event delegation model, Event sources and Event handlers	2	02-11-2022 & 3-11-2022		TLM1	CO4	
36.	Event categories, Event Listeners	1	05-11-2022		TLM1	CO4	
37.	Mouse Events	1	07-11-2022		TLM1	CO4	
38.	KeyEvents **Tutorial- 8**	1	09-11-2022		TLM1	CO4	
39.	Adapter class, Inner class	1	10-11-2022		TLM1	CO4	
	No. of classes required to complete UNIT-IV	**13**			**No. of classes taken:**		

UNIT-V: AWT Controls, Swing Components

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
40.	AWT Components Introduction	1	12-11-2022		TLM1	CO5	
41.	AWT Controls	1	12-11-2022		TLM1	CO5	
42.	Layout Managers, **Tutorial- 9**	1	12-11-2022		TLM1	CO5	
43.	Introduction to Swings, Features of Swings,D/B AWT and Swing	1	14-11-2022		TLM1	CO5	
44.	Swing Components, Tabbed Panes, Scrollpanes, Table	1	14-11-2022		TLM1	CO5	
45.	Mid-II Exams		**21-11-2022**				
46.	Mid-II Exams		22-11-2022				
47.	Mid-II Exams		**26-11-2022**				
	No. of classes required to complete UNIT-V	**05**			**No. of classes taken:**		

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	Data types and null values Scope rules	1	16-11-2022		TLM1	CO1	
2.	Deadlock of Threads	1	17-11-2022		TLM1	CO3	
3.	Daemon Thread	1	19-11-2022		TLM1	CO3	
4.	Types of applets	1	19-11-2022		TLM1	CO4	

Teaching Learning Methods					
TLM1	Chalk and Talk	**TLM4**	Problem Solving	**TLM7**	Seminars or GD
TLM2	PPT	**TLM5**	Programming	**TLM8**	Lab Demo
TLM3	Tutorial	**TLM6**	Assignment or Quiz	**TLM9**	Case Study

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	8W
I Mid Examinations	**19-09-2022**	**24-09-2022**	**1W**
II Phase of Instructions	26-09-2022	19-11-2022	8W
II Mid Examinations	**21-11-2022**	**26-11-2022**	**1W**
Preparation and Practical's	28-11-2022	03-12-2022	1W
Semester End Examinations	05-12-2022	17-12-2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment-I (Unit-I)	1,2,3,4	A1=5
Assignment-II (Unit-II)	1,2,3,4	A2=5
I-Mid Examination (Units-I & II)	1,2,3,4	M1=20
I-Quiz Examination (Units-I & II)	1,2,3,4	Q1=10
Assignment-III (Unit-III)	1,2,3,4	A3=5
Assignment-IV (Unit-IV)	1,2,3,4	A4=5
Assignment-V (Unit-V)	1,2,3,4	A5=5
II-Mid Examination (Units-III, IV & V)	1,2,3,4	M2=20
II-Quiz Examination (Units-III, IV & V)	1,2,3,4	Q2=10
Attendance	1,2,3,4	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	1,2,3,4	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	1,2,3,4	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)		B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	**1,2,3,4**	**40**
Semester End Examination (SEE)	**1,2,3,4**	**60**
Total Marks = CIE + SEE	**1,2,3,4**	**100**

POs:(Program Outcomes)

1. Apply the knowledge of mathematics,science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. 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 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.
4. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. 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. 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. 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.

PEOs (Program Educational Objectives):

PE-1: To inculcate the adaptability skills into the students for software design, software development or any other allied fields of computing.
PE-2: To equip the graduates with the ability to analyze, design and synthesize data to create novel products.
PE-3: Ability to understand and analyze engineering issues in a broader perspective with ethical responsibility towards sustainable development.
PE-4: To empower the student with the qualities of effective communication, team work, continues learning attitude, leadership needed for a successful computer professional.

Mr.P.Nagababu	Mr.P.Nagababu	Dr.K.NagaPrasanthi	Dr.D.Veeraiah
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC & NBA (Under Tier - I) ISO 9001:2015 Certified Institution

Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE HANDOUT

PROGRAM : EEE-VII-Sem-B Sec

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : **JAVA PROGRAMMING & 17CS80**

L-T-P STRUCTURE : 3-0-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : **Mr.P.Nagababu**

COURSE COORDINATOR : **Mr.P.Nagababu**

1. Pre-requisites:

- C , C++ Programming
- Need to know basics of programming language, data types and using loops instructions
- Basic need of Java for quick learning and understanding is Knowledge of basic programming like C/C++

2. Course Educational Objectives (CEOs):

- Concentrates on the methodological and technical aspects of software design and Programming based on OOP.
- Acquire the basic knowledge and skills necessary to implement object-oriented Programming techniques in software development through JAVA.
- Know about the importance of GUI based applications and the development of those Applications through JAVA.
- Get sufficient knowledge to enter the job market related to Web development.

3. Course Outcomes (COs): At the end of the course, the student will be able to:

CO1: Identify Object Oriented concepts through constructs of JAVA.

CO2: Understand the importance of Packages, Interfaces and implement Exception Handling Mechanism.

CO3: Explore the concepts of Exception Handling,Multi-threading

CO4: Design GUI based applications using Applet class and explore the concept of Event Handling using JAVA.

CO5: Design some examples of GUI based applications using AWT controls and Swings.

4. Course Articulation Matrix (Correlation between COs&POs,PSOs):

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	2-	-	-	-	-	-	-	-	-	1	3	-	1	-
CO2	2	3	2	-	1	-	-	-	-	-	-	1	3	-	1	-
CO3	3	2	3	-	1	-	-	-	-	-	-	1	3	-	1	-
CO4	3	2	3	-	1	-	-	-	-	-	-	1	3	-	1	-
CO5	3	2	2	-	1	-	-	-	-	-	-	1	3	3	1	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

SYLLABUS

UNIT – I

Introduction: Drawbacks of POP, Object Oriented paradigm, OOP concepts.

Java Language: History of Java, Java Buzzwords, The Byte code, Simple types, Arrays, Type conversion and casting, simple java programs.

Introducing classes: Class fundamentals, declaring objects, access control and recursion, Constructors, garbage collection, Simple example programs of String and StringBuffer classes, Wrapper classes.

UNIT – II

Inheritance &Polymorphism: Inheritance basics, using super keyword, multilevel hierarchy, Method overloading, Method overriding, Dynamic method dispatch, abstract class, Object class and final keyword.

Packages: Defining a package, Accessing a Package, Understanding CLASSPATH, importing packages, exploring java.util package (StringTokenizer, date classes).

Interfaces: Defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Differences between classes and interfaces.

UNIT – III

Exception Handling: Exception handling fundamentals, exception types, usage of try& catch, throw, throws and finally, Java Built-in Exceptions.

Multithreading: Differences between multi-threading and multitasking, java thread model, Creating thread, multiple threads and synchronizing threads.

