SAPTHAGIRI College of Engineering Creating Tomorrow

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
SAPTHAGIRI COLLEGE OF ENGINEERING, BENGALURU.
LESSON PLAN FOR THE ACADEMIC YEAR 2018-19 (EVEN SEM.)
(Faculty)

Course	POWER SYSTEM OPERATION AND CONTROL				Course code		15EE81
Faculty	Mr. A DHAMODARAN				Semester & Section		8th Sem. A Sec.
Core / Elective	Contact Hours / week			Total Hours	Assessment		Credits
Core	L	T	P	50	CIE	SEE	4
	4	-	-		20	80	
Prerequisite	Mathematics, Basic Electrical Engineering, Power Generation and Economics, Transmission and distribution, Power System Analysis – 1 & 2.						

Course Objectives	
1	To describe various levels of controls and the vulnerability of the power system and to explain components, architecture and configuration of SCADA.
2	To define unit commitment, explain various constraints in unit commitment and its solution methods.
3	To explain issues of hydrothermal scheduling and solutions to hydrothermal problems.
4	To explain basic generator control loops, functions of Automatic Generator Control, speed governors and mathematical models of Automatic Load Frequency Control.
5	To explain the Automatic Load Frequency Control in an interconnected power system.
6	To describe voltage and reactive power control in an interconnected power system.
7	To describe reliability and contingency analysis, state estimation and its related issues in power system.

Syllabus	RBT Level
MODULE 1	
Introduction: Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Energy Management Centres. **Supervisory Control and Data acquisition (SCADA):** Introduction to SCADA and its Components, Standard SCADA Configurations, Users of Power Systems SCADA, Remote Terminal Unit for Power System SCADA, Common Communication Channels for SCADA in Power Systems, Challenges for Implementation of SCADA. **Unit Commitment:** Introduction, Simple Enumeration, Constraints, Priority List Method, Dynamic Programming Method for Unit Commitment.■	L1, L2, L4
MODULE 2	
Hydro-thermal Scheduling: Introduction, Scheduling Hydro Systems, Discrete Time Interval Method, Short Term Hydro Thermal Scheduling Using $\gamma - \lambda$ Iterations, Short Term Hydro Thermal Scheduling Using Penalty Factors. **Automatic Generation Control (AGC):** Introduction, Basic Generator Control Loops, Commonly used Terms in AGC, Functions of AGC, Speed Governors.■	L2, L3, L4

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MODULE 3	
Automatic Generation Control (continued): Mathematical Model of Automatic Load Frequency Control, AGC Controller, and Proportional Integral Controller. **Automatic Generation Control in interconnected Power systems:** Introduction, Tie–Line Control with Primary Speed Control, Frequency Bias Tie - Line Control, State–Space Models.■	L3
MODULE 4	
Automatic Generation Control in interconnected Power system (continued): State-Space Model for Two–Area System, Tie-Line Oscillations, Related Issues in Implementation of AGC. **Voltage and Reactive Power Control:** Introduction, Production and Absorption of Reactive Power, Methods of Voltage Control, Dependence of Voltage on Reactive Power , Sensitivity of Voltage to Changes in P And Q, Cost Saving, Methods of Voltage Control by Reactive Power Injection, Voltage Control Using Transformers, Voltage Stability. ■	L3
MODULE 5	
Power System Reliability and Security: Introduction, Security Levels of System, Reliability Cost, Adequacy Indices, Functions of System Security, Contingency Analysis, Linear Sensitivity Factors, Contingency Selection and Ranking. **State estimation of Power Systems:** Introduction, Linear Least Square Estimation, DC State Estimator, Other Issues in State Estimation.■	L2, L3, L4

Text Book:

1. Dr. K. Uma Rao, *"Power System Operation and Control"*, Wiley, 1st Edition, 2012.

Reference Books:

1. Allen J Wood etal, *"Power Generation Operation and Control"*, Wiley, 2nd Edition, 2003.
2. Kundur, *"Power System Stability and Control"*, McGraw Hill, 8th Reprint, 2009.

Course Outcomes (CO)	
At the end of this course the students will	
CO1	Describe various levels of controls in power systems, the vulnerability of the system, components, architecture and configuration of SCADA.
CO2	Solve Unit Commitment Problems.
CO3	Explain the issues of hydrothermal scheduling and solutions to hydro thermal problems.
CO4	Explain basic generator control loops, functions of Automatic Generation Control and speed governors.
CO5	Develop and analyse mathematical models of Automatic Load Frequency Control.
CO6	Explain Automatic Generation Control in an interconnected power system.
CO7	Explain voltage and reactive power control in an interconnected power system.
CO8	Explain reliability, security, contingency analysis, state estimation and its issues in power systems.

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LESSON PLAN

Period	Planned Date	Topic Planned	Actual Date	Topic covered	Remarks
1.	11-02-19	Introduction about the subject "Power System Operation and Control" and syllabus.	12/2/19	Introduction about the subject "power system operation and control" and syllabus.	11/2/19 – Placement activities
2.	11-02-19	**MODULE – 1: Introduction,** Operating states of a power system, Objectives of power system control.	12/2/19	module-1: Introduction operating states of a power system, objective of power system control.	classes 'A & B' are combined.
3.	12-02-19	Key Concepts of reliable operation, Preventive and emergency controls, Energy management centres.	13/2/19	key concepts of reliable operation, preventive & emergency controls.	

