SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF ENGINEERING & TECHNOLOGY

ELECTRICAL ENGINEERING

Syllabus for

S.E. (Electrical Engineering) w.e.f. Academic Year 2017-18

Choice Based Credit System

SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF ENGINEERING & TECHNOLOGY

Electrical Engineering

PROGRAMME: BACHELOR OF ELECTRICAL ENGINEERING PROGRAMME OBJECTIVES

A. Program Educational Objectives

1. To develop an ability to understand the basic concepts of fundamental laws in electrical circuits and their applications in the Working principle of electrical apparatus.
2. To introduce students about the power generation, transmission, distribution and utilization of electrical energy and their controls.
3. To develop an application oriented understanding amongst the students about electrical energy utilization.
4. To develop an analytical skills amongst the students about electrical systems used in power sector and various industries.

B PROGRAMME OUTCOMES

Students attain the following outcomes:-

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data,
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multidisciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of the need for, and an ability to engage in life-long learning,
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

SOLAPUR UNIVERSITY, SOLAPUR
Faculty of Engineering & Technology
S.E. (Electrical Engineering)

Choice Based Credit System Syllabus Structure of S. E. Electrical Engineering W.E.F. 2017-2018 **Semester I**

Course Code	Theory Course Name	Hrs./week			Credits	Examination Scheme			
		L	T	P		ISE	ESE	ICA	Total
EL211	Engineering Mathematics-III	4	1	-	5	30	70	25	125
EL212	Electrical Machines-I	4	-	-	4	30	70	-	100
EL213	Electrical Measurement and Instrumentation	3	-	-	3	30	70	-	100
EL214	Power Plant Engineering	3	1	-	4	30	70	25	125
EL215	Electronic Devices and Circuits	4	-	-	4	30	70	--	100
EL216	Object Oriented Programming with C++	2	-	-	2	-	--	--	--
Sub Total		20	2	-	22	150	350	50	550
ENV21	Environmental Science	1	-	-	-	-	-	-	-
Laboratory Course Name									
							ESE		
							POE	OE	
EL212	Electrical Machines-I	-	-	2	1	-	50	-	25	75
EL213	Electrical Measurement and Instrumentation	-	-	2	1	-	50	-	25	75
EL215	Electronic Devices and Circuits	-	-	2	1	-		-	25	25
EL216	Object Oriented Programming with C++	-	-	2	1	-	50	-	25	75
Sub Total		-	-	8	4	-	150		100	250
Grand Total		**20**	**2**	**8**	**26**	**150**	**500**		**150**	**800**

- *Abbreviations: L- Lectures, P –Practical, T- Tutorial, ISE- In Semester Exam, ESE - End Semester Exam, ICA- Internal Continuous Assessment, ESE - University Examination (Theory &/ POE &/Oral examination)*

SOLAPUR UNIVERSITY, SOLAPUR
Faculty of Engineering & Technology
S.E. (Electrical Engineering)

Choice Based Credit System Structure of S.E. Electrical Engineering W.E.F. 2017-2018 **Semester II**

Course Code	Theory Course Name	Hrs./week			Credits	Examination Scheme			
		L	T	P		ISE	ESE	ICA	Total
EL221	Numerical Methods and Linear Algebra	4	1		5	30	70	25	125
EL222	Electrical Machines-II	4	-	-	4	30	70	-	100
EL223	Elements of Power System	4		-	4	30	70	-	100
EL224	Analog and Digital Integrated Circuits	4		-	4	30	70	-	100
EL225	Network Analysis	4	1	-	5	30	70	25	125
Sub Total		20	2	-	22	150	350	50	550
ENV 22	**Environmental Science**	1	-	-	-	-	-	-	1
Laboratory Course Name									
							ESE		
							POE	OE	
EL222	Electrical Machines-II	-	-	2	1	-	50	-	25	75
EL223	Elements of Power System	-	-	2	1	-	_	25	25	50
EL224	Analog and Digital Integrated Circuits	-	-	2	1	-	50	-	25	75
EL226	Programming and Simulation by Using MATLAB	-	-	2	1	-	-	-	50	50
Sub Total		-	-	8	4	-	125		125	250
Grand Total		**20**	2	**08**	**26**	**150**	**475**		**175**	**800**

- *Abbreviations: L- Lectures, P –Practical, T- Tutorial, ISE- In Semester Exam, ESE - End Semester Exam, ICA- Internal Continuous Assessment, ESE - University Examination (Theory &/ POE &/Oral examination)*

Note –

- Batch size for the SE practical /tutorial shall be of 20 students. On forming the batches, if the strength of remaining student exceeds 9, then a new batch shall be formed.

- Vocational Training (evaluated at B.E. Part-I) of minimum 15 days shall be completed in any vacation after S.E. Part-II but before B.E. Part-I & the report shall be submitted and evaluated in B.E. Part-I

- Appropriate Elective I & II Subjects may be added when required.

- Student shall select one Self Learning Module at T.E. Part I and T.E. Part II each from Technical and Humanities and Social Sciences Group with at least one Self Learning Module from the Humanities and Social Sciences Group

- Curriculum for Humanities and Social Sciences Self Learning Modules is common for all under graduate programmes of faculty of Engineering and Technology

- Minimum four assignments for Self-Learning Modules at T.E. Part I and T.E. Part II shall be submitted by the students which shall be evaluated by a Module Coordinator assigned by institute / department

- Project group for T.E.(Electrical) Part II Mini Project shall not be of more than **three** student

- Project group for B.E. (Electrical) Part I and Part II shall not be of more than **three** students.

- ICA shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable

Solapur University, Solapur

S.E. (Electrical Engineering) Semester-I

EN211**Engineering Mathematics III**

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hours/week, 4 Credits	**ESE – 70 Marks**
Tutorial – 1 Hour/week, 1 Credit	**ISE – 30 Marks**
	ICA - 25 Marks

This course introduces linear differential equation and its applications in Electrical Engineering Problems, Partial differential equations, Laplace transform, Fourier series, Z transform and Complex Variable theory.

Course Prerequisite:

Student shall have knowledge of Ordinary differential equation, Partial differentiation, Complex number and also to have basic knowledge of functions, intervals. He shall also have basic knowledge of derivatives and Integration.

Course Objectives:

1. To make student understand basics of solving differential equation to electrical circuits.
2. To introduce to student basics of Laplace Transform and its applications.
3. To make student to have knowledge of partial differential equations under different conditions.
4. To make student understand theory and mathematical forms of Z transform and Fourier Series
5. To make student understand functions complex variable.

Course Outcomes:

1. Student can solve problems of linear differential equation.
2. Students can apply Laplace transform to solve problems of electrical fields.
3. Student can apply Z transform under different conditions and can derive equation from them.
4. Student can able to understand Fourier series.
5. Student can analyze the functions of complex variable.

Section-I

Unit 1– Linear Differential Equations with Constant Coefficients No of lectures – 08

- **Prerequisite:**
  Trigonometry, differentiation, integration.

- **Objectives:**

1. Revision of concepts of derivatives
2. To introduce different forms of differential equation
3. To make students to understand different techniques
4. To make students to understand applications of linear differential equations

- **Outcomes:**
  After completing this unit, students -

1. Can apply these methods to solve electric circuit problems
2. Can calculate parameters of electrical circuits (current, resistance, time etc.)
3. Can convert the problems to simple forms to analyze

- **Unit Content:**
  Basic definition, differential operator, complimentary functions, particular integral shortcut method for standard functions like , e^{ax}, sinax, cosax, e^{ax} V , XV and particular integral general method (without method of variation of parameters) for other functions

- **Content Delivery Methods:**
  Chalk and talk

- **Assessment Methods:**
  Electrical problems and derivation related to linear differential equation.

Unit 2–Homogeneous and Legendre's Linear Differential equations No of lectures – 06

- **Prerequisite:**
  Linear differential equation with its different functions

- **Objectives:**

1. To make students to understand concepts of homogenous differential equation.
2. To make students to analyze Legendre differential equation.
3. To make students to derive homogenous differential equation from Legendre differential equations

- **Outcomes:**
  After completing this unit, students –

1. Can convert difficult problems to simple form.
2. Can solve problems of homogenous and Legendre differential equations.

- **Unit Content:**
  Cauchy's & Legendre's Linear equations, Applications to Electrical Engineering Problems

- **Content Delivery Methods:**
  Chalk and talk.

- **Assessment Methods:**
  Problems related to Cauchy's & Legendre's Linear equations, Applications Electrical Engineering Problems.

Unit 3–Laplace Transform **No of lectures – 06**

- **Prerequisite:**
  Concepts of function, intervals, differentiation, integration

- **Objectives:**

1. To make students to derive Laplace at different conditions and for different functions.
2. To make students to apply Laplace for getting solution for electric circuits.
3. To introduce concept of derivative and integral.
4. To make students to understand shifting and change of scalar properties.

- **Outcomes:**
  After completing this unit, students –

1. Can apply Laplace Transform to electrical circuit theory
2. Can apply Laplace transforms to convert integral and differential equations into algebraic equations.
3. Can convert time domain signal into frequency domain signal

- **Unit Content:**
  Definition, Laplace Transform of standard functions, Properties First shifting, change of scale, multiplication of powers of t and division by t, Laplace Transform of derivative and integral, Laplace transform of Periodic functions, Unit step functions and unit Impulse functions

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, videos

- **Assessment Methods:**
  Numerical problems and derivation related to above Content

Unit 4– Inverse Laplace Transform **No of lectures – 06**

- **Prerequisite:**
  Concepts of function, intervals, differentiation, integration

- **Objectives:**

1. To make students to derive inverse Laplace at different conditions and for different functions.

2. To make students to apply inverse Laplace for getting solution to differential equation.
3. To introduce to student concept of convolution.

- **Outcomes:**
  After completing this unit, students –

1. Can apply Inverse Laplace Transform to electrical circuit Problems.
2. The Laplace transforms converts integral and differential equations into algebraic equations.
3. It also converts a function in the complex domain to time-domain.

- **Unit Content:**
  Methods of finding Inverse Laplace transforms, Convolution Theorem, Applications to solve linear differential equations related to electrical circuits with constant coefficients

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, videos

- **Assessment Methods:**
  Numerical problems and derivation related to above Content.

Section-II

Unit 5- Partial Differential Equations **No of lectures – 08**

- **Prerequisite:**
  Concepts of function of two variables, differentiation, integration

- **Objectives:**

1. To introduce to student concept of partial differential equation
2. To make students able to solve partial differential equations
3. To introduce concept of application of partial differential equations for different fields

- **Outcomes:**
  After completing this unit, student –

1. Can analyse difference between solutions to ordinary and partial differentiation
2. Can derive solutions partial differential with its different forms
3. Can apply to evaluate partial differential equations for different electric fields
4.

- **Unit Content:**
  Four standard forms of Partial Differential equations of first order, Solution of partial differential equations by method of separation of variables

- **Content Delivery Methods:**
  Chalk and talk

- **Assessment Methods:**
  Numerical problems and derivation related to above Content

Unit 6-Functions of Complex variables **No of lectures – 06**

- **Prerequisite:**
  Concepts of complex Number, Partial Derivatives, Integration

- **Objectives:**

1. To make students to understand analytic function
2. To understand Cauchy-Riemann equations and harmonic function
3. To make students to understand Cauchy integration

- **Outcomes:**
  After completing this unit, students –

1. Can derive analytic function wave equation using Maxwell equation for different media
2. Can derive Cauchy-Riemann equations and harmonic function
3. Can solve Cauchy integral problems

- **Unit Content:**
  Analytic functions, Cauchy's Riemann equations, Harmonic functions, Line integral, Cauchy's integral theorem, Cauchy's integral formula

- **Content Delivery Methods:**
  Chalk and talk

- **Assessment Methods:**
  Numerical problems and derivation related to above Content

Unit 7- Z-Transform **No of lectures – 06**

- **Prerequisite:**
  Sequence and Series, convergence

- **Objectives:**

1. To make students to understand Z - transform and Inverse Z – Transform
2. To make students to convert discrete time Domain into a complex frequency domain
3. To make students to understand region of convergence

- **Outcomes:**
  After completing this unit, students –

1. Can find Z - transform to different functions
2. Can used to finding frequency response
3. Can calculate Inverse Z - Transform to different functions

- **Unit Content:**
  Z - Transform of elementary Functions, Properties of Z - Transform and Inverse Z Transform
- **Content Delivery Methods:**
  Chalk and talk

- **Assessment Methods:**
  Numerical and derivation related to above Content

Unit 8- Fourier series **No of lectures – 06**

- **Prerequisite:**
  Function, Interval, Differentiation, Integration

- **Objectives:**
  1. To introduce basic properties and function of Fourier series
  2. To make students to understand Fourier series for different functions
  3. To introduce concept of Half range series

