Scheme of Instruction, Evaluation

and Syllabi

of

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

With effect from Academic Year 2026-27

Estd. 1917

DEPARTMENT OF ELECTRICAL ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING

(Autonomous)

Osmania University

Hyderabad – 500 007, TG, INDIA

UNIVERSITY COLLEGE OF ENGINEERING

The University College of Engineering (UCE) has the distinction of being the oldest and the biggest among the Engineering Colleges of the State of Telangana. Established in the year 1929, eleven years after the formation of Osmania University, it was the 6th Engineering College to be established in the whole of British India. The College moved to its present permanent building in the year 1947. Today it is the biggest among the campus colleges of Osmania University. The Golden Jubilee of the College was celebrated in 1979, the Diamond Jubilee in 1989 and the Platinum Jubilee in 2004. The College was made autonomous in 1994.

The College offers four-year engineering degree courses leading to the award of Bachelor of Engineering (B.E.) in Artificial Intelligence and Machine Leaning,Biomedical Engineering, Civil Engineering, Computer Science and Engineering, Electrical and Electronics Engineering, Electronics and Communications Engineering and Mechanical Engineering and Mining Engineering . The College also offers courses leading to Master of Computer

Applications, Master of Science by Research and also Ph.D., in the various branches of Engineering. Part-time courses are offered both at undergraduate and postgraduate levels.

Vision

The Vision of the institute is to generate and disseminate knowledge through harmonious blending of science, engineering and technology. To serve the society by developing a modern technology in students' heightened intellectual, cultural, ethical and humane sensitivities, fostering a scientific temper and promoting professional and technological expertise.

Mission

- To achieve excellence in Teaching and Research
- To generate, disseminate and preserve knowledge
- To enable empowerment through knowledge and information
- Advancement of knowledge in Engineering, Science and Technology
- Promote learning in free thinking and innovative environment
- Cultivate skills, attitudes to promote knowledge creation
- Rendering socially relevant technical services to the community
- To impart new skills of technology development
- To inculcate entrepreneurial talents and technology appreciation programmes
- Technology transfer and incubation.

DEPARTMENT OF ELECTRICAL ENGINEERING

The Department of Electrical Engineering started in 1949 to offer B.E in Electrical Engineering. Presently, the Department is offering B.E. in Electrical & Electronics Engineering. Continuing Education for employed diploma holders was started in 1963 through the four-year Part-Time Degree course in Electrical Engineering; The Post-graduate course in Electrical Machines was started in 1966. Later, in the year 1987, B.E in Instrumentation was offered.

With a view to provide diversity and industrial orientation to the Post Graduate programs, currently the Department currently offers M.E. programs in Industrial Drives & Control and Power Systems, both of which were introduced in 1971. Department also offers part time PG courses in Industrial Drives & Control and Power Systems for the working academicians and engineers. A new PG program in Power Electronic Systems is introduced in the year 2008. The Part-Time Ph.D. program in Electrical Engineering is being offered since 1972. Providing opportunities for working professionals and academicians to pursue advanced research in various areas of Electrical Engineering.

The Department has eighteen regular faculty members who are highly experienced and actively involved in research activities. The department is also equipped with state-of-art equipment and well qualified technical staff. The department is accredited by NBA for 5 years from the year 2013 and re-accredited for 3 years from the year 2019 and in 2022 for BE(EEE) program. PG Programs in Industrial Drives & Control and Power Systems are accredited by NBA for 3 years from the year 2021. Further BE(EEE) program is accredited by NBA for 3 years from the year 2025 to 2028 and PG Programs in Industrial Drives & Control , Power Systems and Power Electronic Systems is accredited by NBA for 3 years from the year 2024 to 2027.

Vision

To strive for excellence in education and research; meet the requirement of industry in the field of electrical engineering to serve the nation.

Mission

- To provide knowledge-based technology and serve to meet the needs of society in electrical and allied industries.
- To help in building national capabilities for excellent energy management and to explore non-conventional energy sources.
- To create research-oriented culture and to provide competent consultancy.
- To create and sustain environment of learning in which students acquire knowledge and learn to apply it professionally with due consideration of ethical and economic issues.
- To be accountable through self-evaluation and continuous improvement.

Programme Educational Objectives (PEO):

PEO1: To provide students with a solid foundation in Mathematics, Sciences and Electrical Engineering which prepares students for further studies and hence research in Electrical Engineering and for a wide range of career opportunities in Industries and academics.

PEO2: To train the students with good engineering breadth so as to comprehend, analyze, innovate and design new products in electrical domain, to provide technical solutions to real life problems and to render technical services to the needs of the society.

PEO3: To inculcate professional and ethical attitude, creative, effective communication and presentation skills and enhanced ability to work in teams to pursue complex, open-ended investigations and research in electrical engineering for effective knowledge transfer.

PEO4: To provide students with an academic environment aware of excellence, pro activeness, leadership positions in multidisciplinary teams, entrepreneurial talent and lifelong learning for successful professional career.

PROGRAM OUTCOMES (POs)

POs	Engineering Graduates will be able to:
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
	PROGRAM SPECIFIC OUTCOMES (PSOs)
PSO1	Find solutions for effective operations and control of power systems to achieve quality and reliable power supply
PSO2	Provide solutions for effective and intelligent control of electric drives and renewable energy systems with electronic circuits for domestic and industrial applications

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (Electrical and Electronics Engineering)

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I – Semester

S.No.	Code	Course Title	Scheme of Instruction			Contact Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	MC 100 HS	Induction Program	3 weeks							
2	BS 101 MT	Matrices and calculus	3	-	-	3	3	40	60	3
3	BS 101 PH	Engineering Physics	3	-	-	3	3	40	60	3
4	ES 101 CS	Programming for Problem Solving	3	-	-	3	3	40	60	3
5	PC 101 EE	Electrical Wiring Estimation and Installation	3	-	-	3	3	40	60	3
6	PC 102 EE	Electrical and Electronics Engineering Materials	3	-	-	3	3	40	60	3
Practicals										
7	BS 151 PH	Engineering Physics Lab	-	-	3	3	3	25	50	1.5
8	ES 151 CS	Programming for Problem Solving Lab	-	-	3	3	3	25	50	1.5
9	ES 151 CE	Engineering Graphics	2	-	4	6	3	25	50	4
Total			**17**	**-**	**10**	**27**	**24**	**275**	**450**	**22**

Interdisciplinary Courses Offered to Other Departments in B.E. Semester – I (CSE,ECE &AIML)

S.No.	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	ES 101 EE	Basic Electrical Engineering	3	-	-	3	3	40	60	3
Practicals										
2	ES 151 EE	Basic Electrical Engineering Lab	-	-		3	3	25	50	1.5

S101MT	**Matrices and Calculus**						**Credits**
Prerequisite if any:	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		
Mathematical Knowledge of 12th/ Intermediate level	**L**	**T**	**P**		**CIE**	**SEE**	
	3	-	-	3	40	60	3

Course Objectives:

- To study Matrices as vector spaces, subspaces, linear transformation and its use in solving system of linear equations.
- To study Eigenvalue problems, Diagonalizable Matrices and Quadratic Forms.
- To introduce the concepts of Functions of Several Variables and its Applications.
- To introduce the concepts of Multiple Integrals and its Applications.
- To study Vector Differential and Integral Calculus.

Course Outcomes: After completion of this course, the students will be able to:

1. Find vector spaces and subspaces and solutions of system of linear equations.
2. Solve Eigenvalue problems, Similar & Diagonalizable Matrices and Canonical Form of Quadratic Forms
3. Find the maximum and minimum values of multiple variable functions.
4. Use the knowledge of Multiple Integrals in finding the area and volume of any region bounded by given curves
5. Apply the knowledge of Vector Calculus to find line, surface and volume integrals.

Course Articulation Matrix:

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO1 1**	**PO12**
CO1	3	2	2	1	1	1	-	-	1	-	-	2
CO2	3	2	1	2	2	2	-	-	1	-	-	2
CO3	3	2	2	3	2	2	-	-	1	-	-	2
CO4	3	2	1	1	1	2	-	-	1	-	-	2
CO5	3	2	2	3	1	2	-	-	1	-	-	2

UNIT - I

Matrices and Vector Spaces: Vector Spaces, Subspaces, Linear Independence of Vectors, Dimension and Basis, Linear Transformation, Solution of General linear System of Equations, Elementary row and Column Operations, Echelon form of a Matrix, Gauss Elimination Method for Non – Homogeneous Systems, Homogeneous System of Linear Equations.

UNIT - II

`` **Eigenvalue Problems:** Eigenvalues and Eigenvectors, Cayley - Hamilton theorem (without Proof), Similar and Diagonalizable Matrices, Special Matrices, Quadratic Forms, Canonical Form of a Quadratic Form.

UNIT - III

Functions of Several Real Variables: Introduction, Functions of Two Variables, Limits, Continuity, Partial Derivatives, Total Differential and Differentiability, Derivatives of Composite and Implicit Functions, Higher Order Partial Derivatives, Homogeneous functions, Taylor's Theorem (without Proof), Maximum and Minimum Values of Function, Lagrange's Method of Multipliers.

