Program: B.TECH. (ELECTRICAL) Semester – III 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		DC & AC Machines	3	2	1	60	40	25	-	25	150	3	1	1	5
2		Power system Engineering	4	2	-	60	40	25	25	-	150	4	1	-	5
3		Design of Electrical Installations	3	2	-	60	40	25	-	-	125	3	1	-	4
4		Computational Algorithms	4	2	-	60	40	25	25	-	150	4	1	-	5
5		*Operating Systems	4	2	-	60	40	25	25	-	150	4	1	-	5
6		Application Softwares in Electrical Engineering	-	4	-	-	-	25	-	-	25	-	2	-	2
7		Vocational Course-I AutoCAD Electrical	-	-	-	-	-	25	25	-	50	-	2	-	2
8		MOOC-I	-	-	-	-	-	-	-	-	-	-	-	-	2
9		**Environmental Studies	-	-	-	-	-	-	-	-	-	-	-	-	-
		Total	18	14	1	300	200	175	100	25	800	18	9	1	30

***** Industry Taught Course **Mandatory Audit Course, Theory Exam of 100 Marks

Program: B.TECH. (ELECTRICAL) Semester – IV 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		Special Purpose Machines	4	2	-	60	40	25	-	25	150	4	1	-	5
2		Network & Synthesis	3	2	1	60	40	25	-	25	150	3	1	1	5
3		Power Electronics	4	2	-	60	40	25	-	25	150	4	1	-	5
4		*Industrial Organization & Financial Management	3	-	-	60	40	-	-	-	100	3	-	-	3
5		Database management system (SQL)	4	2	-	60	40	25	-	25	150	4	1	-	5
6		IT Practices	-	6	-	-	-	25	25	-	50	-	3	-	3
7		Social Activities-I	-	-	-	-	-	-	-	-	-	-	-	-	2
8		Vocational Course-II Solar Power plant designing	-	-	-	-	-	25	25	-	50	-	2	-	2
9		**Disaster Management	-	-	-	-	-	-	-	-	-	-	-	-	-
		Total	18	14	1	300	200	150	50	100	800	18	9	1	30

***** Industry Taught Course **Mandatory Audit Course, Theory Exam of 100 Marks

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

DC & AC Machines		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours/week	End Semester Examination: 60 Marks	Theory: 04
Practical: 02 Hours/week	Continuous Assessment: 40 Marks	Practical: 01
Tutorial: 1 Hour/Week	Practical: 25 Marks TW: 25Marks	Total: 05

Course Pre-requisites:

The Students should have knowledge of

1.	Magnetic Physics, AC & DC Fundamentals
2.	Basic laws of rotating machines like Faraday's Law, Lenze's Law, etc
3.	Basics of Electrostatics and electromagnetic
4.	Transformer operation

Course Objectives:

	This course introduces knowledge about rotating machines. The course is designed to learn DC and AC machines with their constructional feature, operating principles, performance characteristics and applications. Also, to learn the different tests on machines and various speed control techniques.

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

1	Describe the basics of dc machine, armature reaction, commutation, characteristics & applications of dc generators, dc motors & identify the different parts.
2	Apply the concepts of three phase induction motor and estimate the losses, different motor parameters.
3	Apply the concepts of induction machine and analyze the results using different tests, draw phasor diagram, state specifications.
4	Describe & identify the different parts of synchronous generators, different excitation systems, armature windings, estimate winding factor, impedance and reactance by different methods.
5	Draw the capability curves of synchronous generators; estimate the regulation by different methods and describe the methods of synchronizing alternators.
6	Describe working principle, characteristics and applications of synchronous motors

UNIT – I	**DC Machines**	**(06 Hours)**
	Introduction, Basic Electromagnetic Laws, Emf induced in a coil rotating in a magnetic field, forces and torques in magnetic field systems, Energy balance, Energy in singly excited magnetic field systems. Construction of DC machines, E.M.F. equation of D.C. generator. Process of commutation & types, causes of bad commutation and remedies, Basic principle of working of DC motor, Significance of Back e.m.f., Torque equation, Types, characteristics and applications of d.c. motors, Starting, reversing and armature voltage and field control method of speed control, Armature reaction, Losses, efficiency, condition for maximum efficiency and maximum power output. Testing of DC motor: Brake test and Swinburne's test. Maintenance, types.	
UNIT - II	**Induction Machines Part-I**	**(06 Hours)**
	Construction of 3-phase induction motor, Concept of rotating magnetic field, Principle of Operation, Concepts of Speed & Slip, Frequency of rotor voltage & current, Power Flow Diagram & development of Equivalent Circuits, Losses, Relationship between rotor copper loss, rotor input & gross mechanical power developed, Efficiency, Torque–Slip/Speed characteristics, Effect of rotor resistance on Torque-Slip characteristics, Condition for maximum torque, Relations between starting, Full load & Maximum torque. Starters.	
UNIT - III	**Induction Machines Part-II**	**(06 Hours)**
	Open circuit and short circuit test, Circle diagram and computation of performance parameters, High Torque Cage Motors - Deep bar & Double cage rotor, Speed control mechanisms. Cogging & Crawling of induction motors, Applications. Maintenance of induction motor. Construction of single-phase induction motor, double revolving field theory, methods of self-starting and types: Resistance start, Capacitor start, Capacitor start-Capacitor run, Shaded Pole motor, equivalent circuit, torque-speed/slip characteristics, applications.	

UNIT - IV	**Synchronous Generators Part-I**	**(06 Hours)**
	Multiply excited magnetic field systems, Forces and torques in systems with permanent magnets, Dynamic equations, Winding in machines and materials used in electrical machines. Types of synchronous machines & their constructional features, Excitation Systems. Principle of working, Estimation of winding factor, EMF Equation, Rating of Generator, Generator on no load & balanced load, Armature reaction & its effect under load power factors, Synchronous Impedance, Equivalent Circuit & Phasor Diagram, Two Reaction Theory model, Estimation of Direct & Quadrature axes Synchronous Reactance by Slip Test, Phasor Diagram.	
UNIT - V	**Synchronous Generators Part-II**	**(06 Hours)**
	Power Flow (Transfer) Equations, Power – Power angle relation and Capability Curves of synchronous generators. DC resistance test, Open circuit Test & Short Circuit Test on synchronous generator, Determination of Voltage Regulation by direct load test & by Indirect Methods-EMF, MMF. Losses & Efficiency and Short Circuit Ratio. Parallel Operation of alternators - Necessity, Conditions, Concept of Infinite bus, alternators connected to infinite bus bar, Methods of synchronizing alternators (synchronizing lamps and synchro-scope), Significance of Synchronizing Power Coefficient.	
UNIT - VI	**Three Phase Synchronous Motor**	**(06 Hours)**
	Principle of operation, Methods of starting, Equivalent Circuit & Phasor Diagrams, Pull-in & Pull-Out Torque, Power Flow Equations, Operation with constant excitation & variable load and with Constant load & variable excitation (V Curves & Inverted V Curves), Phenomenon of Hunting & its remedies, Applications.	

Term Work:

The term work shall consist of record of minimum eight experiments. (Perform any 3 experiments from DC machines and any 2 experiments from induction machines and synchronous machines)

1. Identification of DC machine windings and resistances.
2. Speed control of D. C. Shunt motor by Armature and Field control.
3. Brake test on DC shunt motor
4. Swinburn's Test on DC shunt Motor.
5. Load Test on three phase induction motor
6. No load & Blocked Rotor Test on three phase induction motor: Determination of Equivalent Circuit Parameters/Plotting Circle diagram
7. Load test on single phase induction motor.
8. Direct loading test on alternator
9. Open circuit and short circuit test on alternator – regulation by emf and mmf method
10. Slip test on salient pole alternator – regulation by two reaction theory
11. Synchronization of alternator with bus bar
12. V-Curves of synchronous motor
13. Load test on synchronous motor

Project Based Learning :

1. Demonstration and operation of three and four point starter
2. Demonstration of reversing the direction of rotation of dc motor
3. Demonstration of verification of Electromagnetic laws
4. Demonstration of operation of Induction Motor as induction generator
5. To identify the windings of single phase induction motor, types of windings
6. MATLAB based project DFIG
7. Application based MATLAB Project:

i) Torque speed characteristics of DC Shunt motor for Centrifugal Pumps, Lifts, Weaving Machine, Lathe Machines, Blowers, Fans, Conveyors, Spinning machines, etc

ii) Torque speed characteristics of DC Series motor for vacuum cleaner, traction systems, sewing machines, cranes, air compressors etc.

iii) Analysis of performance characteristics of 3-phase induction motor –

Squirrel Cage IM-for Pumps and submersible, Pressing machine, Lathe machine, Grinding machine, Conveyor, Flour mills, Compressor And other low mechanical power applications

Slip Ring IM-Steel mills, Lift, Crane Machine, Hoist, Line shafts and other heavy mechanical workshops etc

iv) Torque speed characteristics of single phase IM for fans, refrigerators, Air-conditioners, Vacuum cleaners, washing machines, centrifugal pumps, tools, small farming appliances, blowers etc

v) Similarly for Single phase IM

vi) Alternators

vii) Synchronous motors

8. Maintenance of Machines: Preparation of maintenance schedule of electrical motors of machine laboratory
9. List the commonly used instruments for maintenance and find out the voltage between phases and between phase and neutral, test the continuity and insulation, measure earth resistance.
10. List the commonly used tools for maintenance
11. Dynamic Model of machines in MATLAB

Text Books:

1. Nagrath Kothari, "Electrical Machines", Tata McGraw Hill
2. A. E. Fitzgerald, Charles Kingsley, Jr. Stephen D. Umans, "Electric Machinery", Tata McGraw Hill
3. M.G. Say, " Alternating Current Machines", Pitman Publishing Ltd.
4. Ashfaq Husain, "Electric Machines", Dhanat Rai & Co.