- **Outcomes:**

After completing this unit, students –

1. Can define Fourier series for different functions
2. Can use for circuit analysis
3. Can calculate half range series for different functions

- **Unit Content:**
  Definition, Euler's formula, Expansions of function, Change of interval, even and odd functions, half range Fourier series

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical and derivation related to above Content

- **Internal Continuous Assessment (ICA) :**
  ICA shall consists of minimum eight assignments based upon above curriculum. Tutorial/Assignments shall include numerical problems

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- **Text Books:**

1. "A textbook of Applied Mathematics Vol II", Vidyarthi Grah Prakashan, Pune, JN and PN Wartikar
2. "Higher Engineering Mathematics" , Khanna Publications, Delhi, B S Grewal
3. "Advanced Engineering Mathematics", Wiley & SMS, Newyork, Kreyzig-John

- **Reference Books:**

1. "Advanced Engineering Mathematics", Cengage Learning, Peter O'Neil
2. "Higher Engineering Mathematics" , Tata McGraw-Hill Education, BV Ramana

Solapur University, Solapur

SE (Electrical Engineering) Semester-I

EL212 ELECTRICAL MACHINES - I

Teaching Scheme	**Examination Scheme**
Lectures– 4 Hours/week, 4 Credits	**ESE –70 Marks**
Practical– 2 Hours/week, 1 Credit	**ISE – 30 Marks**
	ICA - 25 Marks
	POE- 50 Marks

This course introduces Electrical machines like DC Machines and Transformer including their theoretical and analytical performance

Course Prerequisite:

Student shall have knowledge of Magnetic Circuit, DC Circuit, AC Fundamentals and AC Circuit

Course Objectives:

1. To get detailed knowledge of construction, operating principles of DC machines and transformer
2. To find equivalent circuit parameters and performance parameters for transformer and DC machines
3. To understand different testing methods of DC Machines

Course Outcomes:

Upon successful completion of this course,:

1. Student will be able to analyze performance of DC generators and motors
2. Student will be able to examine performance of single phase and three phase transformer
3. Students will be able to identify applications of DC machines & transformer in power sector

SECTION-I

Unit 1: DC Generators: **No of lectures – 10**

- **Prerequisite:**
  Concepts of magnetic flux and basics of AC circuit

- **Objectives:**
  1. To make students understand operation of dc generator
  2. To make students analyze operating parameters of dc generator

- **Outcomes:**
  After completing this unit, student -
  1. Can apply operation of DC generator
  2. Can find different operating parameters of DC generator

- **Unit Content:**
  Construction of armature and field systems, Basic Principle of working, EMF equation, Types of Armature windings, Characteristics and applications of different types of DC Generators, EMF built up process in DC Shunt Generator, Armature reaction- Demagnetizing and Cross magnetizing MMFs and their estimations, Remedies to overcome the armature reaction, Commutation Process, Types of Commutation, Causes of bad commutation and remedies, inter poles, Compensating windings

- **Delivery Methods:**
  Chalk and talk, Video lectures

- **Assessment Methods:**
  Numerical problems and derivation related to Armature reaction, EMF equation and Types of DC generator

Unit 2: DC Motors: **No of lectures – 10**

- **Prerequisite:**
  Concepts of magnetic flux and basics of AC circuit

- **Objectives:**
  1. To make students understand operation of DC motor
  2. To make students analyze operating parameters of DC motor

- **Outcomes:**
  After completing this unit, students -
  1.Can apply operation of DC motor
  2.Can find different operating parameters of DC motor

- **Unit Content:**
  Principles of working, Significance of Back EMF, Torque Equation, Types of DC motors, Losses and efficiency, Condition for maximum efficiency, Characteristics and selection of DC motors for various applications, Starting of DC motors (3-point, 4-point starters), Speed control of DC shunt and series Motors, Braking of DC Motors - Plugging, Dynamic Braking, Regenerative Braking

- **Content Delivery Methods:**
  Chalk and talk, Video lectures, Animations

- **Assessment Methods:**
  Numerical problems and derivations related to torque equation, losses and efficiency and speed control methods of dc motor

Unit 3: Testing of DC Machines: **No of lectures – 06**

- **Prerequisite:**
  Necessity of testing

- **Objectives:**
  1. To make student understand concepts and operation of various testing methods
  2. To make student analyze various testing methods

- **Outcomes:**
  After completing this unit, students –
  Can analyze various testing methods

- **Unit Content:**
  Direct and indirect methods of testing, brake test, Swinburne's test, Hopkinson's test

- **Content Delivery Methods:**
  Chalk and talk

- **Assessment Methods:**
  Numerical problems on brake test and Swinburne's test

Section II

Unit 4: Single Phase Transformer: **No of lectures – 13**

- **Prerequisite:**
  Basics of magnetic flux and AC circuit

- **Objectives:**
  1. To make students understand operation of single phase transformer
  2. To make students analyze operating parameters of single phase transformer

- **Outcomes:**
  After completing this unit, students -
  1. Can understand operation of single phase transformer
  2. Can find different operating parameters of single phase transformer

- **Unit Content:**
  Transformer construction and types, Transformer on no-load and on-load condition with phasor diagrams, Losses and Efficiency, Transformer equivalent circuits, Effect of load on power factor, Testing-Polarity test, Open Circuit Test (OC), Short Circuit Test (SC), Sumpner's Test, Regulation of transformers, Percentage resistance and reactance, All day Efficiency, Parallel operation, Auto- Transformer

- **Content Delivery Methods:**
  Chalk and talk, Video lectures, Animations

- **Assessment Methods:**
  Numerical problems on losses, efficiency and regulation, equivalent circuit parameters

Unit 5: Three Phase Transformers: **No of lectures – 13**

- **Prerequisite:**
  Basics of magnetic flux and ac circuit

- **Objectives:**
  1.To make students understand operation of three phase transformer
  2.To make students analyze operating parameters of three phase transformer

- **Outcomes:**
  After completing this unit, students -
  1. Can understand operation of three phase transformer
  2. Can find different operating parameters of three phase transformer

- **Unit Content:**
  Special constructional features, Three phase transformer connections, Labeling of transformer terminals, Star/Star connection, Delta/Delta Connection, Star/Delta, Delta/Star connection, Delta/Zigzag Star, Star/Zigzag Star, Vector groups, Choice of transformers connections, Magnetizing inrush current, Parallel operation of transformers, Three winding transformers and its equivalent circuits, Open delta connection, Three/Two phase conversion (Scott connection), On-Off Load tap changing transformers

- **Content Delivery Methods:**
  Chalk and talk, Video lectures, Animations

- **Assessment Methods:**
  Numerical problems on transformer connections, Parallel operation of transformers

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- **Internal Continuous Assessment (ICA) :**

  ICA shall consist of minimum eight experiments from following list
  1. Determination of magnetization, external and internal characteristics of DC Generator
  2. Determination of efficiency and voltage regulation of DC Shunt generator by direct loading
  3. Speed control of D C shunt motor by armature and field control
  4. Determination of efficiency and speed regulation of DC shunt motor by direct loading
  5. Determination of efficiency and speed regulation of DC Shunt motor by indirect loading
  6. Determination of efficiency of a DC series motor by load test
  7. Determination of efficiency of a DC machine by performing Swinburne's test
  8. Determination of efficiency of a DC machine by performing Hopkinson's test
  9. Determination of efficiency of single phase transformer by Back to Back test
  10. Parallel operation of Single phase transformer
  11. Sumpner's test on two identical single phase transformers
  12. Determination of equivalent circuit parameters of single phase transformer
  13. Scott connection of three phase transformers
  14. Direct load test on three phase transformer for various connections

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- **Text Books:**
  1. Electric Machines, Third Edition, Tata McGraw Hill Publication, I J Nagrath, D P Kothari
  2. Electrical Machines, Third Edition, Tata McGraw Hill Publication, S K Bhattacharya
  3. Theory and Performance of Electrical Machines, S K Kataria& Sons , J B Gupta
  4. A Text Book of Electrical Technology Volume II, S Chand, B L Theraja

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- **Reference Books:**

1. Electrical Machinery, Sixth Edition 2002, Tata McGraw Hill, AEFitzgerald, CKingsley, SDUmans
2. Electrical Machinery, Khanna Publishers, P S Bhimbhra
3. Electrical Machines, Dhanpat Rai & Sons, Ashfaq Hussain
4. Theory and Performance of Electrical Machines, S K Kataria and sons, J B Gupta
5. Principles of electronic machines & Power electronics, Wiley India,P.C.Sen

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Solapur University, Solapur

SE (Electrical Engineering) Semester-I

EL213 ELECTRICAL MEASUREMENT AND INSTRUMENTATION

Teaching Scheme	**Examination Scheme**
Lectures– 3Hours/week, 3 Credits	**ESE – 70Marks**
Practical– 2 Hours/week, 1 Credit	**ISE – 30Marks**
	ICA- 25 Marks
	POE- 50 Marks

This course introduces different types of meters and instruments for measurement of various electrical parameters like resistance, inductance, capacitance, voltage, current, power, energy etc Also this course include display and recording techniques of various electrical parameters

Course Prerequisite:

Student shall have knowledge of magnetic circuit, circuit theory

Course Objectives:

1. To impart in depth knowledge of the operating principle, construction, mechanisms used in Measuring instruments used for the measurement of electrical quantities

2. To introduce the concept of accuracy and precision in the measurement of electrical quantities

3. To make the students capable of selecting the proper instrument for the measurement

Course Outcomes:

1. The students will be able to use Analog instruments in practical applications

2. The students will be able to apply potentiometer & bridges for measurements of resistance, Inductance & capacitance

3. The students will be able to find the applications of instrument transformer and data acquisition system for sensing & control of electrical quantities

4. The students will be able to use digital instruments for various measurements.

SECTION-I

Unit -1 Basic Concept of Measurement **No of lectures – 04**

- **Prerequisite:**
  Magnetic flux and its properties, Basics of torques

- **Objectives:**
  To make student understand different types of instruments and their characteristics

- **Outcomes:**
  After completing this unit, students –
  can able to apply the characteristics of measuring instruments

- **Unit Content:**
  Standards & their classification, Types of errors, Characteristics of measuring instruments (static & dynamic) - accuracy, linearity, speed of response, dead zone, repeatability, resolution, span, reproducibility, drifts, need for calibration

- **Content Delivery Methods:**
  Chalk and talk

- **Assessment Methods:**
  Theoretical questions related to various characteristics of measuring instruments

Unit -2 Analog Instruments **No of lectures – 10**

- **Prerequisite:**
  Concept of electromechanical energy conversion, Mutual induction, Concept of induced torque

- **Objectives:**
  1.To make student understand construction and operation of different measuring instruments
  2. To make student analyze operation and performance parameters of different measuring instruments

- **Outcomes:**
  After completing this unit, students –

  Can able to analyze various parameters of different measuring instruments

- **Unit Content:**

a) Classification of instrument- absolute & secondary, Types of secondary instrument- indicating, recording, analog, digital, Essentials of indicating instrument; PMMC, PMMI, Electrodynamometer instrument- operating principle, torque equation, errors, shape of scale, Measurement of ac/dc current, voltage and power; Measurement of power using two wattmeter method for balanced & un balanced load, Shunt & multiplier ohmmeter, Megger, Earth teste

b) 1-Φ & 3-Φ Electro dynamo meter & moving iron type power factor meter, Weston type Frequency meter, Synchro scope

- **Content Delivery Methods:**
  Chalk and talk, Analogy, Power point presentation

- **Assessment Methods:**
  Numerical problems related to PMMC, PMMI and Electrodynamometer instrument

Unit- 3 Potentiometer & Bridges **No of lectures – 08**

- **Prerequisite:**
  Concepts of circuit networks, resistance, inductance and capacitance

- **Objectives:**

1. To make student understand various methods for measurement of resistance, inductance and capacitance
2. To make student analyze various measuring bridges

- **Outcomes:**
  After completing this unit, students –

1. Can analyze various measuring bridges
2. Can apply operation and construction of various measuring bridges

- **Unit Content:**
  a) Principle of DC potentiometer, Crompton's type DC Potentiometer; Applications of DC Potentiometer, principle of AC potentiometer & its applications
  b) DC bridges-Wheatstone's, Kelvin's double bridge for measurement of resistance; AC bridges-Maxwell's, Hey's, Anderson's bridges for inductance measurement, Desauty, Schering bridges for capacitance measurement

