Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-
2015'B' Grade
(CGPA 2.62)

Name of the Faculty: Engineering & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: ELECTRICAL ENGINEERING

Name of the Course: S.Y. B.Tech

(Syllabus to be implemented from w.e.f. June 2021)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Engineering & Technology
B.Tech (Electrical Engineering)
PROGRAMME: BACHELOR OF ELECTRICAL ENGINEERING
PROGRAMME OBJECTIVES

A. PROGRAM EDUCATIONAL OBJECTIVES

1. Deliver fundamental as well as advanced knowledge with research initiatives in the field of electrical engineering with emphasis on state-of-the-art technology.
2. Graduates will demonstrate measurable progress in the fields they choose to pursue.
3. Design and develop technically feasible solutions for real world applications which are economically viable leading to societal benefits.
4. To nurture Graduates to be sensitive for ethical, societal and environmental issues while conducting their professional work.

B. PROGRAMME OUTCOMES

Students attain the following outcomes: -

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

2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6 **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11 **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12 **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

C. PROGRAMME SPECIFIC OUTCOMES

1 An ability to specify, design and analyze Power System, Electrical Machinery, Electronic Circuits, Drive Systems, Lightning Systems and deliver technological solution by adapting advances in allied disciplines.

2 Apply knowledge of electrical engineering to meet the desired needs within realistic constraints viz. economical, ethical, and environmental and safety.

3 Apply modern software tools for design, simulation and analysis of electrical systems to successfully adapt in multi-disciplinary environments.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Engineering & Technology
S.Y. B Tech. (Electrical Engineering

Choice Based Credit System Syllabus Structure of S.Y. B. Tech. Electrical Engineering W.E.F. 2021-22 ***Semester I***

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
EL 211	Engineering Mathematics-III	2	1		3	30	70	25	125
EL 212	Electrical Machines-I	3	-		3	30	70	-	100
EL 213	Electrical Measurement and Instrumentation	3	-		3	30	70	-	100
EL 214	Power System I	3	1		4	30	70	25	125
EL 215	Electronic Devices and Circuits	3	-		3	30	70	-	100
EL 216	Object Oriented Programming with C++	1	-		--	--	--	-	--
Sub Total		**15**	**2**	**-**	**16**	**150**	**350**	**50**	**550**
Environmental Science		1							
Laboratory Course Name									
							ESE		
							POE	OE	
EL 212	Electrical Machines-I	-	-	2	1	-	50	-	25	75
EL 213	Electrical Measurement and Instrumentation	-	-	2	1	-	50	-	25	75
EL 215	Electronic Devices and Circuits	-	-	2	1	-		-	25	25
EL 216	Object Oriented Programming with C++	-	-	2	1	-	50	-	25	75
Sub Total		**-**	**-**	**8**	**4**		**150**		**100**	**250**
Grand Total		**15**	**2**	**8**	**20**	**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)*

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Engineering & Technology
S. Y. B. Tech. (Electrical Engineering)

Choice Based Credit System Structure of S.Y.B.Tech. Electrical Engineering W.E.F. 2021-2022 ***Semester II***

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
EL 221	Numerical Methods and Linear Algebra	2	1	-	3	30	70	25	125
EL 222	Electrical Machines-II	3	-	-	3	30	70	-	100
EL 223	Power System II	3	1	-	4	30	70	25	125
EL 224	Analog & Digital Integrated circuits	3	-	-	3	30	70	-	100
EL 225	Network Analysis	3	-	-	3	30	70	-	100
Sub Total		**14**	**2**	**-**	**16**	**150**	**350**	**50**	**550**
Environmental Science		1	-	-	-	-	-	-	-
Laboratory Course Name									
							ESE		
							POE	OE		
EL 222	Electrical Machines-II	-	-	2	1	-	50	-	25	75
EL 225	Network Analysis	-	-	2	1	-	50	-	25	75
EL 224	Analog & Digital Integrated circuits	-	-	2	1	-	-	-	25	25
EL 226	Computer Aided Design and Simulation	-	-	2	1	-	50	-	25	75
Sub Total		**-**	**-**	**8**	**4**	**-**	**150**		**100**	**250**
Grand Total		**14**	**2**	**8**	**20**	**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)*

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 & and evaluated on the basis of presentation as well as training report.
- 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 FOUR 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

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-I
Engineering Mathematics III

Teaching Scheme	Examination Scheme
Theory: - 2 Hrs/Week,2 Credits	**ESE –** 70 Marks
Tutorial: - 1 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks

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:**

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

- **Course Outcomes:**

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

SECTION-I

Unit 1– Linear Differential Equations with Constant Coefficients No of lectures – 04

- **Prerequisite:**

Trigonometry, differentiation, integration.