Reference Books:

1. Dr. S. K. Sen, "Electric Machinery", Wiley Eastern
2. B. H. Deshmukh, "Electrical Technology", NiraliPrakashan
3. M. G. Say, "Alternating Current Machines", McGraw Hill
4. A. S. Langsdroff, "Theory of Alternator Current Machinery", Tata McGraw Hill

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

Power System Engineering		
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
	Term Work : 25 Marks, Oral: 25 Marks	Total : - 05

Course Pre-requisites:

The Students should have knowledge of

1.	Electromagnetic energy conversion system
2.	Electromagnetics and its applications

Course Objectives:

	This course introduces knowledge about electrical power generation, its transmission and distribution. Thecourse is designed to learn different methods of power generation. Also it focuses on performance of transmission line and distribution system along with its design consideration.

Course Outcomes: Students will be able to

1.	Understand block diagrams and describe the function of components of various Power Generation techniques byConventional energy Sources.
2.	Understand block diagrams and describe the function of components of various Power Generation techniques by nonconventional energy Sources.
3.	Define and analyze the significance of terms such as load factor , diversity factor etc on economics of power generation.
4	Compute string efficiency, sag and R, L, C parameters of different types of transmission line. (Design transmission line model and understand mechanical components of transmission line.)
5	Represent TEE and PI model of line and analyze the performance of transmission line.
6	Explore different type of cables & its calculations along with the computation of performance of AC distribution.

UNIT - I	**Power Generation techniques by Conventional energy Sources**	**(08 Hours)**
	Introduction to energy sources, selection of site – classification – general arrangements and operations – functions of each component – types of turbines – electric generators – advantages and disadvantages - list of major power stations : of Hydro electric , Thermal and Nuclear power plants in India with capacity. Basic layout and working of diesel and gas power plant. Concept of grid, types of grids.	
UNIT - II	**Power Generation techniques by Non -Conventional energy Sources**	**(08 Hours)**
	Different types of Nonconventional Energy Sources, Comparative benefits over conventional type, contribution of conventional & nonconventional energy sources, Solar energy – Its characteristics, basic concept of solar power plant, major solar power plants in India/world, Wind power plant– schematic arrangement - vertical axis, horizontal axis – electrical generator Hybrid solutions: Wind Turbine, diesel, WT-solar etc. – major wind farms in India / world, Power generation by bio gas, biomass, geothermal energy and tidal energy– its types, Magneto Hydro Dynamics (MHD), Concept of carbon credit.	
UNIT - III	**Load Curves and Economic Aspects**	**(08 Hours)**
	Load Curves: load curve – base load station and peak load station - demand factor – maximum demand – average demand – diversity of load – load factor – diversity factor – significance of high load factor & diversity factor – plant factor – capacity factor – connected load – load duration curve – integrated load duration curve – selection of units. (Simple numericals on various factors) Per capita energy consumption of developed & developing countries.Concept of cogeneration and captive generation.	
UNIT - IV	**Design of Transmission Line**	**(08 Hours)**
	Transmission Line Components and its types - Line Supports, Conductors, Insulators, Potential distribution over a string of insulators, methods of equalizing the potential, string efficiency. (Simple numericals) Circle Diagram Sag: Catenary curve – calculation of sag and tension – effects of wind and ice loading sag templates – vibration dampers for transmission lines. (Simple numericals) Corona and interference, Various effects – Skin, Proximity, Ferranti etc. Various Parameters of Transmission Line – Resistance, Inductance and capacitance and their calculation (Simple numericals). String efficiency and methods of improving string efficiency (Simple numericals).	

UNIT - V	**Transmission Line Performance analysis :**	**(08 Hours)**
	Circuit Representation of Transmission Line: Representation and performance of short, medium and long transmission line – Surge Impedance Loading (SIL), Characteristic Impedance, Generalized circuit constants: - Representation of tee and pi models of lines as two port networks – evaluation and estimation of ABCD constants (Simple numericals) –sending end and Receiving end.	
UNIT - VI	**Underground Cables and Distribution System**	**(08 Hours)**
	Underground Cables - Classification – construction - insulation resistance – capacitance – dielectric stress in single core cable (Simple numericals). Grading of cables. Laying of cables – Cable Terminations, cable jointing – causes of failure – cable faults and location of faults. Distribution System – Classification – A.C. distribution connection schemes - requirements of distribution system – design consideration – design of radial, ring distributors for concentrated, distributed loads.	

Term Work:

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

1. Measurement of A, B, C, D constants of short transmission line.
2. Measurement of A, B, C, D constants of Medium transmission line.
3. Measurement of A, B, C, D constants of Long transmission line.
4. Drawing Sheet on power generation by Conventional energy Sources
5. Drawing Sheet on power generation by nonconventional energy Sources
6. Drawing Sheet on types of insulator
7. Drawing Sheet on types of cables
8. Industrial visit to cable manufacturing company.
9. Industrial Visit report of HPS
10. Industrial Visit report of TPS / GAS PP
11. Industrial Visit report of WPS / Solar PP
12. Design analysis of transmission line model using any simulating software.

Project based learnings:

1. Sag calculations using MATLAB
2. String efficiency calculations using MATLAB
3. Load curve calculations using MATLAB
4. Creating small models of Hydroelectric power plant
5. Creating small models of Thermal power plant
6. Creating small models of Nuclear power plant
7. Creating small models of Solar power plant
8. Creating small models of Wind power plant
9. Creating small models of Solar-Thermal power plant
10. Creating small models of Gas-Turbine power plant
11. Creating small models of Biogas power plant
12. Creating small models of Biomass power plant
13. Creating small models of Diesel power plant
14. Creating small models of Geothermal power plant
15. Use of Google earth software to design of transmission line

Text Books:

1. A Course in Power System - J. B. Gupta - S. K. Kataria & Son's
2. V. K. Mehta, "Electrical Power System", S. Chand Publications
3. R. K. Rajput, "A text book on Power System Engineering", Laxmi Publications (P) Ltd

Reference Books:

1. Electrical Power - S. L. Uppal - Khanna Publication
2. Energy Technology - S. Rao, Dr. B B Panelkar - Khanna Publication
3. A Course in Power Plant Engineering - Arrora, Domkundwar - Dhanpatrai & Co. Publications
4. A Course in Electrical Power - Soni, Gupta, Bhatanagar - Dhanpatrai & Co. Publications

Syllabus for Unit Test:

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

Design of Electrical Installations		
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
	TW: 25 Marks	Total: 04

Course Pre-requisites:

The Students should have knowledge of

1.	Fundamentals of Electrical Engineering

Course Objectives:

1. To understand the basic concepts of regarding design of electrical installations.
2. To enable candidate to understand service connections, domestic commercial and industrial installations.
3. To understand practical aspects of transformer commissioning & HT/LT distribution lines.

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

1	Explain electrical installation design methodology.
2	Develop and design of service connections.
3	Develop design of domestic and commercial installation.
4	Develop and design of industrial installation.
5	Illustrating transformer commissioning and HT/LT distribution lines.
6	Explain contract and tendering.

UNIT – I	**Electrical Installation Design Methodology**	**(06 Hours)**
	General rules of electrical installation design, Installed power loads - Characteristics and Power loading of an installation, Connection to the MV utility distribution network, Connection to the LV utility distribution network, LV Distribution,Protection against electric shocks and electrical fires, Sizing and protection of conductors, Energy Efficiency in electrical distribution, Characteristics of particular sources and loads, Green and economical energy-Photovoltaic installation.	
UNIT - II	**Design of Service Connections**	**(06 Hours)**
	Concept of service connection. Types of service connection and there features. Methods of installation of service connections. Difference between overhead and underground service connection. List of materials and accessories for service connections.IE rules for service connections. Electrical panel designing. Estimation and costing of service connections.	
UNIT -III	**Design of Domestic and Commercial Installation**	**(06 Hours)**
	Concept of domestic/commercial installation. The general IS codes regarding internal wiring. General rules while executing internal wiring of domestic/commercial installation. Computing the conductor size and the procedure for determines the size. Define the circuits and sub circuits. Drawing the layout of wiring. Describing the preparation of the estimate and cost of materials used for internal wiring of domestic/commercial buildings. Earthing in domestic/commercial installations. Sequence to be followed to prepare estimation. Compute simple problems. Study of domestic/commercial electricity bill.	
UNIT -IV	**Design of Industrial Installation**	**(06 Hours)**
	Concept of motor wiring circuit and single line diagram. Guidelines about power wiring and motor wiring. Design considerations of electrical installation in industry/factory/ workshop. Calculation of input current of the motor. Selection of size and rating of cable. Determination of rating of fuse. Determination of size of conductor. Sequence to be followed to prepare estimation. Proper method of earthing in industrial installation. Finding out estimation chart. IE rules for industrial wiring. Compute simple problems.	
UNIT - V	**Transformer Commissioning & HT/LT distribution Lines**	**(06 Hours)**

	Common Pre-commissioning Tests of Transformer, Buchholz Relay Test, **Insulation Resistance (IR), Break-Down Voltage (BDV) Test, Voltage Ratio Test, Winding Resistance Measurement Test, Marshalling Box Scheme Check, Temperature Indicator Test, Off-Circuit Tap Selector (OCTS).** Difference between HT/LT power, HT/LT power rates- domestic, commercial and industrial rates. Impact of increasing HT lines, Voltage level for HT/LT lines, LT/HT Lines and transmission lines, Loss reduction by improving ratio of HT/LT line in Electrical Distribution System.	
UNIT -VI	**Contracts And Tendering**	**(06 Hours)**
	Contracts, Tenders: Concept of contract & tenders, Types of contracts & contractors, Types of tenders, Requirement of valid contract and good contractor, Tender notice, Procedure for submission and opening of tenders, Comparative statement for selection of contractors, Role of Electrical inspector in design and installation and duties, Electrical Liasoning services.	