- **Content Delivery Methods:**
  Chalk and talk Power point presentation

- **Assessment Methods:**
  Numerical problems on Wheatstone, Hey, Anderson, Deasauty Bridge

SECTION II

Unit 4– Instrument Transformers **No of lectures – 06**

- **Prerequisite:**
  Basic Concepts of transformer

- **Objectives:**

1. To make student understand applications of transformer in instrumentation
2. To make student understand analysis of instrument transformer

- **Outcomes:**
  After completing this unit, students –

1. Can find applications of instrument transformer
2. Can analyze instrument transformer

- **Unit Content:**
  Construction and theory of instrument transformers (CT & PT), equations for ratio and phase angle error, turns compensation

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation

- **Assessment Methods:**
  Derivations and numerical related to CT and PT ratio

Unit – 5 Digital Instruments **No of lectures – 06**

- **Prerequisite:**
  Basics of digital electronics

- **Objectives:**
  To make student understand operation of digital instruments

- **Outcomes:**
  After completing this unit, students–

  Can find suitable application of digital instruments

- **Unit Content:**
  Digital voltmeter, Types of digital voltmeter, Digital multi-meter, Electronic counter, Digital measurement of frequency & time period, Q- meter, Electronic energy meter, LED and LCD display

- **Content Delivery Methods:**
  Chalk and talk, animations

- **Assessment Methods:**
  Theoretical questions related to above content

Unit-6 Data Acquisition System (DAS) **No of lectures – 06**

- **Prerequisite:**
  Signal conditioning

- **Objectives:**
  1. To make student understand working operation of DAS
  2. To make student understand working operation of different recording instruments

- **Outcomes:**
  After completing this unit, students–

  Can apply operation of DAS and Recorders

- **Unit Content:**
  Types of data acquisition system, Multiplexing & its types, Strip chart recorder, X-Y recorder

- **Content Delivery Methods:**
  Chalk and talk

- **Assessment Methods:**
  Theoretical questions related to above contents

Unit – 7 Oscilloscopes **No of lectures – 04**

- **Prerequisite:**
  Basics of oscilloscope

- **Objectives:**

1. To make student understand working operation of various oscilloscopes

- **Outcomes:**
  After completing this unit, students –

  Can apply operation of various oscilloscopes

- **Unit Content:**
  Introduction, Block diagram of CRO & working of each block, CRT features, Basics of digital storage oscilloscope, Use of DSO for voltage, current, phase, frequency & time measurement

- **Content Delivery Methods:**
  Chalk and talk, Animations

- **Assessment Methods:**
  Theoretical questions related to above contents

- **Internal Continuous Assessment (ICA) :**
  ICA shall consist of minimum eight experiments from following list.

1. Measurement of low resistance by using Kelvin's double bridge
2. Measurement of high resistance by using Whetstone's bridge
3. Measurement of inductance by using Maxwell's bridge
4. Measurement of capacitance by using Schering Bridge
5. Measurement of power in 3-ph circuit by 2-wattmeter method for balanced load
6. Measurement of power in 3-ph circuit by 2-wattmeter method for unbalanced load
7. C T & P T testing
8. To measure the insulation resistance by Megger
9. To measure the power factor of single phase load by PF meter and verifying through current, voltage & power measurement
10. Measurement of unknown voltage & resistance by DC potentiometer
11. Measurement of CT, PT Ratio and phase angle error
12. Energy Measurement using energy meter
13. Measurement of various parameters like voltage, current, frequency, time period using oscilloscope
14. Measurement of Q-factor by Q-meter

- **Text Books:**

1.HS Kalsi"Electronics instrumentations", Tata McGrew Hill, 3rd Edition, HS Kalsi

2."Electrical & Electronics Measurements", Dhanpat Rai & Sons 9th Edition, AK Sawhney

3."Electrical Measurements & Measuring Instruments", S chand, 2010 Edition, RKRajput

4."Instrument Devices & Systems", Tata McGrew Hill, 2nd Edition, Rangan, Mani, Sharma

- **Reference Books:**

1. "Principles of measurement system", 3rd Edition, Pearson Education 2000, John P Beately

2. "Modern electronic instrumentation & measuring techniques", PHI, 2009 Edition, Cooper D & A D Helfrick

3. "Electronic Instrumentation & Measurement", Oxford Publication, 2nd Edition 2009, David A Bell

4. "Electrical Measurement & Measuring Instruments", Pitman, Golding & Widdies

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Solapur University, Solapur

SE (Electrical Engineering) Semester-I

EL214 POWER PLANT ENGINEERING

Teaching Scheme	**Examination Scheme**
Lectures – 3 Hours/week, 3 Credits	**ESE – 70 Marks**
Tutorial – 1 Hour/week, 1 Credit	**ISE – 30 Marks**
	ICA- 25 Marks

This course introduces power plant which deals with generation of electrical energy The course also introduces economic aspects of different power plants

Course Prerequisite:

Knowledge of Basic Electrical Engineering, simple mathematical calculations Student shall have knowledge of energy conversion Student shall also have basic knowledge types of energy sources

Course Objectives:

1. To develop conceptual & analytical understanding of operation of different power plants
2. To learn economic aspects of different power plants
3. To study necessity and types of non-conventional energy sources

Course Outcomes:

After successful completion of this course,

1. Student will be able to analyze different types of power plants considering technical, environmental & economic aspects
2. Student will be able to select the type of power plant for a site considering technical, environmental & economic aspects
3. Student will be able to investigate need and areas of application for non-conventional energy sources

SECTION-I

Unit 1 Energy Sources — No of lectures-03

- **Prerequisite:**
  Energy sources, Energy conversion methods

- **Objectives:**

1. Revision of Energy Sources
2. To introduce student to different Conventional & non-Conventional Energy sources
3. To make student understand need of non-Conventional sources
4. To make student understand Structure of power industry

- **Outcomes:**
  After completing this unit, students -

1. Can define conventional & non-conventional sources
2. Can analyze various power sources for generation of power merit/Demerits

- **Unit Content:**
  Power to progress, Different types of conventional energy sources, types of non-conventional energy sources, Structure of power industry

- **Content Delivery Methods:**
  Chalk and talk, Power point presentations on Energy Sources

- **Assessment Methods:**
  Theory questions related to conventional & non-conventional sources

Unit 2 Hydro Power Plants — No of lectures-06

- **Prerequisite:**
  Knowledge of Basic Electrical Engineering, applied physics

- **Objectives:**

1. To introduce student to hydro power generation
2. To make student analyze typical layout of hydro power plant
3. To make student understand different small hydro schemes

- **Outcomes:**
  After completing this unit, students –

1. Can understand the operation hydro power generation
2. Can understand classification merits & demerits of hydro power plants
3. Can understand site selection of hydro power plant
4. Can analyze and describe load curve and types of curve

- **Unit Content:**
  Review of hydro power (advantages & disadvantages), Typical layout of power plant, Site selection, Classification of hydro plants, Stream flow, Hydrograph, Flow duration curves, Hydrology, Types of turbines (pelton wheel turbine, Francis and Kaplan turbines), economics of small hydro schemes

- **Content Delivery Methods:**
  Chalk and talk, Power point presentations, Video lectures on above content

- **Assessment Methods:**
  Theory questions related to above content

Unit 3 Thermal Power Plants: **No of lectures-06**

- **Prerequisite:**
  Knowledge of Basic Electrical Engineering & fundamental principles of thermodynamics

- **Objectives:**

1. To introduce student to Thermal power generation
2. To make student analyze typical layout of Thermal power plant
3. To make student understand equipment in thermal power plant

- **Outcomes:**
  After completing this unit, students –

1. Can apply the operation Thermal power generation
2. Can define merits & demerits of Thermal power plants
3. Can define site selection of Thermal power plant

- **Unit Content:**
  Review of Thermal power plant (advantages & disadvantages), typical layout of power plant, Site selection, Fuels & their handling, Combustion process (fluidized bed combustion), Ash handling, Dust collection, Prospects and development of thermal plants in India, Environmental Aspects

- **Content Delivery Methods:**
  Chalk and talk, power point presentations on above content

- **Assessment Methods:**
  Theory questions related to above content

Unit 4 Nuclear Power Plants **No of lectures-06**

- **Prerequisite:**
  Knowledge of Basic Electrical Engineering & nuclear reaction

- **Objectives:**

1. To introduce student to Nuclear power generation
2. To make student analyze typical layout of nuclear power plant
3. To make student understand equipment in nuclear power plant

- **Outcomes:**
  After completing this unit, students –

1. Can apply the operation nuclear power generation
2. Can find merits & demerits of nuclear power plants
3. Can define site selection of nuclear power plant

- **Unit Content:**
  Review of Nuclear power plant (advantages & disadvantages), Typical layout of power plant, Site selection, Nuclear reaction, Materials, Radioactive decay, Half life, Classification of nuclear reactor (AGR,PWR,BWR), Nuclear waste disposal, Environmental Aspects

- **Content Delivery Methods:**
  Chalk and talk, power point presentations on above content

- **Assessment Methods:**
  Theory questions related to above content

SECTION-II

Unit 5 Diesel & Gas Turbine Power Plants **No of lectures-5**

- **Prerequisite:**
  Knowledge of Basic Electrical Engineering & nuclear reaction

- **Objectives:**

  1.To introduce student to Diesel & Gas Turbine Power Plants
  2. To make student analyze typical layout of Diesel & Gas Turbine Power Plants

- **Outcomes:**
  After completing this unit, students –

  1.Can apply the operation of Diesel & Gas Turbine Power Plants
  2.Can find merits & demerits of Diesel & Gas Turbine Power Plants
  3.Can define site selection of Diesel & Gas Turbine Power Plants

- **Unit Content:**
  Review of Diesel Plants (advantages & disadvantages), Typical layout of power plant, site selection, Review of Gas Turbine Plants (advantages & disadvantages), Typical layout of power plant, Site selection, gas fuels, gas turbine materials, Open loop and Closed loop power plants

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Theory questions related to above content

Unit 6 Economic Aspects of Power Generation **No of lectures-9**

- **Prerequisite:**
  Knowledge of Basic Electrical Engineering, simple mathematical calculations

- **Objectives:**

1. To introduce to student basic terms used in power system operation
2. To make student understand load curve
3. To introduce student to types of loads
4. To familiarize the students with the tariff methods for electrical energy consumptions

- **Outcomes:**
  After completing this unit, students –

1. Can define different terms in power system operation
2. Can analyze selection of generating units
3. Can calculate usage of electrical power & tariff

- **Unit Content:**
  Review of terms commonly used in system operations, Variable load on power station, Peak load, Base load, Diversity factor, Plant utility factor, Maximum demand, Load curves, load duration curves, Types of loads, Selection of generation units, Interconnected grid systems, Cost of electrical energy, Tariff & different types of tariff

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Numerical problems related to cost of electrical energy and tariff, Theory questions related to above content

Unit 7 Non-Conventional Energy Sources **No of lectures-7**

- **Prerequisite:**
  Knowledge of Basic Electrical Engineering

- **Objectives:**

1. To introduce student to solar & Wind Power Plants
2. To make student analyze typical layout of solar & Wind Power Plants

- **Outcomes:**
  After completing this unit, students –

1. Can apply the operation of solar & Wind Power Plants
2. Can find merits & demerits of solar & Wind Power Plants

- **Unit Content:**
  Review of Solar Energy (advantages & disadvantages), Typical layout of solar thermal power plant, Site selection, Solar thermal receiver system (introduction), Review of wind energy (advantages & disadvantages), Typical layout of wind power plant, Site selection, Wind turbine operation review of geothermal energy, MHD, Bio-mass and Tidal energy

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Theory questions related to above content

- **Internal Continuous Assessment (ICA) :**
  ICA shall consist of
  Minimum six tutorials/assignments and report on visit to any one of the generating power plant

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- **Text Books:**

1. "A course in Electrical Power", S K Kataria & Sons, J B Gupta
2. "Generation of Electrical Energy", S Chand Publication, B R Gupta
3. "Power System Engineering", Laxmi Publications, R K Rajput
4. "Power Plant Engineering", New Age International Publication, A K Raja

- **Reference Books:**

1. " Power Plant Technology", Tata Mc Graw Hill,MMEI-Wakil
2. "Power Plant Engineering", S Chand Publications, Samsher Gautam

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Solapur University, Solapur

SE (Electrical Engineering) Semester-I

EL215 ELECTRONIC DEVICES & CIRCUITS

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hours/week, 4 Credits	**ESE – 70 Marks**
Practical – 2 Hours/week, 1 Credit	**ISE – 30 Marks**
	ICA- 25 Marks

This course introduces the basics concepts and application of Electronic Devices

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Course Prerequisite:

