Pune Vidyarthi Griha's

College Of Engineering and Technology & G. K. Pate (Wani) Institute of Management, PUNE-9

(Affiliated To Savitribai Phule Pune Universit, Pune)

DEPARTMENT OF ELECTRICAL ENGINEERING

CURRICULUM BOOK

SE 2019 Pattern

FOR THE PROGRAMME

SECOND YEAR – ELECTRICAL ENGINEERING

Pune Vidyarthi Griha's

College Of Engineering and Technology & G. K. Pate (Wani) Institute of Management, PUNE-9

VISION

TO ACHIEVE EXCELLENCE IN ENGINEERING EDUCATION

MISSION

- **To satisfy all stakeholders**
- **To develop ethical, highly motivated engineering professionals with good human values, requisite skills and competencies**
- **To adopt innovative teaching mechanisms**
- **To promote research culture**
- **To contribute to country's economic development**
- **To be responsive to changes in technology, socio-economic and environmental conditions**

DEPARTMENT OF ELECTRICAL ENGINEERING

VISION

To develop Electrical Engineering Department as one of the premier facility centre for disseminating the state of the art education.

MISSION

- **Providing Quality education in the field of Electrical Engineering.**
- **Developing State of the art facilities in the department.**
- **Creating platform Training, Research and Development**
- **Producing Sound electrical engineers catering need of industry and other stake holders.**

PROGRAM EDUCATIONAL OBJECTIVES

PEO1:-Electrical Engineering Graduate will demonstrate knowledge base of Electrical Engineering to excel in industry and higher studies.

PEO2:- Electrical Engineering Graduate will exhibit competency in analytical abilities and problem solving capabilities on the basis of strong fundamentals in Electrical Engineering.

PEO3:- Electrical Engineering Graduate will develop sustainable solutions for society with ethics and professionalism.

PEO4:- Electrical Engineering Graduate will show professional qualities such as team work, leadership, entrepreneurial thinking and communication skills.

PEO5:- Electrical Engineering Graduate will be habitual to lifelong learning abilities.

PROGRAMME OUTCOMES

Electrical Engineering Graduates will have:

PO1: Engineering Knowledge: An ability to apply knowledge of mathematics, science and Engineering fundamentals to analyze complex engineering problems.

PO2: Problem Analysis: An ability to identify, formulate and analyze complex engineering problems by reviewing research literature to arrive at substantiated conclusions.

PO3: Design/Development of Solutions: An ability to design solutions for complex engineering problems, system components or processes to meet the specified needs of the society, considering safety and environment.

PO4: Conduct Investigations of Complex problems: Ability to carry out experiments, simulations and apply research methodologies to investigate the data for providing valid conclusions.

PO5: Modern tool usage: An ability to select and apply appropriate techniques, resources and modern engineering tools such as advanced controllers and application softwares for engineering activities

PO6: The Engineer and society: An ability to assess and develop professional engineering practices catering the need of society considering safety, health, regulatory and other relevant issues.

PO7: Environment and sustainability: An ability to apply professional engineering knowledge to understand the impact on society and environment demonstrating the need for the sustainable development.

PO8: Ethics: An ability to adopt professional ethics while committing professional and social responsibilities.

PO9: Individual and Team work: An ability to develop multidisciplinary skills as an individual and as a member or leader in diverse teams.

PO10: Communication: An ability to communicate effectively with engineering community and society at large with effective documentation and presentation on engineering activities.

PO11: Project management and Finance: An ability to demonstrate knowledge of Engineering and Management principles as a member or a leader to manage project and multidisciplinary tasks.

PO12: Life-long Learning: An ability to understand need and develop the habit of being lifelong learner to adopt to technological changes.

PROGRAMME SPECIFIC OUTCOMES

PSO1: An ability to acquire adequate proficiency in the area of Energy Systems and Sustainability.

PSO2: An ability to acquire multidisciplinary skills in the area of Control and Drives.

PSO3 : An ability to acquire enhanced skills and core competency in the field of Electrical Engineering through hands on training.

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Second Year

Curriculum Book

Syllabus Structure of Savitribai Phule Pune University, Pune

S.E. Electrical Engineering 2015 – Course (w. e. f. 2016-2017)

Semester I

Sr. No.	Subject Code	Subject Title	Teaching Scheme			Semester Examination Scheme of Marks						Credit	
						Paper							
			TH	TUT	PR	In Sem (Online)	End Sem	TW	PR	OR	Total	TH / TUT	PR+OR
1.	203141	Power Generation Technologies	04	--	--	50	50	--	--	--	100	**04**	---
2.	207006	Engineering Mathematics-III	04	01	--	50	50	25	--	--	125	**05**	---
3.	203142	Material Science	04	--	02	50	50	--	--	50	150	**04**	**01**
4.	203143	Analog and Digital Electronics	04	--	02	50	50	25	50	--	175	**04**	**01**
5.	203144	Electrical Measurements and Instrumentation	04	--	02	50	50	25	50	--	175	**04**	**01**
6.	203151	Soft Skills	--	--	02	--	--	25	--	--	25	--	**01**
										Total		**21**	**04**
	Audit Course I		--	--	--	--	--	--	--	--	--	Grade: PP/NP	
	Total		**20**	**01**	**08**	**250**	**250**	**100**	**100**	**50**	**750**	**25**	

Semester II

Sr. No.	Subject Code	Subject Title	Teaching Scheme			Semester Examination Scheme of Marks						Credit	
						Paper							
			TH	TUT	PR	In Sem (Online)	End Sem	TW	PR	OR	Total	TH / TUT	PR+OR
1.	203145	Power System I	04	--	--	50	50	--	--	--	100	**04**	--
2.	203146	Electrical Machines I	04	--	02	50	50	25	50	--	175	**04**	**01**
3.	203147	Network Analysis	04	--	02	50	50	50	--	--	150	**04**	**01**
4.	203148	Numerical Methods and Computer Programming	04	01	02	50	50	25	50	--	175	**05**	**01**
5.	203149	Fundamentals of Microcontroller and Applications	04	--	02	50	50	--	--	50	150	**04**	**01**
										Total		**21**	**04**
	Audit Course II											Grade: PP/NP	
Total			**20**	**01**	**08**	**250**	**250**	**100**	**100**	**50**	**750**	**25**	

SE (ELECTRICAL)

Semester I&II

Power Generation Technologies

Course Name : Power Generation Technologies **Course Number : 203141**		
Teaching Scheme **Theory : 4 Hrs. / week**	**Credits** **Th / Tut : 04**	**Examination Scheme [Marks]** **In Sem (Online) : 50 Marks** **End Sem : 50 Marks**

Designation of the Course : Professional-Core

Prerequisites :

1. Fuel calorific value
2. Semi conduction material for PV cells
3. Work, power and energy calculation

Course Objectives :

1.	Learn the basic fundamentals, working principle, different theories related to power generation with respect to thermal, hydro and nuclear
2.	Understand design of different power plants along with performance characteristics, operational aspects and environmental issues
3.	Understand the role of renewable energy resources in power generation specially wind, solar, biomass and municipal waste
4.	Study of design and working of power plants using renewable resources along with their performance characteristics.