UNIT - IV

Multiple Integrals: Double Integrals, Evaluation of double integrals by two successive integrations, Application of double integrals, Triple Integrals, Application of triple integrals, Evaluation of triple integrals Change of Variables in Integrals.

UNIT - V

Vector Differential and Integral Calculus: Gradient of a Scalar Field and Directional Derivative, Divergence and Curl of a Vector Field, Line Integrals, Line Integrals Independent of the Path and Green's Theorem (without Proof), Surface Integral, Divergence Theorem of Gauss and Stoke's Theorem (without Proof).

Suggested Reading:

1. R. K. Jain & S. R. K. Iyengar, Advance Engineering Mathematics, Narosa Publications, 5th Edition 2016 (Fifteenth Reprint 2026).
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley publications, 11thEdition, 2025.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 45th Edition, 2024(Reprint 2025).
4. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, 11th Edition, 2025.
5. H. K. Dass and Er. Rajnish Varma, Higher Engineering Mathematics, S. Chand Publications 3rd Revised Edition 2014(Reprint 2025).

e-resources: https://onlinecourses.nptel.ac.in/e-learning/noc26_ma133

BS 101 PH	**Engineering Physics**						
Prerequisite if any:	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**	**3**	**40**	**60**	**3**

Course Objectives:

a) To understand the fundamental laws of electromagnetism and how they lead static and time-varying electric and magnetic fields and to apply wave theory to optical phenomena, such as interference, diffraction, and polarization

2. To appraise significance of stimulated emission and laser light production. Subsequently propagation of light through optical fibers.
3. To make student understand the formation of energy bands and classification of the solids based on the band theory and to sensitize the students towards nanomaterials.
4. To understand the different types Magnetic materials and Dielectric materials with their origin of evolution.
5. To understand Schrodinger's wave equation and its applications and to understand the concept of superconductors.

Course Outcomes: After completion of this course, the students will be able to:

- know how electric and magnetic fields lead the behavior of electromagnetic wave. It bridges classical physics and modern optics, empowering learners to analyze complex electromagnetic systems and waves optics.
- understand the construction and working of different laser systems and apply them to propagate light through optical fiber cable as cutting edge application.
- understand the semiconducting materials and their properties, operating electronic devices, and applying them in circuits and also equips students with the fundamental principles, how materials behave at the nanoscale and how these unique physical, chemical, and biological properties differ from bulk materials.
- understand the fundamental physics behind how materials interact with electric and magnetic fields.
- enrich and understand the implications of matter waves in quantum mechanics evolution and to equip students with the theoretical skills to analyze, and apply materials that conduct electricity with zero resistance and expel magnetic fields.

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**1**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**3**
CO2	**3**	**2**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**
CO3	**3**	**2**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**
CO4	**3**	**2**	**1**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**3**
CO5	**3**	**2**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**

UNIT-I

Modern Optics: Interference – Newton's Rings by reflected light – Experimental arrangement – Types of diffraction – Diffraction due to single slit - Diffraction due to double slit (qualitative)-diffraction grating (Conditions of maxima and minima) – Polarization – Malus law – Double refraction – Nicol's Prism. – Optical activity and polarimeter.

Electro Magnetic Theory: Basic laws of electricity and magnetism – Derivation of Maxwell's equations in integral and differential forms - Conduction and displacement current – modification of Ampere's law - Equation of plane wave in free space – Poynting theorem.

UNIT-II

Lasers: Characteristics of lasers – Absorption of radiation, spontaneous and stimulated emission of radiation - Einstein's coefficients and their relation - Population inversion– Types of lasers - Ruby laser, Helium-Neon laser and semiconductor laser – state of art applications of lasers.

Fiber Optics: Construction of an optical fiber – Propagation of light through an optical fiber - Acceptance angle - Numerical aperture – Types of optical fibers (Based on number of modes and refractive index profile) – Fiber drawing process (double crucible method) - Applications of optical fibers

UNIT-III

Quantum Mechanics: Schrödinger's time independent and time dependent wave equation – Physical significance of wave function – Particle in 1-D box – Wave function, Probability function – Quantum states – Introduction to quantum technology and applications.

Semiconductor Physics: Classification of materials based on band theory - Kronig-Penney model (qualitative treatment) - Energy band formation in solids - Intrinsic and Extrinsic semiconductors - Concept of a hole - Carrier concentration and conductivity in intrinsic semiconductors – Formation of P-N junction diode, Light Emitting Diode and their I-V characteristics – Thermistor and its characteristics - Hall effect and its applications.

UNIT-IV

Dielectric Materials: Dielectrics - Types of polarizations – Electronic, Ionic, Orientational and Space charge polarizations – Expression for Electronic polarizability - Frequency and temperature dependence of dielectric polarizations - Determination of dielectric constant by capacitance Bridge method - Ferro electricity - Barium Titanate – Piezo electricity – Super capacitor.

Nanomaterials: Introduction - Properties of materials at reduced size - Surface to volume ratio – Quantum confinement effect – Classification of nanomaterials - Preparation of nanomaterials: bottom–up methods (e.g., Sol Gel method and Chemical Vapor Deposition method), Top-down methods (e.g., Ball milling method) - Basic ideas of carbon nanotubes – Applications of nanomaterials and their health hazards.

UNIT-V

Magnetic Materials: Origin of magnetism (Orbital and Spin magnetic moments) - Classification of magnetic materials: dia, para, ferro, antiferro and ferrimagnetic materials – Weiss molecular field theory of ferromagnetism - Magnetic domains - Hysteresis curve - Soft and hard magnetic materials – Ferrites: Applications of ferrites.

Superconductivity: Introduction - General properties of super conductors - Meissner effect - Type I and Type II superconductors - BCS theory (qualitative) – Introduction to High T_c superconductors - Applications of superconductors.

Suggested Reading:

a) M.S. Avadhanulu and P.G. Kshirasagar - Engg. Physics, S.Chand & Co.

b) C.M. Srivastava and C. Srinivasan - Science of Engg. Materials, New Age International.

c) R.K. Gour and S.L. Gupta – Engg. Physics, Dhanpat Rai Publications.

d) B.K. Pandey and S.Chaturvedi – Engineering Physics, Cengage Learning.

e) A.K Bhandhopadhya - Nano Materials, New Age International.

Course Code ES 101 CS	PROGRAMMING FOR PROBLEM SOLVING						Credits
	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

Course Objectives :

1 To introduce the basic concepts of Computing environment, number systems and flowcharts

2 To familiarize the basic constructs of C language – data types , operators and expressions

3 To understand modular and structured programming constructs in C

4 To learn the usage of structured data types and memory management using pointers

5 To learn the concepts of data handling using files

Course Outcomes :

On completion of this course, the student will be able to :

CO-1 Explain various functional components in computing environment

CO-2 Develop algorithmic solutions to problems and draw the flow charts

CO-3 Explain and use basic constructs of C in writing simple programs

CO-4 Use standard library functions in C and develop modular programs using user defined functions and structured data types

CO-5 Use files and file handling for applications.

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	-	1	-	-	-	1	-	1
CO2	3	3	2	-	1	-	-	-	1	-	1
CO3	3	2	2	-	2	-	-	-	-	-	1
CO4	3	3	3	1	2	-	-	-	1	-	1
CO5	2	2	3	1	3	-	-	-	1	-	1

UNIT – I

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. **Number Systems**: Binary, Octal, Decimal, And Hexadecimal.

Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements

Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

UNIT – II

Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and Go to statements.

Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. **Recursion-** Recursive Functions. **Storage Classes:** Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers

UNIT– III

Pre processors: Pre processor Commands.

Arrays - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two-Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.

UNIT – IV

Pointers - Introduction, Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, L -value and R-value, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments.

Strings - Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions

UNIT –V

Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self Referential Structures, Unions, Type Definition (typedef), Enumerated Types.

Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/Output Functions, Character Input/Output Functions.

Suggested Reading:

1. B.A. Forouzan and R.F. Gilberg, "*A Structured Programming Approach in C"* , Cengage Learning, 2007
2. Kernighan BW and Ritchie DM, "*The C Programming Language"*, 2nd Edition, Prentice Hall of India, 2006.
3. Rajaraman V, "*The Fundamentals of Computer"*, 4th Edition, Prentice-Hall of India, 2006.
4. Dromey " *How to Solve it By Computer* , Pearson education, 2006

Course Code PC 101 EE	ELECTRICAL WIRING ESTIMATION AND INSTALLATION						Credits
	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

Course Objectives

1. To provide the knowledge and estimation of different electrical components selection and purchase.
2. To give awareness about electrical wiring.
3. To introduce the basic concepts of earthing and materials used for earthing.
4. To acquire the basic knowledge of domestic service wire and fuses.
5. To explain the students about different electrical ventilation systems and basic domestic wiring.

Course Outcomes:

After completion of this course, the students shall be able to:

- Understand different electrical components estimations.
- Construct wiring diagrams for different domestic and intertrial applications.
- Ability to design practical earthing circuits and usage of materials for earthing.
- Obtain the knowledge of fuses and installation of service wire.
- Apply the concepts electrical ventilations and installations of fan and lighting.