UNIT – IV

Applet Class: Concepts of Applets, differences between applets and applications, applet architecture, skeleton, creating applets, passing parameters to applets, working with Graphicsclass.

Event Handling: Events handling mechanisms, Events, Event sources, Event classes, Event Listeners interfaces, Delegation event model, handling mouse and keyboard events, Adapterclasses, Inner classes.

UNIT – V

AWT controls: label, button, scrollbars, text components, check box, check box groups, Choices controls, lists, scrollbar, text field, layout managers – border, grid, flow.

Introducing Swing:– Introduction, key features of swings, limitations of AWT, components &containers, swing packages, creating swing applet- JApplet class, JComponents- Labels, text fields, buttons – The JButton class, Tabbed Panes, Scroll Panes, Tables.

TEXT BOOKS

Herbert Schildt, ―Java: The complete reference‖, TMH Publications, 7th edition, 2006.

REFERENCES

1.Dr.R.NageswaraRao,―Core JAVA: An Integrated Approach‖, Dreamtech Press, 1st Edition, 2008.

2.E.Balaguruswamy,―Programming with JAVA‖, TMH Publications, 2ndEdition, 2000.

3.Patrick Niemeyer & Jonathan Knudsen, ―Learning Java‖, O'REILLY Publications, 3rd Edition, 2005.

4.Benjamin J Evans & David Flanagan,―Java–in a Nutshell – A desktop quick reference, O'REILLY Publications, 6th Edition, 2014.

5.David Flanagan, ―Java Examples In a nutshell – A Tutorial companion to java in a nutshell, O'REILLY Publications, 3rd Edition, 2004.

Course Delivery Plan

UNIT-I: Introduction to Java, Introduction to classes

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	Introduction to OOPS ,Course Outcomes Types of Languages	1	11-07-2022		TLM1	CO1	
2.	OOPS concepts	1	13-07-2022		TLM1	CO1	
3.	Introduction to Java, History of Java collection	1	14-07-2022		TLM1	CO1	
4.	Features of Java	1	15-07-2022		TLM1	CO1	
5.	JVM, Garbage, Identifiers and Keywords, Data types, Programming concepts of basic java	2	18-07-2022 & 20-07-2022		TLM1	CO1	
6.	Expressions in Java, Control structures	2	21-07-2022 & 23-07-2022		TLM1	CO1	
7.	Decision making statements **Tutorial-1**	1	25-07-2022		TLM1	CO1	
8.	Arrays Introduction and types Recursion and Wrapper classes	2	27-07-2022 & 28-07-2022		TLM1	CO1	
9.	String ,String Buffer class, **Tutorial-2**	1	29-07-2022		TLM1	CO1	
10	Class Fundamentals Declaring objects, Constructors, Access Control,	1	01-08-2022		TLM1	CO1	
	No. of classes required to complete UNIT-I	**13**			**No. of classes taken:**		

Unit-II: Polymorphism, Inheritance and Packages

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
11.	Method Overloading & Method Overriding	1	03-08-2022		TLM1	CO2	
12.	Finalization, this, Super keywords **Tutorial-3**	1	04-08-2022		TLM1	CO2	
13.	Subclasses (Inheritance), and types	2	05-08-2022 & 08-08-2022		TLM1	CO2	
14.	Static data, Static methods, Static blocks, class modifiers	1	10-08-2022		TLM1	CO2	
15.	Abstract Classes	1	11-08-2022		TLM1	CO2	
16.	Interfaces, Inner classes Implementing and extending interfaces	2	12-08-2022 & 17-08-2022		TLM1	CO2	
17.	Packages, Package access Importing packages and classes, User defined packages, Class-path.	2	18-08-2022 & 22-08-2022		TLM1	CO2	
18.	final with inheritance, Dynamic method dispatch	1	22-08-2022		TLM1	CO2	
19.	**Tutorial-4** Util package	1	24-08-2022		TLM1	CO2	
20.	Revision of unit-1	2	26-08-2022		TLM1	CO2	
21.	Revision of unit-2	2	02-09-2022		TLM1	CO2	
22.	Mid-I Exams		19-09-2022				
23.	Mid-I Exams		20-09-2022				
24.	Mid-I Exams		24-09-2022				
	No. of classes required to complete UNIT-II	**14**			**No. of classes taken:**		

UNIT-III: Exception Handling and Multi Threading

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
25.	Types of Exceptions, try, catch, finally, throw keywords	2	26-09-2022 & 28-09-2022		TLM1	CO3	
26.	Handling User defined Exceptions	1	29-09-2022		TLM1	CO3	
27.	Nested Try Statement and multiple catch blocks, **Tutorial- 5**	1	06-10-2022		TLM1	CO3	
28.	Processes and threads, Thread states, D/B multi-threading and multitasking	2	07-10-2022 & 10-10-2022		TLM1	CO3	
29.	Thread life cycle	2	12-10-2022 &13-10-2022		TLM1	CO3	
30.	Creating threads, Interrupting threads Synchronizing threads **Tutorial- 6**	2	17-10-2022 & 19-10-2022		TLM1	CO3	
	No. of classes required to complete UNIT-III	**10**			**No. of classes taken:**		

UNIT-IV: Applet Class, Event Handling

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
31.	Applet definition and Types of Applets,	2	20-10-2022 &21-10-2022		TLM1	CO4	
32.	Applet life cycle	1	26-10-2022		TLM1	CO4	
33.	Parameter Passing to an Applet Graphics class, **Tutorial- 7**	2	27-10-2022 & 28-10-2022		TLM1	CO4	

34.	Event handling mechanism, Events	1	31-10-2022		TLM1	CO4	
35.	Event delegation model, Event sources and Event handlers	2	02-11-2022 & 3-11-2022		TLM1	CO4	
36.	Event categories, Event Listeners	1	04-11-2022		TLM1	CO4	
37.	Mouse Events	1	07-11-2022		TLM1	CO4	
38.	KeyEvents **Tutorial- 8**	1	09-11-2022		TLM1	CO4	
39.	Adapter class, Inner class	1	10-11-2022		TLM1	CO4	
	No. of classes required to complete UNIT-IV	**13**			**No. of classes taken:**		

UNIT-V: AWT Controls, Swing Components

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
40.	AWT Components Introduction	1	11-11-2022		TLM1	CO5	
41.	AWT Controls	1	14-11-2022		TLM1	CO5	
42.	Layout Managers, **Tutorial- 9**	1	14-11-2022		TLM1	CO5	
43.	Introduction to Swings, Features of Swings,D/B AWT and Swing	1	16-11-2022		TLM1	CO5	
44.	Swing Components, Tabbed Panes, Scrollpanes, Table	1	17-11-2022		TLM1	CO5	
45.	Mid-II Exams		**21-11-2022**				
46.	Mid-II Exams		24-11-2022				
47.	Mid-II Exams		**26-11-2022**				
	No. of classes required to complete UNIT-V	**05**			**No. of classes taken:**		

