Program: B.TECH. (ELECTRICAL) Semester – I CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/ OR/ PR	T	Total
1		Partial differentiation and complex numbers	3	-	1	60	40	-	-	-	100	3	-	1	4
2		Modern Physics	3	2	-	60	40	50	-	-	150	3	1	-	4
3		Electromagnetics and its applications	4	2	-	60	40	25	-	25	150	4	1	-	5
4		Solid State Devices &Electronic Circuits	4	2	-	60	40	25	-	25	150	4	1	-	5
5		Computer Architecture & Data Structures with C	4	2	-	60	40	25	25	-	150	4	1	-	5
6		Electrical Workshop Practices	-	4	-	-	-	50	-	-	50	-	2	-	2
	Total		18	12	1	300	200	175	25	50	750	18	6	1	25

Program: B.TECH. (ELECTRICAL) Semester – II CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/ OR/ PR	T	Total
1		Mathematics for electrical engineering	4	-	1	60	40	-	-	-	100	4	-	1	5
2		Electro-Chemistry	3	2	-	60	40	50	-	-	150	3	1	-	4
3		Instrumentation & Measurements	4	2	-	60	40	25	-	25	150	4	1	-	5
4		Industrial Safety Practices	3	2	-	60	40	25	25	-	150	3	1	-	4
5		Object oriented programming with C++	4	2	-	60	40	25	-	25	150	4	1	-	5
6		Simulation & Programming	-	4	-	-	-	25	-	25	50	-	2	-	2
	Total		18	12	1	300	200	150	25	75	750	18	6	1	25

Bharati Vidyapeeth Deemed to be University, Pune
Faculty of Engineering & Technology
Programme :B.Tech (Electrical Engineering) Sem – I (2021 Course)

Partial Differentiation and Complex Numbers

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours/Week	End Semester Examination : 60 Marks	Theory : - 03
Tutorial: 01 Hours/Week	Continuous Assessment: 40 Marks	Tutorial : - 01
		Total : - 04

Course Pre-requisites:

The Students should have knowledge of

Basics of Complex number, derivatives and integration.

Course Objectives:

To study

- Ordinary and partial differentiation.
- Vector calculus and its applications.
- Complex differentiation and integration.

Course Outcomes: Students will be able to

1.	Understand methods of finding nth derivative of functions.
2.	Understand methods of finding partial derivatives.
3.	Understand the method of locating stationary points and value.
4	Understand line, surface and volume integral.
5	Understand the analytic functions.
6	Understand methods of evaluating contour integration

UNIT - I	**Differential Calculus and Expansion Of Functions:**	**(06 Hours)**
	Successive Differentiation, nth Derivatives of Standard Functions, Leibnitz's Theorem, Taylor's Series and Maclaurin's Series.	
UNIT - II	**Partial Differentiation And Applications:**	**(06 Hours)**
	Partial Derivatives, Euler's Theorem on Homogeneous Functions, Implicit functions, Total Derivatives, Change of Independent Variables. Errors and Approximations.	
UNIT - III	**Jacobian and Maxima And Minima:**	**(06 Hours)**
	Jacobians and their applications, Chain Rule, Functional Dependence. Maxima and Minima of Functions of two variables, Lagrange's method of undetermined multipliers.	
UNIT - IV	**Vector Integral Calculus and Applications:**	**(06 Hours)**
	Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Fluid Mechanics, Continuity equations, Streamlines, Equations of motion, Bernoulli's equation.	
UNIT - V	**Complex Variables:**	**(06 Hours)**
	Function f(z) of complex variable, limit, continuity and differentiability of f(z),Analytic function, necessary and sufficient conditions for f(z) to be analytic (without proof),Cauchy-Riemann equations in Cartesian coordinates (without proof)Milne-Thomson method to determine analytic function f(z) when real part (u) or Imaginary part (v) or its combination (u + v or u-v) is given, Harmonic function, Harmonic conjugate and orthogonal trajectories.	
UNIT - VI	**Complex Integration:**	**(06 Hours)**
	Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof).Taylor's and Laurent's series (without proof). Definition of Singularity, Zeroes, poles of f (z), Residues, Cauchy's Residue Theorem (without proof).	

Project based learning:

1. Finite order differentiation of standard functions
2. Leibnitz theorem
3. Errors and Approximation
4. Total derivative
5. Implicit functions
6. Maxima and minima for function of two variables
7. Langrage method of Undetermined multipliers

8. Continuity Equation
9. Bernaulli's Equation
10. Harmonic function
11. Singularities
12. Cauchy Residue Theorem
13. Taylor's and Laurent's series
14. Green's lemma
15. Gauss divergence theorem
16. Stokes theorem
17. Orthogonal Trajectories
18. Analytic functions

Text Books:

1. P. N. Wartikar and J. N. Wartikar, Applied Mathematics (Volumes I and II), 7th Ed., Pune Vidyarthi Griha Prakashan, Pune, 2013
2. B. S. Grewal, Higher Engineering Mathematics, 42nd Ed., Khanna Publication, Delhi
3. B.V. Ramana, Higher Engineering Mathematics, 6th Ed., Tata McGraw-Hill, New Delhi, 2008.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Ed., John Wiley & Sons, Inc., 2015.
2. Peter V. O' Neil Advanced Engineering Mathematics, 7th Ed., Cengage Learning, 2012.
3. Michael Greenberg Advanced Engineering Mathematics, 2nd Ed., Pearson Education, 1998.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Modern Physics		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination : 60 Marks	Theory : - 03
Practical: 02 Hrs/Week	Continuous Assessment: 40 Marks	Practical : - 01
	Term Work: 50 Marks	Total : - 04

Course Pre-requisites:

The Students should have knowledge of

- Basic understanding of Physics and Calculus.

Course Objectives:

- To impart knowledge of basic concepts in physics relevant to engineering applications in a broader sense with a view to lay foundation for the Electrical and Computational Engineering.

Course Outcomes: Students will be able to

1.	Interpret the electric and magnetic fields and apply the principles of Coulomb's Law and Gauss's law to electric fields in various coordinate systems.
2.	Summarize the magnetism, different magnetic materials and its properties.
3.	Explain mechanical properties of solid matter, and connect to applications in the field of engineering.
4	Interpret the properties of nucleus and apply it for socioeconomic purposes.
5	Interpret the superconductivity and perfect diamagnetism, and give a qualitative description of the Meissner effect and its applications.
6	Summarize the structure and properties of lasers to their performance and intended applications such as optical fiber in the field of communication.

UNIT - I	**Electromagnetic Theory:**	**(06 Hours)**
	Introduction of Electrostatics: electric charge and electric field, electric potential, electric dipole, Gauss's law for electric field on integral form, Capacitors, electrostatic energy. Stationary electromagnetism: magnetic fields and flux density and magnetic forces, Ampere's law for B-field in integral form, Electromagnetic induction: Faraday's and Lenz' laws, self and mutual inductance.	
UNIT - II	**Magnetism and Dielectric Materials:**	**(06 Hours)**
	Origin of magnetism, Classification of magnetism on the basis of permeability (qualitative), Domain theory of ferromagnetism, Hard and soft magnetic materials, Dielectric parameter (Dielectric constant, Electric displacement, Polarization & Polarizability), Types of polarization and dielectric materials, temperature and frequency effect, Applications of magnetic devices: transformer cores, magnetic storage.	
UNIT - III	**Solid State Physics:**	**(06 Hours)**
	Free electron theory, Density of states, Bloch theorem (Statement only), Origin of band gap, Energy bands in solids, Effective mass of electron, Fermi-Dirac probability function and position of Fermi level in intrinsic semi-conductors (with derivation) and in extrinsic semi-conductors, Band structure of p-n junction diode under forward and reverse biasing, Conductivity in conductor and semi-conductor, Hall effect and Hall coefficient, Photovoltaic effect, Solar cell and its characteristics.	
UNIT - IV	**Nuclear and Particle Physics:**	**(06 Hours)**
	Nuclear fission, Liquid drop model of nucleus, Nuclear fission in natural uranium, Fission energy, Critical mass and size, Reproduction factor, Chain reaction and four factor formula, Nuclear fuel and power reactor, Nuclear fusion and thermonuclear reactions (Stellar reaction), Merits and demerits of nuclear energy, Fundamental forces, Particle physics, Quark model, Neutrino properties and their detection.	
UNIT - V	**Superconductivity:**	**(06 Hours)**
	Introduction to superconductivity; Properties of superconductors: zero electrical resistance, critical fields, persistent current, Meissner effect- Type I and Type II superconductors, Low and high temperature superconductors (introduction and qualitative), AC/DC Josephson effect; SQUID: basic construction and principle of working, Applications of SQUID, Applications of superconductors.	
UNIT - VI	**Laser and Fibre Optics:**	**(06 Hours)**
	Principle of laser, Einstein's coefficients, Spontaneous and stimulated emission, Population inversion, Semiconductor laser, Properties of lasers, Applications of lasers (Engineering/ industry, medicine, Computers). Principle of fibre optics, Construction, Numerical Aperture for step index fibre, critical	

	angle, angle of acceptance, types of optical fibres, Fibre optic communication system, advantages and disadvantages of fibre optics.	

Term Work:

The term work shall consist of record of minimum eight experiments from below list.