- **Objectives:**

1. Revise 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, x^m ,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 – 04

- **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.
5. To make students to derive inverse Laplace at different conditions and for different functions.

- **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
4. The Laplace transforms converts integral and differential equations into algebraic equations.

- **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, Unit step functions and unit Impulse functions, Methods of finding Inverse Laplace transforms by Convolution Theorem only.

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

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

SECTION-II

Unit 4- Partial Differential Equations **No of lectures – 04**

- **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 analyze 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

- **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 5 -Functions of Complex variables **No of lectures – 04**

Prerequisite:
Concepts of complex Number, Partial Derivatives, Integration, Concepts of Analytic functions, Cauchy's Riemann equations, Harmonic functions.

- **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
4. Can solve complex Integration
5. Can find Residue

Unit Content:
Line integral, Cauchy's integral theorem, Cauchy's integral formula, Cauchy Residue theorem (without proof)

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

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

Unit 6- 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
4. To make students to understand Fourier series for different functions

- **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
4. Can use for circuit analysis

- **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

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

- **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

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Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-I
ELECTRICAL MACHINES – I

Teaching Scheme	Examination Scheme
Theory: - 3 Hrs/Week,3 Credits	**ESE –** 70 Marks
Practical: - 2 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks
	POE: 50Marks

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

Course Prerequisite:

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

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Course Objectives:

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

Course Outcomes:

Upon successful completion of this course:

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

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SECTION-I

Unit 1: DC Generators: **No of lectures – 08**

- **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, 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

- **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 – 09**

- **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

- **Content Delivery Methods:**

  Chalk and talk, Video lectures, Animations
- **Assessment Methods:**
  Numerical problems and derivations related to torque equation, losses and efficiency

Unit 3: Testing of DC Machines: **No of lectures – 04**

- **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 – 11**

- **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 –
  - Can understand operation of single-phase transformer
  - Can find different operating parameters of single-phase transformer
- **Unit Content:**

  Transformer construction and types, EMF equation, Voltage ratio, KVA rating, Transformer on no-load and on-load condition with phasor diagrams, Losses and Efficiency, Condition for maximum efficiency, Transformer equivalent circuits, Effect of load on power factor, Testing- Polarity test, Open Circuit Test (OC), Short Circuit Test (SC), 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, Auto-Transformer

Unit 5: Three Phase Transformers: **No of lectures – 10**

- **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, 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

- **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. Determination of equivalent circuit parameters of single-phase transformer
  12. Scott connection of three phase transformers
  13. Direct load test on three phase transformers for various connections

- **Text Books:**

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

- **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

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-I
ELECTRICAL MEASUREMENT AND INSTRUMENTATION

Teaching Scheme	Examination Scheme
Theory: - 3 Hrs/Week,3 Credits	**ESE –** 70 Marks
Practical: - 2 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks
	POE: 50Marks

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:

- To impart in depth knowledge of the operating principle, construction, mechanismsused in Measuring instruments used for the measurement of electrical quantities
- To introduce the concept of accuracy and precision in the measurement of electrical quantities
- To make the students capable of selecting the proper instrument for the measurement

Course Outcomes:

- The students will be able to use Analog instruments in practical applications
- The students will be able to apply potentiometer & bridges for measurements ofresistance, Inductance & capacitance
- The students will be able to find the applications of instrument transformer and dataacquisition system for sensing & control of electrical quantities
- The students will be able to use digital instruments for various measurements.

SECTION-I

Unit -1 Basic Concept of Measurement **No of lectures – 05**

- **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 – 08**

- **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 –

1. Can able to analyze various parameters of different measuring instruments
2. Can draw the construction and working of measuring instruments.

- **Unit Content:**
  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, Measurement of power in AC(Two Wattmeter) and DC Circuits, Shunts & multipliers, ohmmeter, Megger, Earth tester
  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:**
  Principle of DC potentiometer, Crompton's type DC Potentiometer; principle of AC potentiometer
  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 Bridge circuits.