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	Data types and null values Scope rules	1	17-11-2022		TLM1	CO1	
2.	Deadlock of Threads	1	17-11-2022		TLM1	CO3	
3.	Daemon Thread	1	18-11-2022		TLM1	CO3	
4.	Types of applets	1	19-11-2022		TLM1	CO4	

Teaching Learning Methods					
TLM1	Chalk and Talk	**TLM4**	Problem Solving	**TLM7**	Seminars or GD
TLM2	PPT	**TLM5**	Programming	**TLM8**	Lab Demo
TLM3	Tutorial	**TLM6**	Assignment or Quiz	**TLM9**	Case Study

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	8W
I Mid Examinations	**19-09-2022**	**24-09-2022**	**1W**
II Phase of Instructions	26-09-2022	19-11-2022	8W
II Mid Examinations	**21-11-2022**	**26-11-2022**	**1W**
Preparation and Practical's	28-11-2022	03-12-2022	1W
Semester End Examinations	05-12-2022	17-12-2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment-I (Unit-I)	1,2,3,4	A1=5
Assignment-II (Unit-II)	1,2,3,4	A2=5
I-Mid Examination (Units-I & II)	1,2,3,4	M1=20
I-Quiz Examination (Units-I & II)	1,2,3,4	Q1=10
Assignment-III (Unit-III)	1,2,3,4	A3=5
Assignment-IV (Unit-IV)	1,2,3,4	A4=5
Assignment-V (Unit-V)	1,2,3,4	A5=5
II-Mid Examination (Units-III, IV & V)	1,2,3,4	M2=20
II-Quiz Examination (Units-III, IV & V)	1,2,3,4	Q2=10
Attendance	1,2,3,4	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	1,2,3,4	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	1,2,3,4	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)		B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	**1,2,3,4**	**40**
Semester End Examination (SEE)	**1,2,3,4**	**60**
Total Marks = CIE + SEE	**1,2,3,4**	**100**

POs:(Program Outcomes)

1. Apply the knowledge of mathematics,science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. 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 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.
4. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. 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. 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. 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.

PEOs (Program Educational Objectives):

PE-1: To inculcate the adaptability skills into the students for software design, software development or any other allied fields of computing.
PE-2: To equip the graduates with the ability to analyze, design and synthesize data to create novel products.
PE-3: Ability to understand and analyze engineering issues in a broader perspective with ethical responsibility towards sustainable development.
PE-4: To empower the student with the qualities of effective communication, team work, continues learning attitude, leadership needed for a successful computer professional.

Mr.P.Nagababu	Mr.P.Nagababu	Dr.K.NagaPrasanthi	Dr.D.Veeraiah
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (Autonomous)
L.B. Reddy Nagar , Mylavaram-521 230. Andhra Pradesh, INDIA
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New Delhi & Certified by ISO 9001:2015, http://www.lbrce.ac.in
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
Phone: 08659-222933/Extn: 203 hodeee@lbrce.ac.in, eee.lbrce@gmail.com

COURSE HANDOUT

PROGRAM : B.Tech., VII-Sem., EEE(A)

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE :**Power Electronics Lab.**& 17EE69

L-T-P STRUCTURE : 0-0-2

COURSE CREDITS : 2

COURSE INSTRUCTOR : Mr.P.Deepak Reddy/Mr.V.Prabhakar Reddy

COURSE COORDINATOR : Mr.P.Deepak Reddy

PRE-REQUISITE: **Power Electronics**

COURSE OUTCOMES(CO):

Power Electronics Lab

CO1 Examine the characteristics of Power electronic devices.
CO2 Simulate and analyze the performance of power converters.
CO3 Choose an appropriate power converter with suitable control technique for real time applications

COURSE ARTICULATION MATRIX (Correlation between COs&POs,PSOs):

	a	b	c	d	e	f	g	h	i	j	k	l	PSOa	PSOb	PSOc	PSOd	PSOe
CO1	3	2			3				3	3		3	1	2	1		
CO2	2			2	3				3	3			2	2	3		2
CO3	3	3		3	3	2			3	3		3	2	2	2		1

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

LIST OF EXPERIMENTS

CYCLE1

1. Charcteristics of SCR, IGBT, MOSFET
2. Single phase AC voltage controller with R & RL Loads.
3. Single phase fully controlled bridge converter With R & RL Loads.
4. Single phase IGBT inverter.
5. Three phase fully controlled bridge converter with R Load.
6. Single phase dual converter with RL load.
7. Analysis of four Quadrant operation chopper with R-Load
8. Analysis of Single phase cyclo converter with R& RL-load co1
9. Single Phase ac to dc converter with LC filter using MATLAB/SIMULINK
10. Single phase inverter with current controlled PWM technique using MATLAB/SIMULINK

SECTION-B SCHEDULE

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

DAY: Monday(18-258 to 19-234)

B.NO.	H.T. Nos	I Week	II Week	III Week	IV Week	V Week	VI Week	VII Week	VIII Week	IX Week	X Week	XI Week	XII Week	XIV Week
Tentative Date		11/7	18/7	25/7	1/8	8/8	22/8	29/8	26/9	10/9	17/10	31/10	7/11	14/11
Actual Date														
B-1		Demo	1	2	3	4	5	6	7	8	9	10	Repetition	INTERNAL TEST
B-2		Demo	1	2	3	4	5	6	7	8	9	10		
B-3		Demo	1	2	3	4	5	6	7	8	9	10		
B-4		Demo	1	2	3	4	5	6	7	8	9	10		
B-5		Demo	1	2	3	4	5	6	7	8	9	10		
B-6		Demo	1	2	3	4	5	6	7	8	9	10		
B-7		Demo	1	2	3	4	5	6	7	8	9	10		
B-8		Demo	1	2	3	4	5	6	7	8	9	10		
B-9		Demo	1	2	3	4	5	6	7	8	9	10		
B-10		Demo	1	2	3	4	5	6	7	8	9	10		

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

DAY: Friday(19761A0235 to 20765A0211)

B.NO.	H.T. Nos	I Week	II Week	III Week	IV Week	V Week	VI Week	VII Week	VIII Week	IX Week	X Week	XI Week	XII Week	XIII Week	XIV Week	XV Week
Tentative Date		15/7	22/7	29/7	5/8	12/8	26/8	2/9	30/9	7/10	14/10	21/10	28/10	4/11	11/11	18/11
Actual Date																
B-1		Demo	1	2	3	4	5	6	7	8	9	10	Repetition	Repetition	Repetition	INTERNAL TEST
B-2		Demo	1	2	3	4	5	6	7	8	9	10				
B-3		Demo	1	2	3	4	5	6	7	8	9	10				
B-4		Demo	1	2	3	4	5	6	7	8	9	10				
B-5		Demo	1	2	3	4	5	6	7	8	9	10				
B-6		Demo	1	2	3	4	5	6	7	8	9	10				
B-7		Demo	1	2	3	4	5	6	7	8	9	10				
B-8		Demo	1	2	3	4	5	6	7	8	9	10				
B-9		Demo	1	2	3	4	5	6	7	8	9	10				
B-10		Demo	1	2	3	4	5	6	7	8	9	10				