Course Outcomes :
At the end of the course, a graduate will be able to –

CO1.	Describe the basic fundamentals, working principle, different theories related to power generation with respect to thermal and nuclear power plant.
CO2.	Describe the working of different systems involved in Gas & Diesel power plant.
CO3.	Describe the working of different equipments involved in hydro power plant.
CO4.	Describe the operational, performance peculiarities of renewable energy resources such as wind & solar energy systems
CO5.	Explain the importance of renewable energy resources and their utilization in power generation
CO6.	Explain the importance of other renewable energy resources such as biomass, municipal solid waste, geothermal, tidal, wave & ocean thermal energy system.

Course Contents :

Unit 1 :	**Thermal Power Plant**	**[9 Hrs]**

Basic thermodynamic cycles: Thermodynamic cycle of steam flow; Rankine cycle; Actual Rankine cycle; Reheat cycle; Carnot cycle, heat rate.
Thermal Power Plants: Site selection, Main parts and its working.
Types of boilers, Feed water and its treatment, Various boiler controls, assessment of heat recovery systems Steam turbines types, selection and control of turbines.

Fuel Handling: delivery of load, unloading, preparation, transfer, outdoor (dead) storage, Indoor (live) storage, In plant Handling, Coal weighing.
Ash disposal and dust collation: Draught systems, electrostatic precipitator
Recent Development in thermal power plants

Unit 2 :		**[9 Hrs]**

A) **Nuclear power plant**: Introduction, atomic physics, nuclear reaction, materials, site selection, nuclear reactors and working of each part, classification of nuclear reactor, nuclear waste disposal, plant layout. Recent Development in nuclear power plants
B **Diesel Power Plants**: Main components and its working, Diesel plant efficiency and heat balance, choice and characteristic of diesel power plant. Selection of components and sizing.
C) **Gas power plant**: Introduction to gas cycles. Simple gas turbine power plant, methods to improve thermal efficiency, open loop and closed loop cycle power plants, gas fuels, gas turbine materials, plant layout. Combined cycle power plants and concept of heat to power ratio. Recent Development in Gas power plants

Unit 3 :	**Hydro Power Plant**	**[8 Hrs]**

Site selection, Hydrology, storage and pondage, general arrangements and operation of hydro power plant, Hydraulic turbines, turbine size, pelton wheel turbine, Francis and Kaplan turbines, selection of turbines, Dams, Spillways, gates, intake and out take works, canals and layout of penstocks, water hammer and surge tank, simple numerical on hydrographs and number of turbine required. Control of hydro turbines. Small, mini and micro hydro power plant, Recent Development in hydro power plants

Unit 4 :	**Wind Energy Systems**	**[8 Hrs]**

Historical Development of Wind Power, Types of wind turbine electrical generators, Power in the Wind, Impact of Tower Height, Maximum Rotor efficiency, Speed control for Maximum Power, Average Power in the wind, Wind turbine power converters (block diagrams), Wind Turbine Economics, Simple Estimates of Wind Turbine Energy, Environmental Impacts of Wind Turbines. Change in wind pattern and its effect on power generation. Control of wind turbine generator.

Unit 5 :	**Solar Energy**	**[8 Hrs]**

Principles of solar radiations, solar constant, cloudy index and concentration ratio, measurement of solar radiation. Solar energy collectors (solar thermal applications), principle of energy conversion, collection systems and their features, types of collectors with comparison. Solar thermal power plants. Over view of recent development of PV technologies. A Generic Photovoltaic Cell, The Simplest Equivalent Circuit for a Photovoltaic Cell From Cells to Modules to Arrays, The PV I–V Curve under Standard Test Conditions (STC), Impacts of Temperature and Insolation on I–V Curves, Shading Impacts on I–V curves, System: Introduction to the Major Photovoltaic System Types

Unit 6 :	**Other sources and grid connection**	**[6 Hrs]**

Biomass energy, conversion to electricity, municipal solid waste to energy conversion, geothermal energy and ocean energy and Fuel cell Energy storage requirements and selection criteria, stand alone, hybrid stand alone and grid connected renewable systems and their requirements

Text Books :	
[T1]	Power Plant Engineering, by P. K. Nag, Tata McGraw Hill Publications.
[T2]	Power Plant Engineering by Dr. P. C. Sharma, S.K. Kataria Publications.
[T3]	A text book on Power System Engineering,by R.K.Rajput, Laxmi Publications (P) Ltd.
[T4]	A text book on Power System Engineering by Chakrabarti, Soni, Gupta, Bhatnagar, Dhanpat Rai publication
[T5]	Non-Conventional Energy Sources and Utilization, by R.K. Rajput, S. Chand Publications
[T6]	Power plant engineering, M.M. Wakil McGraw Hill, Indian edition
[T7]	Renewable Energy Sources by G. D. Rai, Khanna Publications.
Reference Books :	
[R1]	A Course in Power Plant Engineering, by Arora and Domkundwar, Dhanpat Rai Publication
[R2]	Solar Energy by Dr. S. P. Sukhatme. Tata McGraw Hill Publication.
[R3]	Wind and Solar Power Plants, by Mukund Patel, CRC Press.
[R4]	Renewable Energy by Gilbert Masters, John wiley and sons publications

Self-Learning Topics :

1. Feed water and its treatment.
2. Biomass energy, conversion to electricity.
3. Municipal solid waste to energy conversion.
4. Geothermal energy and Ocean energy.
5. Fuel cell Energy storage requirements and selection criteria.
6. Stand alone, hybrid stand alone and grid connected renewable systems and their requirements

Assignment Topics :

Unit-I:-

1. Explain the operation of a steam power plant with the help of schematic diagram.
2. What are the advantages of Reheat cycle explain with the help of schematic & T-s diagram.

Unit-II:-

1. Explain the working of Pressurized Water Reactor and Boiling Water Reactor.
2. Describe the Breeder Reactor with a neat sketch. What are its advantages and disadvantages?
3. Draw the schematic diagram of diesel power plant. Discuss its working.
4. Draw and explain open and closed loop cycle gas power plant.