At the end of this topic, students will be able to

- **Explain different operating states of a power system.**
- **Describe objectives of power system control and its key concepts.**
- **Explain preventive and emergency controls in a power system.**
- **Describe the Energy Management Centres and its major components.**

4.	13-02-19	**Supervisory Control and Data Acquisition (SCADA):** Introduction to SCADA and its various components.	14/2/19	Energy management centres Supervisory control & Data Acquisition (SCADA): Intro. to SCADA & its components.	
5.	14-02-19	Standard SCADA configurations.	18/2/19	components of SCADA (continued) standard SCADA configurations	
6.	18-02-19	Users of Power Systems SCADA, Remote Terminal Unit for Power System SCADA.	18/2/19	standard SCADA configuration (continued). Users of power systems SCADA.	
7.	18-02-19	Common Communication Channels for SCADA in Power Systems, Challenges for Implementation of SCADA.	19/2/19	RTUs for power system SCADA. Common communication channels for SCADA in power systems.	

At the end of this topic students will be able to

- **Describe the architecture of SCADA and its components.**
- **Discuss the standard configurations of SCADA.**
- **Explain the RTUs in SCADA and various common communication channels for SCADA.**

8.	19-02-19	**Unit Commitment:** Introduction, Simple Enumeration (Brute Force Technique).	20/2/19	Unit commitment: Introduction simple Enumeration (Brute Force technique).	
9.	20-02-19	Constraints in Unit Commitment.	25/2/19	constraints in unit commitment.	21/2/19 – classes suspended (IV Sem. only) on account of CRPF
10.	21-02-19	Priority List method: Algorithm and flow chart with an example.	25/2/19	Priority list method: problem on it.	
11.	25-02-19	Dynamic Programming (DP) method for Unit Commitment; DP algorithm, Forward DP approach – Flow chart.	26/2/19	Algorithm & flow chart - priority list method. Dynamic programming method (DP) for UC.	

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Period	Planned Date	Topic Planned	Actual Date	Topic covered	Remarks
At the end of this topic students will be able to • **Explain Unit Commitment and its solution methods.** • **Describe various constraints in Unit Commitment problem.** • **Discuss in detail the UCP solution methods; Priority List method and Dynamic Programming method.**					
12.	25-02-19	**MODULE – 2 Hydro-thermal Scheduling:** Introduction, Classification of hydro plants. Scheduling Hydro Systems, Algorithms for hydrothermal scheduling.	27/2/19	MODULE-02 Hydrothermal scheduling: Introduction scheduling of hydrosystems Algorithms for hydrothermal scheduling.	
13.	26-02-19	Discrete Time Interval Method; mathematical formulation of objective function, Operational constraints, Discretization, Dependent variables, Lagrange function and Algorithm.	28/2/19	Discrete time interval method, mathematical formulation of objective function, Discretization and dependent variables.	
14.	27-02-19	Problems on hydrothermal scheduling by discrete time interval method.	5/3/19	Solution technique, Lagrange function and Algorithm	
15.	28-02-19	Short-term hydrothermal scheduling using $\gamma - \lambda$ iterations; Algorithm and Flow chart.	6/3/19	Short term hydrothermal scheduling using $\gamma - \lambda$ iterations, Algorithm & flow chart.	
16.	05-03-19	Numerical problems on it.	7/3/19	Short term hydrothermal scheduling using penalty factors.	
17.	06-03-19	Short-term hydrothermal scheduling using penalty factors.	8/3/19	Problems (numerical) on all methods.	Special class arranged.
18.	07-03-19	Numerical problems on it.	12/3/19	Numerical problems on it	IA Test-I postponed to 14/3/19 & 15/3/19.
At the end of this topic students will be able to • **Identify scheduling of hydro systems.** • **Perform hydrothermal scheduling using discrete time Interval method.** • **Solve short-term hydrothermal scheduling using $\gamma - \lambda$ iterations and penalty factors.**					
19.	14-03-19	**Automatic Generation Control (AGC):** Introduction, Basic Generator Control Loops, Commonly used Terms in AGC.	18/3/19	AGC:- Introduction, Basic generator control loops, commonly used terms in AGC.	
20.	18-03-19	Functions of AGC, Speed Governors; Introduction.	18/3/19	Functions of AGC, Speed governors, Introduction	
21.	18-03-19	General governor operation; steam turbine governing system, conventional governor and Electronic Hydraulic governing system.	19/3/19	General governor operation steam turbine governor, conventional governor, Electronic hydraulic governor system.	
22.	19-03-19	Modes of Governor operation; Isochronous operation and Droop mode operation. Numerical problems on it.	20/3/19	modes of governor operation Isochronous and droop mode load sharing between units in parallel.	