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
Phone: 08659-222933/Extn: 203 hodeee@lbrce.ac.in, eee.lbrce@gmail.com

COURSE HANDOUT

PROGRAM : B.Tech., VII-Sem., EEE(B)

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE :**Power Electronics Lab.**& 17EE69

L-T-P STRUCTURE : 0-0-2

COURSE CREDITS : 2

COURSE INSTRUCTOR : Mrs.T.Nagadurga/Mr.P.Deepak Reddy

COURSE COORDINATOR : Mr.P.Deepak Reddy

PRE-REQUISITE: **Power Electronics**

COURSE OUTCOMES(CO):

Power Electronics Lab

CO1 Examine the characteristics of Power electronic devices.
CO2 Simulate and analyze the performance of power converters.
CO3 Choose an appropriate power converter with suitable control technique for real time applications

COURSE ARTICULATION MATRIX (Correlation between COs&POs,PSOs):

	a	b	c	d	e	f	g	h	i	j	k	l	PSOa	PSOb	PSOc	PSOd	PSOe
CO1	3	2			3				3	3		3	1	2	1		
CO2	2			2	3				3	3			2	2	3		2
CO3	3	3		3	3	2			3	3		3	2	2	2		1

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

LIST OF EXPERIMENTS

CYCLE1

1. Charcteristics of SCR, IGBT, MOSFET
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5. Three phase fully controlled bridge converter with R Load.
6. Single phase dual converter with RL load.
7. Analysis of four Quadrant operation chopper with R-Load
8. Analysis of Single phase cyclo converter with R& RL-load co1
9. Single Phase ac to dc converter with LC filter using MATLAB/SIMULINK
10. Single phase inverter with current controlled PWM technique using MATLAB/SIMULINK

SECTION-B SCHEDULE

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

DAY: Wednesday(18-283 to 19-286)

B.NO.	H.T. Nos	I Week	II Week	III Week	IV Week	V Week	VI Week	VII Week	VIII Week	IX Week	X Week	XI Week	XII Week	XIII Week	XIV Week
Tentative Date		13/7	20/7	27/7	3/8	10/8	17/8	24/8	31/8	28/9	12/10	19/10	2/11	9/11	16/11
Actual Date															
B-1		Demo	1	2	3	4	5	6	7	8	9	10	Repetition	Repetition	INTERNAL TEST
B-2		Demo	1	2	3	4	5	6	7	8	9	10			
B-3		Demo	1	2	3	4	5	6	7	8	9	10			
B-4		Demo	1	2	3	4	5	6	7	8	9	10			
B-5		Demo	1	2	3	4	5	6	7	8	9	10			
B-6		Demo	1	2	3	4	5	6	7	8	9	10			
B-7		Demo	1	2	3	4	5	6	7	8	9	10			
B-8		Demo	1	2	3	4	5	6	7	8	9	10			
B-9		Demo	1	2	3	4	5	6	7	8	9	10			
B-10		Demo	1	2	3	4	5	6	7	8	9	10			

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

DAY: Saturday(19761A0287 to 20765A0222)

B.NO.	H.T. Nos	I Week	II Week	III Week	IV Week	V Week	VI Week	VII Week	VIII Week	IX Week	X Week	XI Week	XII Week	XIII Week	XIV Week
Tentative Date		16/7	23/7	30/7	6/8	13/8	20/8	27/8	3/9	1/10	15/10	22/10	29/10	5/11	12/11
Actual Date															
B-1		Demo	1	2	3	4	5	6	7	8	9	10	Repetition	Repetition	INTERNAL TEST
B-2		Demo	1	2	3	4	5	6	7	8	9	10			
B-3		Demo	1	2	3	4	5	6	7	8	9	10			
B-4		Demo	1	2	3	4	5	6	7	8	9	10			
B-5		Demo	1	2	3	4	5	6	7	8	9	10			
B-6		Demo	1	2	3	4	5	6	7	8	9	10			
B-7		Demo	1	2	3	4	5	6	7	8	9	10			
B-8		Demo	1	2	3	4	5	6	7	8	9	10			
B-9		Demo	1	2	3	4	5	6	7	8	9	10			
B-10		Demo	1	2	3	4	5	6	7	8	9	10			

HEAD OF THE DEPARTMENT

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.G.Tabita, Dr.P.Sobha Rani,
Course Name & Code : Power Systems Lab (17EE70)
L-T-P Structure : 0-0-2 Credits : 1
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Sections-B A.Y : 2022-23

PRE-REQUISITE: Electrical Power Transmission(17EE12), Power Systems Analysis(17EE18)
COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the student to Verify the theoretical concepts of power and energy systems through experimentation and analyze the same using simulation tools

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Analyze transmission systems under steady state and transient conditions.
CO 2	Perform fault calculation and network protection.
CO 3	Understand the performance of renewable energy systems. /Apply the knowledge of renewable energy systems to practical applications

COURSE ARTICULATION MATRIX(Correlation between COs, POs & PSOs):

PO →	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**H**	**i**	**J**	**K**	**l**	**PSOa**	**PSOb**	**PSOc**	**PSOd**
CO1	3	2	2	2	3				3	3		3	3	2		
CO2	2	2	2	2	3								3	3		2
CO3	2			2		2	2			3		3	2	2		1

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2** – Moderate (Medium), **3** - Substantial (High).

LIST OF EXPERIMENTS

Cycle-I: Simulation based

1. Determination of Receiving end quantities and the line performance of a medium/long transmission line using MATLAB
2. Using MATLAB code determine:
   (i) Bus admittance matrix by inspection method for a 3-bus power system and obtain
   (ii) Power flow solution by Newton-Raphson method.
3. Determination of Sequence components (Positive, Negative and Zero) of an alternator.
4. Transient analysis of a Single Machine Infinite Bus (SMIB) system.
5. Simulation of LG, LL, LLG and LLL faults on a simple power system using PSCAD/MATLAB.
6. Determine steady state frequency error and frequency deviation response for an
   (i) Isolated power system and (ii) Interconnected power system.
7. Plot the Swing curve for a simple 3 or 4 bus power system using MATLAB / PSCAD.