Unit-III:-

1. Explain the working of Hydro Power Plant with the help of neat sketch.
2. Write a short note on Surge Tank & Penstocks?
3. Explain with neat sketch the working of Pelton Turbine.
4. Explain with neat sketch the working of Kaplan Turbine.

Unit-IV:-

1. Derive the relation of power in the wind in case of wind energy system.
2. Explain how change in wind pattern affects the power generation in wind power plant.
3. Explain stand-alone, hybrid stand alone and grid connected renewable energy systems.
4. Explain with neat sketch Wind electric generation system.

Unit-V:-

1. Explain the methods of measurement of solar radiation.
2. Compare flat type solar collector with concentric solar collector.
3. Explain the performance curve of PV cell with the help of I-V curves.
4. Differentiate between stand alone and grid connected PV systems.

Unit-VI:-

1. Write a short note on Ocean Thermal energy conversion.
2. Describe the fuel cells. How are they used for energy storage requirements?
3. Explain the process of municipal solid waste to energy conversion.
4. Write a short note on biomass energy conversion to electricity.

Presentations :

1. Feed water and its treatment.
2. Biomass energy, conversion to electricity.
3. Municipal solid waste to energy conversion.
4. Geothermal energy and Ocean energy.
5. Fuel cell Energy storage requirements and selection criteria.
6. Stand alone, hybrid stand alone and grid connected renewable systems and their requirements

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Engineering Mathematics-III

Course Name : ENGINEERING MATHEMATICS -III **Course Number : 207006**		
Teaching Scheme **Theory : 4 Hrs./Week** **Tutorial : 01 Hr./Week**	**Credits** **Th : 04** **Tut : 01**	**Examination Scheme (Marks)** **Online : 50 Marks** **End Sem : 50 Marks** **Term Work : 25 Marks**
Designation of the course : Professional		
Course Prerequisites :		
A student requires sufficient amount of knowledge of certain topics related to Engineering Mathematics –I & Engineering Mathematics-II, to understand the concepts of Engineering Mathematics-III.		

Course Objectives:	
1.	Linear Differential Equation with constant coefficient & its application.
2.	Laplace Transform ,its properties ,LT of some special functions ,applications of LT for solving differential equations .
3.	Fourier Transform ,application to FT problems on one & two dimensional heat flow problem. Z-Transform ,its properties , definition & standard properties of Z Transform &heir inverses , solving difference equation
4.	Vector Differential Calculus ,physical interpretation of vector differentiation ,Gradient ,Curl , Divergence ,Directional Derivative ,Solenoidal ,Irrotational .
5.	Vector Integral Calculus & its application ,line surface & volume integrals ,Stokes Theorem , Divergence Theorem.
6.	Functions of complex variable ,Analytic functions ,C-R Equations ,Conformal Mapping ,Cauchy`s Integral Theorem ,Residue Theorem.

Course Outcomes:
At the end of the course ,a graduate will be able to –

CO1.	Demonstrate wide knowledge in topics like Linear Differential Equations & its application.
CO2.	Demonstrate the ability for understanding the concepts of laplace transform ,LT of standard functions ,Inverse LT
CO3.	Demonstrate the ability for understanding the concepts of Fourier Transform,& Z-Transform ,its standard properties ,& its sequences &their inverses.
CO4.	Demonstrating the physical interpretation of vector differentiation, by understanding Gradient ,Divergence ,Solenoidal Field ,Irrotational Field.
CO5.	Demonstrating the interpretation of vector integral calculus & its application by understanding line , surface ,volume integrals green`s lemma theorem, Gauss Divergence Theorem ,Stokes Theorem.
CO6.	Demonstrate the knowledge of functions of complex variables ,Analytic Functions ,C-R Equations ,Conformal Mapping ,Cauchy`s Integral Formula .Residue Theorem .

Course Contents :		
Unit-I	**LINEAR DIFFERENTIAL EQUATION AND APPLICATIONS**	**[9 Hrs]**
Introduction to differential equation of 1st order , 1st degree ,explanation about Order and degree of differential equation.Introduction to the concepts of complimentary function and particular integral.Various methods of finding particular integral namely General Method, Variation Parameter, Short Cut Method.Introduction to LDE with constantcoefficients,Homogeneous equations,Cauchy`s & Legendre`s DE, Simultaneous & Symmetric Simultaneous DE.		
Unit-II	**LAPLACE TRANSFORM**	**[9 Hrs]**
Introduction to transform theory ,complex exponential form of Fourier series, Fourier Integral transform, sine & cosine integrals, Fourier transform, Fourier sine & cosine transform & their inverses, application to wave equation, finite transform application to Fourier transform to problems on one & two dimensional heat flow problems. Laplace transform of standard functions ,properties & theorems ,inverse Laplace transform application of Laplace transforms to solve DE, liquid level systems ,second order systems.		
Unit-III	**FOURIER AND Z- TRANSFORM**	**[9 Hrs]**
Introduction to Fourier Transform ,understanding of exponential form of Fourier series Fourier integral theorem, meaning of sine and cosine integrals and their inverses. Introductory to Z-transform ,its meaning standard properties ,standard sequences and their inverses. Uses of Z-Transform in solving difference equations.		
Unit-IV	**VECTOR DIFFERENTIAL CALCULUS**	**[9 Hrs]**
Physical Interpretation of vector differentiation, Radial ,transverse & Normal components of velocity & acceleration, vector differential operator, Gradient, Divergence & Curl.Directional derivatives Solenoidal, Irrotational & Conservative fields Scalar Potential ,Vector Identities.		
Unit- V	**VECTOR INTEGRAL CALCULUS AND APPLICATIONS**	**[9 Hrs]**
Introduction to line, surface, volume integral & its application to find work done,Green`s Lemma, Gauss`s Divergence Theorem, Stoke`s Theorem Application to problem in electromagnetic fields.		
Unit-VI	**COMPLEX VARIABLES**	**[9 Hrs]**
Introduction to functions of complex variable ,analytic functions,Cauchy-riemann equations,Conformal mapping ,Cauchy`s integral formula & residue theorem.		
Text Books:		
[T1]	Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley Eastern Ltd	
[T2]	Advanced Engineering Mathematics by Peter V .O`Neil, Thompson Learning	
Reference Books		
[R1]	Applied Mathematics (Volumes I& II) by P.N.Wartikar, Pune Vidyarthi Griha Prakashan , Pune	
[R2]	Advanced Engineering Mathematics with MATLAB by Thomas L.Harman James Dabney & Norman Richert, 2eCole, Thomson Learning	

[R3]	Advanced Engineering Mathematics by M.D.Greenberg, Pearson Education 2e
[R4]	Higher Engineering Mathematics by B.S.Grewal, Khanna Publication, Delhi
[R5]	Higher Engineering Mathematics by B.V.Ramana, Tata McGraw-Hill

Self-Learning :

Handouts related to important formulas based on algebra ,trigonometric functions ,identities are provided into the initial lectures.