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Period	Planned Date	Topic Planned	Actual Date	Topic covered	Remarks
23.	20-03-19	Load sharing between units in parallel. Numerical problems on it.	26/3/19	Problems on AGC and units in parallel.	21/3/19 to 23/3/19 - Ugadi holidays 25/3/19 - Sankalpa inauguration 26/3/19 to 30/3/19 - Sanpalp 2k19
At the end of this topic students will be able to • **Explain Automatic Generation Control and the basic generator control loops.** • **Discuss the functions of AGC.** • **Explain different governor operation modes.** • **Perform load sharing between units in parallel.**					
24.	21-03-19	**MODULE – 3 Automatic Generation Control (continued):** Mathematical model of ALFC; governor model and generator model.	1/4/19	Module-3 AGC (continued) Mathematical model of ALFC governor model and generator model.	
25.	25-03-19	Load model and numerical problems on it.	1/4/19	Load model and composite model of ALFC.	
26.	25-03-19	Composite model of ALFC and numerical problems on it.	2/4/19	Composite model of ALFC & numerical problems.	
27.	26-03-19	Turbine model and complete ALFC model. Steady state analysis. Problems on steady state analysis of ALFC.	3/4/19	Turbine model & complete ALFC model. Steady state analysis. Numerical problems.	
28.	27-03-19	Transient and dynamic responses. Numerical problems on it.	4/4/19	Transient & dynamic responses. Numerical problems on it.	
29.	28-03-19	Automatic Generation Controller and Proportional Integral controller.	8/4/19	Automatic Generation Controller and proportional integral Controller.	
At the end of this topic students able to • **Develop a complete mathematical model for Automatic Load Frequency Control (ALFC).** • **Analyse the ALFC for transient and dynamic responses.** • **Explain the effect of Proportional Integral control on ALFC.**					
30.	01-04-19	**AGC in Interconnected Power Systems:** Introduction, Tie-line control with primary speed control (two-area system with primary loop).	8/4/19	AGC in interconnected power systems: Intro, Tie-line control with primary speed control (two-area system with primary loop).	
31.	01-04-19	Tie – line control for change of load in area 1, area 2 and in both areas. Problems on it.	9/4/19	Tie-line control for change of load in area 1, area 2 and in both areas. Numerical problems.	
32.	02-04-19	Tie line bias control of two area system. Choice of bias factors in tie line bias control and numerical problems on it.	10/4/19	Tie-line bias control of two area system. Choice of bias factors in tie line bias control. Numerical problems.	
33.	03-04-19	State space model of an isolated power system.	11/4/19	State space model of an isolated power system.	13/4/19 - Assembly elections (MP) - Holiday declared.
34.	04-04-19	Pole placement design of an isolated power system. Numerical problems on it.		Pole placement design of an isolated power system. Numerical problems on it.	

Period	Planned Date	Topic Planned	Actual Date	Topic covered	Remarks
35.	08-04-19	Optimal control design and Numerical problems on it.	22/4/19	optimal control design & numerical problems on it.	
At the end of this topic, students will be able to: • **Explain the tie line control in interconnected power system.** • **Describe tie-line bias control of two area system.** • **Develop a state space model of an isolated power system and design it by pole placement technique.** • **Design an optimal control for isolated power system.**					
36.	08-04-19	**MODULE – 4 AGC in Interconnected Power Systems (continued):** State space model for a two area system. Numerical problems on it.		Module-4 AGC in interconnected power systems: state space model for a two area system Numerical problems on it.	
37.	09-04-19	Tie-line oscillations and numerical problems on it. Related issues in AGC implementation.	22/4/19	Tie line oscillations and numerical problems on it. Related issues in AGC implementation.	
At the end of this topic, students will be able to: • **Develop a state space model for a two area power system.** • **Describe tie-line oscillations in two area interconnected power system.** • **Discuss various issues in implementation of AGC in power system.**					
38.	10-04-19	**Voltage and Reactive Power Control:** Introduction, Production and Absorption of Reactive Power.	23/4/19	Voltage & Reactive Power control: introduction, Production & absorption of Q.	
39.	11-04-19	Methods of voltage control, Dependence of voltage on reactive power. Numerical problems on it.		methods of voltage control, dependence of voltage on Q. Numerical problems on it.	
40.	18-04-19	Injection of reactive power in an interconnected system. Numerical problems on it.	24/4/19	injection of reactive power in an interconnected system. Numerical problems on it.	
41.	22-04-19	Sensitivity of voltage to changes in P and Q. Numerical problems on it.	29/4/19	Sensitivity of voltage to changes in P & Q. Numerical problems on it.	25/4/19 - placement drive.
42.	22-04-19	Cost saving in injection of reactive power. Methods of voltage control by reactive power injection; Shunt reactors, Shunt capacitors.	29/4/19	cost saving in injection of reactive power. Methods of voltage control by reactive power injection; shunt reactors, shunt capacitors.	
43.	23-04-19	Methods of voltage control by reactive power injection (continued); Series capacitors, Synchronous condensers. Voltage control and power factor correction.	29/4/19	Methods of voltage control by reactive power injection; series capacitors, synchronous condensers. Voltage control & power factor correction.	
44.	24-04-19	Voltage control using transformers; phase shifting transformers. Numerical problems on it.		voltage control using transformers; phase shifting transformers. Numerical problems on it.	