SECTION- II

Unit 4– Transducers and Instrument Transformers **No of lectures – 09**

- **Prerequisite:**
  Basic Concepts of transformer

- **Objectives:**
  - To make student understand applications of transformer in instrumentation
  - 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:**
  Resistance Temperature Co-efficient, Classification of transducers, Electric Transducers-RTD, RVDT, LVDT, 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

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, Q- meter, Electronic energy meter, LED and

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

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

Unit – 6 Oscilloscopes **No of lectures – 06**

- **Prerequisite:**
  Basics of oscilloscope

- **Objectives:**
  - 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, 2 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

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-I
POWER SYSTEM-I

Teaching Scheme	Examination Scheme
Theory: - 3 Hrs/Week,3 Credits	**ESE –** 70 Marks
Tutorial: - 1 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks

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

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Course Objectives:

- To develop conceptual understanding of operation of different power plants
- To learn economic aspects of power system.
- To study necessity and types of non-conventional energy sources
- To make students understand overhead structure of power system.

Course Outcomes:

After successful completion of this course,

- Student will be able to understand operation of different power plants
- Student will be able to analyze economic aspects of power system
- Student will be able to investigate need and areas of application for non-conventionalenergy sources
- Students will be able to understand overhead structure of power system.

SECTION-I

Unit 1 Economic Aspects of Power Generation **No of lectures-08**

- **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 2 Base Load Power Plants **No of lectures-08**

- **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 different base load power plants.

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

1. Can define conventional & non-conventional sources
2. Can compare different base load power plants

- **Unit Content:**
  Different types of conventional and non-conventional energy sources, Structure of power industry,
  Hydro Power Plant: Typical layout, Site selection, Classification, Hydrograph, Flow duration curves, Hydrology, Types of turbines.
  Thermal Power Plant: Typical layout, Site selection, Fuels & their handling, Combustion process, Ash handling, Dust collection.
  Nuclear Power Plant: Typical layout, Site selection, Nuclear reaction, Classification of nuclear reactor (AGR, PWR, BWR), Nuclear waste disposal, Environmental Aspects

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

- **Assessment Methods:**

Theory questions related to above content.

Unit 3 Peak Load 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 introduce student to solar & Wind Power Plants
3. To make student analyze typical layout of solar & Wind Power Plants

Outcomes:
After completing this unit, students –

1. Can apply the operation of Diesel & Gas Turbine Power Plants
2. Can apply the operation of solar & Wind 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, Review of Solar Energy (advantages & disadvantages), Typical layout of solar thermal power plant, Site selection, Review of wind energy (advantages & disadvantages), Typical layout of wind power plant, Site selection

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

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

SECTION - II

Unit 4– General structure of power system **No of lectures – 08**

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

- **Objectives:**
  1. To learn basic structure of power systems
  2. To make student understand different transmission systems

- **Outcomes:**

After completing this unit, students -

1. Can distinguish between different supply systems
2. Can compare between AC and DC transmission System.
3. Can compare between overhead and underground System.

Unit Content:
Review of Electrical supply system, typical AC power supply scheme, Comparison DC and AC systems, comparison between overhead and underground system

- **Content Delivery Methods:**

Chalk and talk, power point presentations

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

Unit 5– Economic Aspects of Transmission System **No of lectures – 08**

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

- **Objectives:**
  1) To make student understand conductor cost of different AC transmission systems
  2) To make student understand Economics of power transmission

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

- **Unit Content:**
  Comparison of conductor cost for various Overhead AC transmission systems, comparison of conductor cost for various Underground AC transmission systems, Economic choice of conductor size by 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 6– Mechanical design of overhead lines **No of lectures – 05**

- **Prerequisites:**
  Electrical Material**s** & 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

- **Internal Continuous Assessment (ICA):**
  ICA shall consist of Minimum **FOUR** drawing Sheets on above syllabus and **report on visit** to any one of the generating power plant

- **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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Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-I
ELECTRONIC DEVICES & CIRCUITS

Teaching Scheme	Examination Scheme
Theory: - 3 Hrs/Week,3 Credits	**ESE –** 70 Marks
Practical: - 2 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks

This course introduces the basics concepts and application of Electronic Devices

Course Prerequisite:

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

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Course Objectives:

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

Course Outcome:

- Students will be able to design transistorized circuits based on their conceptual and analytical understanding of BJT
- Students will be able to analyze FET circuits
- Students will be able to analyze the Power amplifiers, feedback amplifiers, oscillator's concepts
- 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-06**

- **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, 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-05**

- **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-05**

- **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)

- **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-05**

- **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, 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-07**

- **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
- **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-07**

- **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-07**

- **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

- **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
4. Electronic Devices and circuits, Wiley India ,Anil K Maini & Varsha Agrawal