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

UNIT – 1

Estimation Principles: Estimation purpose Electrical Schedule, Catalogues, Market Survey and source selection, Recording of estimates, Determination of required quantity of material, Labor conditions, Determination of cost material and labor, Contingencies, Overhead charges, Profit, Purchase system, Purchase enquiry and selection of appropriate purchase mode, Comparative statement, Purchase orders, Payment of bills, Tender form.

UNIT – 2

Wiring and Safety Systems: Systems of distribution of electrical energy, Methods of wiring, Systems of wiring, Choice of wiring systems, general rules for wiring, Determination of number of points, total loads, sub circuits size of conductor, layout of wiring. Fuses, Fuse element material, Necessity of fuse, Types of fuses, Determination of size of fuse wire, Fuse units, HRC fuses, Working principle and installation of MCB, Service line, Service lines installation methods,

UNIT – 3

Installation of Lighting Sub – Circuits and Ventilation: Types of lighting circuits, Various circuit diagrams, two-way switching, bed room lighting. Methods of ventilation, Fans, Terminology, Ceiling fans, Table fans, Pedestal fans, Exhaust fans, Industrial fans, Fan selection, Desert coolers.

UNIT – 4

Earthing: Earthing specifications, Points to be earthed, Methods of reducing earth resistance, earth electrodes and earthing leads, Methods of earthing, Determination of size of earth wire and plate for domestic and motor, Materials required for pipe earthing, Specifications of earth wire and earth plate, Measurement of earth resistance, Effect of electric current on human body.

UNIT – 5

Electrical Installations: Motor installation, determination of input power,input current of motors rating of cable ,rating of fuses,size of conduit. Testing of installations reasons for excess recording of energy consumption by energy meter.

Suggested Reading:

1. J.B.Gupta, "A Course in Electrical Installation Estimating & Costing" S.K.Kataria and Sons, Ninth Edition, reprint 2016.
2. K.B. Raina & S.K. Bhattacharya, "Electrical Design, Estimating and Costing", New age international publishers, 1991.
3. S.L.Uppal, "Electrical Wiring, Estimating and Costing" Khanna Publishers, seventh reprint 2006.
4. Robert C. Elsenpeter, m Toby J. Velte, "Build Your Own Smart Home", McGraw-Hill,

Course Code	ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS						Credits
PC 102 EE							
	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

Course objectives:

The course is taught with the objectives of enabling the student to:

1. Understand conducting and semiconducting materials used in electrical engineering.
2. Understand insulating, magnetic and dielectric materials and their applications.
3. Study non-ferrous alloys, ceramics and advanced engineering materials.
4. Understand dielectric behavior and insulation performance under electrical stress.
5. Understand superconducting and emerging materials for electrical applications.

Course Outcomes:

After successful completion of the course students will be able to

CO1: Explain conduction mechanisms in conductors and semiconductors for electrical applications.
CO2: Analyze the properties and applications of insulating and magnetic materials.
CO3: Evaluate and select non-ferrous alloys and ceramic materials for engineering applications.
CO4: Analyze dielectric behavior, insulation ageing and breakdown phenomena.
CO5: Assess superconducting and advanced materials for modern electrical systems.

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	3	3	-	-	-	-	1	-	-	-	-	1	1	1
CO3	3	2	1	-	-	-	1	-	-	-	-	1	2	1
CO4	3	3	-	2	-	-	2	-	-	-	-	1	2	1
CO5	3	2	-	1	-	-	1	-	-	-	-	2	1	2

UNIT I

Conducting materials: Review of metallic conduction on the basis of free electron theory- Fermi-Dirac distribution – variation of conductivity with temperature and composition, Materials for electric resistances- General Electric properties: brushes of electrical machines, lamp filaments, fuses and solder.

Semiconductors: Compound semiconductors – basic ideas of amorphous and organic semiconductor – preparation of semiconductor materials – zone-refining technique – fabrication of p-n-p junction.

UNIT II

Insulating Materials and their applications: Plastics, classification, Thermosetting materials, Thermo-plastic materials, Natural insulating materials, properties and their applications, Gaseous materials; Air, Hydrogen, Nitrogen, SF6 their properties and applications.

Magnetic materials: Classification of magnetic materials – origin of permanent magnetic dipoles – ferromagnetism - hysteresis curve – hard and soft magnetic materials – magnetic material used in electrical machines, instruments and relays.

UNIT III

Nonferrous Alloys and Ceramics: Aluminum Alloys, Magnesium and Beryllium Alloys, Copper Alloys, Nickel and Cobalt Alloys, Titanium Alloys. Ceramics: Bonding in Ceramics, Structures of Crystalline Ceramics, Defects in Crystalline Ceramics, Flaws in Ceramics, Synthesis and Processing of Crystalline Ceramics, Silica and Silicate Compounds, Inorganic Glasses, Glass-Ceramics, Processing and Applications of Clay Products

UNIT IV

Dielectrics: dielectric polarization under static fields – electronic, ionic and dipolar polarizations – behavior of dielectrics in alternating fields – mechanism of breakdown in gases, liquids and solids - factors influencing dielectric strength – capacitor materials Insulating materials – complex dielectric constant – dipolar relaxation dielectric loss insulator materials used – inorganic materials (mica, glass, porcelain, asbestos) – organic materials (paper, rubber, cotton silk, fibre, wood, plastics, bakelite)- resins and varnishes – liquid insulators (transformer oil) – gaseous insulators (air, SF6, and hydrogen) – ageing of insulators.

UNIT V

Superconducting Materials: Introduction, The Phenomenon of Superconductivity, Electrical Resistance Behavior at Low Temperature, The Critical Magnetic Field, The Meissner Effect, Two Fluid Model, Thermodynamics of Superconductors, Thermal Conductivity, Thermoelectric Power, The Energy Gap, The Isotope Effect, Flux Quantization, The Concept of Coherence Length and Positive Surface Energy, Determination of Energy Gap (Single Particle Tunneling), The Josephson Effect, Type II Superconductors, High Temperature Cuprate Superconductors and Later Discoveries.

Suggested Reading:

- Indulkar, C. S., and S. Thiruvengadam. *An Introduction to Electrical Engineering Materials*. Revised Edition. S. Chand & Company Ltd., 2008.
- Dekker, A. J. *Electrical Engineering Materials*. 1st Edition. Prentice Hall of India, 2008.
- Askeland, Donald R., Wendelin J. Wright, and Benjamin Wheatley. *The Science and Engineering of Materials*. 8th Edition. Cengage Learning, 2026.
- Sharma, R. G. *Superconductivity: Basics and Applications to Magnets*. 2nd Edition. Springer Series in Materials Science, Volume 214. Springer International Publishing, 2021.
- Raina, K. B., and Dr. S. K. Bhattacharya. *Electrical and Electronic Engineering Materials*. 10th Editi

BS 151 PH	**Engineering Physics Lab**						**PF**
Prerequisite if any:	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	-	**-**	**3**	**3**	**25**	**50**	**1.5**

Course Objectives:

b) To provide practical, experimental verification of fundamental physics concepts learned in lectures.

c) To familiarize students with the operation, calibration, and maintenance of modern laboratory equipment and electronic measuring devices such as Four probe setups, Hall effect setup, polarimeters, diodes, lasers, spectrometers, and multimeters.

d) To develop analytical and critical thinking skills. Students learn how to accurately record observations, perform graphical data analysis, apply experimental statistics, and estimate % of error and measurement precision.

e) To estimate and evaluate the physical properties of engineering materials and components (e.g., determining energy gap in semiconductors, magnetic hysteresis or dielectric constants).

f) To train students in the proper execution and documentation of scientific inquiry. This involves constructing proper experimental setups, drawing valid conclusions from collected data, and accurately maintaining laboratory records.

Course Outcomes:

a) Students learn to correlate theoretical physics concepts with real-world observations.

b) Students able to design experimental setups, conduct measurements, and compare your practical findings with theoretical models or calculations.

c) Students will gain expertise in handling advanced lab instruments (e.g., spectrometers, four-probe setups, and lasers etc.). This includes an understanding of instrument sensitivity, targeted accuracy, and error analysis.

d) This course trains the students in meticulous data recording, graphical representation, and logical deduction.

e) Students learn to identify discrepancies between expected and measured values and draw evidence-based conclusions.

List of Experiments:

a) To Estimate Radius of curvature of given lens by forming Newton's rings.

b) To determine specific rotatory power of a given solution by using Laurent's Half shade polarimeter.

c) To determine the wavelength of prominent spectral lines of mercury vapour lamp by plane diffraction grating with the help of spectrometer by using Normal Incidence Method.

d) To determine the Dielectric constant and Phase transition temperature of Lead Zirconium Titanate (PZT)/Barium Titanate ($BaTiO_3$).

e) To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron), and find out (a) Coercivity, (b) Retentivity and (c) Hysteresis loss.

f) To draw the I-V Characteristics of P-N Junction diode and to evaluate the value of potential barrier of the diode.

g) To find the values of Electrical conductivity and energy gap of Ge crystal by Four probe method.

h) To study V-I characteristics of Light Emitting Diode.

i) Determination of carrier concentration, Mobility and Hall Coefficient of Ge Crystal using Hall Effect Experiment.

j) To calculate the Numerical aperture (NA), acceptance angle of a given optical fibre.

k) Determination of wavelength of LASER using diffraction grating.

l) To determine the constants of A, B and α of given Thermistor.