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Period	Planned Date	Topic Planned	Actual Date	Topic covered	Remarks
45.	25-04-19	Voltage stability; definition, mechanism causing voltage instability, parameters to indicate voltage strength.	30/4/19	Voltage stability: definition, mechanism causing voltage instability, parameters to indicate voltage strength.	
46.	29-04-19	P-V curves and voltage collapse, V-Q curves. Reactive power required for specific receiving end voltage in long lines. Numerical problems on it.	2/5/19	P-V curves and voltage collapse V-Q curves. Reactive power required for specific receiving end voltage in long lines. Numerical problems on it.	Kavb
At the end of this topic, students will be able to: • **Explain the production and absorption of reactive power in power system components.** • **Compute the amount of injection of reactive power for voltage control in a node.** • **Describe the various methods of voltage control by reactive power injection and transformers.** • **Explain P-V curves and V-Q curves for voltage stability.**					
47.	29-04-19	**MODULE – 5 Power System Reliability and Security:** Introduction, Security levels of power system; functional zones and hierarchical levels of assessment.	6/5/19	Module-5:- PS reliability & security: Introduction, security levels of PS; functional zones and hierarchical levels of assessment.	
48.	30-04-19	Requirement for power system adequacy assessment. Reliability cost. Adequacy indices; Indices at HL1, HL2 and HL3.		Requirement for power system adequacy assessment. Reliability cost. Adequacy indices; HL1, HL2 & HL3.	
49.	02-05-19	Functions of system security; system monitoring, contingency analysis, Security Constrained Optimal Power Flow (SCOPF). Factors affecting power system security.	6/5/19	Functions of system security; System monitoring, contingency analysis, Security Constrained Optimal Power Flow (SCOPF), Factors affecting power system security.	
50.	06-05-19	Contingency analysis – general procedure. Contingency analysis by linear sensitivity factors; DC Load flow.	7/5/19	Contingency analysis – general procedure Contingency analysis by linear sensitivity factors; DC Load flow;	
51.	06-05-19	Contingency analysis by Generation-shift sensitivity factors; flow chart. Numerical problems on it.	8/5/19	Contingency analysis by generation-shift sensitivity factors. flow chart. Numerical problems on it.	
52.	07-05-19	Contingency analysis by Line-outage distribution factors; flow chart.		Contingency analysis by line-outage distribution factors. flow chart.	
53.	08-05-19	Contingency analysis by AC power flow methods; flow chart. Contingency selection and ranking; System Performance Index (PI) for line power flows.	9/5/19	Contingency analysis by AC power flow methods; flow chart. Contingency selection and ranking; system performance index (PI) for line flows.	
54.	09-05-19	System PI for voltage analysis. 1P1Q method for contingency selection; flow chart.	13/5/19	System PI for voltage analysis 1P1Q method for contingency selection; flow chart.	Kavb

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Period	Planned Date	Topic Planned	Actual Date	Topic covered	Remarks
At the end of this topic, students will be able to: • **Explain different security levels of a power system.** • **Describe the major functions of system security.** • **Discuss the contingency analysis by DC load flow methods such as, linear sensitivity factors, generation-shift sensitivity factors and line-outage distribution factors and AC power flow methods.** • **Explain the contingency selection methods and contingency ranking.**					
55.	13-05-19	**State estimation of Power Systems:** Introduction; mathematical problem formulation of state estimation.	13/5/19	~~State estimation of power systems:~~ Introduction, mathematical problem formulation of state estimation	
56.	13-05-19	Linear least-squares estimation; Formulation, determination of state estimate and observability.		linear least-squares estimation formulation, determination of state estimate and observability	
57.	14-05-19	DC state estimator; state variables in DC power flow, Measurement model	14/5/19	DC state estimator; state variables in DC power flow, measurement model	
58.	15-05-19	Numerical problems in measurement model. Phase-shift estimation, parameter estimation.	15/5/19	Numerical problems in measurement model. Phase-shift estimation, parameter estimation.	
At the end of this topic, students will be able to: • **Formulate mathematical problem of state estimation.** • **Describe the linear least-square estimation method.** • **Discuss the DC state estimator with measurement model.** • **Explain the issues in state estimation.**					

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PROGRAMME OUTCOMES (PO)

Graduation students of ***Bachelor of Electrical and Electronics Engineering*** *program at* **Sapthagiri College of Engineering** will attain the following program outcomes in the field of **Electrical and Electronics Engineering.**

PROGRAM OUTCOMES	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**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.
PO5	**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.
PO6	**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.
PO7	**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.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**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.
PO12	**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.

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PROGRAMME SPECIFIC OUTCOMES (PSO)

Graduation students of **Bachelor of Electrical and Electronics Engineering** program at **Sapthagiri College of Engineering** will attain the following program specific outcomes in the field of **Electrical and Electronics Engineering** at the time of graduation.

PROGRAM SPECIFIC OUTCOMES	
PSO1	The application of fundamental knowledge to identify, formulate and investigate various real time problems of Electrical Machines, Power Electronics, Control System, High Voltage Engineering, Power System and Micro controller.
PSO2	The application of recent techniques along with modern software tools (like MATLAB, AUTOCAD-Electrical, Mi Power, etc) for designing, simulating and analyzing electrical systems as well as electronic system to engage in lifelong learning.
PSO3	The utilization of knowledge regarding project management techniques and sustainable technologies for developing projects in various applications like Renewable energy, Power system, High voltage Engineering, Industrial Drives and Micro controller.

CO-PO Mapping:

Mapping of Course outcomes, Program Objectives and Program specific outcomes
Note: 1 = Slight 2 = Moderate 3 = Strong

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	----	1	----	----	----	----	----	----	3	2	----	2
CO2	3	3	3	----	2	----	----	----	----	----	----	3	2	----	2
CO3	3	3	3	----	1	----	----	----	----	----	----	3	2	----	2
CO4	3	2	1	----	----	----	----	----	----	----	----	3	2	----	2
CO5	3	3	3	----	1	----	----	----	----	----	----	3	2	----	2
CO6	3	3	3	----	2	----	----	----	----	----	----	3	2	----	2
CO7	3	3	3	----	----	----	----	----	----	----	----	3	3	----	3
CO8	3	3	3	----	----	----	----	----	----	----	----	3	3	----	3
Average	**3**	**2.9**	**2.75**	**----**	**1.4**	**----**	**----**	**----**	**----**	**----**	**----**	**3**	**2.25**	**----**	**2.25**

Signature of faculty

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(For students)