Term Work:

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

1. Study of different IE rules.
2. Drawing sheet on wiring design of domestic installation.
3. Drawing sheet on wiring design of commercial installation.
4. Drawing sheet on wiring design of industrial installation.
5. Finding estimation chart for particular installation.
6. Drawing sheet on design of electrical installation.
7. Drawing sheet on design of HT/LT distribution lines.
8. Experiment to understand contracts/tender procedure by sample example.

Project Based Learning

1. Study-visit and prepare report to one domestic electrical installation under construction.
2. Study-visit and prepare report to one commercial electrical installation under construction.
3. Study-visit and prepare report to one industrial electrical installation under construction.
4. Prepare estimation chart of any one class room in the electrical department.
5. Visit and make report of roof top solar plant.
6. Study of IE rules and make a report on it.
7. Drawing single line diagram of electrical machine lab electrical wiring.
8. Study of Buchholz Relay of distribution transformer around college premises.
9. Do temperature indicator test of distribution transformer around college premises.
10. Do voltage ratio test of distribution transformer around college premises.
11. Perform Winding Resistance Measurement Test on distribution transformer around college premises.
12. Perform Insulation Resistance (IR) Test on distribution transformer around college premises.
13. Perform Break-Down Voltage (BDV) Test on distribution transformer around college premises.
14. Visit & study the electric sub-station in college premises.
15. Study of supply connection of your electrical lab.
16. Visit nearby HT line and study its operation.
17. Study Tender notice appeared in local newspaper & make report.
18. Meet Electrical Inspector and understand his/her duties.

Text Books:

1. Surjit Singh- Electrical Estimation and Costing", Dhanpat Rai Publications.

Reference Books:

1. S.L.Uppal-" Electrical Wiring, Estimation & Costing", Khanna Publishers
2. B.V.S. Rao-"Operation & Maintenance of Electrical Equipments", (Vol 2) Media Promoters & Publishers Pvt.Ltd.
3. Raina.K.B. and Bhattacharya S.K., " Electrical Design Estimation & Costing", Tata McGraw Hill, New Delhi.
4. B.D.Arora- Electrical Wiring Estimation & Costing-New Hights, New Delhi.

Syllabus for Unit Test:

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

Computational Algorithms

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

Differentiation and integration of a single real variable, ordinary differential equations, Fundamentals of Programming languages: MATLAB (Introduction), Linear Algebra, Flowchart and algorithm basics.

Course Objectives:

- To emphasize the need of computational techniques and analyze errors involved in the computation.
- To provide sound knowledge of various numerical methods.
- To apply various numerical methods to obtain solution of different types of equations such as transcendental, simultaneous, ODE etc. and also for interpolation, integration and differentiation.
- To impart skills to develop programs using MATLAB

Course Outcomes: Students will be able to

1.	Recall MATLAB Basics, implement basic principles of numerical methods and types of errors in computation and their causes of occurrence.
2.	Identify various types of equations and apply appropriate numerical method to solve different equations.
3.	Apply different numerical methods for interpolation, differentiation and numerical integration.
4	Apply and compare various numerical methods to solve first and second order ODE.
5	Apply and compare various numerical methods to solve linear simultaneous equations.
6	Identify various statistical methods and demonstrate applications of algorithm in electrical engineering.

UNIT - I	**MATLAB Basics, Numerical Methods and Errors:**	**(08 Hours)**
	MATLAB: Data types, Operator, Variables, Control Statements, Loops, Access Control, **Arrays**: Introduction, one and two dimensional arrays. **Basic principle of numerical methods:** Floating point algebra with normalized floating point technique, Significant digits. **Errors:** Different types of errors, causes of occurrence and remedies to minimize them. Generalized error formula.	
UNIT - II	**Solution of Transcendental and polynomial equation and Curve Fitting:**	**(08 Hours)**
	Solution of Transcendental and polynomial equation: Bisection, Secant, Regula-Falsi, Chebyeshev and Newton-Raphson methods, Newton-Raphson method for two variables. **Curve Fitting** using least square approximation – First order and second order.	
UNIT - III	**Interpolation and Numerical Differentiation:**	**(08 Hours)**
	Interpolation: Difference operators, Introduction to interpolation - Newton's forward, backward interpolation formulae, Sterling's and Bessel's central difference formulae, Newton's divided difference formula, Lagrange's interpolation. **Numerical Differentiation** using Newton's forward and backward interpolation formulae.	
UNIT - IV	**Solution of Ordinary Differential Equation(ODE) and Numerical Integration:**	**(08 Hours)**
	Solution of First Order Ordinary Differential Equation (ODE) using Taylor's series method, Euler's, Modified Euler's methods, Solution of Second order ODE using 4th order Runge-Kutta method. **Numerical Integration:** Trapezoidal and Simpson's rules as special cases of Newton Cote's quadrature technique for single and double integrals.	
UNIT - V	**Solution of linear simultaneous equation:**	**(08 Hours)**
	Solution of simultaneous equation: Direct methods - Gauss and Gauss-Jordan elimination methods, concept of pivoting – partial and complete. Iterative methods – Jacobi and Gauss Seidel methods. **Matrix Inversion** using Jordon method and Eigen values using Power method.	
UNIT - VI	**Statistical methods and Application of Algorithms in Electrical Engineering**	**(08 Hours)**
	Statistical Methods: Random Sampling, Sample estimation, Hypothesis testing, Statistical quality control and Monte Carlo methods. **Applications:** Load Forecasting methods, Condition Monitoring, Battery Management System,	

	Electrical Automation, Equation solving methods (simple numerical) for: Load Flow studies, Transient and Harmonic studies.	

Term Work:

The term work shall consist of record of minimum eight experiments in MATLAB with flowchart and results from below list.

1. Solution of a polynomial equation using Birge-Vieta method.
2. Solution of a transcendental equation using Bisection or Regula-Falsi method.
3. Solution of two variable non-linear equation using N-R method.
4. Program for interpolation using Newton's forward or backward interpolation.
5. Program for interpolation using Lagrange's or Newton's Divided difference interpolation.
6. First order curve fitting using Least square approximation.
7. Solution of simultaneous equation using Gauss Seidel or Jacobi method.
8. Solution of simultaneous equation using Gauss elimination or Jordon method.
9. To find largest Eigen value using Power method.
10. Solution of Numerical Integration using Simpson's (1/3) rd or (3/8) th rule.
11. Solution of first order ODE using 4th order RK method or Modified Euler method.

Project Based Learning:

1. Develop an algorithm using any of the method for real time applications.
2. Write a review paper for comparative method based on any type of equations to obtain solution.
3. Develop an article for any method using multiple options in algorithm (loops, functions) and analyze the difference in result.
4. Identify applications in electrical engineering where errors are occurred and find solution how to minimize the errors.
5. Develop a web based application (static or dynamic model) for electrical application using relevant software.

Text Books:

1. M. K. Jain, S.R.K. Iyangar, R. K. Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Publications.
2. T. Veerarajan and T. Ramchandran, "Numerical Methods with Programs in C and C++", Tata McGraw Hill Publication.
3. P.P. Gupta & G.S Malik, "Calculus of Finite Difference and Numerical Analysis", Krishna Prakashan Media Ltd, Meerut
4. Dr. B. S. Grewal, "Numerical Methods in Engineering & Sciences", Khanna Publishers.
5. E. Balagurusamy, "Numerical Methods", Tata McGraw Hill Publication.

Reference Books:

1. J. B. Scarborough, "Numerical Mathematical Analysis", Oxford & IBH, New Delhi.
2. Steven Chapra, Raymond P. Canale, "Numerical Methods for Engineers", Tata McGraw Hill Publication.
3. S.S. Sastry, "Introductory methods of Numerical Analysis", PHI Learning Private Ltd.
4. P. Thangaraj, "Computer oriented Numerical Methods", PHI Learning Private Ltd.

Syllabus for Unit Test:

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

Industry Taught Course-I Operating Systems

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, OR: 25 Marks	Total: 05

Course Pre-requisites:

The Students should have knowledge of

1.	Computer System, Applications of Computers and Computer operation's.

Course Objectives:

	To learn the basic structure and operations of a computer. Understand the memory and I/O organization and recent trends

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

1	Discuss the operating system and their principles
2	Analyze the process management system
3	Elaborate the memory management system
4	Analyze the I/O and file management system
5	Analyze the recent trends and compare the future technologies
6	Examine the various applications of computer systems.