ES151CS	**PROGRAMMING FOR PROBLEM SOLVING LAB**					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50	**CIE**		25	

Course Objectives :	
1	To use tools available under LINUX for C programming
2	To gain hands-on experience on basic constructs of C programming
3	To formulate problems and implement algorithmic solutions in C
4	To write modular programs in C using structure programming techniques and data files.
5	To gain hands-on experience in using Python Programming constructs

Course Outcomes :	
On completion of this course, the student will be able to:	
CO-1	Write, compile and debug C programs in Linux environment
CO-2	Write simple programs using control structures, user defined functions and data manipulation using arrays
CO-3	Use standard C library functions to develop modular programs in C
CO- 4	Write basic Python Programs, using conceptual understanding of Programming.
CO-5	Create Programs, solutions for any problem statements with Programmatic, logic based approach.

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2		3						1	1
CO2	3	3	2		2						1	1
CO3	3	2	3		2	1					1	2
CO4	3	3	3	2	2						1	1
CO5	3	3	3	2	2						1	2

List of Experiments

1. Introducing to programming Environment(Linux commands, editing tools such as vi editor, sample program entry, compilation and execution)
2. Write programs using arithmetic, logical, bitwise and ternary operators.

3. Write programs simple control statements : Roots of a Quadratic Equation, extracting digits of integers, reversing digits ,finding sum of digit ,printing multiplication tables, Armstrong numbers, checking for prime, magic number,
4. Sin x and Cos x values using series expansion
5. Conversion of Binary to Decimal, Octal, Hexa and Vice versa
6. Generating a Pascal triangle and Pyramid of numbers
7. Recursion: Factorial, Fibonacci, GCD
8. Finding the maximum, minimum, average and standard deviation of given set of numbers using arrays
9. Reversing an array ,removal of duplicates from array
10. Matrix addition , multiplication and transpose of a square matrix .using functions
11. Bubble Sort, Selection Sort ,
12. Programs on Linear Search and Binary Search using recursion and iteration
13. Functions of string manipulation**:** inputting and outputting string , using string functions such as strlen( ),strcat( ),strcpy( )……etc
14. Writing simple programs for strings without using string functions.
15. Finding the No. of characters, words and lines of given text file
16. File handling programs : student memo printing
17. Create linked list, traverse a linked list, insert a node, delete a node, reversing list.
18. Python Basics and Input/Output
    a) Print "Hello, Engineering Students!"
    b) Read two integers and display their sum, difference, product, quotient, and remainder.
    c) Calculate the area and circumference of a circle.
    d) Swap two numbers (with and without a temporary variable).
    e) Convert temperature from Celsius to Fahrenheit.
    f) Calculate simple and compound interest.
19. Develop programs using conditional statements.

    a) Find the largest of three numbers.
    b) Check whether a year is a leap year.
    c) Determine whether a number is positive, negative, or zero.
    d) Check whether a number is even or odd.
    e) Display grades based on marks using if-elif ladder.

f) Develop a menu-driven calculator using if-elif.

20. Develop programs using loops

a) Print multiplication table of a given number.
b) Generate first N Fibonacci numbers.
c) Find factorial of a number.
d) Check whether a number is prime.
e) Reverse a given integer.
f) Display Armstrong numbers between 1 and 1000.

21. Develop modular Python programs using functions.

a) Write a function to find the maximum of two numbers.
b) Write a function to calculate factorial using recursion.
c) Write a function to check palindrome.
d) Write a function to compute GCD of two numbers.
e) Write a function to determine whether a number is prime.
f) Create a menu-driven mathematical calculator using functions

22. Lists & Tuples - Perform operations on Python collections.

a) Read N numbers into a list and find the largest and smallest.
b) Compute average and median of list elements.
c) Remove duplicate elements from a list.
d) Sort a list in ascending and descending order.
e) Search an element using linear search.
f) Count frequency of each element in a list.

23. Develop programs using dictionaries.

a) Create a student dictionary containing Roll Number, Name, Branch, and CGPA.
b) Count frequency of characters in a string.
c) Count frequency of words in a paragraph.
d) Create a telephone directory using a dictionary.
e) Implement a simple student record management system using dictionaries.
f) Find the student with the highest marks from a dictionary of student names and marks.

Course Code	ENGINEERING GRAPHICS						Credits
ES 151 CE							
Prerequisite if any:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		
Basic Drawing Concepts	L	T	P		CIE	SEE	
	2	-	4	3	25	50	4

COURSE OBJECTIVES:

1	Introduce the fundamentals of engineering drawing standards, geometrical constructions, conic sections, and engineering curves.
2	Knowledge about AutoCAD software, coordinate systems, drawing tools, and basic drafting techniques for engineering graphics
3	Develop proficiency in the use of AutoCAD commands for creating, modifying, dimensioning, annotating, and printing engineering drawings.
4	Impart knowledge of engineering scales and orthographic projections of points, lines, planes, and solids.
5	Enhance visualization skills for drawing sectional views of Engineering solids and for effective graphical communication of engineering concepts.

COURSE OUTCOMES:

1	Apply the principles of engineering drawing to construct basic geometrical figures and curves using standard drawing practices.
2	Perform drafting operations using Auto CAD 2D commands to create, edit, dimension, and print engineering drawings.
3	Draw engineering scales and apply projection principles to points, straight lines, and various views of 2D and 3D objects.
4	Develop projections, sectional views, of regular solids, including prisms, pyramids, cylinders, and cones, in various orientations.
5	Demonstrate visualization and graphical communication skills using engineering drawing and CAD tools.

CO – PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	1	1	-	-	-	2	-	2	1	1	-	2	2	2
CO-2	1	1	-	-	-	2	-	2	1	1	-	2	2	2
CO-3	1	1	-	-	-	2	-	2	1	1	-	2	2	2
CO-4	1	1	-	-	-	2	-	2	1	1	-	2	2	2
CO-5	1	1	-	-	-	2	-	2	1	1	-	2	2	2

UNIT 1:

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering.

Geometrical Constructions (General method only), Conic sections (General and special method); Cycloid, Epicycloid, Hypocycloid and Involute (line, triangle, square, circle, Regular Polygons), Construction of Tangent and Normal to all General methods of Conic sections, Cycloid, Epicycloid, Hypocycloid and Involutes.

UNIT 2:

Overview of Computer Graphics: Listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning, Snap to objects manually and automatically; Drawings straight lines using various coordinate input entry methods, Applying various ways of drawing circles.

UNIT 3:

Commands, initial settings, Drawing basic entities, Modify commands, Text and Dimensioning, Blocks Applying dimensions to objects, applying annotations to drawings.

Setting up and use of Layers, Create, edit and use customized layers; Changing line lengths through modifying existing lines (Extend/Lengthen); Printing Options.

UNIT 4:

Scales – Reduced and Enlarged scales, Representative Fraction, Problems - Plain, Diagonal and Vernier Scales,

Projections of Points – projection when placed in different quadrants

Projection of Straight lines – Projections when parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes.

UNIT 5:

Projections of Planes – Projections when parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes.

Projections of Regular Solids – Projections covering those parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes.

Sections of Solids - sectional Views of Right regular solids covering Prism, Cylinder, Pyramid, and Cone

Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, SciTech Publishers
5. S.N. Lal., Engineering Drawing (2018), M/s. Cengage Learning India Pvt. Ltd., Pratap Gunj, Delhi
6. CAD Software Theory and User Manuals.

Course Code	BASIC ELECTRICAL ENGINEERING (ECE, CSE, AIML)						Credits
ES 101 EE							
	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:

The course is taught with the objectives of enabling the student to:

1 To understand the fundamentals of DC electrical circuits.

2 To understand the fundamentals of AC electrical circuits

3 To understand the working principles of Transformers

4 To understand the working principles of DC motor and DC generator

5 To understand working principles of protection devices used in electrical circuits.

Course Outcomes:

On completion of this course, the student will be able to :

CO-1 Analyze the performance of simple electrical circuits & Apply different theorems to solve complicated electrical circuits to obtain the current, voltage and power. and AC excitations.

CO-2 Analyze the performance of simple electrical circuits exciting with DC

CO-3 understand the working principles of Transformers and AC Motors

CO-4 Understand the main components, characteristics, applications of different DC and AC electrical machines used in industry.

CO-5 Understand the importance of protective devices and their rating used in electrical circuits and appliances required for any industry.

Course Articulation Matrix

.Course Outcome	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO 2
CO 1	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 3	3	2	2	-	-	1	-	-	-	-	-	-	2	3
CO 4	3	2	2	-	-	2	-	-	-	-	-	-	2	3
CO 5	3	2	1	-	-	2	-	-	-	-	-	-	2	3

Correlation rating**: Low / Medium / High – 1 / 2 / 3** respectively

UNIT – I : DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Ohm`s Law, KCL and KVL, series, parallel circuits, analysis of simple circuits with dc excitation. Thevenin`s, Norton`s & Superposition Theorems.

UNIT - II : AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, and RL, RC, RLC combinations (series only). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - III: Transformers

Transformers: Electromagnetic induction, Faradays laws, statically induced EMF, EMF equation, ideal and practical transformer, OC & SC tests , losses and efficiency, Auto-transformer and three-phase transformer connections.**AC Motors**: Induction Motors and BLDC Motors,Principle of operation ,Advantages and Applications.