1. Study of changing magnetic flux and induced current associated with Faraday's Law of Induction.
2. Plotting the hysteresis loop for given magnetic material
3. To study Hall effect and determine the Hall voltage
4. Calculation of conductivity by four probe method
5. Study of solar cell characteristics and calculation of fill factor
6. Determination of band gap of semiconductor
7. Determination of divergence of a laser beam
8. Particle size by semiconductor laser
9. Determination of wavelength of laser by diffraction grating

Project based learning:

1. Construction and application of heat sensor in process control
2. Design and simulation of automatic solar powered time regulated water pumping
3. Solar technology: an alternative source of energy for national development
4. The study on the effect of length on the resistance of a copper wire (verification of ohms law r directly proportional to l)
5. Possible effects of electromagnetic fields (emf) on human health
6. Design and construction of digital distance measuring instrument
7. Design and construction of remote control fan
8. Design and construction of sound or clap activated alarm
9. Electronic eye (Laser Security) as autoswitch/security system
10. Electric power generation by road power
11. Wireless power transfer
12. Determination of velocity of O-ray and E-ray in different double refracting materials
13. Small wind turbines as a source of electricity
14. Tesla Coil
15. LiFi- wireless data transfer system using light

Text Books:

1. A Textbook of Engineering Physics, M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, S. Chand Publishing (2018)
2. Engineering Physics, R K Gaur and S L Gupta, Dhanpat Rai Publishing Co Pvt Ltd (2015)
3. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, McGraw Hill Education (2017)

Reference Books:

1. Fundamentals of Physics, Jearl Walker, David Halliday and Robert Resnick, John Wiley and Sons (2013)
2. Optics, Francis Jenkins and Harvey White, Tata Mcgraw Hill (2017)
3. Principles of Physics, John W. Jewett, Cengage publishing (2013)
4. Introduction to Solid State Physics, C. Kittel, Wiley and Sons (2004)
5. Principles of Solid State Physics, H. V. Keer, New Age International (1993)
6. Laser and Non-Linear Optics, B. B. Laud, New Age International Private Limited (2011)
7. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni, Capital Publishing Company (2014)
8. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan, New Age International Pvt. Ltd. (1997)
9. Introduction to Electrodynamics –David R. Griffiths, Pearson (2013)
10. Renewable Energy: Power for a Sustainable Future, Boyle, Oxford University Press (2012)

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Electromagnetics And Its Applications		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Lectures: 04 Hours / Week	End Semester Examination: 60 Marks	Theory: 04
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	Practical: 01
	TW: 25 Marks PR:25 Marks	Total: 05

Course Pre-requisites:

1. Students should have basic knowledge of physics i.e. electrical energy and power, magnetism, electrostatics, magnetic materials, magnetic fields, electromagnetic theory etc.
2. Students should have basic knowledge of mathematics i.e. trigonometric functions, matrices, complex numbers, differentiation and integration, vectors etc.

Course objectives:

To introduce fundamental concepts of DC Circuit Analysis and Network Theorems, Magnetic circuit and Electromagnetic Induction, AC Fundamentals & Single-Phase AC Circuits, Three Phase AC Circuits, Transformer, Performance and testing of transformer.

Course Outcomes:

The students will be able to

1.	Evaluate D.C. circuits using network theorems.
2.	Understand theory of electromagnetic induction.
3.	Describe and estimate single-phase A.C. circuits.
4.	Analyze and evaluate three-phase A.C. circuits.
5.	Illustrate constructional features and describe differentparametersof transformer.
6	Identify and analyze performance of transformer.

Topics covered

UNIT - I	**DC Circuit Analysis and Network Theorems:** Circuit Concepts: Concepts of network, Active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements,KCL and KVL, Super node and Super mesh analysis,Network reduction using series-parallel and star-delta transformation,Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem. (Simple numerical problems).	**(08 Hours)**
UNIT - II	**Magnetic circuit and Electromagnetic Induction** **Magnetic Circuit:** flux, flux density, field strength, analogy between electric & magnetic circuits, Right hand thumb rule, magnetic leakage, B-H curve, Magnetic hysteresis, hysteresis and eddy current losses, magnetic circuit calculations, mutual coupling,Series and parallel magnetic circuit and simple numericals. **Electromagnetic Induction:** Faraday's Law of EMI, Statically and dynamically induced emf, Lenz's Law, Self-Inductance, Coefficient of Self-inductance (L), Mutual inductance, Coefficient of Mutual inductance (M), Sign and dot convention,self-induced EMF and mutually induced EMF, Coefficient of Coupling, Inductance, Energy Stored in Magnetic Field. (Simple numerical problems).	**(08 Hours)**
UNIT - III	**AC Fundamentals &Single-Phase AC Circuits:** AC Fundamentals: Sinusoidal, square and triangular waveforms – average and effective values, form and peak factors, concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of series, parallel and series-parallel RLC Circuits: apparent, active & reactive powers, power factor, causes and problems of low power factor, power factor improvement; resonance in series and parallel circuits, (simple numerical problems).	**(08 Hours)**
UNIT -IV	**Three Phase AC Circuits:** Three phase system-its necessity and advantages, meaning of phase sequence, star and delta connections, balanced supply and balanced load, line and phase voltage/current relations,3-ph balanced AC Circuits, three-phase power and its measurement (simple numerical problems).	**(08 Hours)**
UNIT-V	**Transformer:** Single phase transformer: construction, principle of operation,equivalent circuit, phasor diagram,EMF equation,voltage ratio, current ratio, kVA rating, losses in transformer,Concept of ideal transformer. Three phase transformers:Introduction,Three phase transformer connections, Auto-transformer. Welding transformer.	**(08 Hours)**
UNIT-VI	**Performance and testing of transformer**	**(08 Hours)**

	Transformer on no load, Transformer on load, Efficiency of transformer, Condition for maximum efficiency, All-day efficiency, Parallel operation of single-phase transformers, Parallel operation of three-phase transformers. (simple numerical problems). Transformers tests:Open circuit or No-load test, Separation of core losses,Short circuit or impedance test, Regulation of transformer, Sumpner or Back-to-back test. Determination of Efficiency & Regulation by direct load test.	

List of Practical's to be performed in the laboratory:	
1.	Plotting B-H characteristics for a material.
2.	Verification of Kirchhoff's Laws.
3.	Verification of Superposition Theorem.
4.	Verification of Thevenin's Theorem.
5.	Verification of Maximum Power Transfer Theorem.
6.	Identify performance of R-L series, R-C series, R-L-C series circuit.
7.	Identify performanceR-L-C parallel circuit.
8.	Verification of voltage and current relationships in star and delta connected 3-phase networks.
9.	Open circuit or No-load test on transformer.
10.	Direct loading test on single phase transformer.
11.	Sumpner or Back-to-back test on transformer.
12.	Determination of Efficiency & Regulation by direct load test.

Note: The term work shall be the record of minimum eight experiments performed from the above list.

Project based learning: Student shall demonstrate minimum one concept based on syllabus topic.

1. Demonstration of principle of electromagnetism & it's applications.
2. Study and understand practical specifications of transformer.
3. Demonstration of phenomenon of electromagnetic induction.
4. Demonstration of electromagnetism and its applications by using professional software tool.
5. Home automation system using IoT
6. Smart Energy meter using GSM
7. Solar and Smart energy systems
8. Automatic Solar Tracker
9. PCB Manufacturing
10. Smart Calling Bell
11. Wireless Power transmission
12. Gas Leakage Detector
13. Fire detection system 10. Smart Traffic Lighting System
14. Home automation system using IoT

Note: The term work shall be the record of minimum eight experiments performed from the above list.

Reference Books:

1.	Electrical Technology - Edward Huges (Pearson)
2.	Basic Electrical Engineering - D. P. Kothari, J Nagarath (TMC)
3.	Electrical power system technology - S. W. Fordo, D. R. Patric (Prentice Hall)
4.	Principles of Electronics-Dr. H. M. Rai (SatyaPrakashan)
5.	Electronic Devices and Circuit Theory- R. L. Boylestad and L. Nashelsky (PHI)
6.	Electrical, Electronics Measurements and Instruments - (SatyaPrakashan)
7.	Principles of Communication Engineering - Anokh Singh, A. K. Chhabra (S Chand)
8.	A Textbook of Electrical Technology Volume- I, -B.L.Theraja.S.Chand and Company Ltd., New Delhi
9.	A Textbook of Electrical Technology Volume- II, -B.L.Theraja.S.Chand and Company Ltd., New Delhi
10.	Basic Electrical Engineering-V.K.Mehta,Rohit Mehta,S.Chand and Company Pvt Ltd., New Delhi
11.	Electromagnetics and Applications-David H. Staelin, Department of Electrical Engineering and Computer Science Massachusetts Institute of Technology Cambridge, MA(2011)

Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Solid State Devices & Electronic Circuits		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hrs/Week	End Semester Examination: 60 Marks	Theory : 04
Practical: 02 Hrs/Week	Continuous Assessment: 40 Marks	Practical: 01
	TW: 25 Marks PR: 25 Marks	Total: 05

Course Pre-requisites:

The Students should have knowledge of

1.	Fundamentals of Electrical Engineering
2.	Fundamentals of semiconductor physics.

Course Objectives:

1. To study different solid state electronics devices and various electronic systems using these devices and understand the principle of electronic circuits.