Contents beyond Syllabus :

Lagrange method(Method of variation of parameter) :
To understand the particular integral if short cut method fails ,then use of general method involves laborious integration ,in such cases method of variation of parameter helps to determine complete solution. Lagrange Method is also studied for 3rd order linear differential Equation. This method may also be extented to higher order linear differential equations.

Bridging Courses :

Before the commencement of regular classes ,respective teachers conducts 20 minutes session on everyday basis for the first 15 days which focuses on class 12 level basic maths,also revision of certain important topics related to Engineering Mathematics- I and Engineering Mathematics-II are covered to understand the concepts of Engineering Mathematics-III.

Assignment Topics :

AssignmentNo. 1 &2 : Numerical on C.F,P.I ,Shortcut cases Cauchys &Legendres Equation ,Symmteric and simultaneous Equations, Numerical on Laplace Transform ,inverse laplace transform
AssignmentNo. 3&4 : Numerical on Fourier transform ,inverse fourier transform ,Z-transform & its inverse Z-transform.

Tutorials :

1. Numerical on complimentary function ,particular integral ,short cut methods .
2. Numerical on cauchys legendres differential equation , symmetric and simultaneous equations.
3. Numerical on Laplace Transform & Inverse Laplace Transform.
4. Numerical on fourier transform ,fourier cosine transform ,fourier sine transform.
5. Numerical on inverse fourier transform ,inverse fourier cosine and inverse fourier sine transform .+
6. Numerical on Z-Transform & Inverse Z- Transform
7. Numerical on vector algebra ,Gradient ,Divergence ,Curl.
8. Numerical on vector identities.

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Material Science

Course Name : MATERIAL SCIENCE **Course Number : 203142**		
Teaching Scheme **Theory : 4 Hrs. / week** **Practical : 2 Hrs. / week**	**Credits** **Th : 04** **OR : 01**	**Examination Scheme [Marks]** **Online : 50 Marks** **Theory : 50 Marks** **Oral : 50 Marks**
Designation of the Course : Professional-Core		
Prerequisites :		
Students should have knowledge of various classes of materials like solid, liquid, gaseous, conducting, insulating and resistive along with their basic characteristics.		

Course Objectives:	
1.	To classify different materials from Electrical Engineering application point of view.
2.	To understand various properties and characteristics of different classes of materials.
3.	To select materials for applications in various electrical equipment.
4.	To impart knowledge of Nano-technology, battery and solar cell materials.
5.	To develop ability to test different classes of materials as per IS.
6.	To classify different materials from Electrical Engineering application point of view.

Course Outcomes: **At the end of the course, a graduate will be able to –**	
CO1.	Derive Clausius Mossotti Equation by classifying different types of polarization and hence solve problems based on it.
CO2.	Differentiate insulating and dielectric materials and state their uses in various electrical apparatus.
CO3.	Classify magnetic materials by understanding basic definitions of magnetic materials.
CO4.	Describe properties of conducting materials and their applications in the field of electrical engineering.
CO5.	Describe uses of Nano Materials for specific electrical applications by studying their properties.
CO6.	Test different insulating materials (solid, liquid, gaseous) to check their dielectric strengths as per IS.

Course Contents :		
Unit 1A :	**Dielectric Properties of Insulating Materials**	**[6 Hrs]**
Static Field, Parameters of Dielectric material [Dielectric constant, Dipole moment, Polarization, Polarizability], Introduction to Polar and Non- Polar dielectric materials. Mechanisms of Polarizations- Electronic, Ionic and Orientation Polarization (descriptive treatment only), Clausius Mossotti Equation, Piezo-Electric, Pyro-Electric & Ferro-Electric Materials, Dielectric loss and loss tangent, Concept of negative tan delta (δ).		
Unit 1B :	**Optical Properties of Materials**	**[2 Hrs]**

Comparison between materials used for Photo-Conductive, Photo-Electric Emissive and Photo - Voltaic cell. Different materials used for plastic, organic and thin-film solar cells (Mono - Crystalline, Poly-Crystalline). Introduction to fiber optics, materials used and its applications.		
PR :	**1.** To measure Insulation Resistance & kVAr capacity of power capacitor.	
Unit 2A :	**Insulating Materials, Properties & Applications**	**[6 Hrs]**
Introduction, Characteristics of Good Insulating Material, Classification, Solid Insulating Materials- Paper, Press Board, Fibrous Materials, Ceramics, Mica, Asbestos, Resins, Amorphous materials Polymers, Ceramics, Enamels. Liquid Insulating Materials such as Transformer Oil, Varnish, Askarel. Insulating Gases like Air, SF_6. Insulating Materials for Power & Distribution Transformers, Rotating Machines, Capacitors, Cables, Line Insulators and Switchgears.		
Unit 2B :	**Dielectric Breakdown**	**[2 Hrs]**
Introduction, Concept of Primary and Secondary Ionization of Gases (descriptive treatment only), Breakdown Voltage, Breakdown Strength, Factors affecting Breakdown Strengths of Solid, Liquid and Gaseous dielectric materials.		
PR :	**1.** To observe development of tracks due to ageing on different insulating materials e.g. Bakelite, Perspex, polyesters, Mica, Fiberglass etc.	
Unit 3 :	**Magnetic Materials**	**[8 Hrs]**
Introduction, Parameters of Magnetic material [Permeability, Magnetic Susceptibility, Magnetization], Classification of Magnetic Materials, Diamagnetism, Paramagnetism, Ferromagnetism, Ferri-magnetism, Ferro-magnetic behavior below Critical Temperature, Spontaneous Magnetization, Curie-Weiss law, Anti-ferromagnetism, Ferrites, Applications of Ferro-magnetic Materials, Magnetic materials for Electric Devices such as Transformer Core, Core of Rotating Machines, Soft Magnetic Materials, Hard Magnetic Materials, Magnetic Recording Materials, Compact Discs. Introduction to laser and magnetic strip technology.		
PR :	**1.** To obtain Hysteresis Loop of the Ferro-Magnetic Material.	
Unit 4 :	**Conducting Materials**	**[8 Hrs]**
General Properties of Conductor, Electrical Conducting Materials - Copper, Aluminum and its applications, Materials of High & Low Resistivity-Constantan, Nickel-Chromium Alloy, Tungsten, Canthal, Silver & Silver alloys, Characteristics of Copper Alloys (Brass & Bronze), Materials used for Lamp Filaments, Transmission Lines, Electrical Carbon Materials, Materials for Super-capacitors. Material used for Solders, Metals & Alloys for different types of Fuses, Thermal Bimetal & Thermocouple. Introduction to Superconductivity and Super Conductors.		
PR :	**1.** To measure Resistivity of High Resistive Alloys. **2.** To understand the principle of thermocouple & to obtain characteristics of different thermocouples.	
Unit 5A :	**Nanotechnology**	**[6 Hrs]**
Introduction, Concepts of Energy bands & various Conducting Mechanism in Nano-structures, Carbon Nano-structures, Carbon Molecules, Carbon Clusters, Carbon Nano-tubes and applications. Special Topics in Nano Technology such as Single Electron Transistor, Molecular Machines, BN Nanotubes, Nano wires.		
Unit 5 B :	**Batteries**	**[2 Hrs]**