Cycle-II: Experiment based

8. Plot V-I characteristics of Solar panel at various levels of insolation.
9. Study the effects of temperature and irradiance on Solar cell and plot the characteristics.
10. Study the performance of a Wind turbine system at different wind speeds and plot the characteristics.
11. Determination of Earth resistance in humid and dry earth conditions.
12. Study the Over current protection scheme using numerical relay.
13. Determination of Positive, Negative and Zero sequence reactances for a 3-phase alternator.
14. Determination of ABCD parameters and performance of a transmission line.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

DAY: Wednesday -5,6,7
Students: 19761A0287-2A9,20765A0212 - 222

B.NO.	I Week	II Week	III Week	IV Week	V Week	VI Week	VII Week	VIII Week	IX Week	X Week	XI Week	XII Week	XIII Week	XIV Week
Tentative Date	13-07-22	20-07	27-07	03-08	10-08	17-08	24-08	28-09	12-10	19-10	26-10	02-11	09-11	16-11
Actual Date														
B-1	Demo	1	2	3	4	5	6	7	8	9	10	REPETITION LAB	REVISION	INTERNAL TEST
B-2	Demo	1	2	3	4	5	6	7	8	9	10			
B-3	Demo	1	2	3	4	5	6	7	8	9	10			
B-4	Demo	1	2	3	4	5	6	7	8	9	10			
B-5	Demo	1	2	3	4	5	6	7	8	9	10			
B-6	Demo	1	2	3	4	5	6	7	8	9	10			
B-7	Demo	1	2	3	4	5	6	7	8	9	10			
B-8	Demo	1	2	3	4	5	6	7	8	9	10			
B-9	Demo	1	2	3	4	5	6	7	8	9	10			
B-10	Demo	1	2	3	4	5	6	7	8	9	10			

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

DAY: Saturday -2,3,4
Students: 18761A0283,19761A0255-286

B.NO.	I Week	II Week	III Week	IV Week	V Week	VI Week	VII Week	VIII Week	IX Week	X Week	XI Week	XII Week	XIII Week	XIV Week	XV Week	XVI Week
Tentative Date	16-07-22	23-07	30-07	06-08	13-08	20-08	27-08	03-09	01-10	08-10	15-10	22-10	29-10	05-11	12-11	19-11
Actual Date																
B-1	Demo	1	2	3	4	5	6	7	8	9	10	REPETITION LAB	REVISION	REVISION	REVISION	INTERNAL TEST
B-2	Demo	1	2	3	4	5	6	7	8	9	10					
B-3	Demo	1	2	3	4	5	6	7	8	9	10					
B-4	Demo	1	2	3	4	5	6	7	8	9	10					
B-5	Demo	1	2	3	4	5	6	7	8	9	10					
B-6	Demo	1	2	3	4	5	6	7	8	9	10					
B-7	Demo	1	2	3	4	5	6	7	8	9	10					
B-8	Demo	1	2	3	4	5	6	7	8	9	10					
B-9	Demo	1	2	3	4	5	6	7	8	9	10					
B-10	Demo	1	2	3	4	5	6	7	8	9	10					

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
DAY-TO-DAY MARKS(A)	10
RECORD MARKS (B)	10
INTERNAL EXAM (C)	10
VIVA-VOCE (D)	05
ATTENDANCE (E)	05
Cumulative Internal Examination (CIE) : A+B+C+D+E	40
EXTERNAL EXAM (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO- a	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO- b	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO- c	**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 -d	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO -e	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO- f	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO -g	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO- h	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO- i	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO -j	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO- k	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO -l	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO -a	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO -b	Design and analyze electrical machines, modern drive and lighting systems
PSO -c	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO -d	Design controllers for electrical and electronic systems to improve their performance

Mrs.G.Tabita, Dr.P.Sobha Rani,	Dr.M.S.Giridhar	Dr.J.Siva Vara Prasad
Course Instructor	**Module Coordinator**	**HOD**

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.G.Tabita, Dr.P.Sobha Rani,
Course Name & Code : Power Systems Lab (17EE70)
L-T-P Structure : 0-0-2 Credits : 1
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Sections-A A.Y : 2022-23

PRE-REQUISITE: Electrical Power Transmission(17EE12), Power Systems Analysis(17EE18)
COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the student to Verify the theoretical concepts of power and energy systems through experimentation and analyze the same using simulation tools

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Analyze transmission systems under steady state and transient conditions.
CO 2	Perform fault calculation and network protection.
CO 3	Understand the performance of renewable energy systems. /Apply the knowledge of renewable energy systems to practical applications

COURSE ARTICULATION MATRIX(Correlation between COs, POs & PSOs):

PO →	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**H**	**i**	**J**	**k**	**l**	**PSOa**	**PSOb**	**PSOc**	**PSOd**
CO1	3	2	2	2	3				3	3		3	3	2		
CO2	2	2	2	2	3								3	3		2
CO3	2			2		2	2			3		3	2	2		1

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
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LIST OF EXPERIMENTS

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   (ii) Power flow solution by Newton-Raphson method.
3. Determination of Sequence components (Positive, Negative and Zero) of an alternator.
4. Transient analysis of a Single Machine Infinite Bus (SMIB) system.
5. Simulation of LG, LL, LLG and LLL faults on a simple power system using PSCAD/MATLAB.
6. Determine steady state frequency error and frequency deviation response for an
   (i) Isolated power system and (ii) Interconnected power system.
7. Plot the Swing curve for a simple 3 or 4 bus power system using MATLAB / PSCAD.

Cycle-II: Experiment based

8. Plot V-I characteristics of Solar panel at various levels of insolation.
9. Study the effects of temperature and irradiance on Solar cell and plot the characteristics.
10. Study the performance of a Wind turbine system at different wind speeds and plot the characteristics.
11. Determination of Earth resistance in humid and dry earth conditions.
12. Study the Over current protection scheme using numerical relay.
13. Determination of Positive, Negative and Zero sequence reactances for a 3-phase alternator.
14. Determination of ABCD parameters and performance of a transmission line.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

DAY: Monday - 5,6,7 (19761A0235 TO 254,20765A0201-211)

B.NO.	I Week	II Week	III Week	IV Week	V Week	VI Week	VII Week	VIII Week	IX Week	X Week	XI Week	XII	XIII	XIV Week
Tentative Date	11-07-22	18-07	25-07	01-08	08-08	22-08	29-08	26-09	03-10	10-10	17-10	31-10	07-11	14-11
Actual Date														
B-1	Demo	1	2	3	4	5	6	7	8	9	10	REVISION	REVISION	INTERNAL TEST
B-2	Demo	1	2	3	4	5	6	7	8	9	10			
B-3	Demo	1	2	3	4	5	6	7	8	9	10			
B-4	Demo	1	2	3	4	5	6	7	8	9	10			
B-5	Demo	1	2	3	4	5	6	7	8	9	10			
B-6	Demo	1	2	3	4	5	6	7	8	9	10			
B-7	Demo	1	2	3	4	5	6	7	8	9	10			
B-8	Demo	1	2	3	4	5	6	7	8	9	10			
B-9	Demo	1	2	3	4	5	6	7	8	9	10			
B-10	Demo	1	2	3	4	5	6	7	8	9	10			