Course Outcomes: After learning this course students will be able to

1	Explaining the basic semiconductor devices.
2	Illustrate active and passive filters.
3	Explaining about amplifies and oscillators
4	Outlining operational amplifiers
5	Apply amplifiers for creating generalized linear applications.
6	Illustrating specialized IC applications.

UNIT – I	**Review of semiconductor devices**	**(08 Hours)**
	Rectifier diode Zener diode, Tunnel diode, Schottky diode, LED, PIN diode, photodiode, SCR, TRIAC their symbol, construction, principle of operation characteristics, specifications, mathematical equations and applications. BJT-CE, CB, CC configurations, BJT biasing, FET-biasing, MOSFET biasing, Difference between BJT and FET , Basics of NMOS,PMOS, CMOS. Concept of Device modeling. World wide main manufacturers of various solid state devices.	
UNIT - II	**Active & Passive filters**	**(08 Hours)**
	Working of C, L, PI filters, Types of filters: low pass filter, high pass filter, band pass filter , band stop filter, band reject filter, all pass filter. Difference between active and passive filters. Advantages and applications of active and passive filters. Voltage regulators, types and working principle, Block diagram of Regulated DC power supply- Types- Operation of Zener diode voltage regulator, Transistor series voltage regulator, Comparison of series and shunt voltage regulator, use of negative feedback, block diagram and working of SMPS.	
UNIT -III	**Amplifiers and oscillators**	**(08 Hours)**
	Frequency response of BJT and MOSFET amplifier. Single stage Transistor amplifier-load line analysis, voltage gain, classification of amplifiers, amplifier equivalent circuit. Multi-stage Transistor Amplifier-RC coupled transistor amplifier, Transformer and direct coupled amplifiers, comparison of different types of coupling. Transistor audio power amplifiers, difference between voltage and power amplifier, classification of power amplifier. Amplifiers with negative feedback. Sinusoidal Oscillators- LC tank circuit, various of types and circuits of Oscillators such as, Hartely oscillator. Phase shift oscillator-Wien bridge oscillator.	
UNIT -IV	**Operational Amplifier**	**(08 Hours)**
	Concept of virtual short, The ideal Op-amp, equivalent circuit of Op-amp, ideal voltage transfer curve, open loop Op-amp amplifier configurations-The differential amplifier, The inverting amplifier, The non-inverting amplifier. OP-amp parameters, Block diagram representation of feedback configurations-voltage series feedback amplifier, voltage shunt feedback amplifier, differential amplifiers, Frequency response, high frequency Op-amp, Op-amp as adder and substractor. Various Op-amp ICs and their manufacturers.	
UNIT - V	**General Linear Applications**	**(08 Hours)**

	DC and AC amplifiers, AC amplifier with single supply voltage, The peaking amplifier, Summing, Scaling and averaging amplifiers, Inverting configuration, Non-inverting configuration, Differential configuration, instrumentation amplifiers, logarithmic amplifier, voltage to current converter, current to voltage converter, the integrator, the differentiator, comparators and oscillators. Schmitt trigger circuit, Electrical applications of linear circuits Concept of amplifier against step up transformer in electrical engineering. , Role of solid state devices in electrical engineering.	
UNIT -VI	**Specialized IC application**	**(08 Hours)**
	The 555 timer as monostable, astable multivibrartor, applications of monostable and astable multivibrator phase locked loops operating principle , 565 PLL applications, Power amplifiers – power amplifiers using power busters, monolithic power amplifier, voltage regulators –fixed, adjustable, switching and special voltage regulator and commonly ICs used in each type. Various manufacturers and cost of commonly used regulators and timer ICs.	

Term Work:

The term work shall consist of record of minimum eight experiments.

1. Study of JFET drain and transfer characteristics.
2. JFET biasing arrangement Graphical method
3. Build and Test JFET CS amplifier.
4. Find performance parameters for JFET amplifier - A_V, R_i, R_O
5. Simulation of JFET CS amplifier using multisim/spice.
6. Find performance parameters for JFET amplifier - A_V, R_i, R_O and compare with theoretical and practical results.
7. Input and Output Characteristics of BJT CE configuration. Find h-parameters from characteristics.
8. Build and Test BJT in CE amplifier and find performance parameters - A_V, R_i, R_O,A_I
9. Simulation of BJT CE amplifier using multisim/spice
10. Study of MOSFET drain and transfer characteristics
11. Voltage follower by Op-amp.
12. Inverting amplifier by Op-amp.
13. Non-inverting amplifier by Op-amp.
14. Summing amplifier by Op-amp.
15. Difference amplifier by Op-amp.
16. Study of any five ICs studied in the subject – relevant diagrams, costing, various configurations, manufacturers, main specifications and introduction of their data sheet.
17. Self arranged industrial visit to any electronics industry and report writing on same.
18. Attending seminar session / IEEE conference session/ local conference session/webinar/ talks by any electronics related expert and writing report on same

Project Based Learning:

1.Simple LED blinking block.
2.Simulation of logic gates.
3.Study of automatic light control.
4.Design of half wave rectifier (simulation or hardware).
5. Regulated power supply.
6.Circuit designing , simulation and electrical parameter measurement.
7. Application of transistor as a switch.
8.Study of JFET characteristics using software simulation.
9. Application of MOSFET as switch.
10.Application of Op-amp as non-inverting amplifier
11.Design of inverting amplifier.
12. Design of non-inverting amplifier.
13. Design of Op-amp as adder.
14. Design of Op-amp as subtractor.
15 Design of Op-amp as difference amplifier.

Text Books:

1. Neamen- Semiconductor Physics and DevicesTMH
2. Bhattacharya & Sharma- Solid State Electronic Devices-Oxford
3. Maini & Agrawal- Electronics Devices and Circuits-Wiley
4. Principles of Electronics- V.K.Mehta. S. Chand & Company Limited.

5. OP-Amps & Linear Integrated Circuts- Ramakant A. Gayakwad 6. Opearational amplifiers by D.Roychaudhari	
Reference Books:	
1. Milman, Halkias& Jit- Electronics Devices and Circuits-TMH	
2. Bell-Electronics Devices and Circuits-Oxford	
3. Singh &Singh-Electronics Devices and Integrated Circuits–PHI	
4. Bogart, Bisley& Rice-Electronics Devices and Circuits-Pearson	
5. Kasap-Principles of Electronic Materials and Devices-TMH	
6. Boylestad & Nashelsky- Electronics Devices and Circuit Theory-Pearson	
7. Salivahanan, Kumar & Vallavaraj- Electronics Devices and Circuits-TMH	
Unit Tests:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Computer Architecture & Data Structures with C		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hours/Week	End Semester Examination: 60 Marks	Theory: 04
Practical: 02 Hours/Week	Continuous Assessment: 40 Marks	Practical: 01
	TW: 25 Marks & OR: 25 Marks	Total: 05

Course Pre-requisites:	
The Students should have knowledge of	
	Computer System, Applications of Computers and Computer operations.
Course Objectives:	
	To learn the basic structure and operations of a computer. Understand and memory and I/O organization of a typical computer system. Understand the basics and applications of Data Structure.

Course Outcomes:	**After learning this course students will be able to**
1	Explain the basic structure of Computer system and its operation
2	Illustration of Computer Processor and Control Unit
3	Identify Parallelism and Memory Organization
4	Identify the basics of C Programming
5	Discuss the concept of Data Structures
6	Study of Linear and Non Linear Data Structure

UNIT – I	**Basic Structure of Computer System**	**(08 Hours)**
	Computational model, Evolution of computer architecture, Functional Units- Basic Operational Concepts, Performance, Instructions: Language of the Computer,Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.	
UNIT - II	**Processor and Control Unit**	**(08 Hours)**
	A Basic MIPS implementation - Building a Datapath - Control Implementation Scheme - Pipelining - Pipelined datapath and control - Handling Data Hazards & Control Hazards - Exceptions.	
UNIT -III	**Parallelism and Memory Organization**	**(08 Hours)**
	Parallel processing challenges – Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors. Memory Hierarchy - memory technologies - cache memory - measuring and improving cache performance - virtual memory, TLB’s - Accessing I/O Devices - Interrupts - Direct Memory Access - Bus structure - Bus operation - Arbitration - Interface circuits - USB.	
UNIT -IV	**C Programming basics**	**(08 Hours)**
	Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays. Strings- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.	
UNIT - V	**Functions, Pointers, Structures And Unions**	**(08 Hours)**
	Functions – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.	
UNIT -VI	**Linear and Non Linear Data Structure**	**(08 Hours)**
	Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition. Trees – Binary Trees – Binary tree representation and traversals –Binary Search Trees – Applications of trees. Set representations – Union-Find operations. Graph and its representations – Graph Traversals.	

Term Work:

The term work shall consist of record of minimum eight experiments.