Materials used for Batteries: Lead Acid, Lithium-ion, Sodium-Sulphur, Nickel-Cadmium, Zero Emission Battery Research Activity (ZEBRA) Batteries. Batteries used in Electric Vehicle (EV) and Electric Hybrid Vehicle (EHV).		
PR :	**----**	
Unit 6 :	**Testing of Materials**	**[8 Hrs]**
Explanation of following with objectives, equipment required, circuit diagrams and observations to be taken. 1. Measurement of Dielectric Loss Tangent (tan δ) by Schering Bridge-IS 13585-1994. 2. Measurement of Dielectric Strength of Solid Insulating Material-IS 2584. 3. Measurement of Dielectric Strength of Liquid Insulating Material – IS 6798. 4. Measurement of Dielectric Strength of Gaseous Insulating Material as per IS. 5. Measurement of Flux Density by Gauss-meter.		
PR:	**1.** To measure dielectric strength of solid insulating materials. **2.** To measure dielectric strength of liquid insulating materials. **3.** To measure dielectric strength of gaseous insulating materials using Sphere Gap-Unit.	
Text Books:		
[T1]	S. P. Seth, "A Course in Electrical Engineering Materials", Dhanpat Rai and Sons publication.	
[T2]	"Electrical Engineering Materials", T.T.T.I, Madras.	
[T3]	K. B. Raina & S. K. Bhattacharya, "Electrical Engineering Materials", S. K. Kataria & Sons.	
[T4]	P.K. Palanisamy, "Material Science for Electrical Engineering", SciTech Pub. (India) Pvt. Ltd., Chennai.	
[T5]	Charles P. Poole, Jr. Frank & J. Ownes, "Introduction to Nanotechnology", Wiley Student Edition.	
[T6]	Ronald M. Dell and David A.J. Rand, "Understanding Batteries", Royal Society of Chemistry, 2001 Publication.	
Reference Books:		
[R1]	D. M. Tagare, "Electrical Power Capacitors-Design & Manufacture", Tata McGraw Hill Publication.	
[R2]	S. P. Chalotra & B. K. Bhatt, "Electrical Engineering Materials", Khanna Publishers, Nath Market.	
[R3]	C. S. Indulkar & S. Thiruvengadam, "Electrical Engineering Materials", S. Chand & Com. Ltd.	
[R4]	Kamraju & Naidu, "High Voltage Engineering", Tata McGraw Hill Publication.	
[R5]	James F. Shackelford & M. K. Muralidhara, "Introduction to Material Science for Engineering", Sixth Edition by Pearson Education.	
[R6]	"Insulation Technology Course Material of IEEMA Ratner", Pearson Education.	
[R7]	Traugott Fischer, "Materials Science for Engineering Students", Elsevier publications.	
[R8]	Rakosh Das Begamudre, "Energy Conversion Systems", New Age International Publishers.	
[R9]	David Linden, "Handbook of Battery and Fuel Cells", McGraw Hill, 1984, Publication.	

[R10]	Chetan Singh Solanki, "Solar Photovoltaic: Fundamentals, Technologies and Applications", Prentice Hall of India Publication.
[R11]	R. P. Deshpande, "Ultra capacitors – future of energy storage", McGraw Hill, Publication.
[R12]	Linden and Reddy, "Handbook of Batteries", New York McGraw Hill, 2002, Publication.
[R13]	R. P. Khare, "Fiber optics and Optoelectronics", Oxford University publication.

Self-Learning Topics :

- LASER and Magnetic Tape Recorders
- Superconductivity :- types, properties and applications
- Schering Bridge for measurement of Dielectric Loss Tangent

Contents beyond Syllabus :

- Cable, its types and different protective layers for it.
- Use of SWG (Standard Wire Gauge)

Extra Experiments :

- Effect of Uniform and Non- Uniform Electric Field on Breakdown of Insulating Materials.
- To make a chart / poster containing samples of different electrical materials, such as Conducting, Insulating and Magnetic etc.
- Study of various magnetic materials along with their properties and applications.

Industrial Visit :

An Industrial Visit is arranged to manufacturing and testing unit of power capacitors.

Bridging Courses :

- Different types of capacitors.
- Different types of cables.
- Nano materials developed for Solar Cell or Batteries.

Assignment Topics :

- Types of Polarization
- Properties of insulating materials used in Capacitors, Cables, Transformers, Rotating Machines, Switchgears (Circuit Breakers), Insulators
- Magnetic Parameters with their definitions and their Units
- Thermocouple and Thermal Bimetal
- Carbon nano structures , carbon clusters, carbon nanotubes
- Testing of Solid, Liquid and gaseous insulating materials as per IS

Presentations :

- Fiber Optics
- Different Types of Batteries
- Nano Materials and their Applications

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Analog and Digital Electronics

Course Name : Analog And Digital Electronics **Course Number : 203143**		
Teaching Scheme **Theory : 4 Hrs. / week** **Practical : 2 Hrs. / week**	**Credits** **Th / Tut : 04** **PR : 01**	**Examination Scheme [Marks]** **In Sem (Online) : 50 Marks** **End Sem : 50 Marks** **Practical : 50 Marks** **Term Work : 25 Marks**
Designation of the Course : Professional-Core / Elective / Humanities		
Prerequisites :		
Basics of numbering system. Basics of diodes and BJT.		

Course Objectives :

1.	To demonstrate the concept of numbering system & Boolean's algebra reduction using K map.
2.	To design and analyze sequential and combinational circuits.
3.	To develop the concept of basics of operational Amplifier and its applications.
4.	To introduction to BJT and diode rectifier.