Course	ELEMENTS OF CIVIL ENGINEERING AND MECHANICS				Course code		18 CIV 24
Faculty	GEETHA T S				Semester		1 EC(G Section)
Core/Elective	Contact Hours /week			Total Hours	Assessment		Credits
Core	L	T	P	40	CIE	SEE	3
	2	1	-		40	60	

Course Objectives

1	To make students to understand about the scope of different fields of Civil Engineering. the role of Civil Engineers in the Infrastructural development, effect of infrastructural facilities on socio-economic development of a country.
2	To understand about basic idealizations of mechanics, definition of force, various types of forces, laws on forces, Moment of a force, resultant of a force and concept of resolution and composition of a force.
3	To analyze Free body diagrams, Lami's theorem, Equations of Equilibrium, equilibrium of concurrent and non concurrent coplanar force systems, friction and types, laws on friction. To solve the various problems on wedge, ladder friction.
4	To gain the basic knowledge types of beams, supports, support reactions, types of loads, trusses analyzing the various loads on trusses based on method of joints and sections.
5	To find the Centroid of the simple and build-up sections, the moment of inertia of the simple and composite sections
6	To apply the concepts of kinetics and kinematics, to understand about curvilinear and rectilinear motion and to analyze the various problems based on these.

Syllabus

MODULE 1	RBT Level
Introduction to Civil Engineering: Scope of different fields of Civil Engineering; Surveying, Building Materials, Construction Technology, Geotechnical Engineering, Structural Engineering, Hydraulics, Water Resources & Irrigation Engineering, Transportation Engineering and Environmental Engineering. Role of Civil Engineers in the Infrastructural development, effect of infrastructural facilities on social economic development of a country. (02 hours) **Introduction to Engineering Mechanics**: Basic concepts of idealization- Particle, Continuum and Rigid Body; Force; Systems of Forces; Basic Principles – Physical Independence of forces, Superposition, Transmissibility, Newton's Laws of Motion, Resolution and Composition of forces, Law of parallelogram of forces, Polygonal law, Resultant of Concurrent coplanar force systems, Coplanar Non Concurrent Force System: Moment of a Forces, couple, Varignon's theorem, Resultant of Coplanar non-concurrent force system. (06 hours)	L1,L2,L3,
MODULE 2	
Equilibrium of Forces: Free body diagrams, Lami's theorem, Equations of Equilibrium, equilibrium of concurrent and non concurrent coplanar force systems. (4 hours) **Friction:** Types of friction, Laws of dry Friction, Limiting friction, Concept of Static and Dynamic Friction; Numerical problems on motion of single and connected bodies on planes, wedge friction, ladder friction, rope and Pulley systems (4 hours)	L1,L2,L3,

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MODULE 3	
Support Reactions: Types of Loads and Supports, statically determinate and indeterminate beams, Support Reaction in beams, Numerical problems on support reactions for statically determinate beams (Point load, uniformly distributed & uniformly varying loads and Moments) (3 hours) **Analysis of Simple trusses:** Types of trusses, Analysis of statically determinate trusses using method of joints and method of sections. (5 hours)	L1,L2,L3
MODULE 4	
Centroid: Centroid of simple figures from first principle, Centroid of composite/built-up sections; Moment of Inertia: Introduction, second moment of area of plane sections from first principles, Parallel axes and perpendicular axes Theorems, Radius of gyration, Moment of inertia of composite area and built-up sections. Concept of Product of Inertia(No Problems) (8 hours)	L1,L2,L3
MODULE 5	
Kinematics: Definitions, Displacement, Average velocity, Instantaneous velocity, Speed, Acceleration, Average acceleration, Variable acceleration, Acceleration due to gravity, Newton's Laws of Motion. Rectilinear Motion–Numerical problems. Curvilinear Motion-Super elevation, Projectile Motion, Relative motion, Numerical problems. Motion under gravity, Numerical problems, (6 hours) **Kinetics:** D'Alembert's principle and its applications in plane motion and connected bodies including pulleys (2 hours)	L1,L2,L3

Text Books:

1. R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
2. Bansal R.K., A Text Book of Engineering Mechanics, Laxmi Publications

Reference Books:

1. Andy Ruina and Rudra Pratap , Introduction to Statics and Dynamics, Oxford University Press
2. Reddy Vijaykumar K. and K. Suresh Kumar, Singer's Engineering Mechanics
3. F. P. Beer and E. R. Johnston, Mechanics for Engineers, Statics and Dynamics, McGraw Hill
4. Irving H. Shames, Engineering Mechanics, Prentice Hall.

Course outcomes	
At the end of this course the students will be	
CO1	Able to mention the applications of various fields of Civil Engineering.
CO2	Able to compute the resultant of given force system subjected to various loads.
CO3	Able to comprehend the action of Forces, Moments and other loads on systems of rigid bodies and compute the reactive forces that develop as a result of the external loads.
CO4	Able to locate the Centroid and compute the Moment of Inertia of regular and built-up sections
CO5	Able to express the relationship between the motions of bodies and analyze the bodies in motion
CO6	Able to apply the concepts of kinetics and kinematics, to understand about curvilinear and rectilinear motion and to analyze the various problems based on these.