- **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 unregulated power supply
8. To design Positive voltage regulator using 78XX
9. To design Negative Voltage Regulator Using 79XX

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-I
OBJECT ORIENTED PROGRAMMING WITH C++

Teaching Scheme	Examination Scheme
Theory: - 1 Hrs/Week	**ICA-**25Marks
Practical: - 2 Hrs/Week, 1 Credit	**POE:** 50Marks

Course Prerequisite:
Student shall have knowledge of C Fundamentals

Course Objectives:
- To learn fundamental concepts and principles of Object-Oriented Programming (OOP) with basic C++ syntax and convention
- To apply the OOP concepts for writing simple object-oriented programs

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Course Outcomes:
After learning the course
- Students will be able to read, understand and analyze simple C++ program
- Students will be able to apply principle of OOP concept and explore theirskill to develop Complex C++ program
- Students will be able to write the simple object-oriented programs in C++ using objects and classes
- Students will be able to develop the applications using object-oriented programming with C++

SECTION-I

Unit 1 – Concepts of OOP **No of lectures – 02**

- **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 – 01**

- **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 – 02**

- **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 – 02**

- **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 – 02**

- **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,

- **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 7 – Streams and Files **No of lectures – 02**

- **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 consist 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 program of Function Overriding structure
12. Implementation of control structure
13. 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,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

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

S. Y. B. Tech. Electrical Engineering Semester-II

Numerical Methods and Linear Algebra

Teaching Scheme	Examination Scheme
Theory: - 2 Hrs/Week,2 Credits	**ESE –** 70 Marks
Tutorials: - 1 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks

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:

- 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
- To provide students with mathematics fundamental, necessary to formulate, solve and analyze engineering problems
- To make student understand to develop a simple model by using matrix method
- To introduce numerical techniques that can be used on computer

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Course Outcomes:

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

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SECTION-I

Unit 1–Solution of Algebraic and Transcendental Equations **No of lectures – 03**

- **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, 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 – 03**

- **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, 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 – 03**

- **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 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 – 05**

- **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

- **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 – 03**

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

- **Content Delivery Methods:**

Chalk and talk, power point presentations

- **Assessment Methods:**

Numerical problems related to above Content

Unit 6-Vector Spaces **No of lectures – 03**

- **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, coordinate systems, the dimension of vector space, 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 – 03**

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

- **Objectives:**

To introduce to student the theory of eigen values and eigen vectors
To make student understand the concept of application to differential equations
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 diagonalize 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 – 05**

- **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, diagonalization 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,
     a. 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
  3) V. Krishnamurthy, V.P. Mainra and J.L. Arora, "An introduction to Linear Algebra" Affiliated East–West press, Reprint 2005.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-II
ELECTRICAL MACHINES – II

Teaching Scheme	Examination Scheme
Theory: - 3 Hrs/Week,3 Credits	**ESE –** 70 Marks
Practical: - 2 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks
	POE: 50Marks

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:

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

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Course Outcomes:

After Successful completion of this course-

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

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SECTION-I

Unit 1– Introduction to AC Machines **No of lectures – 05**

- **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 – 06**

- **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 of Induction 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 – 05**

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

- **Objectives:**

1. To make student understand starting methods of Induction Motors
2. To make student understand speed control methods of Induction Motors

- **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, 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, slip power recovery)

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

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

Unit 4– Performance of Three Phase Induction Motor **No of lectures – 05**

- **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:**
  Numerical related to Circle Diagram and Double cage Induction Motor

SECTION-II

Unit 5-Single Phase Induction Motor **No of lectures – 07**

- **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 – 07**

- **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), Parallel operation of alternators, Methods of synchronization

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

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

Unit 7-Synchronous Motor **No of lectures – 07**

- **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, Losses and Efficiency, V and inverted V curves, Hunting- its causes and remedies

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

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

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

- **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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Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-II
POWER SYSTEM-II

Teaching Scheme	Examination Scheme
Theory: - 3 Hrs/Week,3 Credits	**ESE –** 70 Marks
Tutorial: - 1 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks

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

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Course Objectives:
- To learn basic structure of power systems and mechanical design of overhead lines
- To study various effects related to overhead transmission lines
- To gain knowledge about need of power transmission using underground cables, types of underground cables
- To understand DC & AC distribution systems and substations

Course Outcomes:
- Students will be able to understand overall structure of power system
- Students will be able to understand mechanical design of transmission lines
- Students will be able to implement the knowledge to design underground power distribution system
- Students will be able to analyze various performance parameters of transmission lines