1. Study of peripherals, components of a Computer System
2. Study of Binary and Decimal Inter-Conversion system.
3. Study of Binary Addition
4. Study of Binary Subtraction.
5. Study Booth's Multiplication algorithm
6. Study of Restoring Division
7. Study of Non Restoring Division Algorithm
8. Study of Logisim Tool.
9. Realization of the basic logic and universal gates
10. Design of half-adder circuit using basic gates
11. Design of full-adder circuit using basic gates.
12. Program to create & manipulate database using structure
13. Program to add two polynomial using array of structure.
14. Program to implement primitive operation on Sequential file.
15. Program to search for record from a given list of records stored in array using i) Linear search ii) Binary search
16. Program to sort an array of names using i) Bubble sort ii) Insertion sort iii) Quick sort

Project based learning:

1) Development of Phone Book Application in C
2) Development of Temperature Conversion Table
3) Study of Mother Board components.
4) C- Programming experiments
5) Write a C program to add, subtract multiply and divide two non-zero numbers.
6) Write a C program to print all odd numbers from 1 to 100 using for loop and even numbers using while loop.
7) Write a C program to create a menu of math operations using switch case and do-while loop. The program should input 1-2 numbers and give options like square, cube, exponent (x^y or y^x), multiply , divide . ensure non zero numbers.
8) Write a C program to copy all numbers in an array to another array in reverse order and display the result.
9) Write a C program to find the factorial of a given number using recursive function.
10) Write a C program to reverse the string(in the same space) and print the resultant string. Make use of pointers.
11) Project work (Options) :
12) Phonebook application (Non persistent)
13) Temperature conversion table (-50C to 150C)
14) Customer billing system.
15) Bus/ Airplane seat reservation system.

Text Books:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fourth Edition, Morgan Kaufmann / Elsevier, 2009.
2. PradipDey and Manas Ghosh, ―Programming in C, Second Edition, Oxford University Press, 2011.
3. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

Reference Books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.
4. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.
5. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996

Unit Tests:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Electrical Workshop Practices		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: - NA	End Semester Examination: - NA	NA
Practical: 04 Hours / Week	Continuous Assessment: -	
	TW: 50 Marks	02 Credit

Course Pre-requisites:	
The Students should have knowledge of	
1.	Basic concepts of electrical engineering.
Course Objectives:	
	1. To make the students familiar with construction, working and maintenance of electrical appliances in daily use 2. To prepare students for working on different hardware projects by developing hardware skills.
Course Outcomes: After successful completion of this course, student will be able to	
1.	Understand the use of electrical safety devices
2.	Understand the working of electrical tools and their applications
3.	Understand various electrical accessories and their applications
4	Undertsand various types of wiring and luminaries.
5	Undertsand overhauling of a motor / generator
6	Undertsand electric vehicle, various motors and batteries
Instructions:	
	• Term work shall consist of reports for minimum five exercises. • The exercise must be carried out in a group of maximum 4 students. • Students should write the procedure, observations and conclusion in the form of report which will be evaluated for term work.
Content	
I	**Electrical Safety Devices and methods awareness** Various safety devices for protection of electrical installation, earthing rods, megger, insulation tester, etc. Various safety devices used for first aid and electric fire hazards. Artificial respiration. Electrical safety devices for working on over head lines, inspection of overhead lines with drones, thermal camera Operation of safety equipment, Operation of fire equipment, high voltage maintenance uniform, maintenance with drones and helicopters
II	**Study of Electrical tools** Acquaintance of various tools for wiring such as wire stripper, bearing puller, hand drilling machine, pliers etc. and various electrical measuring instruments such as digital and analogue multi-meter, ammeters, voltmeters, wattmeter, frequency meters, phase sequence meters, tong tester, etc. Study of various tools for wiring such as wire stripper, bearing puller, hand drilling machine, pliers etc Study of various electrical measuring equipment such as digital and analogue multi-meter, ammeters, voltmeters, wattmeter, frequency meters, phase sequence meters, tong tester, megger, test lamp, insulation tester, earthing rods, thermal camera etc. Bread board assembly and general-purpose PCB soldering and de-soldering Dismantling and assembly of switchgears in simple electrical installations. Development of hardware kit for DC circuit and network theorems. Development of combined ±12V ,±5V regulated power supply. Development of mobile charger Development of extension board Cable jointing and termination kit
III	**Electrical accessories** Soldering kit. s electrical power supplying equipments), Wiring of distribution box . contactors, with wiring. distribution box with MCB, ELCB, RCCB and MCCB. Assembly of star delta starter, autotransformer starter, DOL and 3 point starter with NVC connections and overload operation. Energy meter, Soft starters switches, various sensors temperature sensors, pressure sensors, speed sensors, moisture sensors, humidity sensors, various types of anemometers, solar panel concept of electrical supply ac supply, dc supply, three phase ac supply, electricity bill **Electrical components and materials** Types of cables, Cable jointing and termination kit, wires, light sources, resistors, capacitors, inductors. transformer, variac, d.c.power supply, insulators, insulating and conducting materials, Gang operated device

IV	**Wiring and luminaries** Batten wiring, plastic casing and capping wiring, wooden casing and capping wiring, cleat wiring, conduit wiring, concealed conduit wiring, Wiring of 40 W fluorescent lamp Halogen lamp, sodium vapor lamp, LED lamp, Metal Halide lamps, mercury lamp
V	**Overhauling of a motor / generator (hands on experience)** Induction motor, synchronous motor, brushless DC motor, dc motor, single phase, three phase Motor rewinding Design and fabrication of reactor/ electromagnet for different inductance values. Design and fabrication of single phase Induction motor / three phase induction motor / alternator,
VI	**Electric vehicle and batteries** Brushless DC motor, Reluctance motor, Synchronous reluctance motor Harness wiring, Maintenance of electric vehicle, Battery management system
VII	**Electric motors**
	1. Dismantle and assemble any available electric motor from above list 2. Removing the old winding of motor 3. Familiarity with rewinding machine 4. Rewinding of electric motor. 5. Maintenance of motor for different faults.
VIII	**Domestic appliances for Heating purpose - Water heater, Geyser, Room heater, Electric iron, Oven, Microwave oven** 1. Maintenance of water heater, 2. Maintenance of Geyser 3. Maintenance of room heater for different faults. 4. Dismantle and assemble the electric iron. 5. Maintenance of electric iron for different faults. 6. Maintenance of oven **7.** Maintenance of microwave oven **Domestic appliances for Cooling purpose - Refrigerator, Air conditioner** 1. Maintenance of refrigerator 2. Maintenance of water cooler 3. Check and replace thermostat and relay of refrigerator. 4. Maintenance of window air conditioner 5. Split air conditioner 6. Central air conditioning system **Domestic appliances using Motors - Mixer, Grinder Washing machine, ceiling fan, table fan, blower fan, water pump** **1.** Dismantle and assemble the ceiling fan. **2.** Dismantle and assemble the table fan. **3.** Dismantle and assemble the blower fan. **4.** Connection of table and ceiling fans with regulators. 5. Maintenance of ceiling and table fan for different faults 6. Testing of different parts of washing machine. 7. Preventive Maintenance and maintenance of of water pump, 8. Preventive Maintenance and maintenance of washing machine for different faults. 9. Dismantle and reassemble mixer and grinder. 10. Check and replace thermostat and relay of refrigerator. 11. Check the internal connections and identify the fault in microwave oven. 12. Maintenance of refrigerator for different faults. 13. Maintenance of oven for different faults. 14. Maintenance of mixer and grinder for different faults. **Domestic appliances for Energy storage - SMPS, UPS** 1. Practical study of SMPS. 2. Practical study of UPS. 6. Practical study of home inverter.
IX	**Electrical workshop visit**
	Study of trouble shooting of electrical equipment based on actual visit to repair workshop.
	List of experiments / jobs to be prepared by students Note : -List of practicals / jobs is not restricted to following topics. Faculty can add new experiment / job related to subject to encourage project based learning. 7. Students have to prepare any one job from each group of the given list
	Group 1 wiring and cables

	1. Prepare a batten wiring sample **2.** Prepare conduit wiring sample 3. Staircase wring model 4. Go down wiring model 5. Drawing cross sectional view of different types of cables. **Group 2 Rewinding** **6.** Rewinding of choke **7.** Manufacturing small transformer **Group 3 Renewable Generation** **8.** Preparation of kit for application of small solar panel 9. manufacturing of small horizontal axis wind turbine model 10. manufacturing of small vertical axis wind turbine model **Group 4 maintenance of home appliance** 11. Maintenance of Ceiling fan 12. Maintenance of table fan **Group 5 laboratory equipment maintenance** 13. Maintenance of dimmerstat 14. Dismantle and assemble any available electric motor from above list 15. Study of electricity bill, computation of electricity bill for home for given load 16. Study of specification of all electrical equipment like motors, , generator, transformer, appliances **Group 6 charger and battery** 17. Power supply for charging mobile phones 18. Energy audit preliminary energy audit of any industry 19. Maintenance of battery lead acid battery. Keep level of acid in the lead acid battery using distilled water **20. Group 6 load bank and earth resistance** 21. Preparation of lamp bank with facility of different types of connections 22. Preparation of inductive lamp with facility of different types of connections 23. Preparation of 3 phase Capacitive bank 24. preparation of bride rectifier using bread board 25. Measurement of earth resistance with earth tester for different types of soils like sand dry soil, wet soil **Group 7 maintenance of electrical accessories** 26. Development of small solar pumping system model 27. Dismantling and assembly of relay 28. Dismantling and assembly of contactor 29. Development of extension board **Group 9 industrial visit** 8. Industrial visit cable manufacturing plant/ transformer manufacturing plant
	Project based learning: 1. Prepare a batten wiring sample 2. Prepare conduit wiring sample 3. Rewinding of choke 4. Manufacturing small transformer 5. Preparation of kit for application of small solar panel 6. Industrial visit cable manufacturing plant/ transformer manufacturing plant 7. Maintenance of Ceiling fan 8. Maintenance of table fan 9. Maintenance of dimmerstat 10. Dismantle and assemble any available electric motor from above list 11. Staircase wring model 12. Go down wiring model 13. Study of electricity bill, computation of electricity bill for home for given load 14. Measurement of earth resistance with earth tester for different types of soils like sand dry soil, wet soil 15. Power supply for charging mobile phones 16. Energy audit preliminary energy audit of any industry 17. Maintenance of battery lead acid battery. Keep level of acid in the lead acid battery using distilled water 18. Preparation of lamp bank with facility of different types of connections 19. Preparation of inductive lamp with facility of different types of connections 20. preparation of bride rectifier using bread board 21. manufacturing of small horizontal axis wind turbine model 22. manufacturing of small vertical axis wind turbine model