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LESSON PLAN FOR THE ACADEMIC YEAR: ODD 2018-19
(For students)

Lesson plan

Period	Date	Topic Planned	Actual Date	Topic Covered	Remarks
1	2/03/2019	**Module-1 Introduction to Civil Engineering:** Scope of different fields of Civil Engineering; Surveying, Building Materials, Construction Technology, Geotechnical Engineering, Structural Engineering, Hydraulics, Water Resources & Irrigation Engineering	2/3/19	Introduction to Civil Engg. Scopes Branches of civil Engineering.	
2	5/03/2019	Transportation Engineering and Environmental Engineering. Role of Civil Engineers in the Infrastructural development, effect of infrastructural facilities on social economic development of a country	5/3/19	Role of Civil Engg. effect of infrastructural development	
3	7/03/2019	**Introduction to Engineering Mechanics:** Basic concepts of idealization- Particle, Continuum and Rigid Body; Force; Systems of Forces; Basic Principles – Physical Independence of forces, Superposition, Transmissibility	7/3/19	Basic Idealization Force, System of forces. Basic principles.	
4	11/03/2019	Newton's Laws of Motion, Resolution and Composition of forces, Law of parallelogram of forces	8/3/19 11/3/19	Newtons laws of motion parallelogram of forces	Extra class
5	12/03/2019	Polygonal law, Resultant of Concurrent coplanar force systems, Coplanar Non Concurrent Force System: Moment of a Forces, couple,	12/3/19	Resultant of concurrent coplanar force systems moment	
6	14/03/2019	Varignon's theorem, Resultant of Coplanar non-concurrent force system.	14/3/19	couple, Forces Varignon's theorem	
7	18/03/2019	Problems on Above	18/3/19	problems	
8	19/03/2019	Problems on Above	19/3/19	problems	
At the end of this topic students will be able mention the applications of various fields of Civil Engineering and Understand action of forces, moments and other loads on systems of rigid bodies					
9	21/03/2019	**Module-2 Equilibrium of forces:** Free body diagrams, Lami's theorem, Equations of Equilibrium,	21/3/19	Equilibrium of forces FBD, Lamis theorem Equations of equilibrium	
10	25/03/2019	Equilibrium of concurrent and non concurrent coplanar force systems.	25/3/19	problems	
11	26/03/2019	Problems on Above	26/3/19	problems	
12	28/03/2019	Problems on Above	1/4/19	problems	Technical talk
13	1/04/2019	**Friction:** Types of friction, Laws of dry Friction, Limiting friction, Concept of Static and Dynamic Friction	2/4/19	Friction, Types problems	
14	2/04/2019	Numerical problems on motion of single and connected bodies on planes, wedge friction ladder friction, rope and Pulley system.	5/4/19	Problems. rope & pulley arrangement	

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15	5/04/2019	Problems on Above	8/4/19	Problems	
16	8/04/2019	Problems on Above	9/4/19	Problems	
At the end of this topic students will be able to able to analyze the forces during equilibrium of a body and various forces during friction.					
17	9/04/2019	**Module-3 Support Reactions:** Types of Loads and Supports, statically determinate and indeterminate beams, Support Reaction in beams	11/4/19	Support reactions Types of loads, Beams, Supports	
18	11/04/2019	Numerical problems on support reactions for statically determinate beams (Point load, uniformly distributed & uniformly varying loads and Moments)	12/4/19	Problems on Beams UDL UVL, point load	
19	18/04/2019	Problems on Above	22/4/19	Problems	Election
20	22/04/2019	Problems on Above	23/4/19	Problems	
21	23/04/2019	**Analysis of Simple Trusses:** Types of trusses, Analysis of statically determinate trusses using method of joints	25/4/19	Problems on method of Joints	
22	25/04/2019	Analysis of statically determinate trusses using method of sections	29/4/19	Problems on method of sections	
23	29/04/2019	Problems on Above	30/4/19	Problems	
24	30/04/2019	Problems on Above	2/5/19	Problems	
At the end of this topic students will be able to analyze various loads on beams and to analyze the trusses.					
25	2/05/2019	**Module-4 Centroid:** Centroid of simple figures from first principle	3/5/19	Centroid derivations	Extra class
26	6/05/2019	Centroid of composite/built-up sections;	6/5/19	Centroid problems	
27	7/05/2019	Problems on Above	7/5/19	Problems	
28	9/05/2019	Problems on Above	9/5/19	Problems	
29	13/05/2019	Moment of Inertia: Introduction, second moment of area of plane sections from first principles, Parallel axes and perpendicular axes Theorems, Radius of gyration	13/5/19	MI introduction Parallel & ⊥ar axes theorems	
30	14/05/2019	Moment of inertia of composite area and built-up sections. Concept of Product of Inertia	14/5/19	MI of composite area. Built up Sections problems	
31	20/05/2019	Problems on Above	20/5/19	Problems	
32	21/05/2019	Problems on Above	21/5/19	Problems	
At the end of this topic students will be able to locate the Centroid of the various sections and Compute moment of inertia of the composite sections					
33	23/05/2019	**Module-5 Kinematics:** Definitions, Displacement, Average velocity, Instantaneous velocity, Speed, Acceleration, Average acceleration, Variable acceleration, Acceleration due to gravity, Newton's Laws of Motion	23/5/19	Kinematics definations	

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(For students)

34	27/05/2019	Rectilinear Motion–Numerical problems. Curvilinear Motion-	27/5/19	Rectilinear motion, Curvilinear motion } problems
35	28/05/2019	Problems on Above	28/5/19	problems
36	30/05/2019	Super elevation, Projectile Motion, Relative motion	30/5/19	Super elevation, Projectile motion, } problems
37	3/06/2019	Problems on Above	3/6/19	problems on Relative motion
38	4/06/2019	Relative motion, Numerical problems. Motion under gravity, Numerical problems,	4/6/19	problem on motion under gravity.
39	6/06/2019	**Kinetics:** D'Alembert's principle and its application in plane motion and connected bodies including pulleys	6/6/19	D'Alembert's principle applications.
40	13/06/2019	Problems on Above	13/6/19	problems
41	17/06/2019	Problems on Above	17/6/19	problems.