UNIT – I	**OPERATING SYSTEM**	**(08 Hours)**
	Computer System functions. The Evolution of Operating Systems, Developments Leading to Modern Operating Systems, Virtual Machines Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.	
UNIT - II	**PROCESS AND THREAD MANAGEMENT**	**(08 Hours)**
	Processes-Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors.	
UNIT -III	**MEMORY MANAGEMENT**	**(08 Hours)**
	Memory Management Requirements, Swapping, continuous memory allocation Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Segmentation. Virtual Memory: Hardware and Control Structures, Operating System Software, Linux Memory Management, Windows Memory Management, Android Memory Management.	
UNIT -IV	**INPUT/OUTPUT AND FILE MANAGEMENT**	**(08 Hours)**
	I/O Management and Disk Scheduling: I/O Devices, Organization of the I/O Function, Operating System Design Issues, I/O Buffering, Disk Scheduling, Disk Cache, Linux I/O. File Management: Overview, File Organization and Access, File Directories, File Sharing, Record Blocking, Secondary Storage Management, Linux Virtual File System, Android File Management.	
UNIT - V	**TRENDS IN OPERATING SYSTEMS**	**(08 Hours)**
	Linux Kernel Module Programming, Embedded Operating Systems: Characteristics of Embedded Systems, Embedded Linux, and Application specific OS. Basic services of NACH Operating System. Introduction to Service Oriented Operating System (SOOS), Introduction to Ubuntu EDGE OS, etc.	
UNIT -VI	**LINUX SYSTEM AND CASE STUDY**	**(08 Hours)**
	Basic Concepts of LINUX, Multifunction Server, Virtualization- Xen, VMware with Linux Host, Android operating system –Features, characteristics, Basic building blocks, Architecture, System services. Case Study: DOS and Windows Operating System, Unix Operating System	

Term Work:

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

1. Process control system calls
2. Apply Banker's algorithm
3. Inter process communication in Linux
4. Linux Kernel configuration, compilation and rebooting from the newly compiled kernel. Requirements
5. Kernel space programming
6. Implementing a CPU scheduling policy in a Linux OS.
7. Implementing a memory management policy in a Linux OS.
8. Implementing a file system in a Linux OS.
9. Apply disk Scheduling algorithms

Project Based Learning

1) To develop several system calls to enable user programs to interface with the file system.

2) Functioning threading system- scheduling algorithm, interrupt handling.

3) To enable the memory system by enabling virtual memory, including adding paging support, stack growth, memory mapped file support, and protects user level pages while in use by the kernel.

Text Books:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons ,Inc., 9th Edition,2012.
3. Maurice J. Bach, "Design of UNIX Operating System", PHI

Reference Books:

1. Dhananjay M Dhamdhere, 'Operating Systems - A Concept Based approach ', Tata McGraw, Hill publication
2. Abraham Silberschatz, Peter B. Galvin &Grege Gagne (Wiley))'. Operating System Concepts '
3. Sumitabha Das, 'Unix Concepts and Applications, Tata McGraw Hill
4. Achyut S. Godbole, 'Operating System with case studies in Unix, Netware and Windows NT' Tata McGraw Hill
5. Karim Yoghmour 'Embedded Android', O'Reilly Publication

Syllabus for Unit Test:

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

Application Softwares in Electrical Engineering

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Practical: 04 Hrs/Week	Term Work : 25 Marks	TW :- 02

Course Pre-requisites:

The Students should have knowledge of

Basic Electric Machines, Magnetic Theory, Introduction to Electrical Power system , Structure of Electrical power system, Sources of Electrical Energy, Elements of Power system

Course Objectives:

- Students will get well familiar with importance of electrical design, different design techniques and application of tools for electrical design and analysis.

Course Outcomes: Students will be able to

1.	Relate the basic knowledge of electrical system with electrical design
2.	Understand the importance of software tool and explore its GUI
3.	Apply the knowledge of toolbar for understanding the design concept
4	Identify various electrical applications as per software tools
5	Discuss the methods of software simulation in electrical engineering
6	Apply the knowledge for design and analysis of electrical machines

UNIT - I	**Introduction to Electrical Design:**	
	Introduction to Electrical System for Electrical Design and analysis, Application of Electrical Design, Purpose of Electrical Design, Basic Design philosophy, Importance of Results from design tools, design optimization, Standard Rules for Electrical Design.	
UNIT - II	**Introduction to ETAP Software:**	
	Introduction to ETAP software, Importance of ETAP for System design, History of ETAP, Key features & Benefits of ETAP, Codes & Standards, Working with ETAP software- Starting ETAP software, Creating a new project, Changing the Project standard, File Management, Exploring GUI.	
UNIT - III	**Toolbar and Library for ETAP:**	
	Toolbar Description - Project Toolbar, Theme Toolbar, System Toolbar, Mode Toolbar, Base & Revision Toolbar, Inserting Circuit Elements- Library for Circuit Elements, System Elements and Components, Element Classification - AC Elements , DC Elements , AC-DC Elements , Instrumentation Elements , Component Editor	
UNIT - IV	**Introduction to ANSYS Maxwell software:**	
	Introduction to ANSYS Maxwell software and general applications, Applications of software in electrical engineering, Maxwell solvers-electric and magnetic solution, GUI, RMXprt tool, Introduction to 2D simulation, Introduction to 3D simulation.	
UNIT - V	**ANSYS Maxwell software simulation:**	
	Finite element method, Selection of Geometry and solver types, Defining analysis plane, selection of solver, model units, Exploiting magnetic/excitation symmetry in model, Assigning material properties, Assigning excitation and boundary conditions, Model verification.	
UNIT - VI	**Electric Machine simulation:**	
	Need for machine simulation, Applications of ANYSY Maxwell software for machine simulation, Design and analysis of any one electric machine using RMXprt tool, Maxwell 2D simulation, Maxwell 3D simulation, Discussion on simulations results.	

Term Work:

The term work shall consist of record of minimum eight experiments in ETAP and ANSYS with flowchart and results from below list.

1. Prepare the list of tools used for Electrical Design and Analysis
2. Prepare a new project and change the project standard using ETAP software
3. Study of system toolbars in details with its application in ETAP software
4. Study of system elements and components in ETAP software
5. Study of Library for ETAP software and its applications

6. Study the components editor and its working in ETAP software
7. Design and analysis of any one conventional electrical motor using RMXprt tool.
8. Study of 2D model for any one conventional electrical motor using ANSYS Maxwell software.
9. Study of 3D model for any one conventional electrical motor using ANSYS Maxwell software
10. Design and analysis of any one special purpose machine using RMXprt tool.
11. Study of 2D model for any one special purpose machine using ANSYS Maxwell software.
12. Study of 3D model for any one special purpose machine using ANSYS Maxwell software.

Project based Learning:

1. Obtain and prepare Single Line Diagram from any real time project in ETAP software without any errors.
2. Develop a substation SLD of any voltage level by giving suitable input parameters
3. Generate reports through above analysis and give presentation on the results obtained.
4. Designing Induction motor/BLDC motor/ Switched Reluctance motor as per specifications using RMXprt.
5. 2D model of assigned machine through ANSYS Maxwell software.
6. Develop an article based on any content related to ETAP software get it published in conference/technical journal, etc.
7. Develop an article based on any content related to ANSYS software get it published in conference/technical journal, etc.

Text Books:

1. Hemchandra Madhusudan Shertukde, "Power Systems Analysis Illustrated with MATLAB and ETAP", CRC Press, Taylor and Francis Group
2. Vivek Ravindran, Prajith Kumar, Sumit Tomar, "Modeling, Simulation and Optimization of a Power System Network: A case study using ETAP software", LAP Lambert Academic Publishing.
3. John E.Matsson, "An introduction to ANSYS Fluent 2021", SDC Publications.
4. Huei-Huang Lee, "Finite Element Simulations with ANSYS Workbench 2021 Theory, applications and case studies ", SDC Publication.

Reference Books:

1. T.Stolarski, Y.Nakasone,S.Yoshimoto "Engineering analysis with ANSYS software", BH Publication.
2. Saeed Moaveni, "Finite Element Analysis Theory and application with ANSYS", Third edition, Pearson publication .
3. Dr.Marius Rosu, Dr.Ping Zhou, Dr.Dingsheng Lin, "Multiphysics Simulation by Design for Electrical Machines, Power electronics and Drives", IEEE Press Wiley.

Vocational Course-I AutoCAD Electrical		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	TW: 25 Marks OR: 25 Marks	Credits: 02

Course Pre-requisites:

The Students should have basic knowledge of

1.	A working knowledge of the AutoCAD software and electrical terminology

Course Objectives:

	Navigate the AutoCAD Electrical user interface. Use the fundamental features of AutoCAD Electrical. Build intelligent ladder diagrams and panel layouts. Create, view, and edit the project settings and properties. Extract data from drawings into reports formatted to match users' standards. Insert and edit parametric PLC modules, nonparametric PLC modules, and stand- alone PLC I/O points.

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

1	Illustrate the basics of electrical drawings and list the common symbols in electrical drawings.
2	Explain the basics of schematics.
3	Construct the circuit and mark the cables.
4	Explain the panel layout and identify the components.
5	Explain the PLC, its layout, PLC parameter selection and connection of wires from source to equipment.
6	Compare and examine the generated report.

UNIT – I	**Basics of electrical drawings**	
	Need of Drawings, Electrical Drawings, Common Symbols in Electrical Drawings, Wire and its Types, Labeling. Design Environment, Basic Workflow, Project Manager, Project Drawing List, Moving Through a Project, Copy Projects, **GUI.**	
UNIT - II	**Schematics**	
	Single wires/components, referencing, Ladders, Wire Type, Wire Numbers, PLC I/O wire numbers, 3-Phase Circuits, Source and Destination Signal Arrows, Multi Wire 3-Phase Circuits, Point-2-Point Connectors.	
UNIT - III	**Circuit and Cables**	
	Cable markers, Fan In/Out, insert saved circuits, save circuits to ICON menu, circuit clipboard, circuit builder, copy component, align, delete componentand attribute editing commands.3 D model of electrical assembly. Drawings of electrical machineshalf sectional end and half sectional elevation.	
UNIT - IV	**Panels**	
	Panel Layout, Foot Prints, Footprints from Schematic list, Footprints from icon menu, Din rails, Balloons, Wire Annotations, Create Assembly, Editing & Modifying Footprints. Creating Own Footprint, Placing a Terminal. Terminal Editor	
UNIT - V	**PLC**	
	Generate PLC Layout Modules, PLC parametric selection, Module layout, Insert PLC modules, Edit PLC module, PLC Database File. Point to Point Wiring Tools, Introduction to Connector Diagrams, Inserting Connectors, Editing & Modifying Connectors, Link components by dashed lines, Grouping Wires	
UNIT - VI	**Reports**	
	Generate Reports, Types of schematic reports, Generate a schematic report, Types of panel reports, Generate a panel report, Run automatic reports, Automatic report generation, Audit: Missing Catalog, Electrical Audit, Signal Error/ List, Drawing Audit Import/Export: To Spreadsheet. From Spreadsheet	

Term Work:

The term work shall consist of record of minimum eight (2 based on schematics, 2 based on 3D model of electrical assembly, 2 based on panel layout and 2 based on PLC Circuit)sheets.