Course Outcomes:
At the end of the course, a graduate will be able to –

CO1.	Perform conversion of number system, perform binary arithmetic and reduce Boolean expressions by K- Map.
CO2.	Demonstrate basics of various types of Flip flops, design registers and counter.
CO3.	Analyze parameter of Op-amp and its applications.
CO4.	Apply the knowledge of Op-amp as wave form generators & filters.
CO5.	Use BJT as amplifier with various configurations.
CO6.	Analyze of uncontrolled rectifier.

Course Contents :

Unit 1 :	**Number system & Boolean's Algebra:**	**[8 Hrs]**
Numbering systems-binary, octal, decimal and hexadecimal and their conversion, codes-BCD, Grey and excess3, Binary arithmetic: - addition and subtraction by 1's and 2's compliment. Booleans algebra, De-Morgan's theory etc. K-map: - structure for two, three and four Variables, SOP and POS form reduction of Boolean expressions by K-map.		
PR/Tut :	NIL	
Unit 2 :	**Combinational & Sequential circuits:**	**[8 Hrs]**
Concept of Combinational & Sequential circuits, Flip flops – R-S, Clocked S-R, D latches, Edge Triggered D flip-flops, Edge triggered JK flip flops, JK Master - slave flip flop, Register- Buffer		

registers, shift registers, controlled shift registers, ring counter, Counters – asynchronous Counters, synchronous counter, up - down counter , twisted ring counters, N –module Counters.		
PR/Tut :	1. Study of ring counter and twisted ring counter. 2. Study of up - down counters (IC 74192/74193) and N- modulo counter. (IC 7490/7493). 3. Study of various flip-flops and verification of truth table. 4. Study and verify shift register operation (IC 7495).	
Unit 3 :	**Operational Amplifier & Applications:**	**[8 Hrs]**
Op-Amp: Block diagrams of 741, ideal and practical parameters, open loop and close loop configuration of Op-Amp. Applications of Op- Amp- Comparator, Schmitt trigger, zero crossing detectors, V-I and I-V converters, Instrumentation amplifier, peak detector.		
PR/Tut :	1. Study of op-amp as a ZCD & Comparator. 2. Study of Instrumentation amplifier using three Op-amp for CMMR measurement. 3. Study of Op-amp as Schmitt trigger.	
Unit 4 :	**Waveform generators, Filters & Regulators:**	**[8 Hrs]**
Waveform generation using Op-amp - sine, square, saw tooth and triangular generator, Active filters-Its configuration with frequency response, Analysis of first order low pass and high pass filters, IC 555 –construction, working and modes of operation- astable and monostable multi vibrators, Sequence generator, voltage regulators using ICs 78xx, 79xx, LM 317.		
PR/Tut :	1. Study of Op-amp as sine, and triangular wave generator. 2. Study of IC-555 applications- astable, monostable multivibrator. 3. Study of active filters- Low pass and high pass filters.	
Unit 5 :	**BJT & Applications:**	**[8 Hrs]**
BJT amplifier: Introduction, Class A amplifier, AC-DC load line analysis, Single stage and Multistage BJT amplifier, direct coupled, RC coupled and transformer coupled, Darlington pair, Push-Pull amplifier and differential amplifier FET-construction, Parameters, Characteristics.		
PR/Tut :	Transistor amplifiers: frequency response of BJT, multistage BJT amplifier.	
Unit 6 :	**Diode & Precision Rectifiers:**	**[8 Hrs]**
Diode rectifier: Introduction, Single phase half wave rectifier with R, RL loads. Single phase full wave rectifier-Center tap and bridge rectifier supplying R and RL load and performance parameters. Three phase full wave bridge rectifier with R load. Comparison of single phase half wave and full wave rectifiers, Precision rectifiers: Half wave and Full wave. Comparison of diode and precision rectifier.		
PR/Tut :	1. Study of Single Phase Full-wave bridge rectifier with RL load. 2. Study of Three Phase Full-wave Rectifier with R load. 3. Study of Single Phase Half-Wave Rectifier.	
Text Books:		
[T1]	Floyd and Jain, "Digital Fundamentals", Pearson Education.	
[T2]	R. P. Jain, "Digital Electronics", Tata McGraw Hill, New Delhi.	

[T3]	Malvino, "Digital Computer Electronics- An Introduction to Microcomputers," Tata McGraw Hill.
[T4]	Gaikwad R., "Operational Amplifier", PHI New Delhi.
[T5]	Floyd, "Electronics Devices", Pearson Education.
[T6]	Mottershed, "Electronics Devices & Circuits", PHI New Delhi
[T7]	Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", 3rd edition, Pearsons Education.
Reference Books:	
[R1]	Tokheim, "Digital Electronics-Principles and Application", 6th edition, Tata McGraw Hill, New Delhi.
[R2]	A Jaico and Charles H. Roth, "Fundamentals of Logic Design" Jr. Forth Edition.
[R3]	K. R. Botkar, "Integrated Circuits", Khanna Publication, New Delhi.
[R4]	James, "Operational Amplifier and Linear Integrated Circuits Theory and Application."
[R5]	P John Paul, "Electronics Devices and circuits", New Age international Publications.
[R6]	P. S. Bimbhra, "Power Electronics", Khanna Publications.

Self-Learning Topics :

- Op-Amp: Block diagrams of 741, ideal and practical parameters.
- Op-Amp: open loop and close loop configuration of Op-Amp.
- FET-construction, Parameters, Characteristics.

Contents beyond Syllabus :

1. Octal and Hexadecimal arithmetic: - addition and subtraction.
2. Study of Op-Amp as inverting, non-inverting, summer, voltage follower and differential.
3. Brief introduction of passive filter and bistable multivibrators.

Extra Experiments :

1. Study of Op-Amp as inverting, non-inverting, summer, voltage follower and differential.
2. Study of IC-555 applications as sequential timer.
3. Study of half wave and full wave precision rectifier using Op-Amp.

Assignment Topics :

Q 1 Using De-Morgan's Theorem, Prove

i) $AB + CD = \overline{(\overline{AB} * \overline{CD})}$ ii) $\overline{(\overline{B} + A) * (\overline{A} + B)}$

Q 2 Simply the following expression, using Boolean's expression

i) $BC + A\overline{C}$ + AB +BCD

ii) A + $\overline{A}$B + A$\overline{B}$

Q 3 Simplify the following expression using k-map

i) Y=$\overline{A}$B + C + A$\overline{C}$D + $\overline{ABCD}$ + $\overline{CD}$

ii) F(A,B,C,D) = π M(4,5,6,7,8,12,13) + d(1,15)

Q 4 Write short notes on Edged triggered flip-flop and Master-Slave flip-flop.

Q 5 List the basic types of shift registers in terms of data movement & state their applications.