UNIT IV: - DC Machines

DC Generators: Dynamically induced emf, construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications
DC Motors: Principle of working, Torque expression**,** Types of DC Motors, characteristics, applications.

UNIT - V: Electrical Installations

Components of LT Switchgear: Switch, Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing & types of Earthing. Elementary calculations for energy consumption, power factor improvement by capacitors.

Suggested Reading:

1 J.B.Gupta, “Fundamentals of Electrical Engineering and Electronics” S.K.Kataria & Sons Publications, 2002.
2 J.B.Gupta, “Utilization of Electric Power and Electric Traction” S.K.Kataria & Sons Publications, 2010
3 V.N.Mittle,Aravind Mittal “Basic Electrical Engineering” *Tata Mc.Graw Hill Publicationss* second edition2007.
4 Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Wesley Longman Inc., 1995.
5. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda,“Basic Electrical Engineering” Tata McGraw Hill, Publications, 2009

Course Code	BASIC ELECTRICAL ENGINEERING LAB (CSE,ECE, AIML)						Course Type Core/PF/FE
ES 151 EE							core
Prerequisite if any:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	3		25	50	1.5

Course Objectives:

The course is taught with the objectives of enabling the student to:

1 To understand the fundamentals of DC and AC electrical circuits.

2. To Analyze the balanced three phase circuits to obtain the current, voltage and power.

3. To understand the working principles of Transformers and three phase transformer connections

4 To understand the working and performance characteristics of DC Motors

5 To understand the Magnetization characteristics of DC Generators

Course Outcomes:

On completion of this course, the student will be able to:

CO-1 Get an exposure to common electrical components and their ratings.

CO-2 To Make electrical connections by wires of appropriate ratings.

CO-3 Understand the usage of common electrical measuring instruments.

CO-4 Analyze the performance of AC and DC circuits with appropriate operating conditions.

CO-5 Understand the basic operation ahd characteristics of transformers and electrical machines.

Course Outcome	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 3	3	2	2	-	-	-	-	-	-	-	-	-	2	3
CO 4	3	2	2	-	-	-	-	-	-	-	-	-	2	3
CO 5	3	2	2	-	-	-	-	-	-	-	-	-	3	3

Correlation rating:**Low / Medium / High – 1 / 2 / 3** respectively

List of Laboratory Experiments/Demonstrations:

I - Cycle

Demonstration: Basic safety and precautions - Introduction and use of measuring instruments, characteristics of machines: DC machine, and three phase transformer connections.

1. Verification of Kirchhoff's Laws
2. Verification of Thevenin's & Norton's Theorems
3. Verification of superposition Theorem
4. Sinusoidal steady state response of series R-L-C circuits-impedance calculation and verification
5. Open Circuit &Short Circuit Test on single phase Transformer
6. Steady-state and transient time-response of R-C circuit to a step change in voltage
7. Load test on single phase transformer: Measurement of primary and secondary voltages, currents and power
8. Three-phase Transformer: Star and Delta connections. Voltage and current relationship
9. Performance Characteristics of DC-Shunt Motor
10. Magnetization curve of a separately excited DC Generator

Suggested Reading:

1 J.B.Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K.Kataria & Sons Publications, 2002.

2 J.B.Gupta, "Utilization of Electric Power and Electric Traction" S.K.Kataria & Sons Publications, 2010

3 V.N.Mittle,Aravind Mittal "Basic Electrical Engineering" *Tata Mc.Graw Hill Publicationss* second edition2007.

4 Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Wesley Longman Inc., 1995.

5. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda,"Basic Electrical Engineering" Tata McGraw Hill, Publications, 2009

SCHEME OF INSTRUCTION AND EVALUATION

B.E. (Electrical and Electronics Engineering)

II – Semester

S No	Code	Course Title	Scheme of Instruction			Contact Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	BS 201 MT	Differential Equations and Fourier series	3	-	-	3	3	40	60	3
2	BS201 CH	Engineering Chemistry	3	-	-	3	3	40	60	3
3	HS201 EG	Communicative English	3	-	-	3	3	40	60	3
4	ES 201 EC	Analog Electronics	3	-	-	3	3	40	60	3
5	PC 201 EE	Power Systems-I	3	-	-	3	3	40	60	3
Practicals										
6	BS 251 CH	Engineering Chemistry Lab	-	-	3	3	3	25	50	1.5
7	HS 251 EG	Communicative English Lab	-	-	3	3	3	25	50	1.5
8	ES 252ME	Workshop Practice	-	-	6	6	3	25	50	3
9	ES 252 EE	Computer Aided Electrical Drawing lab	-	-	3	3	3	25	50	1.5
Total			**15**	**-**	**15**	**30**	**24**	**300**	**500**	**22.5**

Interdisciplinary Courses Offered to Other Departments

S.No.	Code	Course Title	Scheme of Instruction			Contact Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory(BME, CE, MINING, ME)										
1	ES 201 EE	Basic Electrical Engineering	3	-	-	3	3	40	60	3
2	ES 202 EE	Electrical Technology And Mechanical Technology	3	-	-	3	3	40	60	3
Practicals(BME, ME, MINING)										
3	ES 251 EE	Basic Electrical Engineering Lab	-	-	3	3	3	25	50	1.5

BS201MT	**Differential Equations and Fourier series**						**Course Type Core/PF/FE**
Prerequisite if any:	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
Mathematical Knowledge of 12th/ Intermediate level	3	-	-	3	40	60	3

Course Objectives:

- To study the ordinary differential equations of first order.
- To study the linear ordinary differential equations of second and higher order with variable and constant coefficients.
- To apply general methodology to solve linear first order and second order partial differential equations.
- To learn about expansion of functions by Fourier series.
- To study the classification of second order partial differential equations and solve them by using separation of variables methods.

Course Outcomes: After completion of this course, the students will be able to:

1. Find the solutions of ordinary differential equations of first order.
2. Find the solutions of linear ordinary differential equations of second and higher order with variable and constant coefficients.
3. Find the solutions of first and second order PDE.
4. Obtain the Fourier series for a given function.
5. Find solutions of the heat equation, wave equation, and the Laplace equation subject to boundary conditions.

Course Articulation Matrix:

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO**	**PO9**	**PO1 0**	**PO1 1**	**PO12**
CO1	3	2	2	1	1	1	-	-	1	-	-	2
CO2	3	2	1	2	2	2	-	-	1	-	-	2
CO3	3	2	2	3	2	2	-	-	1	-	-	2
CO4	3	2	1	1	1	2	-	-	1	-	-	2
CO5	3	2	2	3	1	2	-	-	1	-	-	2

UNIT - I

Ordinary Differential Equations of First Order: Exact First Order Differential Equations, Integrating Factors, Linear First Order Equations, Bernoulli Equation, Application of Differential Equations of First Order –Newton's Law of Cooling, Rate of Decay of Radio – Active Materials.

UNIT - II

Linear Differential Equations: Introduction, Solutions of Linear Differential Equations, Linear Independence and Dependence, Methods for Solution of Linear Equations, Differential Operator ***D***, Solutions of Second and Higher Order Linear Homogeneous Equations with Constants Coefficients, Method of Reduction of Order for Variable Coefficient Linear Homogeneous Second Order Equations, Solutions of Non- Homogeneous Linear Equations, Method of Variation of Parameters,

Solution of Euler – Cauchy Equation, Operator Methods for Finding Particular Integrals Case $r(x)= e^{\alpha x}$, Case $r(x)=$ ***cos cos*** (αx) ***or sin***(αx), Case $r(x)= x^{\alpha}$, $\alpha>0$ and integer.

UNIT - III

Partial Differential Equations: Introduction, Formation of First and Second Order Equations, Solution of First Order Equations, Lagrange's Equation, Higher Order Linear Equations with Constant Coefficients.

UNIT - IV

Fourier series: Introduction, Fourier series, Fourier series Expansions of Even and Odd functions, Convergence of Fourier series, Fourier Half - Range Series.

UNIT - V

Applications of Fourier series: Classification of Linear Second Order Partial Differential Equations, Separation of Variables Method (Fourier Method) Fourier series Solution of the Heat Equation, Fourier series Solution of the Wave Equation, Fourier series solution of the Laplace Equation.

Suggested Reading:

6. R. K. Jain & S. R. K. Iyengar, Advance Engineering Mathematics, Narosa Publications, 5th Edition 2016 (Fifteenth Reprint 2026).
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley publications, 11thEdition, 2025.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 45th Edition, 2024(Reprint 2025).
4. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, 11th Edition, 2025.
5. H. K. Dass and Er. Rajnish Varma, Higher Engineering Mathematics, S. Chand Publications 3rd Revised Edition 2014(Reprint 2025).

e-resources: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ma98

BS 201 CH	**ENGINEERING CHEMISTRY**						
Prerequisite if any: Mathematical Knowledge of 12th/ Intermediate level	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**	**3**	**40**	**60**	**3**

Course Objectives:

- To understand the fundamentals and principles of water chemistry relevant to Engineering chemistry.
- To acquire the knowledge of polymers used for industrial purposes with various applications.
- Interpret spectroscopic data for structural elucidation of molecules.
- Analyze the spontaneity and equilibrium of chemical reactions.
- Apply knowledge of batteries and nanomataerials to aid in engineering and technical applications.