At the end of this topic students will be able express the relationship between the motion bodies and analyze the bodies in motion.

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LESSON PLAN FOR THE ACADEMIC YEAR: ODD 2018-19
(For students)

PROGRAMME OUTCOMES

Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge and behavior. Graduation students of **Bachelor of Mechanical Engineering** program at Sapthagiri College of Engineering will attain the following program outcomes **in the field of mechanical engineering.**

	PROGRAM OUTCOME
PO1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2.	**Problem analysis** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3.	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4.	**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.
PO5.	**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.
PO6.	**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.
PO7.	**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.
PO8.	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9.	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10.	**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.
PO11.	**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.
PO12.	**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.

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DEPARTMENT OF CIVIL ENGINEERING
SAPTHAGIRI COLLEGE OF ENGINEERING
LESSON PLAN FOR THE ACADEMIC YEAR: EVEN 2018-19
(Faculty)

PROGRAMME SPECIFIC OUTCOMES

The graduates of Civil Engineering program of Sapthagiri College of Engineering should be able to attain the following at the time of graduation.

	PROGRAM SPECIFIC OUTCOMES
PSO1	Expertise in Design and technical areas of Civil Engineering such as Design of RCC Structures, Design of Steel Structures, Design of Composite Structures Materials and pre-stressed concrete structures with a focus on research and innovation.
PSO2	Ability of problem solving by adopting analytical, numerical and experimental skills with awareness of societal impact.
PSO3	To apply the knowledge of environmental studies such as water supply engineering, sanitary and sewage engineering, industrial waste water engineering and to know the impact of environmental issues.
PSO4	To comprehend and apply the ideas of Construction the executives, quality and authority.

CO-PO Mapping

Mapping of Course outcomes, Program Objectives and Program Specific outcomes
Note: 1 = Slight 2 = Moderate 3 = Strong

Course outcomes	Program Outcomes												Program Specific Objectives				Total
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	
CO-1	2	2			1		2					3	2	1			13
CO-2	3	3	1		2							2	3	2			16
CO-3	3	3	1		2							2	3	2			16
CO-4	3	3	1		2							2	3	2			16
CO-5	3	2			2							3	3	2			15
Average	2.8	2.6	0.6		1.8		0.4					2.5	2.8	1.8			15.3

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

SAPTHAGIRI COLLEGE OF ENGINEERING

LESSON PLAN FOR THE ACADEMIC YEAR: 2018-19 EVEN SEM

(Faculty)

Course	CONTROL SYSTEMS				Course code		17EC43
Faculty	Varshini K				Semester		4 A
Core/Elective	Contact Hours /week			Total Hours	Assessment		Credits
Core	L	T	P	50	CIE	SEE	4
	4	1	-		40	60	
Prerequisite	1. Laplace Transforms 2. Basics of Network Analysis						

COURSE OBJECTIVES

1	To develop a mathematical model for electrical and mechanical systems by understanding the basic features, configurations and applications of control systems
2	To derive the transfer function for a given control system
3	To determine the time response of first and second order systems from the transfer function
4	To analyze the stability of a system from the transfer function by various techniques
5	To develop a control system model in continuous and discrete time using state variable techniques

SYLLABUS	
MODULE 1	**RBT Level**
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs	L1, L2, L3
MODULE 2	
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design)	L1, L2, L3
MODULE 3	
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci	L1, L2, L3
MODULE 4	
Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with	L1,L2,L3

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transportation lag excluded) Introduction to lead, lag and lead-lag compensating networks (excluding design)	
MODULE 5	
Introduction to Digital Control System: Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diagonalization	L1,L2,L3

Text Book:

1. J. Nagarath and M. Gopal, — Control Systems Engineeringl, New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7

Reference Books:

1. Modern Control Engineering, K. Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7
2. Automatic Control Systems, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008
3. Feedback and Control System, Joseph J Distefano III et al., Schaum's Outlines, TMH, 2nd Edition 2007

COURSE OUTCOMES	
At the end of this course the students will be able to:	
CO1	Develop the mathematical model of mechanical and electrical systems and derive transfer function for a given control system using block diagram reduction techniques and signal flow graph method
CO2	Determine the time domain specifications for first and second order systems
CO3	Analyze the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique
CO4	Analyze the stability of a system in the frequency domain using Nyquist and bode plots
CO5	Develop a control system model in continuous and discrete time using state variable techniques

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LESSON PLAN FOR THE ACADEMIC YEAR: 2018-19 EVEN SEM

(Faculty)