1. To create a schematic for 3 phase motor starters
2. To create a schematic drawing of any circuit of dc machines experiment
3. To create a schematic drawing of Load test on a Linear Induction Motor
4. To create a schematic drawing of Load test on a AC Series motor.
5. To Create schematic of the given circuit. Design the panel for the user and then generate the report for the components.
6. To draw the half sectional end and half sectional elevation of Squirrel cage motor
7. To draw the half sectional end and half sectional elevation of DC generator
8. To draw the detailed drawing of each part of single phase transformer
9. To draw the 3-phase, double layer lap winding with full pitch and chorded coils
10. To create a panel layout of3 phase motor starters
11. To create a panel layout ofLoad test on a Linear Induction Motor
12. To create a panel layout ofLoad test on a AC Series motor.
13. Create the PLC circuit of the given figure

Text Book:

1. AUTOCAD ELECTRICAL 2016 BLACK BOOK By *Gaurav Verma CAD/CAM/CAE Expert Matt Weber CAD/CAE Expert (CADCAMCAE Works, Georgia)*
2. AutoCAD Electrical 2019: Fundamentals with NFPA Standards: Autodesk Authorized Publisher
3. AutoCAD Electrical 2016 for Electrical Control Designers, Prof. Sham TickooPurdue University
4. Getting Started AutoCAD® Electrical 2005
5. AutoCAD Electrical 2012 User's Guide

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

Special Purpose Machines		
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 Oral: 25 Marks	Total: 05

Course Pre-requisites:

The Students should have basic knowledge of

1.	Electrical Machines (DC and AC) and Power Electronics.

Course Objectives:

	This course aims at understanding the construction, working principle, control, performance and applications of special purpose machines as an extension to the study of basic electrical machines.

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

1	Explainconstruction, principal of operation and applications of special types of DC/AC machines.
2	Explaintypes, characteristics and control methods of servo motors.
3	Describe the types, characteristics of stepper motor and select the motor as per applications.
4	Explaintypes, characteristics, applications and control methods of Reluctance motor.
5	Describe construction, principal of operationand applications ofBrushless DC Motor.
6	Describe construction, principal of operation and applications ofPermanent Magnet Synchronous Motor.

UNIT – I	**Special Types ofDC/AC Machines**	**(08 Hours)**
	Construction, operating principle, characteristics and applications of: Induction generator, Rosenberg Generator, three wire generator, Electric Welding Generator, Printed Circuit Board Motor, Universal motor, Linear induction motor, DYNA Motors, phase advancer, Rotary Amplifiers, Series Boosters.	
UNIT - II	**Control Motors (Servo Motors)**	**(08 Hours)**
	Servo Mechanism, fundamental characteristics, types – **DC Servo Motors:** field controlled, armature controlled and permanent magnet armature-controlled dc motor with schematic diagrams. **AC Servo Motors: C**onstruction, production of torque, torque speed characteristics, types, methods of control and applications.	
UNIT - III	**Stepper Motor**	**(08 Hours)**
	Constructional features – Principle of operation. Types of stepper motors-Variable reluctance motor, Hybrid motor, Permanent magnetmotor. Single and multistack configurations. Theory of torque production, Torque equations – Modes of excitation. Characteristics of stepper motor - Static and dynamics characteristics. Concepts of lead angles, micro stepping, Drive circuits, Applications and selection of motor.	
UNIT - IV	**Reluctance Motors**	**(8 Hours)**
	Synchronous Reluctance Motor: Constructional features, Operating principle, Voltage and Torque Equations, Phasor diagram, performance characteristics and Applications. **Switched ReluctanceMotor:** Constructional features, Principle of operation, Torque production, Steady state performance prediction, Analytical method. Power Converters and their controllers. Methods of Rotor position sensing, Sensor less operation, Characteristics and Closed loop control. Applications. Comparison between VR Stepper Motor and SR Motor	
UNIT - V	**Brushless DC Motor**	**(8 Hours)**
	Basic concepts, Magnetic materials. **Brushless DC Motor:** Construction, Principal of operation, Types, EMF and torque equations – Commutation - Power Converter Circuits and their controllers, Comparison with DC motor, Applications.	
UNIT - VI	**Permanent Magnet Synchronous Motor**	**(8 Hours)**

	Sinewave Motor/Permanent Magnet Synchronous Motors (PMSM): Ideal and practical motor.Construction,Principle of operation, EMF and Torque equations, Armature MMF, Synchronous Reactance, Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements– Applications.	

Term Work:

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

1. Load test on a Universal Motor and determine the performance with dc/ac supply voltages.
2. Laboratory demonstration of Induction Generator.
3. Load test on a Linear Induction Motor and determine the speed thrust characteristic.
4. Laboratory demonstration of AC / DC Servo motor.
5. Experimental analysis of Stepper Motor Drive.
6. Load test in order to determine the performance characteristics of the Reluctance Motor.
7. To determine the d-axis and q-axis synchronous reactance of the Reluctance Motor.
8. Experimental analysis/simulation of Switched Reluctance Motor Drive.
9. Experimental analysis/simulation of Permanent Magnet BLDC Motor Drive
10. Experimental analysis/simulation of PMSM motor drive.
11. Load Characteristics of Brush less DC Motor.
12. Study of different software's for design and analysis of special purpose machines.
13. Theoretical design of any one type of special purpose machine.

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

1. Development of prototype of any one type of special purpose machine.
2. Practical study of any one type of special purpose machine.
3. Theoretical design/software simulation of any one type of special purpose machine.

Text Books:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.
3. D.P. Kothari and I J Nagarath : 'Electric Machines,' Third Edn, Tata McGraw-Hill Pub.,2004.
4. V. K. Mehta, Principles of Electrical Machines, S Chand Publication.
5. B.L.Theraja,A.K.Theraja . 'A Textbook of electrical technology-AC & DC Machines' Volume-II, S.Chand publication.
6. Bhimbhra P. S., 'Electrical Machine and Power Electronics' Tata-McGraw Hill Publication.
7. Ashfaq Husain, "Electric Machines", Dhanpat Rai and co. publications.
8. PrithwirajPurkait, Indrayudh Bandyopadhyay "Electrical Machines" Oxford University Press
9. Charles I. Hubert, "Electrical Machine, Theory, Operation, Applications, Adjustments and Control" Low Price Edition, Pearson Education.

Reference Books:

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
3. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
4. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
5. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.
6. Ogata K., 'Modem control Engineering', Prentice Hall.
7. A. E. Fitzgerald, Charles Kingsley, Stephen Umans, 'Electric Machinery', Tata McGraw Hill Publication
8. P. C. Sen, " Principles of Electrical Machines and Power Electronics", John Willey & Sons
9. Ion Boldea, 'Linear Electric Machines, Drives and Maglevs', CRC Press
10. Daune C. Hanselman, "Brushless Permanent Magnet Motor Design" McGraw Hill, Inc.

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

Network & Synthesis		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	Theory : - 04
Practical: 02 Hrs/Week	Continuous Assessment: 40 Marks	Practical : - 01
Tutorial: 01 Hrs/Week	TW : 25 Marks, PR: 25 Marks	Total : - 05

Course Pre-requisites:

The Students should have knowledge of

Terminology of electrical networks, series and parallel combinations of resistance, Laplace transforms , linear differential equations.

Course Objectives:

- To develop the strong foundation for Electrical Networks.
- To develop analytical qualities in Electrical circuits by application of various theorems.
- To understand the behavior of circuits by analyzing the transient response using classical methods and Laplace Transform approach.
- To apply knowledge of laws and Network theory for analysis of 2-port networks and design of other circuits like filters.

Course Outcomes: Students will be able to

1.	Calculate current/voltage in electrical circuits using simplification techniques, Mesh, Nodal analysis.
2.	Calculate current/voltage in electrical circuits using Network theorems and understand the graph theory.
3.	Analyze the response of RLC circuit with electrical supply in transient and stead state.
4	Apply Laplace transform to analyze behavior of an electrical circuit.
5	Derive formula and solve numerical of two port network and Design of filters.
6	Apply knowledge of network theory to find transfer function, poles and zeroes location to perform stability analysis and parallel resonance.