Basics of Semiconductor, KVL, KCL, Basics of Inductor and Capacitor

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Course Objectives:

1. To develop conceptual & analytical understanding of BJT
2. To develop conceptual & analytical understanding of Field effect transistors
3. To make student understand the concepts of various Power amplifiers, feedback amplifiers and Oscillator circuits
4. To develop the design procedures for unregulated power supplies

Course Outcome:

1. Students will be able to design transistorized circuits based on their conceptual and analytical understanding of BJT
2. Students will be able to analyze FET circuits
3. Students will be able to analyze the Power amplifiers, feedback amplifiers, oscillator's concepts
4. Students will be able to design unregulated power supplies for practical applications

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SECTION-I

Unit 1 Bipolar Junction Transistor: **No of lectures-7**

- **Prerequisite:**
  Semiconductor diode, KVL-KCL

- **Objective :**
  To develop conceptual & analytical understanding of Bipolar Junction Transistor(BJT)

- **Outcomes:**
  After completing this unit-
  Students will be able to design transistorized circuits based on their conceptual understanding

- **Unit Content:**
  Biasing circuits- DC circuit analysis, load line, thermal runaway, stability factor analysis, Biasing circuits (fixed, collector to base, self bias), compensation techniques BJT as an amplifier, AC & DC equivalent circuit of CE amplifier, Cascade amplifier- Types of couplings, effect of couplings on performance of BJT amplifier, cascade connection, Darlington pair

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods :**
  Derivation, Numerical, Theoretical questions

Unit 2 Frequency response of BJT amplifier: **No of lectures-5**

- **Prerequisite:**
  Basics of Capacitance

- **Objective :**
  To analyze the frequency response of BJT

- **Outcomes:**
  After completing this unit-

  Students will be able to analyze the performance of BJT at different frequency

- **Unit Content:**
  Low & high frequency response of CE amplifier, effect of C_e, C_c & C_i on frequency response of RC coupled CE amplifier, Design of driver circuits- design of single stage RC coupled BJT amplifier

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods:**
  Design, Numerical and Theoretical questions

Unit 3 Hybrid Model of BJT: **No of lectures-6**

- **Prerequisite:**
  Transistor parameters

- **Objective :**
  To define and analyze Hybrid model of BJT

- **Outcomes:**
  After completing this unit-
  Students will be able to analyze transistor using Hybrid model

- **Unit Content :**
  Determination & meaning of h parameters, hybrid equivalent circuit of CE,CB,CC, Determination of amplifier parameter(A_v, A_i ,R_o, R_i), Determination of h-parameters from input & output characteristics

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods :**
  Derivation, Numerical and Theoretical questions

Unit 4 Field Effect Transistor: **No of lectures-6**

- **Prerequisite:**
  Semiconductors knowledge

- **Objective :**
  To develop conceptual & analytical understanding of Field effect transistors

- **Outcomes:**
  After completing this unit-
  Students will be able to analyze Field effect transistors circuits

- **Unit Content:**
  Junction Field Effect Transistor (JFET) construction, characteristics, small signal JFET parameters, DC biasing of JFET, common source JFET amplifier, common drain amplifier, Metal Oxide Semiconductor Field Effect Transistor (MOSFET)- construction & characteristics of depletion type & Enhancement type

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods :**
  Derivation, Numerical and Theoretical questions

SECTION-II

Unit 5 Design of Unregulated power supply: **No of lectures-6**

- **Prerequisite:**
  Basics of Inductor & Capacitor

- **Objective :**
  To develop the design procedures for unregulated power supplies

- **Outcomes:**
  After completing this unit-
  Students will be able to design unregulated power supplies for practical applications

- **Unit Content:**
  Various types of filters C, L, LC & π, derivation of ripple factor of C & L type filter, Design of unregulated power supply, Fixed voltage Regulator IC 78XX, & 79XX, Variable voltage Regulator IC LM723

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods :**
  Derivation, Numerical and Theoretical questions

Unit 6 Feedback Amplifier: **No of lectures-8**

- **Prerequisite:**
  Transistor Basics

- **Objective :**
  To analyze different topologies of feedback amplifier

- **Outcomes:**
  After completing this unit-
  Students will be able to analyze different topologies of feedback amplifier

- **Unit Content:**
  Introduction to positive & negative feedback, types of negative feedback (current series, current shunt, voltage series & voltage shunt), its effect on input and output impedance, voltage gain, current gain & bandwidth

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods :**
  Derivation, Numerical and Theoretical questions

Unit 7 Power Amplifier: **No of lectures-4**

- **Prerequisite:**
  Conduction Angle of Transistor, VI Characteristics of Transistor

- **Objective:**
  To make student understand the types of power amplifier

- **Outcomes:**
  After completing this unit-
  Students will be able to classify various types of power amplifier

- **Unit Content:**
  Classification of large signal amplifiers, circuit operation, waveforms, derivation of efficiency for Class A, Class B, Class AB amplifier, Crossover distortion in power amplifier

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods:**
  Derivation, Numerical and Theoretical questions

Unit 8 Oscillators: **No of lectures-6**

- **Prerequisite:**
  Feedback Amplifiers

- **Objective :**
  To make student understand the types of Oscillator

- **Outcomes:**
  After completing this unit-
  Students will be able to classify the oscillator circuits for various application

- **Unit Content:**
  Basic principles of oscillator, Positive feedback, Barkhausen's criteria, Sinusoidal oscillators- expression for frequency of oscillation & condition of sustained oscillations for RC oscillators & LC Oscillators- (Hartley, colpitts & crystal oscillators) Non-sinusoidal oscillators: Construction & characteristics of UJT, UJT relaxation oscillator

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods :**
  Derivation, Theoretical questions

- **Text Books:**

1. Electronic Devices and Circuits , Allen Mottershead , PHI Publication
2. Electronic Devices & Circuit Theory , Robert Boylestad, Louis Nashelsky, Pearson Education
3. Electronic Devices and circuits, Jacob Milman, ChristosHalkias, McGraw-Hill publication
4. Electrical Technology Volume IV , B L Theraja&A K Theraja , S Chand Publication
5. Applied Electronics , R S Sedha, S Chand Publication

- **Reference Books:**

1. Electronic Devices, Floyd, Pearson Education
2. Electronic Devices and circuits , S Salivahan, N Sureshkumar, Avallavraj, Tata Mc-Graw Hill Publication
3. Electronic Devices and circuits, Mantri and Jain
   Electronic Devices and circuits, Wiley India ,Anil K Maini & Varsha Agrawal

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- **Internal Continuous Assessment (ICA) :**

ICA shall consist of minimum eight experiments, out of which minimum five experiments will be Hardware Based and Minimum three experiments will be simulation based.

1.To design single stage BJT CE amplifier circuit for given gain factor and measure its gain performance
2.To measure the bandwidth of single stage RC coupled BJT CE amplifier
3.To design JFET amplifier and measure its gain performance
4.To design MOSFET amplifier and measure its gain performance

5.To find out the gain with & without feedback ,for negative feedback amplifiers
6.To measure the Bandwidth of with & without feedback ,for negative feedback amplifiers
7.To design and verify RC phase shift Oscillator circuits
8.To design and verify Wein Bridge Oscillator circuits
9.To design and verify UJT Relaxation Oscillator
10.To design unregulated power supply
11.To design Positive voltage regulator using 78XX
12.To design Negative Voltage Regulator Using 79XX
13.To design Variable voltage Regulator

Solapur University, Solapur

SE (Electrical Engineering) Semester-I

EL216 OBJECT ORIENTED PROGRAMMING WITH C++

Teaching Scheme	**Examination Scheme**
Lectures– 2Hours/week, 2 Credits	**ICA- 25 Marks**
Practical– 2 Hours/week, 1 Credit	**POE- 50Marks**

Course Prerequisite:

Student shall have knowledge of C Fundamentals

Course Objectives:

1. To learn fundamental concepts and principles of Object Oriented Programming (OOP) with basic C++ syntax and convention
2. To apply the OOP concepts for writing simple object oriented programs

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Course Outcomes:

After learning the course

1 Students will be able to read, understand and analyze simple C++ program

2 Students will be able to apply principle of OOP concept and explore their skill to develop Complex C++ program

3. Students will be able to write the simple object oriented programs in C++ using objects and classes

4. Students will be able to develop the applications using object oriented programming with C++

SECTION-I

Unit 1 – Concepts of OOP **No of lectures – 03**

- **Prerequisite:**
  Basics of C

- **Objectives:**
  To make student understand the basic concepts of object oriented programming

- **Outcomes:**
  After completing this unit, students -
  Can compare Procedural vs Object Oriented Programming

- **Unit Content:**
  Review of OOP, Procedural Vs object oriented programming, Principles of OOP, Benefits and applications of OOP

- **Content Delivery Methods:**
  Chalk and talk

- **Assessment Method:**
  Apply programing skill in C and C++

Unit 2 – C++ Programming Basics **No of lectures – 03**

- **Prerequisite:**
  Concept of C

- **Objectives:**

1. To make student understand basics of C++
2. To make student analyze small C++ programs

- **Outcomes:**
  After completing this unit, students –
  Can write small C++ programs

- **Unit Content:**
  Overview, Program structure, Namespace, Identifiers, Variables, Constants, Enum, Operators, Typecasting, Control structures

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation

- **Assessment Method:**
  Apply programing skill in C and C++

Unit 3 –Functions **No of lectures – 03**

- **Prerequisite:**
  Concepts of C, C++ and OOP

- **Objectives:**
  To make student understand various OOP functions

- **Outcomes:**
  After completing this unit, students –
  Can apply various functions in programs

- **Unit Content:**
  Simple functions, Call and Return by reference, Inline functions, Macro Vs Inline functions, Overloading of functions, Default arguments, Friend functions

- **Content Delivery Methods:**
  Chalk and talk Power point presentation

- **Assessment Method:**
  Apply programing skill in C and C++

Unit 4 – Arrays and Strings **No of lectures – 04**

- **Prerequisite:**
  Concepts of C, C++ and OOP

- **Objectives:**
  To make student understand concepts of Arrays and Strings

- **Outcomes:**
  After completing this unit, students –
  Can apply arrays and strings in small programs

- **Unit Content:**
  Array fundamentals, Arrays as class member data, Arrays of objects, C- strings, arrays of strings, C++ string class, modifying string objects

- **Content Delivery Methods:**
  Chalk and talk Power point presentation

- **Assessment Method:**
  Apply programing skill in C and C++

SECTION II

Unit 5 – Objects and Classes **No of lectures – 03**

- **Prerequisite:**
  Concepts of C, C++ and OOP

- **Objectives:**
  To make student understand concepts of objects and class in C++, Private and public members and various constructors

- **Outcomes:**
  After completing this unit, students –
  Can write programs with the help of private and public members and various constructors

- **Unit Content:**
  Basics of object and class in C++, Private and public members, Static data and function members, Constructors and their types, Destructors, Operator overloading, Type conversion

- **Content Delivery Methods:**
  Chalk and talk Power point presentation

- **Assessment Method:**
  Apply programing skill in C and C++

Unit 6 - Inheritance **No of lectures – 03**

- **Prerequisite:**
  Concepts of C, C++ and OOP

- **Objectives:**
  To make student understand concepts of various inheritance and their applications

- **Outcomes:**
  After completing this unit, students –
  Can write programs by using various inheritance

- **Unit Content:**
  Concept of Inheritance, Types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class

- **Content Delivery Methods:**
  Chalk and talk Power point presentation

- **Assessment Method:**
  Apply programing skill in C and C++

Unit 7 - Pointers **No of lectures – 04**

- **Prerequisite:**
  Concepts of C, C++ and OOP

- **Objectives:**
  To make student understand concepts of pointers and its applications

- **Outcomes:**
  After completing this unit, students –
  Can write programs by using pointers

- **Unit Content:**
  Pointers in C++, Pointes and Objects, This pointer, Virtual and pure virtual functions, implementing polymorphism

- **Content Delivery Methods:**
  Chalk and talk Power point presentation
- **Assessment Method:**
  Apply programing skill in C and C++

Unit 8 – Streams and Files **No of lectures – 03**

- **Prerequisite:**
  Concepts of C, C++ and OOP

- **Objectives:**
  To make student understand concepts of streams and files and its applications

- **Outcomes:**
  After completing this unit, students–
  Can write programs by using streams and files

- **Unit Content:**
  Concept of streams, cin and cout objects, C++ stream classes, Unformatted and formatted I/O, manipulators, File stream, C++ File stream classes, File management functions, File Modes, Binary and random Files

- **Content Delivery Methods:**
  Chalk and talk Power point presentation
- **Assessment Method:**
  Apply programing skill in C and C++