	23. Development of small solar pumping system model 24. Dismantling and assembly of relay 25. Dismantling and assembly of contactor 26. Development of extension board 27. Study of specification of all electrical equipment like motors, , generator, transformer, appliances 28. Drawing cross sectional view of different types of cables.

1.	**Reference Books:**
2.	S. Rao, Testing Commissioning Operation and Maintenance of Electrical Equipment, Khanna publishers.
3.	S. K. Shastri – Preventive Maintenance of Electrical Apparatus – Katson Publication House.
4.	B. V. S. Rao – Operation and Maintenance of Electrical Equipment – Asia Publication.
5.	S. L. Uppal, Electrical Wiring and Costing Estimation, Khanna Publishers, New Delhi.
6.	Surjit Singh, Electrical wiring, Estimation and Costing, Dhanpat Rai and company, New Delhi.
7.	Raina K.B. and Bhattacharya S.K., Electrical Design, Estimating and Costing, Tata McGraw Hill, New Delhi
8.	Hand book of condition monitoring by B. K. N. Rao, Elsevier Advance Tech., Oxford (UK).
9.	B.L.Theraja,A.K.Theraja , “Electrical Technology”, Vol-II, S.Chand publication.
10.	A.K.Sawhney, “A Course in Electrical and Electronic measurements and Instrumentation”, Dhanpat Rai publication.
11.	Uppal , Electricl estimation and costing
12.	Arora, Electrical estimation and costing

Bharati Vidyapeeth Deemed to be University, Pune
Faculty of Engineering & Technology
Programme :B.Tech (Electrical Engineering) Sem – II (2021 Course)

Mathematics for Electrical Engineering

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hours/Week	End Semester Examination : 60 Marks	Theory : - 04
Tutorial: 01 Hours/Week	Continuous Assessment: 40 Marks	Tutorial : - 01
		Total : - 05

Course Pre-requisites:

The Students should have knowledge of

Algebra of matrices, probability and numerical methods for algebraic equations.

Course Objectives:

To study

- Rank of matrix and test consistency of system of linear equations.
- Fourier series and Fourier transform technique.
- Finite difference methods, probability theory and graph theory.

Course Outcomes: Students will be able to

1.	Understand rank of matrix and test consistency of system of linear equations.
2.	Understand to represent periodic function as Fourier series.
3.	Understand the methods to find Fourier and Z transform.
4	Understand various numerical technique for ordinary and partial differential equation..
5	Understand the hypothesis techniques.
6	Understand the concept of graph and its applications of tree.

UNIT - I	**Linear Algebra: Matrices:**	**(08 Hours)**
	Rank, Normal form, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations. Eigen values, Eigen Vectors, Cayley – Hamilton Theorem. Application to problems in Engineering	
UNIT - II	**Fourier Series and its applications:**	**(08 Hours)**
	Definition, Dirichlet's conditions, Fourier Series and Half Range Fourier Series, Harmonic Analysis	
UNIT - III	**Fourier Transform and Z-Transform:**	**(08 Hours)**
	Fourier Transform (FT): Complex Exponential Form of Fourier series, Fourier Integral Theorem, Sine & Cosine Integrals, Fourier Transform, Fourier Sine and Cosine Transform and their Inverses. Introductory Z-Transform (ZT): Definition, Standard Properties, ZT of Standard Sequences and their Inverses. Solution of Simple Difference Equations	
UNIT - IV	**Finite Difference Methods:**	**(08 Hours)**
	Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.	
UNIT - V	**Probability and Probability Distributions:**	**(08 Hours)**
	Probability, Bayes Theorem, Probability density function, Probability distributions: Binomial, Poisson, Normal, Test of hypothesis: Chi-square test, t-test.	
UNIT - VI	**Graph theory:**	**(08 Hours)**
	Introduction to graphs, graph terminology, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths, planar graphs, graph coloring, introduction to trees, application of trees.	

Project based learning:

1. Eigen values and Eigen vectors
2. Cayley Hamilton theorem
3. System of linear equations
4. Fourier Series
5. Harmonic Analysis
6. Wave equation
7. One Dimensional Heat Equation
8. Two Dimensional Heat Equation

9. Coefficient of variation
10. Reliability of regression estimates
11. Chi square test
12. Theoretical probability distribution
13. Bayes theorem
14. Isomorphism of graphs
15. Coloring of graphs
16. Planer graph

Text Books:

1. P. N. Wartikar and J. N. Wartikar, Applied Mathematics (Volumes I and II), 7th Ed., Pune Vidyarthi Griha Prakashan, Pune 2013.
2. B. S. Grewal, Higher Engineering Mathematics, 42th Ed., Khanna Publication, Delhi
3. B.V. Ramana, Higher Engineering Mathematics, 6th Ed., Tata McGraw-Hill, New Delhi, 2008.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Ed., John Wiley & Sons, Inc., 2015.
2. Peter V. O'Neil Advanced Engineering Mathematics, 7th Ed., Cengage Learning, 2012.
3. Michael Greenberg Advanced Engineering Mathematics, 2nd Ed., Pearson Education, 1998.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Electro-Chemistry		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours/Week	End Semester Examination : 60 Marks	Theory : - 03
Practical: 02 Hours/Week	Continuous Assessment: 40 Marks	Practical : - 01
	Term Work: 50 Marks	Total : - 04

Course Pre-requisites:

The Students should have knowledge of

Basic understanding of Chemistry, Electrochemical series, Electrode potential, Primary and secondary cells. Definition of corrosion, Terms related Nano-science.

Course Objectives:

- To develop the interest among the students regarding chemistry and their applications in engineering.
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.
- The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the field such as Electrical Engineering.

Course Outcomes: Students will be able to

1.	Understand the concept of the battery with its applications.
2.	Understand different types of Hydrogen storage systems for various engineering applications.
3.	Understand and apply the knowledge of Processes of nanotechnology.
4	Apply the knowledge of industrial chemical process to study process instrumentation with safety.
5	Understand types of corrosion control measures for various engineering applications.
6	Understand importance of Green Chemistry for Clean Technology.

UNIT - I	**Battery and its Types:**	**(06 Hours)**
	Introduction, Batteries and Battery Technology- characteristics, specifications and applications, Construction and Working of - Acid and Alkaline Storage Battery, Dry Cell, Lead acid battery, Coin Cell Batteries, Ni-Cd Batteries, Ni-MH Batteries, Li-Ion Batteries, Li-Po Batteries. Basic Maintenance of Batteries.	
UNIT - II	**Energy Storage Systems:**	**(06 Hours)**
	Introduction, Fuel cell, Types and Examples of Fuel Cells, Applications and limitations of Fuel Cells, Flywheel energy storage system. Hydrogen storage with types and reactions:- Physical storage- Metal Hydride and Carbon nano-fibers; Chemical storage :- Sodium boro-hydride and Alkali metal hydrides.	
UNIT - III	**Nano-Science and Technology:**	**(06 Hours)**
	Introduction, Nanotechnology applications -Energy sector:- Nano-batteries, Wind power generations – nano-generators, Solar paints or photovoltaic paints – can replace solar panels and Electronic sector:- Nano-RAM etc. Material self assembly, Molecular Vs material self assembly, Self assembling materials, Two dimension assemblies, Meso-scale self assembly (MESA), Coercing colloids, Processes of nanotechnology, Processes used in bottom up approach [sol-gel processing, chemical vapor deposition (CVD), plasma or flame spraying synthesis, laser pyrolysis] Nano-material, Nano-crystals,/Nano-particles, Nanostructure.	
UNIT - IV	**Industrial Chemical Process:**	**(06 Hours)**
	Introduction, classification of chemical industries, material of construction and selection of materials, process instrumentation, safety, fire protection and waste disposal, Electro-thermal industries: Introduction, classification and advantages of electric furnace.	
UNIT - V	**Protective Coatings:**	**(06 Hours)**
	Introduction, Metallic coatings, Hot dipping :- Galvanising and Tinning Anodizing, Electroplating, Methods of cleaning articles before electro-deposition, Electroplating methods, Electro-less plating, Some other metallic coatings, applications of protective coatings in electrical industry, Chemical conversion coatings, Organic Coatings, Paints, Varnishes, Enamels, Special paints.	
UNIT - VI	**Green Chemistry for Clean Technology:**	**(06 Hours)**
	Introduction, Twelve Principles of Green chemistry, Efficiency parameters of reactions, numerical on atom economy, Synthesis by using Traditional and Green pathway for Adipic acid and Indigo,	

	Disadvantages and Advantages related to synthesis method, Green solvents (Ionic liquid supercritical CO_2) and products from natural materials.	