UNIT - I	**Basics of Network with types, Mesh & Nodal Analysis**	**(06 Hours)**
	Lumped and Distributed, Linear and Nonlinear, Bilateral and Unilateral, Time-variant and Time invariant. Independent and Dependent (controlled) voltage and current sources. Concept of voltage and current divider, Source transformation and shifting. Network Equations: Network equations on Loop basis and Node basis, choice between Loop analysis and Nodal analysis. Concept of super node and super mesh, mutual inductance, Dot convention for coupled circuits, Concept of duality and dual networks.	
UNIT - II	**Network Theorems and Graph Theory:**	**(06 Hours)**
	Network Theorems: Superposition, Thevenin's, Norton, Maximum Power Transfer Theorem, Reciprocity, Millman's theorems applied to electrical networks with all types of sources. **Graph Theory:** Tree ,Co-tree, Incidence matrix ,F-cutest Matrix, Tie set B Matrix	
UNIT - III	**Transients in RLC circuit:**	**(06 Hours)**
	Solutions of differential equations and network equations using classical method for R-L, R-C and R-L-C circuits with DC and sinusoidal excitation (under-damped, over-damped and critically damped conditions with derivation), Initial and Final Condition (series and parallel).	
UNIT - IV	**Laplace Transform and its Applications:**	**(06 Hours)**
	Basic Properties of Laplace Transform, Laplace Transform of Basic R, L and C components, Solutions of differential equations and network equations using Laplace transform method for RL, R-C and R-L-C circuits (series and parallel), Inverse Laplace transforms, transformed networks with initial conditions. Analysis of electrical circuits with applications of step, pulse, impulse & ramp functions, shifted & singular functions the convolution integral, application of initial and final value theorem, Application of Laplace transformation technique in electric circuit analysis.	
UNIT - V	**Two port network and Filters:**	**(06 Hours)**
	Two Port Network: Short circuit admittance, open circuit impedance, Hybrid parameters and transmission parameters, Interrelations between parameters. **Filters:** Introduction to passive filters, low pass filters, high pass filters and m-derived LPF and HPF filters and design.	
UNIT - VI	**Network Functions:**	**(06 Hours)**
	Poles and Zeros: Terminal pairs or ports, network functions for the one port and two ports, the	

	calculation of network functions, general networks. Poles and zeros of network functions, Restrictions on poles and zeros locations for transfer functions and driving point function, Time –domain behavior from the pole and zero plot. Stability of active networks. Parallel Resonance, Resonance frequency, Quality factor, Current and resonance.	

Term Work:

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

1. Verification of Superposition theorem in A.C. circuits.
2. Verification of Thevenin's theorem in A.C. circuits.
3. Verification of Reciprocity theorem in A.C. circuits.
4. Verification of Millman's theorem.
5. Verification of Maximum Power Transfer theorem in A.C. circuits.
6. Determination of time response of R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor).
7. Determination of time response of R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit).
8. Determination of time response of R-L-C series circuit to a step D.C. voltage input.
9. Determination of parameter of Two Port Network.
10. Determination of current under parallel Resonance condition.
11. Determination of Resonance, Bandwidth and Q factor of R-L-C series circuit.

Project based learning:

1. Prepare a hardware model based on any of the network theorem and calculate current flowing through the load.
2. Prepare a simulation model for the above hardware model in any software and compare the results with hardware model.
3. Develop an article based on hardware and software model and get it published in conference/technical journal, etc.
4. With the help of CRO perform transient analysis of voltage and current for any of the circuit.

Text Books:

1. Network Analysis Third Edition by M. E. Van Valkenburg, Prentice Hall of India Private Limited.
2. Network Analysis & Synthesis by G. K. Mittal, Khanna Publication.
3. Network Analysis and Synthesis by Ravish R Singh, McGraw Hill.
4. Introduction to Electric Circuits by Alexander & Sadiku, McGraw Hill.
5. Introduction to Electric Circuits by S. Charkarboorty, Dhanpat Rai & Co.
6. Fundamentals of Electrical Networks by B.R.Gupta & Vandana Singhal- S.Chand Publications
7. Electrical Circuit Analysis 2nd Edition by P. Ramesh Babu, Scitech Publication India Pvt. Ltd.

Reference Books:

1. Network Analysis by Cramer , McGraw Hill Publication.
2. Engineering Circuit Analysis by William H. Hayt, Jr. Jack E. Kemmerly, McGraw Hill Publication.
3. Schaum's Outline of Electric Circuits, McGraw-Hill Education; 7 edition

Syllabus for Unit Test:

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

Power Electronics		
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
	Term Work: 25 Marks Practical : 25 marks	Total: 05

Course Pre-requisites:

The Students should have knowledge of

1.	Fundamentals of Electronics Engineering and Fundamentals of Electrical Engineering

Course Objectives:

To introduce basic knowledge of electronics devices used for control of power.

To describe characteristics and application circuits of SCR and other power devices.

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

1.	To Understand the working and application of Power semiconductor devices
2.	To Understand the working and application of AC to DC converters
3.	To Understand the working and application of AC voltage controllers
4	To evaluate DC to DC converters
5.	To study DC to AC inverters
6.	To undertand the applications of power Electronics

UNIT - I	Power semiconductor devices	**(08 Hours)**
	Classification of power semiconductor devices Uncontrolled turn-on and turn-off (Diode), Controlled turn-on and uncontrolled turn-off (SCR, TRIAC), Controlled turn-on and controlled turn-off (BJT, MOSFET, Double-diffused MOSFET (DMOS), V shaped gate MOSFET (VMOS), CoolMOS, CoolSic (silicon carbide) MOSFET, CoolGan transistor (Gallium Nitride e-mode HEMTs), Insulated-gate bipolar transistor IGBT, static induction transistor SIT, GTO, Integrated gate-commutated thyristor IGCT, MOS-controlled thyristor MCT, static induction thyristor SITH), Continuous gate signal requirement (BJT, MOSFET, COOLMOS, IGBT, SIT), Diamond wafer technologies for semiconductor device applications, synthetic diamond semiconductor technology. Synthetic chemical-vapor-deposition (CVD) diamond semiconductor technology, Single crystal diamond wafers for high power electronics **Thyristor Power Devices** SCR - static and dynamic characteristics, specifications, two transistor analogy, gate characteristics, triggering circuits, protection of SCR, SITH Protection of power circuit from - over voltage, over current & temperature rise (thermal) Design of Snubber circuit. **Transistor Power Devices** MOSFET, IGBT, MCT, COOLMOS, SIT , Construction, Characteristics, Specifications, Safe Operating Areas, protection, switching action and their control circuit requirement, comparison and area of application of these devices, Diagram and working of Switched Mode Power supply (SMPS) and Uninterrupted Power Supply (UPS)	
UNIT - II	**AC to DC Convertors (Single phase and three phase)**	**(08 Hours)**
	Single phase convertor, three phase semi controlled and fully controlled bridges with R, RL and RLE loads, derivation of average and RMS output voltage and current, rectification and inversion mode of operation, concept of overlap angle and associated voltage drop calculation, dual convertor and selection of transformer and semiconductor devices for convertors. Total Harmonic Distortion (THD).	
UNIT - III	**AC Voltage Controllers**	**(08 Hours)**
	DIAC, TRIAC - construction, characteristics, four mode operation, specifications, triggering of TRIAC using DIAC, AC voltage regulator principle, single phase and three phase analysis with R	

	and RL Load, Harmonics and ripple factor, Applications of two stage, three stage and multistage voltage controllers, derivation of average and RMS output voltage and current	
UNIT - IV	**DC to DC Convertors**	**(08 Hours)**
	Principle of operation of chopper, classification on the basis of operating quadrants control techniques, CLC, TRC, PWM and FM techniques, analysis of step up choppers and numerical with RLE load, area of application, necessity of input filter, derivation of average and RMS output voltage and current	
UNIT - V	**DC to AC Inverters**	**(08 Hours)**
	Single phase and three phase inverters principle of operation, VSI and CSI inverters, applications, operating frequency range. PWM inverters: single pulse, multi-pulse and sinusoidal pulse modulation, PWM techniques for voltage control and harmonic elimination.	
UNIT - VI	**Applications of Power Electronics**	**(08 Hours)**
	Power electronics for renewable energy systems., energy storage systems, smart cities, smart grids, power systems: FACTS, HVDC systems, etc., transport applications (electric vehicles, trains, aircrafts, ships, etc.)., industrial applications., medical applications., in military applications. telecommunication applications., energy harvesting systems., consumable applications. home appliances. Wearable devices	

Term Work:

The term work shall consist of minimum eight experiments.

1. to study software based design of converter circuits
2. V-I Characteristic of SCR, DIAC & TRIAC
3. V-I characteristic of power semiconductor devices GTO, MOSFET, IGBT
4. 1 Phase half Controlled & Full controlled converter (R & RL Load)
5. 3 phase converter (R, RL, RLE Load)
6. Step down Chopper circuit (RC technique)
7. 3 phase Voltage Source transistorized inverter
8. Firing circuit for 3 phase converter
9. 1 phase or 3 phase AC voltage regulator
10. 3 phase AC – DC converter with RLE Load
11. 1 phase PWM bridge inverter

Project based learning:

1. Commutation circuit of SCR
2. Design of Snubber Circuit
3. Collection of data sheets of Power Devices
4. Matlab based experiments on power electronics
5. case study of a industry manufacturing covertors
6. to design and build a rectifier circuit in the laboratory
7. to design and build a ac to DC converter circuit in the laboratory
8. to design and build a DC to DC converter circuit in the laboratory
9. to design and build a Dc to AC inverter circuit in the laboratory
10. to design and build a circuit for application in solar energy in the laboratory
11. to design and build a circuit for application in wind energy in the laboratory
12. to design and build a circuit for application in energy storage system in the laboratory

Reference Books:

1. Vedam SubraManyam - “Power Electronics” - New Age international, New Delhi
2. Dubey, Donald, Joshi, Sinha - “Thyristerised Power Controller”- Wiley Eastern New Delhi
3. M. D Singh & K B Khandchandani, “Power Electronics” - Tata McGraw hill
4. Jai P Agarwal - “Power Electronics, Systems theory & design” LPE Pearson Education
5. L Umanand - “Power Electronic, Essentials & Applications” - Wiley publication
6. Randall , Shaffer - “Fundamental of Power Electronics with Matlab”
7. J. Michale, Jacob - “Power Electronics Principles & Applications”
8. V K Mehta – “Principles of Electronics” – S. Chand Publications

9. Bimal K Bose, Power Electronics in Renewable Energy Systems and smart grid technology and applications, IEEE Wiley	
10. Haithum ABU Rub, Power Electronics in Renewable Energy Systems and smart grid technology and applications, IEEE Wiley	
11. NPTEL website Video lectures by B. G. Fernandes	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Industry Taught Course-II Industrial Organization & Financial Management		
TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
	Continuous Assessment: 40 Marks	

Course Pre-requisites:

The students should have knowledge of professional skill development and basic management terms

Course Objectives:

1. To understand the basic operations in any organization, technical skill sets required by people.
2. To learn terms like Depreciation, Replacement engineering, Product Engineering, Production Planning and Inventory Control.
3. To understand the Job Evaluation techniques, Personnel Management, Behavioral Aspects of Management and Operations Research.