- **Internal Continuous Assessment (ICA) :**
  ICA shall consists of minimum ten programming assignments based on following

  1. Introduction & Implementation of class & object
  2. Implementation of Function Overloading & Inline Function
  3. Implementation of Friend Function
  4. Implementation of Constructor Overloading
  5. Implementation of Destructor
  6. Implementation of Operator Overloading
  7. Implementation of Single & Multiple Inheritance
  8. Implementation of Multilevel & Hierarchical Inheritance
  9. Implementation of Hybrid Inheritance
  10. Implementation of Virtual Function
  11. Implementation of Function Overriding
  12. Implementation of program structure
  13. Implementation of control structure
  14. Implementation of polymorphism

Text Books:

1) Object Oriented Programming with C++, TMH , E Balagurusamy,
2) Object Oriented Programming with C++, BPB Publication Yashwant Kanetkar,
3) Thinking in C++, prentice Hall, Bruce Eckel,
4) Object Oriented Programming in C++, SAMS Publications, Robert Lafore

- **Reference Books:**

1) C++ Programming, Black Book, Steven Holzner, dreamtech
2) Object Oriented Programming with ANSI and Turbo C++, Pearson, Ashok Kamthane,
3) The Compete Reference C++, TMH , Herbert Schlitz
4) Object Oriented Programming with C++, Oxford, Saurav Sahay
5) A Complete Guide to Programming in C++, Bartlett Publishers,Ulla Kirch-Prinz, Jones

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Semester-II

Solapur University, Solapur

SE (Electrical Engineering) Semester-II

EL221 Numerical Methods and Linear Algebra

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hours/week, 4 Credits	**ESE – 70 Marks**
Tutorial – 1 Hour/week, 1 Credit	**ISE – 30 Marks**
	ICA- 25 Marks

This course introduces Numerical methods for solving linear, non linear equations and evaluating definite integrals, and also introduces linear algebra, matrix theory

Course Prerequisite:

Student shall have knowledge of linear equation, types of matrix, Matrix Algebra, Ordinary differential equation He shall also have basic knowledge of Integration

Course Objectives:

1. To make student understand of how a method works, aids in choosing a method It can Also provide an indication of what will go wrong and of the accuracy which may Be obtained by students
2. To provide students with mathematics fundamental, necessary to formulate, solve and analyze engineering problems
3. To make student understand to develop a simple model by using matrix method
4. To introduce numerical techniques that can be used on computer

Course Outcomes:

1. Student can solve numerical problems on to find roots of algebraic and transcendental equations
2. Student will demonstrate understanding and implementation of numerical solution algorithms
3. Student will be able to solve differential equations and eigen value problems numerically
4. Student will demonstrate an ability to identify, formulate and solve electrical Problems using matrix method

Section-I

Unit 1–Solution of Algebraic and Transcendental Equations No of lectures – 06

- **Prerequisite:**
  Basic properties of equations ,Non linear equations, derivative

- **Objectives:**
  1. Revision of concepts of properties of equations
  2. To introduce to student to solve algebraic and transcendental equations by using various methods
  3. To make student understand a numerical method to solve non linear equations

- **Outcomes:**
  After completing this unit, students -
  1. Can apply numerical techniques that can be used on computer
  2. Can calculate roots of algebraic and transcendental equations numerically
  3. Will be able to solve the problems with accuracy

- **Unit Content:**
  Introduction, Basic properties of equations, False position Method,Newton-Rapshon Method, Multiple roots, Newton's iterative formula for obtaining square root only, System of non linear equations by Newton-Rapshon method

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical problems related to above Content

Unit 2–Solution of linear simultaneous Equations No of lectures – 06

- **Prerequisite:**
  Linear equations ,Types of matrix, matrix operations

- **Objectives:**
  1. To make student understand concepts of how to solve linear equations by matrix methods
  2. To make student to solve linear simultaneous equations with its applications
  3. To provide a detailed treatment of accuracy or stability

- **Outcomes:**
  After completing this unit, students –

  1. Can evaluate the solution of simultaneous linear equations by matrix method
  2. Can use the concepts for to solve various electrical circuit examples
  3. Can solve the simultaneous linear equations by approximate methods

- **Unit Content:**
  Direct Methods-Gauss Elimination Method, Gauss Jordan Method, method of Factorization, Iterative Methods-Jacobi's method, Gauss –Seidal Method

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical problems related to above Content

Unit 3–Numerical solutions of Ordinary Differential Equations **No of lectures – 06.**

- **Prerequisite:**
  First order differential equation, Basic Integration formulae

- **Objectives:**
  1. To make student to solve first order differential equation by various methods
  2. To expose students to techniques of solving simultaneous differential equation
  3. To introduce to student concept first order differential equation for electrical network problems

- **Outcomes:**
  After completing this unit, students –

  1. Can evaluate the solution of Ordinary differential Equations numerically
  2. Can solve the simultaneous differential equations by approximate methods
  3. Can apply the method to solve simultaneous differential equations of related circuit problems

- **Unit Content:**
  First order differential equation by Picard's method and Runge – Kutta method (Fourth order), Simultaneous first order differential equation by Picard's method and Runge – Kutta method (Fourth order)

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Numerical problems related to above Content

Unit 4-Numerical Integration **No of lectures – 06**

- **Prerequisite:**
  Basic integration formulae

- **Objectives:**
  1. To introduce the numerical methods for evaluating definite integrals
  2. To make student to solve double integrations numerically
  3. To introduce to student concept of integration in various electric fields

- **Outcomes:**
  After completing this unit, students–

  1. Can analyze difference between actual integration method and numerical integration method
  2. Can find error of solution of answer by actual method and approximate method
  3. Can evaluate double integration using numerical methods

- **Unit Content:**
  Numerical Integration using Newton's-Cotes's formulae-Trapezoidal rule, Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule,Weddels rule, Gaussian quadrature,Romberg integration and Double Integration

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Numerical problem related to above Content

Section II

Unit 5- Linear Equations and Matrix Theory **No of lectures – 06**

- **Prerequisite:**

Linear equations, Types of matrix, matrix operations

- **Objectives:**
  1. To develop the skills essential for solving matrix equations
  2. To make the students to find linear transformation
  3. To make student to understand matrix factorization
  4. To impart the knowledge of invertible matrices

- **Outcomes:**
  After completing this unit, students –

  1. Can solve the problems related to simultaneous linear equations
  2. Can find the solution to linear models
  3. Can able to classify the linear independent set and dependent set
  4. Can find inverse matrix

- **Unit Content:**
  Echelon forms, vector equations, the matrix equations AX=B and AX=0, Linear independence, linear transformations, applications of linear models, characterization of invertible matrices, partitioned matrices
- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical problems related to above Content

Unit 6-Vector Spaces **No of lectures – 06**

- **Prerequisite:**
  Linear equations, matrix row operations

- **Objectives:**
  1. To make student understand vector space
  2. To make student understand the theory of null spaces and column spaces
  3. To introduce to student to classify the Linear independent set and dependent set

- **Outcomes:**
  After completing this unit, students –

  1. Can identify null spaces and column spaces
  2. Can find change of bases
  3. Can calculate the dimension of vector space, rank

- **Unit Content:**
  Vector spaces and subspaces, null spaces, column spaces and linear transformations ,linearly independent sets and bases, co ordinate systems, the dimension of vector space, Rank,Change of bases, Applications to difference equations

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Numerical and problems to above Content

Unit 7-Eigen values and Eigen Vectors **No of lectures – 06**

- **Prerequisite:**
  Matrix theory and Types of matrix

- **Objectives:**
  1.To introduce to student the theory of eigen values and eigen vectors
  2.To make student understand the concept of application to differential equations
  3.To make student understand iterative method to estimate eigen vector

- **Outcomes:**
  After completing this unit, students –

  1.Can find eigen vales and eigen vectors
  2.Can digonalize the matrix
  3.Can find eigen value and eigen vector by power method

- **Unit Content:**
  Eigen values and Eigen vectors, the characteristic equation, diagonalization,Eigen vectors and linear transformations, complex eigen values, discrete dynamical systems, application to differential equations, iterative estimates for eigen values(Power method)

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical problems related to above Content

Unit 8-Inner product and Orthogonality **No of lectures – 06**

- **Prerequisite:**
  Matrix theory and Types of matrix

- **Objectives:**
  1.To introduce to student orthogonality property and inner product concept
  2.To make student understand quadratic forms
  3.To introduce to student concept diagonalization of symmetric matrices

- **Outcomes:**
  After completing this unit, students –

  1.Can solve least square problems
  2.Can solve quadratic forms
  3.Can find orthogonal sets

- **Unit Content:**
  Orthogonality, symmetric matrices and quadratic forms,Inner product and orthogonality,orthogonal sets , least square problems,digonalization of symmetric matrices

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical problems related to above Content

- **Internal Continuous Assessment (ICA) :**
  ICA shall consist of Minimum ten tutorials based on above curriculum, Tutorial and Assignment shall include numerical problems.

- **Text Books:**
  1. "Numerical Methods", Khanna publications-New Delhi, BSGrewal
  2. "Introductory methods of Numerical Analysis"-PHI Learning Publication ,SSShastry
  3. "Linear algebra and Its applications", Peasson Education Inc, David C Lay
  4. "Linear Algebra", 4thedition,PhI learning Pvt Ltd , StephenhFriedberg Arnold,JInsel, Lawrence E Spence

- **Reference Books:**

  1. "Numerical Methods" SChand Publication, DrP Kandasamy
  2. "Numerical methods for scientific and engineering computations"-New age International Ltd MKJain,SRKIyengar,RKJain

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Solapur University, Solapur

SE (Electrical Engineering) Semester-II

EL222 ELECTRICAL MACHINES - II

Teaching Scheme	**Examination Scheme**
Lectures– 4 Hours/week, 4 Credits	**ESE –70Marks**
Practical– 2 Hours/week, 1 Credit	**ISE –30Marks**
	ICA- 25 Marks
	POE-50 Marks

This course introduces electrical machines, which works on AC supply including theoretical and analytical aspects of both three phase and Single phase types

Course Prerequisite:

Student shall have knowledge of Magnetic Circuit, AC Fundamentals and AC series Circuits He/ She shall also have basic knowledge of complex Numbers and Vectors

Course Objectives:

1. To get detailed knowledge of construction and operating principles of Electro Mechanical AC Machines
2. To make student understand equivalent circuit parameters and performance parameters of both synchronous and asynchronous AC Machines
3. To enable student to understand starting and control techniques of AC Motors

Course Outcomes:

After Successful completion of this course-

1. Students will be able to analyze performance of three phase as well as single phase Induction Motors
2. Students will be able to identify applications of Induction Motors in industries & power sector
3. Students will be able to analyze performance of synchronous machines
4. Students will be able to identify applications of synchronous machines in industries & power sector

Section I

Unit 1– Introduction to AC Machines — No of lectures – 04

- **Prerequisite:**
  Magnetic flux and its properties, AC Fundamentals and vectors

- **Objectives:**
  1. To Revise basic concepts of Magnetic Field
  2. To make student understand Generation of rotating magnetic field

- **Outcomes:**
  After completing this unit, students -
  Can define the nature of flux produced with different types of supply

- **Unit Content:**
  Classification of AC Machines, Principle of Operation, Production of two phase rotating magnetic field, Production of three phase rotating magnetic field, Speed of rotating magnetic field

- **Content Delivery Methods:**
  Chalk and talk, Animated Videos

- **Assessment Methods:**
  Concept understanding and derivation related to two phase and three phase rotating magnetic field

Unit 2– Introduction to Three Phase Induction Motor — No of lectures – 08

- **Prerequisite:**
  Concept of electromechanical energy conversion, mutual induction, concept of induced torque and Basics of AC Circuit

- **Objectives:**
  1. To make student understand Construction of different Induction Motors (cage and wound)
  2. To make student analyze operation and characteristics ofInduction Motor

- **Outcomes:**
  After completing this unit, students –
  1. Can analyze various parameters of Induction Motor
  2. Can draw nature of torque slip characteristics at various conditions
- **Unit Content:**
  Construction- Stator, Rotor (Squirrel cage, Wound Type), Principle of operation, Concept of Slip, Rotor current frequency, Rotor current and Power factor, Power flow diagram, Losses and efficiency, Torque Equation, Condition for maximum torque, starting torque, full load torque and their ratios, Torque slip characteristics, Effect of rotor resistance on torque slip characteristics, Crawling and cogging effects

- **Content Delivery Methods:**
  Chalk and talk, Analogy, Power point presentation