Q 6 Draw & explain the working of 4-bit up-down synchronous counter.

Q 7 Explain the working of 8-bit ring counter with timing diagram.

Q 8 Define the following electrical parameters:-

i) Input offset voltage

ii) Input resistance
iii) Common mode rejection ratio
iv) Swing output voltage
v) Slew rate

Q 9 Draw the Op-amp symbol. Explain the various Op-amp terminals. List ideal & practical characteristics of Op-amp. With neat block diagram, describe the constructional features & working principle of Op-amp.

Q10 What is instrumentation amplifier? What are basic requirement of good instrumentation amplifier? Draw & explain the working of instrumentation amplifier.

Q 11 Explain OPAMP as Schmitt trigger, ZCD & Comparator.

Q 12 Explain the working of following generator using Op-amp:-

i) Square wave generator
ii) Triangular wave generator
iii) Sawtooth wave generator

Q 13 Explain the working of IC 555 timer with neat block diagram. State its basic modes.

Q 14 What is voltage regulator? List different types of voltage regulators.

Presentations :

- BJT amplifier: Introduction, Class A amplifier
- AC-DC load line analysis
- Single stage and Multistage BJT amplifier
- Direct coupled and RC coupled
- Transformer coupled and Darlington pair
  Push-Pull amplifier and differential amplifier

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Electrical Measurements and Instrumentation

Course Name : Electrical Measurements and Instrumentation **Course Number : 203144**		
Teaching Scheme **Theory : 4 Hrs. / week** **Practical : 2 Hrs. / week**	**Credits** **Th / Tut : 04** **PR : 01**	**Examination Scheme [Marks]** **In Sem (Online) : 50 Marks** **End Sem : 50 Marks** **Practical : 50 Marks** **Term Work : 25 Marks**
Designation of the Course : Professional-Core		
Prerequisites : AC Fundamentals, single phase ac circuits and poly phase ac circuits		

Course Objectives:

1.	To provide the knowledge of system of units, classification and essentials of measuring instruments.
2.	To get the knowledge about the construction & operation of various electrical & non electrical measuring instruments.
3.	To apply the knowledge to identify the measuring instruments & make use of it for quantifying measurements of electrical parameters.

Course Outcomes:
At the end of the course, a graduate will be able to –

CO1.	Elaborate various characteristics of measuring instruments, their classification and range extension technique.
CO2.	Classify resistance, apply measurement techniques for measurement of resistance, inductance
CO3.	Explain construction and working of dynamometer type wattmeter for measurement of power
CO4.	Demonstrate use of 1-phase and 3-phase induction and static energy meter
CO5.	Use CRO for measurement of various electrical parameters, importance of transducers, their classification, selection criterion and various applications
CO6.	Measure various physical parameters such as pressure, level, displacement etc. using different transducers.

Course Contents :

Unit 1 :	**Classification of Measuring Instruments**	**[9 Hrs]**

Characteristics of measuring instruments: static and dynamic, accuracy, linearity, speed of response, dead zone, repeatability, resolution, span, reproducibility, drifts. Necessity of calibration, standards and their classification, absolute and secondary instruments, types of secondary instruments: indicating, integrating, and recording, analog / digital.

Ammeter and Voltmeter Theory: Essentials of indicating instruments deflecting, controlling and damping systems. Construction, working principle, torque equation, advantages and disadvantages of Moving Iron (MI) (attraction and repulsion), and Permanent Magnet Moving Coil (PMMC), block diagram and operation of digital ammeter & voltmeter.

B. Range Extension: PMMC ammeters and voltmeters using shunts, multipliers. Universal shunt, universal multiplier. Instrument Transformers: Construction, connection of CT & PT in the circuit, advantages of CT / PT over shunt and multipliers for range extension of MI Instruments, transformation ratio, turns ratio, nominal ratio, burden, ratio and phase angle error.(descriptive treatment only)		
PR/Tut :	1. Demonstration of working parts of various types of meter by opening the instrument & explanation of symbols & notations used on instruments. 2. Extension of instrument range: ammeter, voltmeter, watt meter using CT & PT.	
Unit 2 :	**Measurement of Resistance & Inductance**	**[8 Hrs]**
A. Measurement of Resistance: Measurement of low, medium and high resistance. Wheatstone bridge, Kelvin's double bridge, ammeter-voltmeter method, megger, loss of charge method. Earth tester for earth resistance measurement. **B. Measurement of Inductance**: Introduction, sources and detectors for A.C. bridge, general equation for bridge at balance. Measurement of inductance: Maxwell's inductance & Maxwell's inductance – Capacitance Bridge, Anderson's bridge.		
PR/Tut :	1. Measurement of resistance by ammeter voltmeter method. 2. Measurement of low resistance using Kelvin's double bridge. 3. Measurement of inductance using Maxwell's Inductance and Inductance – Capacitance bridge.	
Unit 3 :	**Measurement of Power**	**[8 Hrs]**
Construction, working principle, torque equation, errors and their compensation, advantages and disadvantages of dynamometer type wattmeter, low power factor wattmeter, poly-phase wattmeter. Active & reactive power measurement in three phase system for balanced and unbalanced load using three wattmeter method, two wattmeter method & one wattmeter method. Power analyzer, Multi meter.		
PR/Tut :	1. Measurement of active & reactive power in three phase circuit using two wattmeter methods (balanced & unbalanced loads). 2. Measurement of active & reactive power in three phase balanced circuit using one wattmeter method with two way switch. 3. Measurement of reactive power by one wattmeter with all possible connections of current coil and pressure coil. 4. Measurement of power in three phase, four wire system using three CTs & two wattmeter. 5. Calibration of single phase wattmeter at different power factors.	
Unit 4 :	**Measurement of Energy**	**[8 Hrs]**
Construction, working principle, torque equation, errors and adjustments of single phase conventional (induction type) energy meter. Calibration of energy meter. Block diagram and operation of electronic energy meter. Three phase energy meter, TOD meter.		
PR/Tut :	1. Calibration of single phase static energy meter at different power factors.	
Unit 5 :	**Oscilloscope & Transducers**	**[8 Hrs]**

A. Oscilloscope: Introduction, various parts, front panel controls, use of CRO for measurement of voltage, current, period, frequency. Phase angle & frequency by lissajous pattern & numerical. Introduction to DSO.
B. Transducers: Introduction, classification, types: resistive, inductive, capacitive, basic requirements for transducers.
C. Pressure Measurement: Introduction, classification of pressure as low, medium & high, absolute, gauge, vacuum, static, dynamic & head pressure. High pressure measurement using electric methods, low pressure measurement by McLeod gauge and pirani gauge, capacitive pressure transducer.