Course Outcomes:

The student will be able to

1.	To understand the basic terms related to management like function, principles.
2.	To understand various type of companies and the various financial aspects related with the company.
3.	To understand the terms related with the depreciation, replacement and products of the company
4	To understand the production and inventory related concept
5	To understand the concepts of financial management and capital
6	To understand the concepts of financial services, investment and stock market

UNIT - I	**Management**	**(06 Hrs)**
	Introduction, Phases in Management: scientific management, Behavioral management and Information technology and operations research. Industrial Management, Contents and Principle of Management, Functions of Management: Planning, coordination, motivation and control. Leadership: Qualities of leader, Leading Process. Education and Training of Management. Elements of Quality Management System ISO 9001-2008. SAP, life insurance	
UNIT - II	**Formation of Company and startups**	**(06 Hrs)**
	Introduction, Company definition, Types of company Structure: Proprietorship, Partnership, Joint Stock companies, Limited and Unlimited Company, Private and Public, Corporative, Public, Private and Joint Sector, Trust and Holding Companies. **Start ups** Startup opportunities: The New Industrial Revolution – The Big Idea- Generate Ideas with Brainstorming- Business Startup – Ideation- Venture Choices – The Rise of The startup Economy -The Six Forces of Change – The Startup Equation- The Entrepreneurial Ecosystem -Entrepreneurship in India. Government Initiatives.	
UNIT - III	**Depreciation, Replacement and Product Engineering**	**(06 Hrs)**
	Introduction, objective of Business Enterprise, Depreciation and Depreciation Calculation, Estimation of Life of an Engineering Aspects, Replacement of Plant and Machinery, Product Classification, Initiation of Product, Production Analysis, simplifications and Standardization, Product Research, **Production Planning and Inventory Control** Introduction, Production System, Production Types, Production Planning functions, Efficiency of Production planning and Drawing Office Organization. Inventory Control Functions, Procedures for Purchase,	
UNIT - IV	**Job Evaluation and Personnel Management**	**(06 Hrs)**
	Introduction, Job Evaluations and Analysis, Classification of Job evaluation techniques, Evaluation of wages structures, system of merit rating, measurement of responsibility and wage incentives. Importance of personnel management, human relations, Functions of personnel management. , labour participation in management. Labour turnover, industrial disputes. **Behavioral Aspects of Management and Operations Research** Scientific management, Hawthorne Studies, Elton Mayo, Theory X and Theory Y, Hertzberg's motivation and Hygiene Theory, Organizational goals and Culture. Stresses at workplace, Interpersonal Behavior, power and Politics in organization.,	
UNIT - V	**Financial management and capital**	**(06 Hrs)**
	Financial Management Micro Economics, Principles of Accounting, Quantitative Methods and Statistics Financial Modeling, Managerial Economics, Corporate Finance, Scope and Functions and role of Finance Managers, Scope of Finance; Financial Management	

	Capital Classification of Capital, Capital Procurement, Cost of Capital, Cost of Capital; Cost of Debt; Cost of Preference Capital; Cost of Equity Capital; Approaches to Derive Cost of Equity; Weighted Average Working capital, Operating Cycle Method, : Management of Cash Motives for Holding Cash; Facets of Cash Management; Cash Planning;	
UNIT - VI	Financial services, investment and stock market	**(06 Hrs)**
	Meaning of financial services , types , players in financial services , merchant banking , **Primary market** : face value of shares , debenture issue of shares on premium , discount initial public offer (IPO) , Follow on public offer (FPO). **Secondary market** : differences between primary and secondary market , role of stock exchanges , demutualization of stock exchanges **Derivatives** : Types of derivatives optional premium , commodity exchange , commodity derivative **Investment** Need of Investment , Physical assets like real estate, gold / jewellery, commodities etc, Currency trading, Commodity market **Stock market** **Share market basics** B.S.E.. N.S.E : organizational structure , index construction , sensex , NIFTY , sectors, settlement , rolling settlement , pay in and pay out , no delivery period, auction of shares, investor protection, Dmat account, types of charges, primary and secondary market **Intra-day trading**, **Chart study,** Basics of Candle stick chart, analysis of candlestick chart, fifteen candle stick patterns,	

Assignments (Project Based Learning): Students need to complete six assignments from following list

1. Case study 1 study of a start up company
2. Case study 2 study of human resource department of a company
3. Case study 3 visit to Bank and study facilities
4. Conducting an interview for a company
5. Collecting information for Initiating a startup company in a group
6. Fundamental Technical analysis of a share
7. Online investment in commodity market
8. Online currency trading
9. Opening a saving bank account
10. Online Opening of a dmat account,
11. Opening a of a trading account
12. Purchasing a share in intraday trading with minimum rupees to get introduction

Text Books:

1. S. K. Basu, K. C. Sahu, B. Rajiv "Industrial Organization and Management", PHI learning Private Limited, New Delhi.
2. *"Industrial Engineering and Management", O.P. Khanna*, Dhanpat Rai & Sons. New Delhi.

Reference Books:

1. Herman B. Henderson, Albert E. Haas **"**Industrial Organization and Management Fundamentals**",** Industrial Press.
2. K.P. Kaur "Professional Management in Industrial Organisations", , Deep and Deep Publications.
3. Dr. Anil Kumar Dhagat Financial Management 2011, ISBN:9789350040225, 9350040220, Page count:564, May 2011, Publisher:Wiley India Pvt. Limited
4. D Chandra Bose, "Fundamentals of financial management" PHI Learning Private limited
5. Prasanna Chandra, "Financial Management Theory and Practice" Tata McGraw Hill Education Pvt. Limited. s edition ISBN:9789353166533, 9353166535, 2019
6. Rodney Hobson Shares made Simple, Harryman house ltd.
7. Stock Market investing for begineers Tycho Press
8. Robert A Schwartz, The economic function of Stock exchange, Springer
9. Gagari Chakrabarti, Momentum trading on Indian Stock Market, Springer
10. Gaourishankar Hiremath, Indian Stock Market, Springer
11. Palgrave Mcmillan, Startups and innovation ecosystems in emerging markets, Springer
12. Agnieszka Skala, Digital startups in transition economics, Palgrave Mcmillan, Springer
13. Manuel Stagers, University Startups and spin offs, Apress

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

Database Management System (SQL)		
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)Basic understanding of data and data structure
2) Basic understanding of programming language

Course Objectives:

Identify various techniques to communicate with database.
Relate relevant data for effective processing of data.
Construct a database to maintain data adroitly.
Study various queries and tools to deal with the data.
Understand the relation between data set and respective means to access it.
Understand influence of data in the effective development of software.

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

1	Design database to store data related with application.
2	Identify technique to deal with data
3	Extend power of SQL by adding programming paradigm
4	Predict suitable environment for data processing as per type data
5	Apply knowledge of DBMS to process the software efficiently
6	Discuss data computing techniques

UNIT – I	**Introduction to DBMS**	**(08 Hours)**
	What is database management system, Use of database system, view of data, relational databases, database architecture, transaction management, Data Models The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction. Design of Database, ER Diagram Database design. ER Model: overview of ER-Model, Constraints, ER-Diagrams, Extended ER Diagrams.	
UNIT - II	**Relational database model**	**(08 Hours)**
	Logical view of data, keys, integrity rules. Design of Relational Database: features of good relational database design, Normalization (1NF, 2NF, 3NF, BCNF). Relational Algebra and Calculus Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities	
UNIT -III	**Integrity Constraints**	**(08 Hours)**
	What are constraints, types of constrains, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views Introduction to SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Triggers.	
UNIT -IV	**PL/SQL**	**(08 Hours)**
	Introduction ,Declaring Variables , Writing Executable Statements , Interacting with Oracle Server , Writing Control Structures , Working with Composite Data Types , Writing Explicit Cursors , Writing Implicit Cursors , Handling Exceptions , Creating Procedures , Creating Functions , Managing Subprograms , Creating Packages , More Package concepts , Oracle supplied Packages, Manipulating Large Objects , Creating Database Triggers.	
UNIT - V	**Transaction management**	**(08 Hours)**
	ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management	
UNIT -VI	**Data Intensive Computing**	**(08 Hours)**

	Introduction to big data, unstructured data processing using Hadoop , NoSQL database using MangoDB.	

Term Work:

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

List of experiments:

1) Draw an ER Diagram to maintain database of Bank
2) Normalize the database of Library, upto BCNF
3) Perform the following operation for demonstrating the insertion, updation and deletion using the referential integrity constraints
4) Calculate turnover of a banks in pune using group by query
5) WAP to implement auto rollback option on deletion using trigger.
6) WAP to implement Procedure to calculate square of a number.
7) Implement implicit cursor using PL/SQL.
8) Simulate two phase locking protocol on the database of Movie.
9) Perform document processing using Mango DB,.
10) Solve word count problem using Hadoop.