- **Assessment Methods:**
  Numerical and derivations related to torque equation and their ratios, numerical related to losses and efficiency, frequency, slip and rotor current and power factor

Unit 3– Starting and Speed Control of Induction Motor **No of lectures – 08**

- **Prerequisite:**
  Concepts of circuit networks, Torque slip Characteristics

- **Objectives:**
  1. To make student understand starting methods of *Induction Motor*s
  2. To make student understand speed control methods of *Induction Motor*s

- **Outcomes:**
  After completing this unit, students –

1. Can analyze various types of starters for Induction Motor
2. Can understand different speed control techniques of Induction Motor

- **Unit Content:**
  Necessity of starters, Types of starters (DOL, stator resistance, star delta, auto transformer, rotor resistance), Speed control of three phase *Induction Motor*-stator side control methods (applied voltage, frequency, pole changing), Rotor side speed control methods (rotor resistance, EMF Injection, slip power recovery)

- **Content Delivery Methods:**
  Chalk and talk

- **Assessment Methods:**
  Numericals related to starters

Unit 4– Performance of Three Phase Induction Motor **No of lectures – 06**

- **Prerequisite:**
  Concept of open circuit and short circuit**,** Equivalent circuit of transformer

- **Objectives:**
  1.To make student understand circle diagram and impact of different tests on circle diagram
  2.To make student understand analysis of *Induction Motor* through circle diagram

- **Outcomes:**
  After completing this unit, students –

  1.Can draw circle diagram of Induction Motor at different operating conditions
  2.Can analyze Induction Motor performance through circle diagram

- **Unit Content:**
  Equivalent circuit of Induction Motor, Stator resistance test, No load and blocked rotor test, construction of circle diagram, determination of performance parameters from circle diagram, Double cage Induction Motor and its equivalent circuit, Induction generator

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation

- **Assessment Methods:**
  Numericals related to Circle Diagram and Double cage Induction Motor

Section-II

Unit 5-Single Phase Induction Motor **No of lectures – 06**

- **Prerequisite:**
  Principle of operation of three phase Induction Motor, Torque slip characteristics of three phase Induction Motor

- **Objectives:**
  1. To make student analyze behavior and operation of single phase Induction Motor

- **Outcomes:**
  After completing this unit, students –

  Can find suitable application of various single phase Induction Motor as per their torque speed requirement

- **Unit Content:**
  Principle of operation, Concept of double field revolving theory & cross field theory, Types of single phase IM based on method of self-starting and their Torque-slip characteristics, Equivalent circuit, Determination of equivalent circuit parameters using OC & SC Tests

- **Content Delivery Methods:**
  Chalk and talk, Video lectures, Animations

- **Assessment Methods:**
  Numericals related to equivalent circuit of Single phase Induction Motor

Unit 6-Synchronous Generator **No of lectures – 10**

- **Prerequisite:**
  Construction of three phase Induction Motor, Concepts of vector diagrams

- **Objectives:**
  1. To make student understand working operation of synchronous generator
  2. To make student understand various performance analysis methods of synchronous generator

- **Outcomes:**
  After completing this unit, students –

  1.Can find performance parameters through various methods like EMF and MMF Method
  2.Can analyze operation of synchronous generator under parallel operation

- **Unit Content:**
  Construction (Salient and Non – Salient type), Principle of operation, Winding factors, EMF Equation, Armature reaction, Equivalent circuit and Vector diagram, Voltage regulation, determination of voltage regulation (EMF Method, MMF Method, ZPF Method), Power developed in salient and non-salient type alternator, Parallel operation of alternators, Methods of synchronization, Synchronizing Power

- **Content Delivery Methods:**
  Chalk and talk, Video lectures

- **Assessment Methods:**
  Numericals related to EMF, MMF and ZPF Methods, EMF Equation, and Synchronizing Power

Unit 7-Synchronous Motor **No of lectures – 10**

- **Prerequisite:**
  Operation and Construction of three phase Induction Motor, concepts of vector diagrams

- **Objectives:**
  1.To make student understand working operation of synchronous Motor
  2.To make student understand various performance analysis methods of synchronous Motor

- **Outcomes:**
  After completing this unit, students –

  1.Can find performance parameters through various methods like Equivalent circuit and vector diagrams at different excitations

2.Can analyze operation of synchronous Motor under different operating conditions

- **Unit Content:**
  Principle of operation, Methods of starting, Equivalent circuit, Performance and vector diagram with different excitations, V and inverted V curves, Hunting- its causes and remedies, synchronous motor as synchronous condenser

- **Content Delivery Methods:**
  Chalk and talk, Video lectures, Analogies

- **Assessment Methods:**
  Numerical related to equivalent circuit and performance under various excitations

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- **Internal Continuous Assessment (ICA) :**
  ICA shall consist of Minimum EIGHT experiments from following list

1. Determination of efficiency & speed regulation of 3 Phase IM by direct loading method
2. Determination of efficiency & speed regulation of 3 Phase IM by indirect loading method
3. Determination of equivalent circuit parameters of 3 Phase SCIM by conducting No Load & Blocked Rotor Test
4. Speed control methods of 3 Ph SCIM
5. Speed control methods of 3 Ph SRIM
6. Determination of efficiency & speed regulation of 1 phases Induction Motor
7. Determination of efficiency of alternator by direct loading
8. Determination of Voltage regulation of an alternator by EMF method
9. Determination of Voltage regulation of an alternator by MMF method
10. Parallel operation of alternators
11. Determination of V and Inverted V curves of a synchronous motor
12. Determination of efficiency of synchronous motor by indirect loading
13. Determination of efficiency of synchronous motor by direct loading

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- **Text Books:**
  1. Theory and Performance of Electrical Machines, J B Gupta, S K Kataria & Sons
  2. A Text Book of Electrical Technology Vol 2, B L Theraja, S Chand
  3. Principles of Electrical Machines, V K Mehta, Rohit Mehta, S Chand
  4. Electrical machinery, PS Bhimbra, Khanna Publishers

- **Reference Books:**
  1. Electrical Machinery, AE Fitzgerald, C Kingsley, S D Umans, Tata McGraw Hill
  2. Electrical Machines, Ashfaq Hussain, Dhanpat Rai & Sons
  3. Performance and design of AC Machines, MG Say, ELBS Publication

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Solapur University, Solapur

SE (Electrical Engineering) Semester-II

EL223 ELEMENTS OF POWER SYSTEM

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hours/week, 4 Credits	**ESE – 70 Marks**
Practical – 2 Hours/week, 1 Credit	**ISE – 30 Marks**
	ICA- 25 Marks
	OE – 25 Marks

This course introduces elements of power systems which deals with structure of power system & constants of Transmission lines The course also introduces theoretical and analytical aspects of overhead & underground transmission lines, DC & AC distribution systems and substation

Course Prerequisite:

Student shall have knowledge of circuit theory Student shall also have basic knowledge of Transformers, single phase & three phase systems

Course Objectives:

1 .To learn basic structure of power systems and mechanical design of overhead lines
2. To study various effects related to overhead transmission lines
3. To gain knowledge about need of power transmission using underground cables, types of underground cables
4. To understand DC & AC distribution systems and substations

Course Outcomes:

1. Students will be able to understand overall structure of power system
2. Students will be able to understand mechanical design of transmission lines
3. Students will be able to implement the knowledge to design underground power distribution system
4. Students will be able to analyze various performance parameters of transmission lines

SECTION-I

Unit 1– General structure of power system **No of lectures – 06**

- **Prerequisite:**
  DC system, single phase & three phase systems, ohms law

- **Objectives:**
  1.To learn basic structure of power systems
  2.To make student understand conductor cost of different AC transmission systems
  3.To make student understand Economics of power transmission

- **Outcomes:**
  After completing this unit, students -
  1.Can distinguish between different supply systems
  2.Can calculate voltage, conductor cost for various transmission systems
  3.Can calculate Economic conductor size for given transmission system (Kelvin's law)

- **Unit Content:**
  Review of Electrical supply system, typical AC power supply scheme, Comparison DC and AC systems, comparison between overhead and underground system, comparison of conductor cost for various AC transmission systems, Economics of power transmission- Economic choice of conductor size (kelvins law)

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical problems and derivation related to conductor cost for different transmission systems and Kelvin's law Theory questions related to above content

Unit 2– Mechanical design of overhead lines **No of lectures – 06**

- **Prerequisites:**
  Electrical Materials & their properties**,** Capacitance

- **Objectives:**
  1.To introduce concept of overhead transmission line
  2.To introduce different conducting material & their application
  3.To introduce different insulators & their application
  4.To make student understand string efficiency & methods to improve it

- **Outcomes:**
  After completing this unit, students -
  1.Can describe construction and use of different insulators, conductor, line supports
  2.Can calculate string efficiency of given string insulators

- **Unit Content:**
  Review of overhead transmission line, main components, conductor materials, line supports, overhead line insulators, types- pin type, suspension type, strain type insulators, string efficiency, methods of improving string efficiency

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, videos lectures on insulators, line supports

- **Assessment Methods:**
  Numerical problems and derivation related to string efficiency, Theory questions related to above content

Unit 3– Corona & Sag in overhead lines **No of lectures – 06**

- **Prerequisites:**
  Electric field Intensity, phasor addition rule, concept of moment & force

- **Objectives:**
  1.To introduce corona phenomenon and its effects
  2.To introduce concept of sag in design of transmission line
  3.To make student understand about corona & sag in overhead lines
  4.To introduce concept of stringing chart

- **Outcomes:**
  After completing this unit, students -
  1.Can describe phenomenon of corona & sag
  2.Can describe factor affecting corona & method's to reduce corona
  3.Can calculate sag & different voltages related to corona

- **Unit Content:**
  Corona-principle, terms- definitions and empirical formulae related corona, factor affecting corona, advantages and disadvantages of corona, methods of reducing corona effect
  Sag in overhead lines, calculation of sag, stringing charts (Tension and sag relation)

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, animation on corona phenomenon

- **Assessment Methods:**
  Numerical problems and derivation related to sag & corona, Theory questions related to above content

Unit 4– Underground cables **No of lectures – 06**

- **Prerequisite:**
  Electrical Materials, resistance, capacitance

- **Objectives:**
  1.To introduce construction and classification of cable
  2.To make student understand effect of voltage on performance of cable
  3.To introduce economic size of conductor in cable

- **Outcomes:**
  After completing this unit, students -
  1.Can describe construction and classification of cable
  2.Can describe insulation resistance, capacitance & advantages of grading of cable
  3.Can derive and calculate resistance, capacitance, and potential gradient of cable

- **Unit Content:**
  General construction of cables, insulating materials for cables, classification of cables, insulation resistance of a single core cable, capacitance of a single core cable, dielectric stress in a single core cable, grading of cables, and capacitance of 3-phase cables

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, video lectures on types of cable

- **Assessment Methods:**
  Numerical problems and derivation related resistance, capacitance, dielectric stress, grading of cables, Theory questions related to above content

SECTION-II

Unit 5– Constants of transmission lines **No of lectures – 06**

- **Prerequisite:**
  Resistance, inductance, capacitance, fundamental electrical concepts

- **Objectives:**
  1.To introduce constants of transmission lines
  2.To analyze transmission lines by its constants
  3.To introduce concept of GMR and GMD

- **Outcomes:**
  After completing this unit, students-
  1.Can describe constants of transmission lines
  2.Can derive and calculate resistance, inductance, and capacitance of transmission lines

- **Unit Content:**
  Resistance of line, skin effect and proximity effect, inductance of single phase 2 wire line, GMR and GMD, inductance of three phase line with equilateral spacing, unsymmetrical spacing, effect of transposition, line capacitance, capacitance of 1ph and 3ph line, effect of earth on the capacitance of overhead lines

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical problems and derivation related resistance, capacitance, and inductance of transmission lines, Theory questions related to skin effect and proximity effect

Unit 6– Performance of transmission lines **No of lectures – 07**

- **Prerequisite:**
  AC circuits, Power Factor, complex notations, phasor representation

- **Objectives:**
  1.To analyze performance of transmission lines
  2.To make student understand types of transmission lines
  3.To make student understand power factor improvement

- **Outcomes:**
  After completing this unit, students –
  1.Can describe performance of different transmission line
  2.Can describe generalized constants of different transmission line
  3.Can calculate parameters of different transmission lines

- **Unit Content:**
  Review of transmission line, classification of overhead transmission lines, important terms, performance of short transmission line, effect of load PF on regulation and efficiency, medium transmission lines-end condenser method, nominal T method, nominal π method, long transmission lines-rigorous solution, generalized circuit constants of a transmission line, Ferranti effect, derivations of generalized constants (A,B,C,D) of short, medium & long transmission lines, causes of low power factor & benefits of power factor improvement