Term Work:

The term work shall consist of record of all eight experiments from below list.

1. Variation of cell potential in Zn/Zn2+|| Cu2+/Cu with change in concentration of electrolytes (CuSO4 or ZnSO4) at room temperature.
2. Setting of a Galvanic Cell and determination of cell voltage.
3. Synthesis of Ni-SiO2 nano-composites by Sol-Gel technique.
4. To obtain metallic coating on base metal by using the methods, Electroplating and Electro-less plating.
5. Determination of rate of corrosion of aluminium in acidic and basic medium.
6. Preparation of Grignard Reagent with A Greener Alternative.
7. To coat copper and zinc on iron plate using electroplating.
8. Colloidal synthesis of 2-6 or 3-5 semiconductor quantum dots nano-particles.

Project based learning: Students have to complete any six assignments from the list given below:

1. Assignment on Acid and Alkaline Storage Battery, Dry Cell and Lead acid battery.
2. Assignment on Hydrogen storage with types and reactions.
3. Assignment on Processes used in bottom up approach.
4. Assignment on material of construction and selection of materials in Industrial chemical process.
5. Assignment on Coin Cell Batteries, Ni-Cd Batteries and Ni-MH Batteries.
6. Assignment on Molecular Vs material self assembly.
7. Assignment on Organic Coatings, Paints, Varnishes, Enamels, Special paints for corrosion prevention.
8. Assignment on types of Hot dipping :- Galvanising and Tining.
9. Assignment on Green solvents and products from natural materials.
10. Assignment on Synthesis by using Traditional and Green pathway for Adipic acid and Indigo.

Text Books:

1. Engineering Chemistry, Dhanpat Rai & Sons, Delhi, 1992.Jain P.C & Jain Monica
2. Introduction to Nanotechnology, C. P. Poole Jr. , F. J. Owens, Wiley Interscience, 2003
3. Nanotechnology Science, Innovation and Opportunity, L. E. Foster, Pearson Education, 2007
4. Engineering Chemistry- Fundamentals and applications, Cambridge Publishers - 2015.Shikha Agarwal
5. A Text Book of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co, 2004

Reference Books:

1. Engineering Chemistry (16th Edition) Jain, Jain, Dhanpat Rai Publishing Company, 2013
2. Austin G.T, Shreve's "Chemical Process Industries", 5th ed., McGraw Hill [1984]
3. Faith W.L., K., Keyes D.B. and Clark R.L., "Industrial Chemicals" John Wiley [1975]
4. Environmental Chemistry – A. K. De, 5th Edition (New age international publishers)
5. Environmental Chemistry with Green Chemistry A. K Das , Books and Allied (P) Ltd

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Instrumentation and Measurements		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hours/Week	End Semester Examination: 60 Marks	Theory: 04
Practical: 02 Hours/Week	Continuous Assessment: 40 Marks	Practical: 01
	TW: 25 Marks PR: 25 Marks	Total: 05

Course Pre-requisites:

The Student should have knowledge of

1.	Basic electrical Engineering Parameters such as Voltage, Current, Power, Energy, etc.

Course Objectives:

	This course introduces knowledge about electrical measurements and instrumentation. The course is designed to learn different methods of measurements of various electrical parameters and also to learn the different physical parameters with the help of the various measurement and instrumentation techniques.

Course Outcomes: After learning this course students will be able to

1	Explain the importance of measurement and able to find the resistance, inductance and capacitance using various methods.
2	Explain the construction, working principle of wattmeter and Energy meter and apply the knowledge to measure the power and energy.
3	Draw block diagram, state specifications, functions of various digital/automated meters, harmonic analyzer. Observe the waveforms and measure the voltage, current, phase and frequency on CRO and to use DSO.
4	Define, classify transducers and measure the displacement, level and flow using various methods.
5	Explain principle of operation, characteristics of Pressure, temperature, velocity transducers and different methods of measurement.
6	Illustrate and explain types of display devices and recorders.

UNIT – I	**Measurement of circuit parameters**	**(08 Hours)**
	Introduction: Classification of measuring instruments, Static characteristics: Error in measurements, sources of error. Dynamic characteristics: standard. Instrument transformers. **Measurement of Resistance** – Classification of resistances, Measurement of medium resistance – Ammeter-voltmeter method, Wheatstone bridge. Measurement of Low resistance – Kelvin Double bridge. Measurement of high resistance – difficulties, use of guard circuit, Methods: direct deflection, loss of charge, Megger. Measurement of earth resistance – Fall of potential method, earth tester. Localization of cable faults. **Measurement of Inductance and Capacitance** **AC Bridges:** Introduction, sources and detectors for ac bridge, general equation for bridge balance. General form of ac bridge. Measurement of Inductance: Maxwell's Inductance, Hay's bridge, Anderson's Bridge, Owen's bridge. Measurement of Capacitance- De Sauty's bridge, Schering Bridge, High voltage Schering bridge.	
UNIT - II	**Measurement of Power and Energy**	**(08 Hours)**
	Measurement of Power: Construction, working principle, torque equation, advantages/disadvantages, errors and their compensation of dynamometer type wattmeter, low power factor wattmeter, Active & reactive power measurement in three phase balanced & unbalanced system (one wattmeter and two wattmeter methods), Power Measurement using Instrument Transformer, Three Phase wattmeter. **Measurement of energy:** Energy Meters in AC circuits, Single Phase Induction Type Energy Meter - Construction, principle of operation, torque equation of induction type energy meter, errors and adjustments. Three phase three wires, and three phase four wire energy meter, electronic energy meter	
UNIT - III	**Electronic Devices and Signal Analyzer's**	**(08 Hours)**
	Electronic Voltmeters and their Advantages, Vacuum Tube Voltmeters, difference Amplifier Type Voltmeters, DC Voltmeters with direct Coupled Amplifier, Measurement of Power at Audio and Radio Frequencies. Concept of: Numeric meter & its types (TOD, ABT, Prepaid & panel mounted meters. Measurement of power & energy by sampling technique automatic meter reading (AMR) and advanced metering infrastructure (AMI), Meter reading instrument (MRI). Wave Analyzers –	

	Frequency Selective Wave Analyzers and Heterodyne Wave Analyzers and its applications. Harmonic Distortion Analyzer, Spectrum Analyzer, Standing Wave Ratio, Power Analyzer. CRO and Digital Storage Oscilloscope – Principle of operation and waveform reconstruction.	
UNIT - IV	**Displacement, Level and Flow Measurement**	**(08 Hours)**
	Introduction to Transducers, classification, basic requirements for transducers and Advantages of Electrical Transducers. **Displacement measurement:** Potentiometer as displacement transducer**,** Strain Gauge: Theory of Strain Gauges, Types of strain gauges: Un-bonded and Bonded types their construction, working, advantages and disadvantages, load cell, LVDT & RVDT – construction, working, application, null voltage, specifications, advantages/disadvantages, effect of frequency on performance. Capacitive transducers – Advantages, Disadvantages and Applications. **Level measurement:** Introduction and importance of level measurement, level measurement methods: mechanical, hydraulic, pneumatic, Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors **Measurement of flow –** Rate of flow**,** Turbine Meter, Electromagnetic Flow Meters, Hot Wire Anemometer, Ultrasonic Flow Meter.	
UNIT - V	**Pressure, Temperature and Velocity Measurement**	**(08 Hours)**
	Pressure Measurement: Introduction, Types of Pressure Measurements Devices, Pressure Measurement using Electrical Transducers as Secondary Transducers. Low Pressure (vacuum) Measurement – Thermocouple Vacuum Gauge, Pirani Gauges and Ionization Type Vacuum. **Temperature Measurement:** Electrical Resistance Thermometer, Platinum Resistance Thermometer, Semiconductor Thermometers, Thermocouples, Thermistors, Quartz Crystal Thermometers, Bimetallic Thermometers. Electrical methods of temperature measurement – signal conditioning of industrial RTDs and their characteristics – 3 lead and 4 lead RTDs. **Measurement of Velocity** – Measurement of Linear Velocity: Electromagnetic transducers, Moving Magnet Type, Moving Coil Type, Measurement of Angular Velocity: Electrical Tachometers. Electromagnetic Tachometer Generators. Photoelectric Tachometer.	
UNIT - VI	**Display Devices and Recorders**	**(08 Hours)**
	Display Devices: Introduction, electrical Indicating Instruments. Digital Instruments: Advantages of Digital Instruments. Digital versus Analog Instruments. Digital Display Methods, Digital display Units, Rear Projector Display, Light Emitting Diodes (LED), Liquid Crystal Diodes (LCD), Resolution, Sensitivity, accuracy and specifications of Digital Meters. **Recorders:** Necessity of Recorders. Recording Requirements. Analog Recorders. Graphic Recorders. Strip Chart Recorders, Null Type Recorders, X-Y Recorders, Ultraviolet Recorders, Direct Recorders.	