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SECTION-I

Unit 1– Corona & Sag in overhead lines **No of lectures – 07**

- **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

- **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 2– Constants of transmission lines **No of lectures – 07**

- **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 3– Underground cables **No of lectures – 07**

- **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 4– 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

- **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 5– Distribution systems **No of lectures – 07**

- **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 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 6– Substations and Grounding **No of lectures – 07**

- **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 consist 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 . Ra

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Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-II
ANALOG AND DIGITAL INTEGRATED CIRCUITS

Teaching Scheme	Examination Scheme
Theory: - 3 Hrs/Week,3 Credits	**ESE –** 70 Marks
Practical: - 2 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks

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:

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

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Course Outcome:
After successful completion of this course-

- Students will be able to analyze the differential amplifier circuit
- Students will be able to define specification and parameters of Op-amp
- Students will be able to analyze open loop as well as closed loop circuit configurations of operational amplifier
- 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– 05**

- **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–05

- **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–05**

- **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

Unit5- Combinational Logic Circuits **No of lectures–07**

- **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–07**

- **Prerequisite:** Logic gates

- **Objective:**
  To analyze the basics of 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-7 Sequential Logic Circuits **No of lectures– 07**

- **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, up/down Asynchronous counters, modulus of counter, limitations of asynchronous counters, Synchronous counter-Synchronous counter using T, JK flip flops, 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 consist 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, Davidlohns, Kenneth Martin

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Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-II
NETWORK ANALYSIS

Teaching Scheme	Examination Scheme
Theory: - 3 Hrs/Week,3 Credits	**ESE –** 70 Marks
Practical: - 2 Hrs/Week, 1 Credit	**ICA-**25Marks
	ISE- 30Marks
	POE: 50Marks

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

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

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Course Objectives:
- To develop the strong foundation for Electrical Networks
- To develop analytical qualities in Electrical circuits by application of various theorems
- 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:
- Develop strong basics for network theory
- Develop the problem solving technique for networks by application of theorems
- Understand the behavior of the network by analyzing its transient response
- Apply knowledge of Network theory for analysis of 2-port networks

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SECTION-I

Unit 1–Basic Concepts **No of lectures – 07**

- **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:**
  Ideal and 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 – 07**

- **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, Compensation Theorem, Tellegan's Theorem, 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 – 07**

- **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 –07

- **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 – 07

- **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 – 07**

- **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

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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Punyashlok Ahilyadevi Holkar Solapur University, Solapur
S. Y. B. Tech. Electrical Engineering Semester-II
Computer Aided Design and Simulation

Teaching Scheme	Examination Scheme
Practical: - 2 Hrs/Week, 1 Credit	**ICA-**25Marks
	POE: 50Marks

Course Prerequisite:
Student shall have adequate knowledge of programming using any language

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Course Objectives

- To develop conceptual & analytical understanding of Electrical engineering through computer-based simulation.
- To develop design skills so that students become able to handle design software for different applications in electrical engineering.
- To make students familiar with simulation software for electrical engineering.
- To make students familiar with Design software for electrical engineering

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Course Outcome

After successful completion of this course student will be able to

- Create Design of various devices used in electrical engineering.
- Handle design software for different applications in electrical engineering.
- Understand steady state analysis of various electrical devices through simulation.
- Handle Simulation software for different applications in electrical engineering.

Internal Continuous Assessment (ICA):

- **ICA shall consist of Minimum Eight Practical's on any simulation and Design Software**

- **Minimum Four simulation-based Experiment should be conducted but not restricted the following**

1. Simulation for verification of KCL and KVL.
2. Simulation for verification of Thevenins Theorem.
3. Simulation for verification of Superposition Theorem.
4. Steady state analysis of DC Machine using Simulation.
5. Steady state analysis of Induction Motor using Simulation.
6. Steady state analysis of Single-phase Transformer using Simulation.
7. Steady state analysis of Short Transmission Line using Simulation.
8. Steady state analysis of Medium Transmission Line using Simulation.

- **Minimum Four Design based Experiment should be conducted but not restrictedthe following**

1. Design of construction of underground cables.
2. Design of sample one-line diagram of power system.
3. Design of various bus bar arrangements in substation.
4. Design of distribution system network.
5. Design of typical layout of thermal power plant.
6. Design of typical layout of nuclear power plant.
7. Design of typical layout of solar power plant
8. Design of cross-sectional view of wind power plant.