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical problems and derivation related to different types transmission line, generalized Constants, power factor improvement

Unit 7– Distribution systems **No of lectures – 06**

- **Prerequisite:**
  DC circuits, Kirchhoff's laws, generator, transformer

- **Objectives:**
  1.To make student understand types of Distribution systems
  2.To analyze performance of Distribution systems

- **Outcomes:**
  After completing this unit, students -
  1. Can describe performance of different Distribution systems
  2. Can calculate parameters of different Distribution systems

- **Unit Content:**
  Classification & types, connection schemes of distribution systems, DC distribution calculations-DC distributor fed at one end and both ends with concentrated and uniform load, Ring main distributor, AC distribution and its calculations, 3phase 3wire and 3 phase 4 wire connected loads

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Numerical problems and derivation related to different types Distribution systems**,** Theory questions related to above content

Unit 8– Substations and Grounding **No of lectures – 05**

- **Prerequisite:**
  Transformer, bus bar, generator, Earthing, electrical safety measures

- **Objectives:**
  1.To introduce student to substation and its types
  2.To make student understand substation equipment
  3.To make student understand Grounding & its types
  4.To make student understand about importance of Grounding

- **Outcomes:**
  After completing this unit, students -
  1. Can describe different equipment used in substation
  2. Can describe different types of Grounding

- **Unit Content:**
  Substations: classification, symbols for equipment in substations, equipment's in substation
  Grounding: Introduction, Grounding of transformer neutral, resistance grounding, reactance grounding, solid grounding

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, videos on Substations installation & working

- **Assessment Methods:**
  Theory questions related to Substation, Grounding

- **Internal Continuous Assessment (ICA):**

ICA shall consists of one substation visit related to syllabus and report based on it and Any 6 drawing sheets from the following
1.Typical AC power supply system
2.Types of line supports
3.Types of insulators
4.Classification of cables
5.Connection schemes of Distribution system
6.Substation equipment's and symbols
7.Types of Substation
8.Methods of grounding

- **Text Books:**

1.“A course in Electrical power”, S K Kataria and sons, J B Gupta
2.“Principles of power system”, S Chand Publication V K Mehta, Rohit Mehta
3.“Power system engineering”, Dhanpat Rai and sons , M L Soni, P V Gupta, U S Bhatnagar
4.“*Power System Engineering”*, Laxmi Publications, R K Rajput

- **Reference Books:**

1.“Electrical power system”, New age international, C L Wadhwa
2.“Electrical power generation transmission and distribution”, PHI New Delhi, S M Singh
3.“Elements of power system design”, AH wheeler and Co, M V Deshpande
4.“Power System operation & Control”, Wiley India, Dr.K.Uma . Rao

Solapur University, Solapur

SE (Electrical Engineering) Semester-II

EL224 ANALOG AND DIGITAL INTEGRATED CIRCUITS

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hours/week, 4 Credits	**ESE – 70 Marks**
Practical – 2 Hours/week, 1 Credit	**ISE – 30 Marks**
	ICA- 25 Marks
	POE - 50 Marks

This course introduces the Operational Amplifier (Op-amp), its application and Logical digital IC

Course Prerequisite:

Basics of amplifier, Frequency response of amplifier, Boolean algebra, Logic gates

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Course Objectives:

1. To make student analyze and understand the basic block of operational amplifier
2. To Define the specification and parameters of Op-amp
3. To analyze various open loop as well as closed loop circuit configurations of operational amplifier
4. To design the combinational as well as sequential logic circuits

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Course Outcome:

After successful completion of this course-

1. Students will be able to analyze the differential amplifier circuit
2. Students will be able to define specification and parameters of Op-amp
3. Students will be able to analyze open loop as well as closed loop circuit configurations of operational amplifier
4. Students will be able to design the combinational as well as sequential logic circuits

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SECTION- I

Unit- 1 Introduction of Differential Amplifier **No of lectures– 04**

- **Prerequisite:**
  KVL law, AC-DC equivalent
- **Objective :**
  To make student analyze and understand the basic building block of op-amp
- **Outcomes:**
  After completing this unit-
  Students will be able to analyze basic building block of op-amp
- **Unit Content:**
  Introduction of differential amplifier and its types- DC and AC analysis of dual input balanced output, dual input unbalanced output, single input balanced output, single input unbalanced output
- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, video lectures
- **Assessment Methods:**
  Derivation, Numerical and Theoretical questions

Unit- 2 Operational Amplifier **No of lectures–-06**

- **Prerequisite:**
  Differential Amplifiers
- **Objective :**
  To Define the specification and parameters of Op-amp
- **Outcomes:**
  After completing this unit
  Students will be able to define specification and parameters of Op-amp
- **Unit Content:**
  Block diagram of typical op-amp, Ideal characteristics of op-amp & practical characteristics of op-amp (IC741) - input offset voltage, input offset current, input bias current, differential input resistance, offset voltage adjustment range, input voltage range, common mode rejection ratio, supply voltage rejection ratio, large signal voltage gain, output voltage swing, output resistance, slew rate, gain bandwidth product, Equivalent circuit of op-amp, ideal voltage transfer curve
- **Content Delivery Methods:**
  Chalk and talk, Power point presentation

- **Assessment Methods:**
  Numerical and Theoretical questions

Unit- 3 Closed and Open loop configurations of Operational Amplifier No of lectures–08

- **Prerequisite:**
  Feedback Amplifiers

- **Objective :**
  To analyze open loop as well as closed loop circuit configurations of operational amplifier

- **Outcomes:**
  After completing this unit-
  Students will be able to analyze open loop and closed loop circuit configurations of an operational amplifier

- **Unit Content:**
  Open loop configurations of op-amp (differential, inverting &non inverting), block diagram of closed loop configurations of op-amp: voltage series, voltage shunt, current series, current shunt feedback Derivation of various parameters for voltage series & voltage shunt feedback op-amp (closed loop voltage gain, input resistance with feedback, output resistance with feedback, bandwidth with feedback, total output offset voltage with feedback), concept of virtual ground condition

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods :**
  Derivation , Numerical and Theoretical questions

Unit -4 Applications of Operational Amplifier No of lectures–06

- **Prerequisite:**
  Basics of op-amp

- **Objective :**
  To make student understand the op-amps applications

- **Outcomes:**
  After completing this unit –
  Students will be able to use op-amp for different electronic applications

- **Unit Content:**
  Voltage follower, Current to Voltage converter, Voltage to Current converter with floating & grounded load, Adder circuit (by using inverting, non inverting & differential configuration of op-amp), Subtractor (by using differential configuration of op-amp), instrumentation amplifier, Integrator & Differentiator

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods :**
  Numerical and Theoretical questions

SECTION-II

Unit- 5 Introduction to Logic **No of lectures–03**

- **Prerequisite:**
  Basics of transistors

- **Objective :**
  To make student understand the digital logic families

- **Outcomes:**
  After completing this unit –
  Students will be able to compare TTL & CMOS

- **Unit Content:**
  TTL & CMOS logic families, their characteristics and comparison

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation

- **Assessment Methods :**
  Theoretical questions

Unit6- Combinational Logic Circuits **No of lectures–09**

- **Prerequisite:** Booleans law

- **Objective :**
  To design combinational logic circuits

- **Outcomes:**
  After completing this unit–
  Students will be able to design various combinational logic circuits

- **Unit Content:**
  Introduction, standard representation for logic functions in Sum of Product and Product of Sum (SOP and POS), Karnaugh map (K map) representation of logic functions up to 3 and 4 variables, Simplifications of logic functions using K map, Minimization of logic functions specified in Minterm and Maxterm, Don't care conditions, Principle and design of Multiplexing, de multiplexing, Half adder and full adder, Digital ICs for multiplexer and de multiplexer

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods :**
  Design and Theoretical questions

Unit-7 Flip Flops **No of lectures–06**

- **Prerequisite:**
  Logic gates

- **Objective :**
  To analyze the basicsof different flip-flops circuit

- **Outcomes:**
  After completing this unit, students –
  Students will be able to analyze the basics of flip-flops circuits

- **Unit Content:**
  Introduction of Latch and Flip flop, RS Flip Flop using NOR and NAND gates, JK Flip Flop, race around condition in JK flip flop, Master Slave JK Flip Flop, D & T flip flops, operation, truth table, characteristic equation, Excitation table, Conversion of SR Flip flop to JK Flip Flop, JK to D Flip Flop

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods:**
  Design and Theoretical questions

Unit- 8 Sequential Logic Circuits **No of lectures– 06**

- **Prerequisite:**
  Basics of Flip-Flop, Characteristic and Excitation table of various Flip Flop

- **Objective :**
  To design sequential logic circuits

- **Outcomes:**
  After completing this unit –
  Students will be able to Design the sequential logic circuits

- **Unit Content:**
  Register-
  Introduction of registers, shift register, types/modes of shift registers, bidirectional shift registers, universal shift registers, applications of shift registers (Ring counter, twisted ring counter, sequence generator)
  Counters-
  Asynchronous counter- Ripple counter using flip flops and IC 7490, up/down Asynchronous counters, modulus of counter, limitations of asynchronous counters, Synchronous counter- Synchronous counter using T, JK flip flops and IC 74191, up/down synchronous counters, modulus of counter

- **Content Delivery Methods:**
  Chalk and talk, Power point presentation, Video lectures

- **Assessment Methods:**
  Design and Theoretical questions

- **Internal Continuous Assessment (ICA):**
  ICA shall consists of Minimum ten experiment from following list out of which SIX experiment on hardware and FOUR experiment on simulation.

1. To Design Application of op-amp as Inverting & non inverting amplifier
2. To Design Application of op-amp as Adder &subtractor circuit
3. To Design Application of op-amp as Integrator circuit
4. To Design Application of op-amp as Differentiator circuit
5. To Design Application of op-amp as Voltage follower circuit
6. To Design Application of op-amp as Voltage to current and current to voltage converter circuits
7. To Implement and Reduce the given logic expression using karnaugh Map
8. To Design Multiplexer and verify the truth table
9. To Design De Multiplexer and verify the truth table
10. To Design and verify the truth table of S-R, J-K flip flops
11. To Design and verify the truth table of D flip-flops
12. To Verify the shift register operation
13. To Design Frequency divider using Counter IC

- **Text books:**

1. OP _AMP' sand Linear IC's , Gayakwad Ramakant A, Prentice Hall of India
2. Modern Digitals Electronic , Jain RP, Tata McGraw Hill, 1984
3. Digital design , Morris M Mano, Prentice Hall International – 1984
4. Digital principal and Application, Malvino& Leach, Tata McGraw Hill, 1991
5. Fundamentals of Digital Circuits, A Anand Kumar,Prentice Hall of India

- **Reference books:**

1. Electronic Devices and circuits , J B Gupta, Katson Publication
2. Digital electronic , Bignell James& Donovan Robert, Delmar, Thomas Learning, 2001
3. Analog Integrated Circuit ,Wiley India, Second edition, Tony chan carusone, David lohns, Kenneth Martin

Solapur University, Solapur

SE (Electrical Engineering) Semester-II

EL225 NETWORK ANALYSIS

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hours/week, 4 Credits	**ESE – 70 Marks**
Tutorial– 1 Hour/week, 1 Credit	**ISE – 30 Marks**
	ICA- 25 Marks

This course introduces basic concepts of Electrical network and different network analysis techniques

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Course Prerequisite:

Student shall have knowledge of terminology of electrical networks, Laplace transforms and linear differential equations

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Course Objectives:

1 .To develop the strong foundation for Electrical Networks
2. To develop analytical qualities in Electrical circuits by application of various theorems
3. To make students understand the behavior of circuits by analyzing the transient response using classical methods and Laplace Transform approach
4. To apply knowledge of Network theory for analysis of 2-port networks

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Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Develop strong basics for network theory
2. Develop the problem solving technique for networks by application of theorems
3. Understand the behavior of the network by analyzing its transient response
4. Apply knowledge of Network theory for analysis of 2-port networks

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Section-I

Unit 1–Basic Concepts **No of lectures – 10**

- **Prerequisite:**
  Series and parallel connection of circuit elements, Ohm's law, Solution of linear equations, Kirchhoff's law

- **Objectives:**
  1. To revise of basic concepts of Electrical Network
  2. To introduce to student network reduction techniques
  3. To make student understand Mesh and Node analysis method

- **Outcomes:**
  After completing this unit, students -
  1. Can apply network reduction techniques to solve numerical
  2. Can apply loop and node analysis to solve numerical

- **Unit Content:**
  Practical sources, Source transformations, Network reduction using Star – Delta transformation, Mesh and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh, coupled circuits and dot conventions