Course Outcomes:

- Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also the techniques of softening of hard water and treatment of water for drinking purpose. Gains knowledge in causes of corrosion and its prevention.
- Analyze the basic methods of reaction of organic molecules and study their properties.
- Distinguishes the ranges of electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalize bulk properties and processes using thermodynamic considerations.
- Apply the knowledge of basic fundamentals of nanoparticles to design nanosystems in every field.

Course Articulation Matrix:

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**		
CO2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**		
CO3	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**		
CO4	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**		
CO5	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**		

UNIT-I

Water Chemistry and Corrosion:

Water chemistry: Hardness of water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Water softening by Ion exchange and Reverse Osmosis methods. Boiler troubles-scales and sludges formation-causes, effects and prevention. Numerical problems.

Specifications of potable water. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization by Chlorination.

Corrosion-causes and its effects. Types of corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion and its types. Factors influencing rate of corrosion.
Corrosion control methods: Cathodic protection methods- Sacrificial anodic and impressed current cathodic protection methods. Surface coating methods: Hot dipping-Galvanizing and Tinning.

UNIT-II
Reaction Mechanism and Polymers:
Reaction Mechanism: Introduction - Addition, Substitution and Elimination reactions. Addition to C=C and C=O, Nucleophilic substitution in aliphatic system: SN^1 and SN^2 mechanism, Elimination reactions: E^1 and E^2 mechanism
Polymers: Introduction, Classification of polymers -Plastics, Fibres and Elastomers.
Preparation, properties and engineering applications of the following polymers:
Plastics: PVC and Bakelite
Fibers: Nylon 6:6, and Dacron.
Elastomers: Buna-S and Butyl Rubber.
Conducting polymers: Introduction. Mechanism of conduction in polymers. Intrinsic conducting polymers: Poly-acetylene and poly-aniline. Applications of conducting polymers. Biodegradable polymers, Applications of polymers in concrete materials – Epoxy resins.

UNIT-III
Molecular Structures and Spectroscopy:
Molecular Orbital Theory. Linear Combination of Atomic Orbital's (LCAO).Molecular Orbital energy level diagrams of diatomic molecules-O_2, N_2 and NO.
Description of Electromagnetic spectrum.
Principles of UV-Visible Spectroscopy: Statement of Beer-Lambert Law. Chromophores and Auxochromes. Absorption and intensity shifts: Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts with one example each. Principle and applications of UV Sensors.
IR Spectroscopy: Principle of IR Spectroscopy.IR active and IR inactive molecules (two examples each). Types of vibrational bands, Degrees of Freedom for linear and non linear molecule, Principle and applications of IR Sensors.
NMR Spectroscopy: Principle of ^{1}H-NMR Spectroscopy. Multiplicity, Chemical Shift. Example-Ethyl chloride, Principle and Applications of MRI.

UNIT-IV
Thermodynamics and Electro Chemistry:
Thermodynamics: Terminology of Thermodynamics, thermodynamic processes, Work done in Reversible isothermal and adiabatic processes, efficiency of heat engine by Carnot cycle, concept of entropy, physical significance of entropy, Work function, Gibbs free energy and their significance, variation of free energy with temperature and pressure, criteria of spontaneity in terms of entropy and free energy-Numericals.
Electrochemistry: Electrochemical cells- Electrolytic and Galvanic cells, cell-notation, cell reaction and cell potentials. Types of electrodes-Calomel, and Glass electrode. Determination of P^H of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells-Nernst equation and its derivation. Application of Nernst equation & Numericals.
Principles and applications of Conductometric titrations.

UNIT-V
Energy Sources and Nanomaterials:
Batteries: Primary batteries-Zn carbon battery. Secondary batteries-Pb- Acid battery and Ni-Cd battery. Lithium-ion batteries- advantages and applications.

Fuel cells: Concept of fuel cells and their advantages. Construction and working of H_2-O_2 and methanol-Oxygen fuel cells.
Solar cells: Concept of solar energy conversion, photovoltaic cells.
Nanomaterials: Introduction. Properties of nanomaterials. Synthesis of nanomaterials-Top down, Bottom up approach and Sol-gel method. Applications of nanomaterials.

Suggested Readings:

1. Jain & Jain, *Engineering chemistry*, Dhanpat Rai publishing Co., 17 th Edition .
2. Shashi Chawla, Text book of Engineering chemistry. Danpat rai & Co.
3. Arun Bahl and BS Bahl, *A text book of Organic Chemistry*, S. Chand Co. Ltd., S. Chand Publishing, 2017.
4. Robert Silverstein spectrometric identifications of organic compounds, Journal of Chemical Education, ACS Publications.
5. L.D.S. Yadav, Organic Spectroscopy. Springer nature-2005.
6. Y.R. Sharma Elementary organic spectroscopy, S.Chand Publications.

HS 101 EG	COMMUNICATIVE ENGLISH						
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**	**3**	**40**	**60**	**3**

Course Objectives

1. To develop students' listening, speaking, reading, and writing (LSRW) skills for academic and professional communication.
2. To enhance vocabulary, grammar, and language accuracy for effective expression.
3. To improve comprehension and critical thinking through prose, poetry, biographies, and professional ethics.
4. To equip students with technical and professional writing skills such as report writing, email writing, presentations, and resume writing.
5. To enable students to communicate confidently and ethically in professional and social environments.

Course Outcomes:

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

1. Demonstrate effective listening, speaking, reading, and writing skills in academic and professional contexts.
2. Apply appropriate vocabulary, grammar, and language structures to communicate accurately and fluently.
3. Analyze literary and non-literary texts to develop comprehension, critical thinking, and interpretation skills.
4. Prepare professional documents such as reports, emails, letters, resumes, and presentations using appropriate formats and conventions.
5. Demonstrate ethical communication practices and interpersonal skills required for teamwork and professional success.

Course Outcome	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	-	-	-	-	-	-	3	3	-	2
CO2	3	2	-	-	-	-	-	-	2	3	-	2
CO3	2	3	-	-	-	-	-	2	2	2	-	3
CO4	2	2	-	-	1	-	-	-	2	3	-	2
CO5	-	2	-	-	-	2	-	3	3	3	-	2

Correlation Rating: **Low/Medium/High-1/2/3 respectively**

Unit I

Prose: Silent Crisis | *Martha C Nussbaum*
Listening: What is Listening; Process of Listening; Importance of Listening
Speaking: Importance of Communication, Types of Communication (Non-verbal and Verbal)
Reading: Importance of Reading
Writing: Features of Writing Composition: Cohesions, Coherence, Precision and Clarity
Vocabulary and Grammar: Homonyms; Homophones; Homographs; Punctuation; Sentence Structure (Simple, Compound, Complex)

Unit II
Poem: Where the Mind is Without Fear | *Rabrindranath Tagore*
Listening: Types of Listening; Non-Verbal and Verbal Signs of Active Listening
Speaking: Types of Communication (Oral, Written, Visual)
Reading: Reading Skills: Skimming, Scanning
Writing: Discourse Markers and Linking Words; Paragraph Writing; Précis Writing
Vocabulary and Grammar: Root Words: Prefix, Suffix; Synonyms; Antonyms; Idioms and Phrasal Verbs; Concord

Unit III

Biography: Homi J. Bhabha
Listening: Effective Listening: Principles and Techniques
Speaking: Styles of Communication; Channels of Communication (Vertical, Horizontal, Interpersonal, Grapevine)
Reading: Intensive and Extensive Reading
Writing: Essay Writing; Report Writing
Vocabulary and Grammar: Words Often Confused; Tenses

Unit IV

Prose: A World Made by Atoms | *Margaret Cavendish*
Listening: Barriers to Effective Listening
Speaking: Barriers to Communication; Johari Window
Reading: SQ3R Method
Writing: Business Communication: Letter Writing; Resume Writing; Email Writing; Etiquette for WhatsApp /other Messaging Services
Vocabulary and Grammar: One Word Substitutes; Active and Passive; Reported Speech

Unit V

Prose: Professional Ethics
Listening: Note-Taking; Critical Listening Exercises
Speaking: Speaking To Communicate Effectively; Proverb Expansion through JAM
Reading: Critical and Inferential Reading Passages
Writing: Creating Writing

Vocabulary and Grammar: Technical Vocabulary; Common Errors in English; Correct Use of Prepositions and Articles; Avoiding Ambiguity; Misplaced Modifiers; Avoiding Redundancy

Suggested Readings:

1. Ashraf, M. Rizvi. *Effective Technical Communication*. Tata McGraw-Hill, 2006.
2. *Language and Life: A Skills Approach*. Orient Blackswan, 2018.
3. Raman, Meenakshi, and Sangeetha Sharma. *Technical Communication: Principles and Practice*. 2nd ed., Oxford University Press, 2011.
4. Swan, Michael. *Practical English Usage*. Oxford University Press, 1995.
5. Vijaya, B. *Communicative English and Employability Skills*. Orient Blackswan, 2026.