LESSON PLAN

Period	Planned Date	Topic Planned	Actual Date	Topic covered	Remarks
1	2/2/2019	Types of Control Systems, Effect of Feedback Systems	2/2/19	Types of Control Systems, Effect of Feedback Systems	
2	5/2/2019	Differential equation of Physical Systems Mechanical Systems	5/2/19	Differential equation of Physical Systems - Mechanical Systems	
3	6/2/2019	Differential equation of Physical Systems Electrical Systems	6/2/19	Differential equation of Physical Systems - Electrical Systems	
4	7/2/2019	Analogous Systems	7/2/19	Analogous Systems	Took Maths class
5	9/2/2019	Transfer functions	7/2/19	Transfer functions	
6	12/2/2019	Transfer functions	8/2/19	Transfer functions	Took tutorial class
7	13/2/2019	Block diagram algebra	12/2/19	Block diagram Algebra	
8	14/2/2019	Block diagram algebra	6/3/19	Block diagram Algebra	Placement training from 13/2/19 to 16/2/19
9	16/2/2019	Signal Flow graphs	7/3/19	Signal flow graphs	
10	19/2/2019	Signal Flow graphs	7/3/19	Signal flow graphs	Took Maths class
At the end of this module, students will be able to develop the mathematical model of mechanical and electrical systems and derive transfer function for a given control system using block diagram reduction techniques and signal flow graph method					
11	20/2/2019	Standard test signals	8/3/19	Standard test Signals	Marriage leave from 17/2/19 to 5/3/19
12	21/2/2019	Unit step response of First order Systems	9/3/19	Unit step response of first order Systems	8/3/19 - Took tutorial class

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13	23/2/2019	Unit step response of Second order Systems	14/3/19	Unit step response of Second order Systems	Took S&S Class
14	26/2/2019	Unit step response of Second order Systems	14/3/19	Unit step response of Second order Systems	
15	27/2/2019	Time response specifications	15/3/19	Time response specifications	16/3/19 – Gave Class to S&S
16	28/2/2019	Time response specifications of second order systems	19/3/19	Time response specifications of second order systems	15/3/19 – Took tutorial Class
17	2/3/2019	Time response specifications of second order systems	20/3/19	Time response specifications of second order systems	
18	5/3/2019	steady state errors and error constants	23/3/19	Steady state errors and error constants	
19	6/3/2019	steady state errors and error constants	23/3/19	Steady state errors and error constants	Took PCS Class
20	7/3/2019	Introduction to PI, PD and PID Controllers	25/3/19	Introduction to PI, PD and PID controllers	Took up Class
At the end of this module, students will be able to determine the time domain specifications for first and second order systems					
21	9/3/2019	Concepts of stability, Necessary conditions for Stability	27/3/19	Concepts of stability Necessary conditions for Stability	26/3/19 – Klo class due to SANKALP events
22	14/3/2019	Routh stability criterion	3/4/19	Routh Stability Criterion	
23	16/3/2019	Routh stability criterion	4/4/19	Routh Stability Criterion	

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(Faculty)

24	19/3/2019	Relative stability analysis	5/4/19	Relative Stability analysis	Took extra class
25	20/3/2019	Introduction to Root-Locus Techniques, The root locus concepts	5/4/19	Introduction to root-locus techniques, the root locus concepts	Took tutorial class
26	21/3/2019	Construction of root loci	9/4/19	Construction of root loci	
27	23/3/2019	Construction of root loci	10/4/19	Construction of root loci	
28	26/3/2019	Construction of root loci	11/4/19	Construction of root loci	
29	27/3/2019	Construction of root loci	11/4/19	Construction of root loci	Took Maths class
30	28/3/2019	Construction of root loci	12/4/19	Construction of root loci	Took tutorial class
At the end of this module, students will be able to analyze stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique					
31	2/4/2019	Introduction	13/4/19	Introduction	
32	3/4/2019	Spectrum Analysis of Sampling process	20/4/19	Spectrum analysis of Sampling process	
33	4/4/2019	Signal reconstruction	20/4/19	Signal reconstruction	Took extra class
34	9/4/2019	Difference equations	23/4/19	Difference equations	
35	10/4/2019	Difference equations	24/4/19	Difference equations	

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		function		Transfer function	
47	7/5/2019	Introduction to Polar Plots, Mathematical preliminaries	10/5/19	Introduction to polar plots, Mathematical preliminaries	Took tutorial class
48	8/5/2019	Nyquist Stability criterion	14/5/19	Nyquist Stability criterion	
49	9/5/2019	Nyquist Stability criterion	15/5/19	Nyquist Stability criterion	
50	14/5/2019	Introduction to lead, lag and lead-lag compensating networks	16/5/19	Introduction to lead, lag, lead-lag compensating networks	Took extra class
At the end of this module, students will be able to analyze the stability of a system in the frequency domai using Nyquist and bode plots					

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PROGRAMME OUTCOMES

Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge and behavior. Graduation students of **Bachelor of Electronics & Communication Engineering** program at Sapthagiri College of Engineering will attain the following program outcomes **in the field of Electrical & Communication Engineering.**

	PROGRAM OUTCOMES
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.
PO4	**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.
PO5	**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.
PO6	**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.
PO7	**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.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**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.
PO12	**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.

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PROGRAMME SPECIFIC OUTCOMES

The graduates of Electronics & Communication Engineering program of Sapthagiri College of Engineering should be able to attain the following at the time of graduation.

	PROGRAM SPECIFIC OUTCOMES
PSO1	Specify, design, build and test analog, digital and embedded systems for signal processing
PSO2	Understand and architect wired and wireless analog and digital communication systems as per specifications and determine their performance

CO-PO MAPPING (GOAL)

Mapping of Course outcomes, Program Objectives and Program specific outcomes
Note: 1 = Slight 2 = Moderate 3 = Strong

Course outcomes	Program Outcomes												PSOs		Total
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO-1	3	3	2	2	1							3	3		17
CO-2	3	3	2	2	1							3	3		17
CO-3	3	3	2	2	1							3	3		17
CO-4	3	3	2	2	1							3	3		17
CO-5	3	3	2	2	1							3	3		17
Average	3	2	2	2	1							3	3		17

Staff

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