- **Content Delivery Methods:**
  Chalk and talk, Video lectures

- **Assessment Methods:**
  Numerical problems and derivation related to Star-Delta transformation, Source transformation, Loop and node analysis, Super node and super mesh, coupled circuits

Unit 2–Network Theorems **No of lectures – 10**

- **Prerequisite:**
  Concept of open circuit and short circuit, equivalent resistance

- **Objectives:**
  1. To make student understand different theorems to analyze electrical network
  2. To make student analyze electric network using network theorems

- **Outcomes:**
  After completing this unit, students –

  Can able to analyze electrical network using network theorems

- **Unit Content:**
  Superposition, Reciprocity, Millman's, Thevenin's, Norton's theorems, Maximum Power transfer theorem applied to both ac and dc circuits
- **Content Delivery Methods:**
  Chalk and talk, Video lectures

- **Assessment Methods:**
  Numerical problems and derivations related to network theorems

Unit 3–Network Topology **No of lectures – 06**

- **Prerequisite:**
  Concepts from linear algebra

- **Objectives:**
  1. To make student understand concepts network topology
  2. To make student understand dual of network

- **Outcomes:**
  After completing this unit, students –

  1. Can analyze electrical network using network topology
  2. Can draw dual of given network

- **Unit Content:**
  Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set matrix, cut-set matrix, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality

- **Content Delivery Methods:**
  Chalk and talk, videos

- **Assessment Methods:**
  Numerical problems on Incidence matrix, cut set, tie set matrices and duality

Section-II

Unit 4-Analysis of Transient Response in Circuits-Classical Method **No of lectures –09**

- **Prerequisite:**
  Node and mesh analysis, Solution of linear differential equations

- **Objectives:**
  To make student analyze behavior of circuit when transient occurs

- **Outcomes:**
  After completing this unit, students –

  Can find circuit response in transient state

- **Unit Content:**
  Initial and Final Condition of network, General and Particular Solution, Transient response of R-L, R-C and R-L-C (DC Supply only) network in time domain

- **Content Delivery Methods:**
  Chalk and talk, Video lectures, animations

- **Assessment Methods:**
  Numerical problems transient response of circuit, derivations of circuit response

Unit 5-Analysis of Transient Response in Circuits: Laplace Transform Approach

No of lectures – 09

- **Prerequisite:**
  Loop and mesh analysis, Laplace transform

- **Objectives:**
  To make student analyze behavior of circuit when transient occurs

- **Outcomes:**
  After completing this unit, students –

  Can find circuit response in transient state

- **Unit Content:**
  Standard test inputs: Step, Ramp, Impulse, Their Laplace transform, Representation of R,L,C in S domain, transformed network, Application of Laplace transform to solve series and parallel R-L, R-C and R-L-C circuits

- **Content Delivery Methods:**
  Chalk and talk, Video lectures, animations

- **Assessment Methods:**
  Numerical problems on transient response of circuit, derivations of circuit response

Unit 6-Two port networks **No of lectures – 08**

- **Prerequisite:**
  Loop and mesh analysis techniques, Linear Algebra

- **Objectives:**
  1. To make student understand two port network parameters
  2. To make student understand relationship between parameters
  3. To make student analyze interconnected networks

- **Outcomes:**
  After completing this unit, students –
  1.Can able to find two port network parameters
  2.Can able to convert one parameter into other
  3.Can able to analyze interconnected two port networks

- **Unit Content:**
  Determination of Z, Y, H and Transmission parameters, relationship between parameters sets, interconnection of two port network

- **Content Delivery Methods:**
  Chalk and talk, Video lectures

- **Assessment Methods:**
  Numerical problems on two port network parameters, conversion of parameters, interconnected two port networks

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- **Internal Continuous Assessment (ICA) :**
  ICA shall consist of Minimum Eight tutorials/Assignments based on above curriculum

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- **Text Books:**

1.“Network Analysis”, Prentice Hall of India Private Limited, Third Edition, M E Van Valkenburg
2.“Network and Systems”, New age international publishers, D Roy Choudhary
3.“Circuit Theory”, DhanpatRai and Company, 7th edition,Abhijit Chakroborty
4.“Network Analysis and synthesis”, McGraw Hill education (India) Pvt Ltd, 3rd edition 2015, Ravish R Singh
5.“Circuits & Networks 4E”, Tata McGraw-Hill Education (India) Pvt Ltd, Anant Sudhakar

- **Reference Books:**

1.“Engineering Circuit Analysis” McGraw William H Hayt, Jr Jack E Kemmerly
2.“Network analysis and Synthesis”, Wiley International Edition Franklin F Kuo
3.“Analysis of Linear Systems”, Narosa Publishing House, 11th reprint, 2002 David K Cheng
4.“Network Analysis and Synthesis”, Khanna Publication G K Mittal

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SE (Electrical Engineering) Semester-II

EL226 Programming and Simulation by Using MATLAB

Teaching Scheme	**Examination Scheme**
Practical– 2 Hours/week, 1 Credit	**ICA- 50 Marks**

Course Prerequisite:

Student shall have adequate knowledge of programming using any language

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Course Objectives

1. To develop conceptual & analytical understanding of MATLAB Programming
2. To develop design skills so that students become able to write programs in MATLAB for different applications
3. To develop conceptual & analytical understanding of MATLAB SIMULINK
4. To develop design skills so that students become able to model a program in SIMULINK for different application

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Course Outcome

After successful completion of this course,student will be able to

Analyze & script the MATLAB programs and Analyze & model the SIMULINK program

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SECTION-I

Unit 1: Introduction to MATLAB basics

- **Prerequisite:**
  Software environment

- **Objectives:**

1. To learn MATLAB Environment
2. To learn Input Output Platform
3. To understand General commands used in MATLAB

- **Outcomes:**
  After completion of this unit,

1. Students will be able to create Input Output Platform
2. Students will be able to create General commands used in MATLAB

- **Unit Content:**
  The MATLAB environment, Input-output, File types, Platform dependence, General commands, creating a script file in MATLAB

- **Content Delivery Methods:**
  Chalk and talk, Video lectures and PPT

- **Assessment Methods:**
  Apply program in MATLAB

Unit 2: Matrices & vectors:

- **Prerequisite:**
  Arithmetic operation of Matrix

- **Objectives:**
  1. To learn Entering Matrix
  2. To understand logical and relation operations

- **Outcome:**
  After completion of this unit,
  1. Students will be able to apply Entering Matrix
  2. Students will be able to apply logical and relation operations

- **Unit Content:**
  Entering Matrix, indexing matrix, matrix manipulation, creating vectors, Matrix and array operations such as arithmetic operators, relational operators, logical operators, Elementary math functions

- **Content Delivery Methods:**
  Chalk and talk, Video lectures and PPT

- **Assessment Methods:**
  Apply programming skill in MATLAB

Unit 3: Programming Structure in MATLAB

- **Prerequisite:**
  Flow chart, condition algorithm

- **Objectives:**
  1.To learn condition using while loops, if else statement and switch case
  2.To understand Break, return, end, continue and nested loops

- **Outcomes:**
  After completion of this unit,
  1. Students will be able to apply condition using while loops, if else statement and switch case
  2.Students will be able to create Break, return, end, continue and nested loops

- **Unit Content:**

  For loops, while loops, if-else if-else statements, switch–case-otherwise statements, Understanding use of Break, return, end and continue, nesting loops

- **Content Delivery Methods:**
  Chalk and talk, Video lectures and PPT

- **Assessment Methods:**
  Apply programming skill in MATLAB

Unit 4: Functions in MATLAB

- **Prerequisite:**
  Concept of function, sub function and nested function

- **Objectives:**
  1. To learn functions
  2. To understand sub functions and nested functions

- **Outcome:**
  After completion of this unit,
  1.Students will be able to apply functions
  2.Students will be able to apply sub functions and nested functions

- **Unit Content:**
  Built in functions & User defined functions in MATLAB, examples of built in functions, creating a user defined function, executing a user defined function, concept of sub-function & nested functions

- **Content Delivery Methods:**
  Chalk and talk, Video lectures and PPT

- **Assessment Methods:**
  Apply programming skill in MATLAB

Unit 5: Graphics

- **Prerequisite:**
  Graphs, 2D and 3D plots

- **Objectives:**
  1.To learn 2D and 3D plots
  2.To learn modifying a plot
  3.To understand concept of mesh and surface plots

- **Outcome:**
  After completion of this unit,
  1.Students will be able to create 2D and 3D plots
  2.Students will be able to apply modifying a plot
  3.Students will be able to create concept of mesh and surface plots

- **Content:**
  Basic 2D plots: labels, title, legend, text objects, axis control, overlay plots, modifying plots with plot editor, subplotsIntroduction to 3D plots: Concepts of mesh & surface plots

- **Content Delivery Methods:**
  Chalk and talk, Video lectures and PPT

- **Assessment Methods:**
  Apply programming skill in MATLAB

SECTION-II

Unit – 6 Introduction to simulation

- **Prerequisite:**
  Graphical user interface, Block diagram

- **Objectives:**
  1.To learn importance of simulation in electrical engineering
  2.To learn block diagram, Simulink simulation

- **Outcomes:**
  After completion of this unit,
  1. Students will be able to apply the importance of simulation in electrical engineering
  2. Students will be able to construct block diagram, Simulink simulation

- **Content:**
  Introduction to simulation, Importance of simulation in Electrical Engineering, Organization of Simulink, constructing a simulink block diagram, simulink simulation

- **Content Delivery Methods:**
  Chalk and talk, Video lectures and PPT

- **Assessment Methods:**
  Apply simulation modelling skill in MATLAB/SIMULINK

Unit – 8 Simulink toolbox

- **Prerequisite:**
  Math operation, logic and bit operation

- **Objectives:**
  1. To learn using Simulink tool box
  2. To understand Math operation, Model verification

- **Outcomes:**
  After completion of this unit,

  Students will be able to apply Math operation, Model verification

- **Content:**
  Introduction to various blockset in simulink toolbox: continuous blockset, discrete blockset , logic and bit operation blockset, lookup tables blockset, Math operation blockset, Model verification blockset, Port and subsystem blockset, signal attributes blockset, signal routing blockset, sinks blockset, sources blockset

- **Content Delivery Methods:**
  Chalk and talk, Video lectures and PPT

- **Assessment Methods:**
- Apply simulation modelling skill in MATLAB/SIMULINK

Unit – 9 Simpower toolbox

- **Prerequisite:**
  Machines, measurement

- **Objectives:**
  1.To learn simpower Tool Box
  2.To learn measurement using block set
  3.To learn Machine block set

- **Outcomes:**
  After completion of this unit,
  1. Students will be able to apply measurement using block set
  2. Students will be able to create Machine block set

- **Content:**
  Study and understanding of every blockset of simpower Toolbox: electrical sources blockset, elements blockset, Machines blockset, Measurement blockset, phasor elements blockset

- **Content Delivery Methods:**
  Chalk and talk, Video lectures and PPT

- **Assessment Methods:**
  Apply simulation modelling skill in MATLAB/SIMULINK

Unit – 10 Electrical applications

- **Prerequisite:**
  Machine Design

- **Objectives:**
  1.To understand model file using machine block set
  2.To learn the performance of DC-Shunt, series motor, induction motor and single phase motors

- **Outcomes:**
  After completion of this unit,
  1.Students will be able to create model file using machine block set

2.Students will be able to analyze the performance of DC-Shunt, series motor, induction motor and single phase motors

- **Content:**
  Creating a model file using Machine blockset of simpower and analyze the performance of DC shunt, series motor, induction motor and single phase motors

- **Content Delivery Methods:**
  Chalk and talk, Video lectures and PPT

- **Assessment Methods:**
  Apply simulation modelling skill in MATLAB/SIMULINK

- **Internal Continuous Assessment(ICA)** :
  ICA Shall consist of minimum ten programming assignments covering above syllabus.(five MATLAB program & five MATLAB Simulink models)

- **Text Books:**

1. "MATLAB Programming for Engineers", Thomson Publication ,Stephan J Chapman
2. "Modeling & Simulation Using MATLAB Simulink", Wiley Publication,Shailendra Jain
3. "Getting started with MATLAB", Pub Oxford University press Rudra Pratap

- **Refrence Books:**

1. "Mastering MATLAB", Pearson Education 2005 Duane Hanselman & Bruce Little field
2. "A guide to MATLAB", Cambridge University Press 2002, Brain R Hunt, Ronald L Lipsman & Jonathan M Rosenberg
3. "Introduction to MATLAB & SIMULINK A project approach", Infinity Science press Firewall Media OBeucher & MWeeks

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