Course Code	ANALOG ELECTRONICS						Course Type Core/PF/FE
ES 201 EC							
Prerequisite if any:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

Course Objectives:

The course is taught with the objectives of enabling the student to:

1 To understand the diode characteristics.

2 To study the input and out characteristics of different Transistor configurations.

3 To understand the design concepts FET and amplifier.

4 To understand the concepts of Feedback

5 To understand the Applications of Oscillators

Course Outcomes:

On completion of this course, the student will be able to :

CO-1 Understand the characteristics of diodes and, Rectifiers

CO-2 Design and analyze amplifier circuits

CO-3 To be able analyze characteristics of FETS and MOSFET.

CO-4 Analyzing of +ve and negative feedback circuits

CO-5 Design sinusoidal oscillators.

Articulation matrix of Course Outcomes with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO1
CO1	3	2	3	1	2	1	-	-	-	-	-	2	3	2
CO2	3	2	2	1	2	1	-	-	-	-	-	2	3	2
CO3	2	3	3	2	2	1	-	-	-	-	-	2	2	3
CO4	2	3	3	2	2	1	-	-	-	-	-	1	2	3
CO5	3	2	1	1	2	-	-	-	-	-	-	-	3	2

UNIT – I

Semiconductors & diodes: Energy bands, Intrinsic and Extrinsic Semiconductors, Mobility and Conductivity, Band structure of PN Junction, Volt – Amp Characteristics, Temperature Dependence, Transition and Diffusion Capacitance of PN Junction, Zener Diode, Diode circuits: Diode as a rectifier-Half-wave, Full-wave and Bridge Rectifiers, types of Filters, Capacitor and inductor filter, zener diode as a voltage regulator, Ripple Factor and Regulation Characteristics.

UNIT- II

Bipolar Junction Transistor: NPN and PNP junction Transistors, Transistor current components CB, CE and CC Configurations and their Characteristics, Saturation, Cutoff and Active Regions Comparison of CE, CB and CC Configurations, Maximum voltage rating, the operating point, fixed bias, emitter stabilized bias circuits, Voltage-divider bias, Stabilization, Thermal Runaway, Therma Stability, High frequency model of a Transistor. The h parameters of the three transisto configurations, Analysis of Transistor Amplifier Circuits using h–parameters.

UNIT- III

Field Effect Transistors: The Junction field effect transistor, Pinch off Voltage, Volt-ampere characteristics, Drain Saturation Current, Small Signal model of FET, MOSFET – Enhancement and Depletion Modes. The low Frequency common source and common drain amplifiers, FET biasing

UNIT - IV

Feedback Amplifiers: Concept of Feedback, Feedback Amplifier Configurations, Circuits, Advantages of Negative feedback, Analysis of Simple feedback amplifiers using BJT and FET'

UNIT - V

Barkhausen Criterion, RC Oscillators: Wien Bridge, Phase shift, LC Oscillators: Hartley and Colpitt's Oscillators, Crystal Controlled Oscillators (analysis of oscillators using BJTs only), stability of oscillators.

Suggested Reading:

Millman J., Halkias C.C. and Satyabrata Jit, Electronic Devices and Circuits, 3rd edition,Tata McGraw-Hill, 2011.
S Salivahanan, N Kumar, and A Vallavaraj, Electronic Devices and Circuits, 2nd ed., McGraw Hill Education, 2007.
Millman J., Halkias C.C. and Parikh C, Integrated Electronics, 2nd edition, Tata McGrawHill, 2009.
JB Gupta, Electronic Devices and Circuits, S.K Kataria & sons, 5th Edition, 2012

Course Code							
PC 201EE	POWER SYSTEMS – I						
Prerequisite if any:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

Course Objectives:

The course is taught with the objectives of enabling the student:

1. To introduce the economic aspects of power generation and tariff methods and understand the concepts of A.C. and D.C. distribution.
2. To understand the working of conventional power plants like Thermal, Hydel and Nuclear.
3. To understand the basic working principles of renewable power plants like Solar, Wind and Gas Turbine power plants.
4. To understand about various overhead line components and cables.
5. To familiarize with transmission line parameter calculations.

Course Outcomes:

On completion of this course, the student will be able to:

- **CO-1** Evaluate various economic aspects of power generation like depreciation fund calculations and Tariffs and perform A.C. and D.C. distribution calculations.
- **CO-2** Understand the operation of conventional power plants.
- **CO-3** Understand the basic working principle of renewable power plants like Solar, Wind, and Gas turbine plants.
- **CO-4** Evaluate the performance of overhead line insulators and underground cables and to perform sag calculations.
- **CO-5** Determine the electrical circuit parameters of transmission line.

Articulation matrix of Course Outcomes with POs:

Course Outcome	Program Outcome													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO-2	3	2	1	-	-	-	2	-	-	-	-	2	3	-
CO-3	3	2	1	-	-	-	2	-	-	-	-	3	3	-
CO-4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO-5	3	3	3	-	-	-	-	-	-	-	-	-	3	-

Economics of Power Generation: Load Curve, Load Demand and Diversified factors, Base Load and Peak load operation, Types of costs and depreciation fund calculations, Methods of power factor improvement, Economics of power factor improvement, Tariffs, Distribution: 2 wire and 3 wire distributors, Ring mains, AC distribution calculations.

UNIT – II

Steam Power Stations: Choice of site, Layout & various parts of station, Boilers, Turbines, Super Heaters, Economizers, Air pre-heaters etc. and their Pulverized fuel, Coal handling.

Hydro-Electric Power plants: Estimation Hydrograph, Flow duration curve, Mass curve, Storage and pondage, Types electric plants and layouts, Prime movers for hydroelectric

plants.

UNIT – III

Nuclear Power Plants: Fissile materials, working principle of nuclear plants and reactor control, Shielding, Types of reactors.

Non-Conventional Energy Sources: Basic principles of Wind, solar and gas turbines.

UNIT – IV

Over-Head Lines: Supports sag and tension calculations, Effect of wind and ice, Erection conditions, Insulators: Types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, Testing of insulators.

Insulated Cables: Conductors for cables, Insulating materials, Mechanical protection, Low voltage cables, Grading of cables, Three phase high voltage cables and Super voltage cables, Capacitance of three-core cables.

UNIT – V

Inductance and Capacitance of Transmission Lines: Inductance and capacitance of overhead line conductors, Single phase and three phase with symmetrical composite conductors, GMR and GMD Spacing, Transposition, Bundled conductors, Effect of earth capacitance.

Suggested Reading:

1	Wadhwa C.L., *Electrical Power Systems*, New Age International (P) Ltd., 8th Edition, 2022.
2	Wadhwa C.L., *Generation, Distribution and Utilization of Electrical Energy*, New Age International (P) Ltd., 4th Edition, 2017.
3	Singh S.N., *Electrical Power Generation*, Transmission and Distribution, Prentice Hall of India, Pvt. Ltd., New Delhi, 2nd Edition, 2008.
4	V.K. Mehta, *Principles of Power Systems*, S. Chand and Co., 7th Edition, 2021.

BS 251 CH	**ENGINEERING CHEMISTRY LAB For EEE/ECE/CSE/ AI&ML branches**						
Prerequisite if any: Mathematical Knowledge of 12th/Intermediate level	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	-	-	**3**	**25**	**50**	**1.5**

Course Objectives:

- To know the quality standards of potable water for health based limits.
- To perform the routine synthesis of commonly used drug in the laboratory.
- Apply electrochemical principles in conductivity, Electrode potentials and verification of Beer' s law.
- To Evaluate Iron content from Iron ores.
- To Synthesize an extensively used polymer in industry.

Course Outcomes:

The chemistry laboratory course use consist of experiments illustrating the principle of chemistry relevant to the study of science and engineering.The students will learn to:

- Estimate te hardness of Water in various water samples.
- Synthesize a small molecule drug.
- Measure of conductance of solutions and redox potentials .
- Analysis of Iron content in Iron ore.
- Synthesize an extensively used polymer in industry

Course Articulation Matrix:

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**2**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**		
CO2	**2**	**3**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**2**		
CO3	**2**	**2**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**2**		
CO4	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**2**		
CO5	**3**	**2**	**1**	**1**	**-**	**1**	**1**	**1**	**-**	**-**	**-**	**1**		

List of Experiments:-

I) Water analysis.

1) Determination of Total hardness of water by EDTA method.
2) Determination of Permanent hardness of water by EDTA method.

II) Synthesis of a drug molecule:

3) Synthesis of Aspirin.

III) Colorimetry:

4) Verification of Beers law and Estimation of the given permanganate.
5) Verification of Beers law and Estimation of the given $CuSO_4$.

IV) Conductance measurements:

6) Determination of cell constant.
7) Estimation of HCl and CH_3COOH by conductometric titration.

V) Potentiometric Measurements:

8) Estimation of HCl by potentiometric titration.
9) Estimation of ferrous iron by potentiometric titration.

VI) Extraction of Iron From Hematite:

10) Determination of Iron in Hematite.

VII) Synthesis of Polymer:

11) Preparation of phenol-Formaldehyde Resin.