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

DAY: Friday - 2,3,4 (18761A0258,294, 19761A0201 - 234

B.NO.	I Week	II Week	III Week	IV Week	V Week	VI Week	VII Week	VIII Week	IX Week	X Week	XI Week	XII	XIII	XIV Week	XV	XVI Week
Tentative Date	15-07-22	22-07	29-07	05-08	12-08	19-08	26-08	02-09	30-09	07-10	14-10	21-10	28-10	04-11	11-11	18-11
Actual Date																
B-1	Demo	1	2	3	4	5	6	7	8	9	10	REPETITION LAB	REVISION	REVISION	REVISION	INTERNAL TEST
B-2	Demo	1	2	3	4	5	6	7	8	9	10					
B-3	Demo	1	2	3	4	5	6	7	8	9	10					
B-4	Demo	1	2	3	4	5	6	7	8	9	10					
B-5	Demo	1	2	3	4	5	6	7	8	9	10					
B-6	Demo	1	2	3	4	5	6	7	8	9	10					
B-7	Demo	1	2	3	4	5	6	7	8	9	10					
B-8	Demo	1	2	3	4	5	6	7	8	9	10					
B-9	Demo	1	2	3	4	5	6	7	8	9	10					
B-10	Demo	1	2	3	4	5	6	7	8	9	10					

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
DAY-TO-DAY MARKS(A)	10
RECORD MARKS (B)	10
INTERNAL EXAM (C)	10
VIVA-VOCE (D)	05
ATTENDANCE (E)	05
Cumulative Internal Examination (CIE) : A+B+C+D+E	40
EXTERNAL EXAM (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO- a	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO- b	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO- c	**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 -d	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO -e	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO- f	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO -g	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO- h	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO- i	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO -j	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO- k	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO -l	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO -a	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO -b	Design and analyze electrical machines, modern drive and lighting systems
PSO -c	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO -d	Design controllers for electrical and electronic systems to improve their performance

Mrs.G.Tabita Dr.P.Sobha Rani,	Dr.M.S.Giridhar	Dr.J.Siva Vara Prasad
Course Instructor	**Module Coordinator**	**HOD**

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

COURSE HANDOUT
PART-A

Name of Course Instructor : Mr.P.Rathnakar Kumar
Course Name & Code : HIGH VOLTAGE ENGINEERING & 17EE92
L-T-P Structure : 4-0-0 Credits : 3
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Sections- A A.Y : 2022-23
Pre-requisites : Electrical Power Transmission, Electrical Engineering Materials

Course Educational Objective: This course enables the student to

- Introduce basics of electrical breakdown and high voltage generation,
- Understand high voltage test systems, measurement and analysis techniques as applied to power system apparatus such as cables, insulators, transformers, and generators.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Illustrate the fundamental concepts of electric breakdown in liquids, gases, and solids.
CO 2	Test the protection equipment in power system for high voltage applications.
CO 3	Analyze the concept of generation of high voltage AC, DC impulse voltages and currents and their measurements.
CO 4	Compare the principles of insulation co-ordination on HV/EHV systems.

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

Cos	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO a	PSO b	PSO c	PSO d
CO1	3	2	2										1			
CO2	3	3		3	3				2	2		2	3	2		
CO3	2	2	2	2	2							1	1	2		2
CO4	3	2	2									1	1	1		2

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

1. E.Kuffel, W.S.Zaengl, J.Kuffel, High Voltage Engineering, Elsevier Publications, 2nd Edition,2008.
2. M.S.Naidu and V. Kamaraju High Voltage Engineering, TMH Publication, 3nd Edition,2017.

REFERENCE BOOKS:

1. C.L.Wadhwa, High Voltage Engineering, New Age Internationals (P) Limited, 3rd Edition,2012.
2. Ravindra Arora, Wolfgang Mosch, High Voltage Insulation Engineering, New Age International (P) Limited, 3rd Edition,2011.
3. Dr. Shailendra Jain, "Modeling and Simulation using MATLAB - Simulink" ,Wiley Publication, 2nd Edition,2011.

4. Dr. Vikramaditya Dave,"Electric Power Transmission & Distribution System with PSCAD (Basic) S", Himanshu Publications ,2017.
5. Atousa Yazdani,"Modern Distribution Systems with PSCAD Analysis", CRC Press, 1st edition,2018 .
6. Tharangika Bambaravanage, "Modeling, Simulation and Control of a Medium-Scale Power System ", Springer, 1st edition, 2017.
7. Subir Ray, "An introduction to High Voltage Engineering", PHI Learning Pvt.Ltd,New Delhi, 2nd edition, 2013.

Part - B
COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: INTRODUCTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, Course outcomes, Electric Field Stresses	1	11-07-2022		TLM1/TLM2	
2.	Gas/Vacuum as Insulator, Liquid Dielectrics, Solid dielectrics	1	14-07-2022		TLM1/TLM2	
3.	Composites, Estimation and Control of Electric Stress	1	15-07-2022		TLM1/TLM2	
4.	Numerical methods for electric field computation	1	16-07-2022		TLM1/TLM2	
5.	Numerical methods for electric field computation	2	18-07-2022 21-07-2022		TLM1/TLM2	
6.	Surge voltages, their distribution and control	2	22-07-2022 23-07-2022		TLM1/TLM2	
7.	Conduction and Breakdown in Gases, Gases as insulating medium	1	25-07-2022		TLM1/TLM2	
8.	Ionization process, Townsend's criteria for breakdown	2	28-07-2022 29-07-2022		TLM1/TLM2	
9.	Paschen's law	1	30-07-2022		TLM1/TLM2	
No. of classes required to complete UNIT-I: 12					No. of classes taken:	

UNIT-II: BREAK DOWN IN LIQUID DIELECTRICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Liquid as Insulator, pure and commercial liquids	1	1-08-2022		TLM1/TLM2	
11.	conduction and breakdown in pure liquids, conduction and breakdown in commercial liquids	2	4-08-2022 5-08-2022		TLM1/TLM2	
12.	Transformer oil, Break Down in	1	6-08-2022		TLM1/TLM2	

13.	Solid Dielectrics, Intrinsic breakdown	2	8-08-2022 11-08-2022		TLM1/TLM2	
14.	Electromechanical breakdown	1	12-08-2022		TLM1/TLM2	
15.	Thermal breakdown	1	18-08-2022		TLM1/TLM2	
16.	breakdown of solid dielectrics in practice	2	20-08-2022 22-08-2022		TLM1/TLM2	
17.	solid dielectrics used in practice	2	25-08-2022 26-08-2022		TLM1/TLM2	
18.	Revision of unit-1 and unit-2	1	27-08-2022		TLM1/TLM2	
19.	MID-I		19-09-2022			
20.	MID-I		22-09-2022			
21.	MID-I		23-09-2022			
22.	MID-I		24-09-2022			
No. of classes required to complete UNIT-II: 13					No. of classes taken:	