Term Work:

The term work shall consist of record of minimum eight experiments.

3. Measurement of resistance by Kelvin double bridge/ Wheatstone bridge/Ammeter-voltmeter method
4. Measurement of capacitance and loss angle by Schering Bridge.
5. Measurement of inductance by Anderson's bridge/ Maxwell's Inductance Bridge.
6. Measurement of resistance, capacitance and inductance using LCR meter.
7. To measure power in three phases balanced load by one wattmeter method.
8. To measure power in three phase balanced/ unbalanced load by two wattmeter method.
9. To measure reactive power in three phase circuit by one wattmeter method.
10. To calibrate single phase energy meter at (i) unity power factor (ii) 0.5 lagging power factor (iii) 0.5 leading power factor (analog /Digital)
11. Measurement of Voltage, current and resistance using digital voltmeter and digital multimeter.
12. To study and analyze the various electrical parameters using Power Analyzer.
13. To study the observation of waveforms on CRO, measurements of voltage and current, measurement of phase and frequency using CRO / digital storage oscilloscope
14. Displacement measurement using LVDT.
15. Strain measurement using strain gauge.
16. Study of process control application of using the instrumentation kit.
17. Measurement of Pressure using Bellows, Bourdon gauge, Diaphragm.
18. Calibration of vacuum gauge using vacuum gauge tester.
19. Characterization of RTD (PT100)

Project Based learning topics

1. Measurement of voltage and current using instrument transformers

2. Calibration of voltmeter, ammeter, wattmeter (Using power analyser)
3. Measurement of earth resistance
4. Measurement of insulation resistance.
5. Design / development / simulation of measurement of any physical parameter using transducer/s.
6. Demonstration of 7 segment LED for measurement
7. Selection of digital instrument for specific application using user manual / data sheet

Text Books:

1. A Course in Electrical and Electronic measurements & Instrumentation – by A. K. Sawhney, Dhanpat Rai & Sons.
2. Electronic Instrumentation: H.S. Kalsi – THM, 2nd Edition 2004.
3. A Course in Electronic and Electronic measurements by J. B. Gupta, S. K. Kataria & Sons.

Reference Books:

1. Electrical Measurement & Measuring Instruments Fifth edition, by E. W. Golding & Widdies, A. H. Wheeler & Co. Ltd.
2. Electronic measurement and instrumentation by Dr. Rajendra Prasad, Khanna Publisher, New Delhi.
3. Introduction to Measurements and Instrumentation, Second Edition by Ghosh, PHI Publication.
4. Introduction to Measurements and Instrumentation by Anand. PHI Publication

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Industrial Safety Practices

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS:
Lectures: 03Hours / Week	End Semester Examination: 60 Marks	Theory:03
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	Practical: 01
	Term Work: 25 Marks Oral: 25 Marks	Total: 04

Course Pre-requisites:

Students should have basic knowledge of safety practices

Course Objectives:

1. To make students aware about the hazards while working in industry and respond appropriately in an emergency.
2. To help prevent workplace injuries, illnesses and fatalities.
3. To reduce and remove existing dangers to improve working conditions.

Course Outcomes:

Students are expected to:

1	To understand importance of safety
2	To understand process safety management
3	To evaluate safety in hazardous area
4	To apply the knowledge of Industrial safety engineering
5	To review of IE rules and acts and their significance
6	To analyse case studies on Industrial Safety Practices

Topics covered

UNIT - I	**Importance of Safety:** Health and environment. Health safety and environmental policy, fundamentals of safety, classification of accidents, Managements responsibility, objectives of safety management, National safety council, Employees state insurance act 1948, approaches to prevent accidents, principles of safety management, safety organization, safety auditing, maintenance of safety, measurements of safety performance, industrial noise and noise control, Industrial Psychology, Industrial accidents and prevention.	**(06 Hours)**
UNIT - II	**Process safety management:** Process safety management, legal aspects of safety, safety with respect to plant and machinery, the explosive act 1884, Petroleum act 1934, personal protective equipment, classification of hazards, protection of respiratory system, work permit system, hazards in refineries and process plants, safety in process plants, pollution in some typical process industry. Safe working practices, housekeeping, safe working environment, safety device and tools, precaution in use of ladders, safety instruction during crane operation, safety instruction for welding, burning and cutting and gas welding equipment, electrical safety, case studies, safety in use of electricity, electric shock phenomena, occurrence of electric shock, medical analysis of electric shock and its effect, safety procedures in electric plants, installation of Earthing system.	**(06 Hours)**
UNIT - III	**Safety in hazardous area:** Hazard in industrial zones, classification of industrial Enclosures for gases and vapors. Mechanical, Chemical, Environmental and Radiation hazards, Machine guards and safety devices, slings, load limits, lifting tackles and lifting equipment, hydrostatic test, Chemical hazards, industrial toxicology, toxic chemicals and its harmful effects on humans, factors influencing the effect of toxic materials, Units of concentration, control measure, environmental hazards, devices for measuring radiation, safety analysis and risk analysis, risk management, First aid, Safety measures to avoid occupational diseases.	**(06 Hours)**
UNIT -IV	**Industrial Safety Engineering:** Industrial Lighting : Purpose of lighting, Uses of good illumination, recommended optimum standards of illumination, Design of lighting installation, Standards for lighting and colour. Vibration and Noise : Activities related to vibrations, its impact on human health, abatement Sources, effects of noise on man, Measurement and evaluation of noise, Silencers, Practical aspects of control of noise. Safety at various Industries: Agro-Industry, Sugar Industry, Textile Industry etc.	**(06 Hours)**
UNIT-V	**Review of IE rules and acts and their significance**:	**(06 Hours)**

	Objective and scope –ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and fire fighting facility. The Electricity Act, 2003.	
UNIT-VI	**Case studies on Industrial Safety Practices:** Case studies in various industries like: Processing industry, Hazardeous material industry, Engineering applications industry etc	**(06 Hours)**

Practicals:

List of Practical's to be performed in the laboratory:

1. Demonstration and training of how to use breathing apparatus,
2. Demonstration and training of Emergency evacuation drill,
3. Train students how to rescue employees using emergency rescue equipments inside confined space.
4. With the help of gas detector train students check the level of oxygen and other, Gases in industries,
5. Training of using of windo meter to measure speed level of wind,
6. Train students use noise level meter and find out different level of noise of different equipments and teach them how to be safe,
7. Train students how to use personal protective equipment ,
8. First Aid training and demonstration.

Project based learning:

1. Study of Home And Industrial Safety Using Fire And Gas Detection System kit/system
2. Industrial IoT Safety project (IIOT): Industrial Internet of Things using Arduino & ESP8266
3. Study of Anti-Collision Light : LGKT017 Simple Circuit Project
4. Study of First Aid Kits & Construction Safety
5. Study of Personal Protective Equipment (PPE) Kit for industry
6. Study of Electrical Safety Kit for industry
7. Case studies on – Learning industrial Safety through films/Videos
8. Case studies on – Learning industrial Safety through posters/charts
9. Case studies on – Learning industrial Safety through periodicals, research publications
10. Conducting electric safety audit of any institute/Engineering college
11. Conducting power quality audit of any institute/Engineering college
12. Auto power supply control from 4 different sources
13. Over Voltage/Under Voltage Electrical Appliance Protector
14. ATM Machine Gate Security System
15. Do-it-yourself intelligent camera

Note:
The term work shall be the record of minimum eight experiments performed from the above list.

Project based learning: Student shall demonstrate minimum one concept based on syllabus topic.

Reference Books:

1. Industrial safety management By: L.M. Deshmukh Publishers: Tata McGraw Hill ,New Delhi Year: 2006 Edition: First
2. Industrial safety health and environment Management system By: R.K. Jain & Sunil S. Rao Publishers: Khanna Publishers Year: 2008 Edition: Second

Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Object Oriented Programming with C++		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04 Hours/Week	End Semester Examination: 60 Marks	Theory : - 04
Practical: 02 Hours/Week	Continuous Assessment: 40 Marks	Practical : - 01
	TW: 25 Marks, PR : 25 Marks	Total : - 05

Course Pre-requisites:

The Students should have knowledge of

1.	C Programming

Course Objectives:

This course introduces knowledge about language C++ and various parameters associated with programming with C++. The object oriented programming with C++ plays important role in creating platform for other advanced programming languages. This course is considered as strong foundation for software related advancements.

Course Outcomes: Students will be able to

1.	Define and describe the basic terms and ideas about object oriented approach along with important paradigms.
2.	Illustrate the function of various classes and objects under object oriented approach with C++
3.	Analyze the significance of inheritance and its application.
4	Describe polymorphism along with hierarchies, categorization, methods of polymorphism.
5	Describe various files and examine them under object oriented approach followed by exception handling.
6	Explore concept of pointer, arrays and their significance in C++ programming.