References:

1. Senior Practical Physical Chemistry, B.D.Khosla, A.Gulati and V.Garg (R.Chand&Co., Delhi)

2. An Introduction to Practical Chemistry,K.K.Sharma and D.S.Sharma (Vikaspublishing, N.Delhi)

HS 151 EG	COMMUNICATIVE ENGLISH LAB						
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	-	**-**	**3**	**3**	**25**	**50**	**1.5**

Course Objectives:

1. To develop learners' pronunciation skills through an understanding of the English sound system, stress, and intonation.
2. To enhance contextual and collaborative communication skills for academic, social, and workplace settings.
3. To improve fluency, confidence, and interpersonal communication through interactive language activities.
4. To develop employability skills required for interviews, group discussions, presentations, and professional interactions.
5. To foster effective communication, teamwork, and lifelong learning skills necessary for career growth.

Course Outcomes:

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

1. Demonstrate correct pronunciation using the English sound system, stress patterns, and intonation in spoken communication.
2. Communicate effectively in various contexts using appropriate verbal and non-verbal communication skills.
3. Participate actively in collaborative communication activities, demonstrating teamwork and interpersonal skills.
4. Apply employability communication skills in interviews, group discussions, presentations, and workplace interactions.
5. Exhibit confidence, professionalism, and ethical communication practices for lifelong learning and career development.

Course Outcome	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	-	-	-	-	-	-	-	2	3	-	2
CO2	-	1	-	-	-	-	-	1	2	3	-	2
CO3	-	-	-	-	-	-	-	1	3	3	-	2
CO4	-	1	-	-	-	1	-	2	2	3	-	2
CO5	-	-	-	-	-	2	-	3	3	3	-	3

Correlation Rating: **Low/Medium/High-1/2/3 respectively**

Unit I English Sound System

a. Sounds of English
b. Vowels
c. Consonants
d. Using Dictionary to decode Phonetic Transcription
e. Transcription exercise with the help of CALL (Computer Aided Language Lab)

Unit II Stress and Intonation

a. Syllable
b. Word-Stress and its importance
c. Intonation-Falling and Rising tone
d. Listening comprehension: Listening to various accents & Listening practice and exercises

Unit III Contextual Conversation Skills

a. JAM
b. Picture Perception
c. Public Speaking
d. Role plays: Use of dialogues in various situations like Social, Formal, Academic and Professional contexts.

Unit IV Collaborative Communication

a. Group discussion forms and techniques
b. Mock GDs
c. Factual GDs and Controversial GDs
d. Abstract GDs and Case Studies
e. Debate: Form, techniques, topics for mock debates in class

Unit V Employability Communication

a. Presentation Skills
b. Presentations with emphasis on visual aids and body language,
c. Interview Skills: Techniques
d. Frequently asked Interview Questions
e. Mock interviews

Suggested Readings

- Kumar, E. Suresh, and P. Sreehari. *A Handbook for English Language Laboratories*. Cambridge University Press, 2014.
- Balasubramanian, T. *A Textbook of English Phonetics for Indian Students*. Macmillan, 2008.
- Sethi, J., et al. *A Practical Course in English Pronunciation*. Prentice Hall of India, 2005.

- Prasad, Hari Mohan. *How to Prepare for Group Discussions and Interviews*. Tata McGraw-Hill, 2006.
- *English for Engineers and Technologists*. Combined ed., vols. 1–2, Orient Blackswan, 2010.
- Vijaya, B. *Communicative English and Employability Skills*. Orient Blackswan, 2026.

Suggested Software:

II Sky Pronunciation Suite
III K-van Software
IV Study Skills
V English Pronunciation Dictionary –CALD

Course Code	**COMPUTER AIDED ELECTRICAL DRAWING LAB**						**Credits**
ES 151 EE							
Prerequisite if any:	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		
	L	**T**	**P**		**CIE**	**SEE**	
	-	**-**	**3**		**25**	**50**	**1.5**

Course Objectives:

1. Understand the fundamentals of electrical engineering drawings and standard drafting practices.
2. Develop skills in preparing electrical installation, machine and power system drawings.
3. Familiarize with the constructional and schematic representations of electrical machines and electrical equipment.
4. Acquire the ability to prepare transmission, distribution and substation engineering drawings.
5. Develop the ability to interpret and document electrical engineering drawings and single-line diagrams.

Course Outcomes:

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

CO1: Prepare standard electrical, electronic and electromechanical drawings.
CO2: Develop electrical installation drawings including wiring, illumination and earthing systems.
CO3: Prepare constructional, winding and starter schematics of electrical machines.
CO4: Develop transmission, distribution and substation engineering drawings.
CO5: Create and interpret single-line diagrams of electrical power systems.

CO`s/ PO`s	**PO1**	**PO2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	2	1	-	-	3	-	-	-	-	1	-	1	1	1
CO2	2	2	1	-	3	-	-	-	-	1	-	1	1	1
CO3	2	2	1	-	3	-	-	-	-	1	-	1	2	1
CO4	2	2	1	-	3	-	1	-	-	1	-	1	3	1
CO5	2	2	1	-	3	-	1	-	-	2	-	2	3	2

Drawing of the following using Electrical CAD / Corel Draw / MS Word / PPT/Visio

1) Basic CAD Operations: Lines, Arcs, Curves, Shapes, Filling of Objects, Object Editing and Transformations.
2) Electrical, Electronic and Electro-Mechanical Symbols.
3) Residential Electrical Wiring Diagrams and Layouts.
4) Illumination System and Lighting Layout Drawings.
5) Constructional Features of D.C. Motors, A.C. Motors and Transformers.
6) Electrical Machine Winding Diagrams and Motor Starter Schematics (A.C. & D.C.).

7) Power and Control Circuit Diagrams.
8) Different Earthing Systems.
9) Transmission Line Diagrams – ACSR Conductor Configurations and Tower Drawings.
10) Generating Station Layout Drawings
11) Substation and Distribution Network Layout Drawings
12) Single Line Diagrams (SLD) of Generation, Transmission and Distribution Systems.

Suggested Reading:

1. K.B. Raina and S.K. Bhattacharya, *Electrical Design, Estimating and Costing*, Wiley Eastern Ltd., November 2024
2. I.J. Nagrath and D.P. Kothari, *Electrical Machines*, Tata McGraw Hill Publishing Company Ltd., Nov 2018.
3. A.K. Sawhney, *A Course in Electrical Machine Design*, Dhanpat Rai and Sons, Sept 2018.
4. C.L. Wadhwa, *Electrical Power Systems*, New Age International Publishers, December 2022.
5. P.K. Nag, *Power Plant Engineering*, McGraw Hill Education, Jul 2021.
6. IEC 60617 / BIS Standards for Electrical Symbols and Drawings.

ourse Code	BASIC ELECTRICAL ENGINEERING LAB						Credits
ES 251 EE	(BME, MINING, ME)						
Prerequisite if any:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		
	L	T	P		CIE	SEE	
	-	-	3		25	50	1.5

Course Objectives :

The course is taught with the objectives of enabling the student to:

1 To understand the fundamentals of DC and AC electrical circuits.

2. To Analyze the balanced three phase circuits to obtain the current, voltage and power.

3. To understand the working principles of Transformers and three phase transformer connections

4 To understand the working and performance characteristics of DC Motors

5 To understand the Magnetization characteristics of DC Generators

Course Outcomes:

On completion of this course, the student will be able to :

CO-1 Get an exposure to common electrical components and their ratings.

CO-2 To Make electrical connections by wires of appropriate ratings.

CO-3 Understand the usage of common electrical measuring instruments.

CO-4 Analyze the performance of AC and DC circuits with appropriate operating conditions.

CO-5 Understand the basic operation ahd characteristics of transformers and electrical machines.

Course Outcome	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 3	3	2	2	-	-	-	-	-	-	-	-	-	2	3
CO 4	3	2	2	-	-	-	-	-	-	-	-	-	2	3
CO 5	3	2	2	-	-	-	-	-	-	-	-	-	3	3

Correlation rating**: Low / Medium / High – 1 / 2 / 3** respectively

List of Laboratory Experiments/Demonstrations:

I - Cycle

Demonstration: Basic safety and precautions - Introduction and use of measuring instruments, characteristics of machines: DC machine, and three phase transformer connections.

1. Verification of Kirchhoff's Laws
2. Verification of Thevenin's & Norton's Theorems
3. Verification of superposition Theorem
4. Sinusoidal steady state response of series R-L-C circuits-impedance calculation and verification
5. Open Circuit &Short Circuit Test on single phase Transformer
6. Steady-state and transient time-response of R-C circuit to a step change in voltage
7. Load test on single phase transformer: Measurement of primary and secondary voltages, currents and power
8. Three-phase Transformer: Star and Delta connections. Voltage and current relationship
9. Performance Characteristics of DC-Shunt Motor
10. Magnetization curve of a separately excited DC Generator

Suggested Reading:

1 J.B.Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K.Kataria & Sons Publications, 2002.

2 J.B.Gupta, "Utilization of Electric Power and Electric Traction" S.K.Kataria & Sons Publications, 2010

3 V.N.Mittle,Aravind Mittal "Basic Electrical Engineering" *Tata Mc.Graw Hill Publicationss* second edition2007.

4 Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Wesley Longman Inc., 1995.

5. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda,"Basic Electrical Engineering" Tata McGraw Hill, Publications, 2009

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