UNIT-III: GENERATION OF HIGH VOLTAGES, CURRENTS AND TESTING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
23.	Generation of High DC Voltages, Generation of High AC voltages	2	29-08-2022 29-08-2022		TLM1/TLM2	
24.	Generation of Impulse Voltages, Generation of Impulse currents	2	1-09-2022 2-09-2022		TLM1/TLM2	
25.	Tripping and control of impulse generators.	1	3-09-2022		TLM1/TLM2	
26.	Testing of Insulators and bushings, Testing of Isolators	2	26-09-2022 29-09-2022		TLM1/TLM2	
27.	Testing of circuit breakers, Testing of cables	2	30-09-2022 1-10-2022		TLM1/TLM2	
28.	Testing of Transformers, Testing of Surge Arresters	2	7-10-2022 10-10-2022		TLM1/TLM2	
29.	Radio Interference measurements. Short circuit testing	1	13-10-2022		TLM1/TLM2	
No. of classes required to complete UNIT-III: 12					No. of classes taken:	

UNIT-IV: MEASUREMENT OF HIGH VOLTAGES AND CURRENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
30.	Measurement of High DC voltages	1	14-10-2022		TLM1/TLM2	
31.	Measurement of High AC and impulse voltages	2	15-10-2022 17-10-2022		TLM1/TLM2	
32.	Measurement of High DC, AC and Impulse currents	2	20-10-2022 21-10-2022		TLM1/TLM2	
33.	Oscilloscope for impulse voltage measurements	2	22-10-2022 27-10-2022		TLM1/TLM2	
34.	Oscilloscope for impulse current measurements	2	28-10-2022 29-10-2022		TLM1/TLM2	
35.	Partial discharge, acoustic measurement	1	31-10-2022		TLM1/TLM2	
No. of classes required to complete UNIT-IV: 10					No. of classes taken:	

UNIT-V: INSULATION CO-ORDINATION AND GROUNDING OF EHV SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Principles of Insulation Coordination on High voltage	2	3-11-2022 4-11-2022		TLM1/TLM2	
37.	Insulation Coordination on High voltage	2	5-11-2022 7-11-2022		TLM1/TLM2	
38.	Extra High Voltage power systems	2	10-11-2022 11-11-2022		TLM1/TLM2	
39.	Generalized Grounding systems	1	14-11-2022		TLM1/TLM2	
40.	Grounding Grids	1	17-11-2022		TLM1/TLM2	
41.	Revision of unit 1&2	1	18-11-2022		TLM1/TLM2	
42.	Revision of unit 3,4 &5	1	19-11-2022		TLM1/TLM2	
43.	MID-II		21-11-2022			
44.	MID-II		24-11-2022			
45.	MID-II		25-11-2022			
46.	MID-II		26-11-2022			
No. of classes required to complete UNIT-V: 10					No. of classes taken:	

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Streamers Theory	1	26-08-22		TLM1/ TLM2	
2.	Measurement of voltages and currents-types	1	29-10-22		TLM1/ TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	8W
CRT classes	05-09-2022	17-09-2022	2W
I Mid Examinations	19-09-2022	24-09-2022	1W
II Phase of Instructions	26-09-2022	19-11-2022	8W
II Mid Examinations	21-11-2022	26-11-2022	1W
Preparation and Practicals	28-11-2022	03-12-2022	1W
Semester End Examinations	5-12-2022	17-12-2022	2W

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1.	Design and develop innovative products and services in the field of Electrical and Electronics Engineering and allied engineering disciplines.
PEO2.	Apply the knowledge of Electrical and Electronics Engineering to solve problems of social relevance, pursue higher education and research.
PEO3.	Work effectively as individuals and as team members in multidisciplinary projects.
PEO4.	Engage in lifelong learning, career enhancement and adapt to changing professional and societal needs.

PART-D

PROGRAMME OUTCOMES (POs):

PO a	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO b	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO c	**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 d	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO e	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO f	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO g	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO h	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO i	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO j	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO k	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO l	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO a	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO b	Design and analyze electrical machines, modern drive and lighting systems
PSO c	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO d	Design controllers for electrical and electronic systems to improve their performance.

Mr.P.Rathnakar Kumar	Mrs. P.Rathnakar Kumar	Dr.M.S.Giridhar	Dr.J.Siva Vara Prasad
Course Instructor	Course Coordinator	Module Coordinator	HOD

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

COURSE HANDOUT
PART-A

Name of Course Instructor : Mr.P.Rathnakar Kumar
Course Name & Code : HIGH VOLTAGE ENGINEERING & 17EE92
L-T-P Structure : 4-0-0 Credits : 3
Program/Sem/Sec : B.Tech., EEE., VII-Sem., Sections- B A.Y : 2022-23
Pre-requisites : Electrical Power Transmission, Electrical Engineering Materials

Course Educational Objective: This course enables the student to

- Introduce basics of electrical breakdown and high voltage generation,
- Understand high voltage test systems, measurement and analysis techniques as applied to power system apparatus such as cables, insulators, transformers, and generators.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Illustrate the fundamental concepts of electric breakdown in liquids, gases, and solids.
CO 2	Test the protection equipment in power system for high voltage applications.
CO 3	Analyze the concept of generation of high voltage AC, DC impulse voltages and currents and their measurements.
CO 4	Compare the principles of insulation co-ordination on HV/EHV systems.

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

Cos	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO a	PSO b	PSO c	PSO d
CO1	3	2	2										1			
CO2	3	3		3	3				2	2		2	3	2		
CO3	2	2	2	2	2							1	1	2		2
CO4	3	2	2									1	1	1		2

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXT BOOKS:

1. E.Kuffel, W.S.Zaengl, J.Kuffel, High Voltage Engineering, Elsevier Publications, 2nd Edition,2008.
2. M.S.Naidu and V. Kamaraju High Voltage Engineering, TMH Publication, 3nd Edition,2017.

REFERENCE BOOKS:

1. C.L.Wadhwa, High Voltage Engineering, New Age Internationals (P) Limited, 3rd Edition,2012.
2. Ravindra Arora, Wolfgang Mosch, High Voltage Insulation Engineering, New Age International (P) Limited, 3rd Edition,2011.
3. Dr. Shailendra Jain, "Modeling and Simulation using MATLAB - Simulink" ,Wiley Publication, 2nd Edition,2011.

4. Dr. Vikramaditya Dave,"Electric Power Transmission & Distribution System with PSCAD (Basic) S", Himanshu Publications ,2017.
5. Atousa Yazdani,"Modern Distribution Systems with PSCAD Analysis", CRC Press, 1st edition,2018 .
6. Tharangika Bambaravanage, "Modeling, Simulation and Control of a Medium-Scale Power System ", Springer, 1st edition, 2017.
7. Subir Ray, "An introduction to High Voltage Engineering", PHI Learning Pvt.Ltd,New Delhi, 2nd edition, 2013.