UNIT - I	**Introduction to Object Oriented Programming:**	**(08 Hours)**
	Introduction to Object Oriented Approach, Overview of other paradigms {Functional, Data decomposition}, Basic terms and ideas about Abstraction, Encapsulation, Inheritance, Polymorphism, Review of C, Difference between C and C++, cin, cout, new, delete, operators.	
UNIT - II	**Classes and Objects:**	**(08 Hours)**
	Encapsulation, Information hiding, Abstract data types, Object & classes, Attributes, Methods, C++ class declaration, State identity and behavior of an object, Constructors and destructors, Instantiation of objects, Default parameter value, Object types, C++ garbage collection, Dynamic memory allocation, Meta class / abstract classes.	
UNIT - III	**Inheritance:**	**(08 Hours)**
	Inheritance, Defining derived classes & Visibility modes, Single, Multilevel, Multiple, Hierarchical and Hybrid inheritance, Virtual base classes & Abstract classes- , Constructors in derived classes, Nesting of classes.	
UNIT - IV	**Polymorphism:**	**(08 Hours)**
	Composition Vs. Classification, Hierarchies, Polymorphism, Categorization of polymorphism techniques, Method polymorphism, Polymorphism by parameter, Operator overloading, Parametric Polymorphism.	
UNIT - V	**Files and Exception Handling in C++ programming:**	**(08 Hours)**
	Object oriented Language, Application of OOP, Introduction to C++, Application of C++, Program Features, Comments, Output Operators, Iostream File, Namespace, Return Type of main (), Exception handling, Generic Classes, Throwing an exception, catching an exception: The try block, Exception handlers, Termination vs. Resumption, Exception specification, rethrowing an exception, uncaught exceptions, Standard exceptions, Programming with exceptions.	
UNIT - VI	**Pointers:**	**(08 Hours)**
	Introduction to Pointer, Declaration and Initialization of Pointer; Dynamic memory allocation/deallocation operators: new, delete; Pointers and Arrays: Array of Pointers, Pointer to an array (1 dimensional array), Function returning a pointer, Reference variables and use of alias; Function call by reference. Pointer to structure: De-reference/Deference operator: *, ->; self referential structure.	

Term Work:

The term work shall consist of record of minimum eight experiments from below list.

1. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.

2. Write a C++ program to declare Struct. Initialize and display contents of member variables.
3. Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class member.
4. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.
5. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).
6. Write a C++ to illustrate the concepts of console I/O operations.
7. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.
8. Write a C++ program to allocate memory using new operator.
9. Write a C++ program to create multilevel inheritance. (Hint: Classes A1, A2, A3)
10. Write a C++ program to create an array of pointers. Invoke functions using array objects.
11. Write a C++ program to use pointer for both base and derived classes and call the member function. Use Virtual keyword.

Assignments: (Project based learning)

1. Phone book
2. Temperature conversion table
3. Calculator
4. Games (Snake etc.)
5. Student data
6. Student report card system
7. Calendar
8. Personal Diary Management System
9. Bus reservation system
10. Library management system
11. Face detection using C++
12. Digital clock in C++
13. Attendance management system
14. Students' attendance system
15. Biometric system

Text Books:

1. E. Balagurusamy – Object Oriented Programming with C++, Fifth edition, Tata McGraw Education Hill , 2011.
2. Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, First Edition, Pearson India

Reference Books:

1. Robert Lafore, Object Oriented Programming in Turbo C++, First Edition, Galgotia Publications.
2. D Ravichandran, Programming with C++, Second edition, Tata McGraw- Hil
3. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education. C++ Programming Lab Manual / II-I SEM / 2019-20 Page 9
4. OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream Tech Press.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Simulation And Programming

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: NA	End Semester Examination: 00 Marks	
Practical: 04	Continuous Assessment: 00 Marks	
	TW: 25 Marks PR: 25 Marks	Credit: 02

Course Pre-requisites:

The Students should have knowledge of

1.	Students should have knowledge of Fundamentals of Electrical Engineering, basic mathematics and basic computer operation

Course Objectives:

	The course introduces fundamental concepts of simulation and programming for problem solving

Course Outcomes: After learning this course students will be able to

1	Describe the concept of simulation
2	Identify and apply knowledge of software simulation
3	Describe and Analyze Programming Techniques using application software's.
4	Describe fundamental concepts of MATLAB Simulink
5	Apply knowledge MATLAB Simulink in Electric Applications
6	Elaborate the scope and applications of PCB design

UNIT – I	**Introduction to Simulation:**	
	What is simulation: Modeling basics, computer simulation (Popularity and advantages, different kinds of simulation), How simulation gets done (by hand, programming in general languages, simulation languages, high level simulators, Uses of simulations (past , present, future). **Fundamentals of simulation:** Goals of simulation study, Analysis options(educated guessing, queueing theory, mechanistic simulation), Pieces of simulation model(entities, attributes, variables, resources, queues, statistical accumulators, events, simulation clock, starting and stopping), Event driven hand simulation, Event and process oriented simulation Randomness in simulation, Simulation with spread sheets, conducting simulation studies.	
UNIT - II	**Software Tools and Simulation:**	
	Types of Analysis: Bias point, Time domain, AC Sweep, DC Sweep, Parametric, Monte Carlo, Noise analysis. **Schematic Design:** Introduction, Description of P-Spice, Types of analysis, Description of simulation software tools (like OrCAD / PROTEL / Proteus / Microcap) Schematic Description: Introduction, Input files, element values, Nodes, circuit elements, sources, output variables, format of circuit and output files, drawing the schematic, Design rule Check (DRC), Netlist details.	
UNIT -III	**Introduction to MATLAB programming:**	
	Introduction, starting and ending a MATLAB session, Fundamentals of MATLAB programming (MATLAB variables, arrays, matrices, matlab operators- arithmetic, relational, logical, MATLAB graphics(plots, subplots, other types of plots), benchmarking and looping functions(branching functions, looping functions), miscellaneous functions(string function, input/output function), *examples on above topics*, advantages of MATLAB, limitations of MATLAB, various matlab commands & their explanation. Introduction to GUI.	
UNIT -IV	**MATLAB Simulink Basics:**	
	Introduction, Introduction to simulink, starting simulink, simple examples on starting a simulink, solving differential equations in simulink, Commonly used blocks, application block sets (power system toolbox) , user defined functions, Simulink modeling.	
UNIT - V	**MATLAB Basic Electrical Engineering Applications:**	
	Basic electrical engineering applications(introduction, elementary definitions, basic waveforms, average value -RMS value -peak value, ohms law, Kirchhoff's laws, independent and dependent Dc sources, series and parallel circuits, resonance phenomenon, network theorems, apparent power-	

	active power-reactive power, three phase source and load simulation, transformers. Application related to Wind and Solar.	
UNIT -VI	**PCB Design and its Applications:**	
	Simulation of following circuits: half wave & full wave rectifier, Zener shunt regulator, transistorized RC coupled amplifier, clipper and clamper. Introduction to PCB design.	

Term Work: The term work shall consist of record of minimum eight experiments and not limited to

List of experiments:

1. Schematic drawing & component symbol creation
2. Hierarchical schematic drawing
3. Simulation and analysis (bias point analysis, time domain, AC sweep, DC sweep, parametric) of :RLC Circuit.
4. Experiments based on PCB design which would include component placement, setting design rules, auto routing and interactive routing.
5. Experiments based on noise analysis and Monte-carlo analysis
6. To simulate simple calculator that performs basic tasks such as addition, subtraction, multiplication and division with special operations like computing xy and x!.
7. To accept the number and Compute a) square root of number, b) Square of number, c) Cube of number d) check for prime, d) factorial of number e) prime factors
8. To accept two numbers from user and compute smallest divisor and Greatest Common Divisor of these two numbers.
9. To accept a number from user and print digits of number in a reverse order.
10. To input binary number from user and convert it into decimal number.
11. Experiment on unit 3: Listing of some common MATLAB commands and executing with examples
12. Experiment on unit 4 : Basic simulation projects
13. Experiment on unit 5: Solving network theorems using MATLAB

Project based learning:

1) Project based on Network Theorems in MATLAB

2) Design of Regulated Power supply in Proteus

3) Design of Electronic circuitry for household applications in Proteus

4) Design of Household applications on PCB

5) Design of Electrical based applications in MATLAB

Text book:

1. M. H. Rashid 'Introduction to P-spice using OrCAD for circuits and Electronics' –Pearson Education

Reference Books:

1. User manuals of PROTEL, PROTEUS, OrCAD, Microcap.
2. W.C. Bosshart 'Printed Circuit Boards-Design & Technology'–Tata McGraw-Hill Publication.
3. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645
4. Romano Fabrizio, "Learning Python", Packt Publishing Limited, ISBN: 9781783551712, 1783551712
5. Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
6. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN-10: 9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
7. Jeeva Jose, P. Sojan Lal, "Introduction to Computing & Problem Solving with Python", Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978- 9382609810
8. Simulation with Arena by W.David Kelton, randall P. Sadowski, nancy B. Swets(Mc Graw Hill international edition)
9. MATLAB and SIMULINK for engineers by Agam Kumar Tyagi (Oxford University Press).
10. MATLAB and its Applications in Engineering by Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma(Pearson India Education Services Pvt Ltd.)
11. Introduction to MATLAB programming toolbox and sumulink by Jaydeep Chakravorthy (University Press India Private Limited)

Assignments:

Assignments should be able to verify course outcome and skills of group work, communication skills. One assignment on each unit (total 6 assignments).