Project Based Learning:

1. Make a project to maintain employee data using files and dynamic object/structure. The project should be able to read, write, modify, add and search records. Also demonstrate the effect of performing change in employer data definition after few records have been added.
2. Make an extended ER diagram for insurance management system. Transform this into ralation design and implement these relations with appropriate domain and integrity constraints.
3. Employ various data control restrictions on databases, relations and attributes of relations.
4. Create a phonebook which enables user to save contacts with additional information and provides various retrieval mechanisms. Provisions should be made to view data in mutliple ways.
5. Design and develop a library management system. The relations in the system should be normalised upto BCNF
6. Design and develop a inventory management system and create multiple views on the relations so that users not authorised to edit the relations should be able to views the data.
7. Implement of audit trails and backup on relations.
8. Create a student result calculation system. However when updating final results after calculation should be only of stduents who paid complete fees, such that transaction of each row is executed seperately. Hint- use explicit cursor
9. Develop a student data management system using hash files.
10. Installation of a NoSQL database and implementing a simple student database to compare with SQL database.

Text book:

1. A Silberschatz, H Korth, S Sudarshan, “Database System and Concepts”, Sixth Edition McGraw-Hill
2. Oracle SQL and PL/SQL Guide Till 10gR2
3. Ramkrishna R., Gehrke J., Database Management Systems, 3rd Edition, McGrawHill

Reference Books:

1. Rob, Coronel, “Database Systems”, Seventh Edition, Cengage Learning.
2. Bipin Desai, Introduction to Database Management Systems.
3. Groff James R., Paul Weinberg, LAN times guide to SQL.

Syllabus for Unit Test:

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

IT Practices

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Practical: 06 Hours / Week	Term Work : 25 Marks, Oral : 25 Marks	Total : - 03

Course Pre-requisites:

The Students should have knowledge of

1.	C Programming

Course Objectives:

This syllabus is a comprehensive study of Core Java. It contains complete industrial Java topics to learn the Java programming language in detail. Java is object oriented, platform independent, simple, secure, architectural–neutral, portable, robust, multi-threaded, high performance, distributed and dynamic.

Course Outcomes: Students will be able to

1.	Become familiar with the features of Java Language & fundamentals
2.	Discover how to write Java code according to Object-Oriented Programming principles.
3.	Become comfortable with concepts such as I/O operations in JAVA & multithreaded programming
4	Learn Java APIs for Collections, I/O Streams
5	Design GUI applications and Applets using AWT and Swing.
6	Develop Multithreaded and Networking applications.

UNIT - I	**Java Language Environment & Java Fundamentals:**	
	Object Oriented, Platform Independent, Automatic Memory Management, Compiled / Interpreted approach, Robust, Secure, Dynamic Linking, Multi-Threaded, Built-in Networking, Data types, Operators, Control Statements, Arrays, Enhanced for-loop, Enumerated types, Static import, Auto boxing, C-style formatted I/O, Variable arguments.	
UNIT - II	**Packages & Exception Handling:**	
	Why packages, Understanding Class path, Access modifiers & their Scope, When an exception occurs, Importance of Exception Handling, Exception Propagation, Exception Types, Using try and catch, throw, throws, finally, Writing User defined Exceptions	
UNIT - III	**I/O Operations in Java & Multithreaded Programming:**	
	Byte Oriented Streams, File Handling, Readers and Writers, Introduction to Multi-Threading, Understanding Threads & its States, Java Threading Model, Thread class & Runnable Interface, Thread Priorities, Thread Synchronization, Interthread Communication, Preventing Deadlocks.	
UNIT - IV	**Java Util Package / Collections Framework:**	
	Collection & Iterator Interface, Enumeration, List and Array List, Vector, Comparator, Set Interface & Sorted Set, Hashtable, Properties	
UNIT - V	**Generics & Abstract Window Toolkit:**	
	Introduction to Generics, Using Built-in Generics Collections, Writing Simple Generic Class, Bounded Generics, Wild Card Generics, Graphics, Color and Font, AWT Components/Controls, Event Handling & Layouts.	
UNIT - VI	**Swing Programming:**	
	Introduction to Swing & MVC Architecture, Light Weight Component, Swing Hierarchy, Atomic Components e.g. JButton, JList and more, Intermediate Container e.g. JPanel, JSplitPane and more, Top-Level Container e.g. JFrame and JApplet, Swing Related Events.	

Term Work:

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

1. Write a Java program that takes a number as input and prints its multiplication table upto 10.
2. Implement a Java function that calculates the sum of digits for a given char array consisting of the digits '0' to '9'. The function should return the digit sum as a long value
3. Write a java program to implement the vectors.
4. Write a java program to open a file and display the contents in the console window.
5. Write a java program to read the student data from user and store it in the file.
6. Design a AWT program to print the factorial for an input value.
7. Design an AWT program to perform various string operations like reverse string, string concatenation etc.
8. Write a java program to implement exception handling.

Assignments: (Project based learning)

1. Write a Java program to print the area and perimeter of a circle.
2. Write a Java program to count the letters, spaces, numbers and other characters of an input string.
3. Write a java program to implement thread life cycle.
4. Write a java program to implement multithreading.
5. Write a java program to copy the contents from one file to other file.
6. Design an AWT application that contains the interface to add student information and display the same.
7. Design a calculator based on AWT application.
8. Design an AWT application to generate result marks sheet.

Text Books:

1. Vaishali Shah, Sharnam Shah, Core Java 8 for Beginners, First Edition, SPD, 2015
2. R. Nageswara Rao, Core Java: An Integrated Approach, First Edition, Dream Tech, 2008

Reference Books:

1. Herbert Schildt, Java: The Complete Reference, 9th Edition, McGraw Hill, 2014
2. Hortsman, Core Java, Volume I: Fundamentals, 9th Edition, Pearson, 2013

Vocational Course-II Solar Power Plant Designing		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
	TW: 25 Marks OR: 25 Marks	Credit: 02

Course Pre-requisites:

The Students should have knowledge of

1.	Energy Systems, potential and need of renewable energy.

Course Objectives:

	To understand the need and scope of cleaner sources of energy. To motivate the use of Solar and Solar based applications.

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

1	Discuss the various energy systems and compare its need, adaptability and potential.
2	Classify the energy sources and understand its capacity and applications.
3	Discuss the need and various concepts related to Solar system's.
4	Understand the basics of Solar Photovoltaic systems, examine its types and installations.
5	Identify the need and scope of solar safety.
6	Design of Solar Electric system and its applications

UNIT – I	**NEED OF ENERGY**	
	Introduction, Definition of Power and energy, difference between power and energy, the role of energy in development, Limitation of renewable energy sources their usefulness seasonal nature, requirement, need for the use of new energy sources. Overview of Global Energy Scenario Various sources of Renewable energy. Potential of Renewable energy. Solar irradiance, irradiation, sun path diagram & peak sun hour	
UNIT - II	**TYPES OF ENERGY SOURCES**	
	Conventional energy sources Hydro Electric, Thermal, Nuclear, Non-Conventional Energy sources Bio-mass, geo-thermal, solar, wind energy, ocean energy, wave energy, advantages and disadvantages, challenges.	
UNIT -III	**SOLAR SYSTEM**	
	Solar system: Energy from the sun, solar window, atmospheric effects, diffused radiations, Air mass, effect of Air Mass, seasonal effects, environmental effects on standard test conditions.	
UNIT -IV	**PRINCIPLES OF SOLAR PHOTOVOLTAIC SYSTEMS**	
	Solar Photovoltaic energy conversion and utilization, solar power generation systems a) off-grid systems b) grid connected systems c) power control and management systems, economics of solar photovoltaic systems, World Energy Requirement, Energy and Role of Photovoltaic, Types of PV Installation, Common Systems type, GRID-TIED System, Hybrid Systems, Photovoltaic in Energy Supply, Types of the solar power plant, the concept of net & gross metering , Selection of inverter, module & balance of system , Array, string & cable layout-KW(rooftop) & MW(ground-mounted) System	
UNIT - V	**SOLAR SAFETY**	
	Electrical safety, electrical safety rules, simple first aid, general safety of tools and equipment, fire extinguishers, types of fire extinguishers, Guideline of Safety measurement in solar plant, Performance and monitoring system, ways to maximize energy, solar cell utility – scale system performance.	
UNIT -VI	**Solar Electric System Installation and Service**	
	Applications of Solar Water Heater, Solar lighting systems, Solar cooking, Roof Top, Solar Integration to grid. Design calculation for solar plant , Protection system, earthing calculation & cable sizing	

Term Work:

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

1) Study of Solar Photovoltaic Fencing
2) Study of Solar Cookers

3) Study of Solar Water Heater
4) Study of Solar Dryer
5) Study of Solar Water Pumping System
6) Study of Solar Lighting System
7) Study of Solar Photovoltaic System
8) Study of Solar Distillation System
9) Study of Solar Pond
10) Visit to Renewable Energy Integrated Plant
11) Open circuit voltage of PV cells
12) Short Circuit Current of PV cells

Text book and Reference Books:

1) Solar Energy: Fundamentals and Applications Book by H. P Garg, Tata Mc Graw Hill Publishing Company Ltd.
2) From Sunlight to Electricity: A Practical Handbook on Solar Photovoltaic Applications Suneel Deambi, The Energy and Resources Institute, TERI
3) Solar Electricity Handbook - 2019 Edition: A Simple, Practical Guide to Solar Energy - Designing and Installing Solar Photovoltaic Systems. Michael Boxwell
4) Solar Energy: The Physics and Engineering of Photovoltaic Conversion, Technologies and Systems.

MOOC-I

Sr. No.	Title of Course
1	Fundamentals Of Electronic Materials and Devices
2	Introduction to Robotics
3	Product Design and Innovation
4	Non-Conventional Energy Resources
5	Steam and Gas Power Systems
6	Energy Resources and Conversion Processes
7	Sensors and Actuators
8	Elements of Solar Energy Conversion
9	Introduction to internet of things
10	Introduction to Industry 4.0 and Industrial Internet of Things
11	Introduction to Machine Learning
12	Programming, Data Structures and Algorithms Using Python