Part - B
COURSE DELIVERY PLAN (LESSON PLAN): Section-B

UNIT-I: INTRODUCTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, Course outcomes, Electric Field Stresses	1	11-07-2022		TLM1/TLM2	
2.	Gas/Vacuum as Insulator, Liquid Dielectrics, Solid dielectrics	1	14-07-2022		TLM1/TLM2	
3.	Composites, Estimation and Control of Electric Stress	1	15-07-2022		TLM1/TLM2	
4.	Numerical methods for electric field computation	1	16-07-2022		TLM1/TLM2	
5.	Numerical methods for electric field computation	2	18-07-2022 21-07-2022		TLM1/TLM2	
6.	Surge voltages, their distribution and control	2	22-07-2022 23-07-2022		TLM1/TLM2	
7.	Conduction and Breakdown in Gases, Gases as insulating medium	1	25-07-2022		TLM1/TLM2	
8.	Ionization process, Townsend's criteria for breakdown	2	28-07-2022 29-07-2022		TLM1/TLM2	
9.	Paschen's law	1	30-07-2022		TLM1/TLM2	
No. of classes required to complete UNIT-I: 12					No. of classes taken:	

UNIT-II: BREAK DOWN IN LIQUID DIELECTRICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Liquid as Insulator, pure and commercial liquids	1	1-08-2022		TLM1/TLM2	
11.	conduction and breakdown in pure liquids, conduction and breakdown in commercial liquids	2	4-08-2022 5-08-2022		TLM1/TLM2	
12.	Transformer oil, Break Down in	1	6-08-2022		TLM1/TLM2	

13.	Solid Dielectrics, Intrinsic breakdown	2	8-08-2022 11-08-2022		TLM1/TLM2	
14.	Electromechanical breakdown	1	12-08-2022		TLM1/TLM2	
15.	Thermal breakdown	1	18-08-2022		TLM1/TLM2	
16.	breakdown of solid dielectrics in practice	2	20-08-2022 22-08-2022		TLM1/TLM2	
17.	solid dielectrics used in practice	2	25-08-2022 26-08-2022		TLM1/TLM2	
18.	Revision of unit-1 and unit-2	1	27-08-2022		TLM1/TLM2	
19.	MID-I		19-09-2022			
20.	MID-I		22-09-2022			
21.	MID-I		23-09-2022			
22.	MID-I		24-09-2022			
No. of classes required to complete UNIT-II: 13					No. of classes taken:	

UNIT-III: GENERATION OF HIGH VOLTAGES, CURRENTS AND TESTING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
23.	Generation of High DC Voltages, Generation of High AC voltages	2	29-08-2022 29-08-2022		TLM1/TLM2	
24.	Generation of Impulse Voltages, Generation of Impulse currents	2	1-09-2022 2-09-2022		TLM1/TLM2	
25.	Tripping and control of impulse generators.	1	3-09-2022		TLM1/TLM2	
26.	Testing of Insulators and bushings, Testing of Isolators	2	26-09-2022 29-09-2022		TLM1/TLM2	
27.	Testing of circuit breakers, Testing of cables	2	30-09-2022 1-10-2022		TLM1/TLM2	
28.	Testing of Transformers, Testing of Surge Arresters	2	7-10-2022 10-10-2022		TLM1/TLM2	
29.	Radio Interference measurements. Short circuit testing	1	13-10-2022		TLM1/TLM2	
No. of classes required to complete UNIT-III: 12					No. of classes taken:	

UNIT-IV: MEASUREMENT OF HIGH VOLTAGES AND CURRENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
30.	Measurement of High DC voltages	1	14-10-2022		TLM1/TLM2	
31.	Measurement of High AC and impulse voltages	2	15-10-2022 17-10-2022		TLM1/TLM2	
32.	Measurement of High DC, AC and Impulse currents	2	20-10-2022 21-10-2022		TLM1/TLM2	
33.	Oscilloscope for impulse voltage measurements	2	22-10-2022 27-10-2022		TLM1/TLM2	
34.	Oscilloscope for impulse current measurements	2	28-10-2022 29-10-2022		TLM1/TLM2	
35.	Partial discharge, acoustic measurement	1	31-10-2022		TLM1/TLM2	
No. of classes required to complete UNIT-IV: 10					No. of classes taken:	

UNIT-V: INSULATION CO-ORDINATION AND GROUNDING OF EHV SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Principles of Insulation Coordination on High voltage	2	3-11-2022 4-11-2022		TLM1/TLM2	
37.	Insulation Coordination on High voltage	2	5-11-2022 7-11-2022		TLM1/TLM2	
38.	Extra High Voltage power systems	2	10-11-2022 11-11-2022		TLM1/TLM2	
39.	Generalized Grounding systems	1	14-11-2022		TLM1/TLM2	
40.	Grounding Grids	1	17-11-2022		TLM1/TLM2	
41.	Revision of unit 1&2	1	18-11-2022		TLM1/TLM2	
42.	Revision of unit 3,4 &5	1	19-11-2022		TLM1/TLM2	
43.	MID-II		21-11-2022			
44.	MID-II		24-11-2022			
45.	MID-II		25-11-2022			
46.	MID-II		26-11-2022			
No. of classes required to complete UNIT-V: 10					No. of classes taken:	

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Streamers Theory	1	26-08-22		TLM1/ TLM2	
2.	Measurement of voltages and currents-types	1	29-10-22		TLM1/ TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	8W
CRT classes	05-09-2022	17-09-2022	2W
I Mid Examinations	19-09-2022	24-09-2022	1W
II Phase of Instructions	26-09-2022	19-11-2022	8W
II Mid Examinations	21-11-2022	26-11-2022	1W
Preparation and Practicals	28-11-2022	03-12-2022	1W
Semester End Examinations	5-12-2022	17-12-2022	2W

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1.	Design and develop innovative products and services in the field of Electrical and Electronics Engineering and allied engineering disciplines.
PEO2.	Apply the knowledge of Electrical and Electronics Engineering to solve problems of social relevance, pursue higher education and research.
PEO3.	Work effectively as individuals and as team members in multidisciplinary projects.
PEO4.	Engage in lifelong learning, career enhancement and adapt to changing professional and societal needs.

PART-D

PROGRAMME OUTCOMES (POs):

PO a	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO b	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO c	**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 d	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO e	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO f	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO g	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO h	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO i	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO j	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO k	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO l	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO a	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO b	Design and analyze electrical machines, modern drive and lighting systems
PSO c	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO d	Design controllers for electrical and electronic systems to improve their performance.

Mr.P.Rathnakar Kumar	Mrs. P.Rathnakar Kumar	Dr.M.S.Giridhar	Dr.J.Siva Vara Prasad
Course Instructor	Course Coordinator	Module Coordinator	HOD