PR/Tut :	1. Measurement of voltage, current, time period, frequency using CRO.

Unit 6 :	**Level & Displacement**	**[8 Hrs]**

Level Measurement: Introduction and importance of level measurement, level measurement methods: mechanical, hydraulic, pneumatic, electrical, nucleonic and ultrasonic.
B. Displacement Measurement: LVDT & RVDT – construction, working, application, null voltage, specifications, advantages & disadvantages, effect of frequency on performance.
C. Strain Gauge: Introduction, definition of strain, types of strain gauge: Wire strain gauge, foil strain gauge, semiconductor strain gauge etc.; their construction, working, advantages and disadvantages.

PR/Tut :	1. Displacement measurement by LVDT.

Text Books:

[T1]	A. K. Sawhney, "A Course in Electrical and Electronic Measurements & Instrumentation" DhanpatRai& Co.
[T2]	J. B. Gupta, "A Course in Electronics and Electrical Measurements and Instrumentation" S. K. Kataria& Sons,
[T3]	R. K. Jain, "Mechanical and Industrial Measurements" Khanna Publishers.
[T4]	B. C. Nakra& K. K. Chaudhari, "Instrumentation Measurement and Analysis", Tata McGraw Hill.

Reference Books:

[R1]	E. W. Golding & F. C. Widdies, "Electrical Measurements & Measuring Instruments" reem Publications.
[R2]	Dr. Rajendra Prasad, Electronic Measurements & Instrumentation, Khanna Publishers
[R3]	Arun K. Ghosh, "Introduction to Measurements and Instrumentation, PHI Publication
[R4]	] M. M. S. Anand "Electronics Instruments and Instrumentation Technology" by, PHI Publication.

Self-Learning Topics :

Block diagram & Operation of Digital ammeters & Voltmeters, strain gauge

Contents beyond Syllabus :

1. Digital power factor meter
2. Digital frequency meter
3. Study of recorders

Bridging Courses :
1. Construction & operation of galvanometers 2. Mechanical methods of pressure measurement
Assignment Topics :
1. Characteristics of measuring instruments, Instrument transformers 2. Measurement of resistance & Inductance 3. Measurement of Power and Energy 4. Oscilloscope & Transducers
Presentations :
1. LVDT 2. Level measurement methods 3. Strain Gauge

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Soft Skills

Course Name : Soft Skills **Course Number : 203151**		
Teaching Scheme **Practical : 2 Hrs. / week**	**Credits** **PR : 01**	**Examination Scheme [Marks]** **Term Work : 25 Marks**
Designation of the Course : Humanities		
Prerequisites :nil		
Course Objectives:		
1.	To possess knowledge of the concept of Self-awareness and Self Development	
2.	To Understand the importance of Speaking Skills, listening skills, Presentation Skills and leadership skills.	
3.	To gain the knowledge of corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting	
4.	To get conversant with Team work, Team effectiveness, Group discussion, Decision making.	
5.	To recognize the importance of time management and stress management.	
Course Outcomes: **At the end of the course, a graduate will be able to –**		
CO1.	Set their personal Goals and SWOT analysis.	
CO2.	Write a formal letter and write proper resume	
CO3.	Develop presentation and take part in group discussion.	
CO4.	Follow and Implement etiquettes in workplace and in society at large.	
CO5.	Work in team with team spirit and develop leadership qualities.	
CO6.	Utilize the techniques for time management and stress management	
Course Contents :		
Unit1	**Self Assesment:**	**[4Hrs]**
A) Self-Assessment , Self-Appraisal, SWOT, Goal setting - Personal & career - Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self-appraisal, Personal Goal setting, B) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting and prioritization.		
PR/Tut :	1. SWOT analysis 2. Personal & Career Goal setting – Short term & Long term	
Unit 2 :	**Communication Skill:**	**[6Hrs]**
A) Importance of communication, types, barriers of communication, effective communication. B) **Speaking Skills:** Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self-expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.		

C) **Listening Skills:** Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening.
D) **Group Discussion:** Characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.
E) **Presentation skills:** Planning, preparation, organization, delivery.
F) **Written Skills:** Formal & Informal letter writing, Report writing, Resume writing - Sentence structure, sentence coherence, emphasis. Paragraph writing. Letter writing skills – form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

PR/Tut :	1.Presentation Skill 2.Letter/Application writing 3.Report writing 4.Presentation 5.Listening skills

Unit 3 :	**Corporate / Business Etiquettes:**	**[2Hrs]**

Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting: Understand the importance of professional behavior at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment), Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

Unit 4 :	**Interpersonal relationship:**	**[4Hrs]**

A) **Team work, Team effectiveness, Group discussion, Decision making –** Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity.
B) **Group Discussion**- Preparation for a GD, Introduction and definitions of a GD, Purpose ofGD,Types of GD, Strategies in a GD, Conflict management, Do's and Don'ts in GD.

PR/Tut :	Group discussion

Unit 5 :	**Leadership skills:**	**[2Hrs]**

Leaders' role, responsibilities and skill required - Understanding good Leadership behaviors, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback.

Unit 6 :	**Other skills:**	**[2Hrs]**

A) **Time management**- The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to priorities using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions , to maximize your personal effectiveness, how to say "no" to time wasters, develop your own individualized plan of action.
B) **Stress management**- understanding the stress & its impact, techniques of handling stress.Problem solving skill, Confidence building Problem solving skill, Confidence building

PR/Tut :	Stress management
Text Books:	
[T1]	Sanjay Kumar and PushpaLata, "Communication Skills", Oxford University Press.
[T2]	Krishna Mohan, MeeraBanerji, "Developing Communication Skill", McMillan India Ltd.
[T3]	Simon Sweeney, "English for Business Communication", Cambridge University Press
Reference Books:	
[R1]	Accenture, Convergys, Dell et.al, "NASSCOM-Global Business Foundation Skills, Foundation Books, Cambridge University Press.
[R2]	E. H. McGrath, "Basic Managerial Skills for all", Eastern Economy Edition, Prentice hall India.
[R3]	Barun K. Mitra, "Personality Development and Group Discussions", Oxford University Press.
[R4]	PriyadarshiPatnaik, "Group Discussions and Interview Skills: Foundation Books", Cambridge University Press.
[R5]	Napoleon Hill, "Think and Grow Rich", Ebury Publishing, ISBN 9781407029252.
[R6]	Tony Robbins, "Awaken the Giant Within", Harper Collins Publishers, ISBN-139780743409384.
[R7]	Wayne Dyer, "Change Your Thoughts, Change Your Life", Hay House India, ISBN-139788189988050.
[R8]	Stephen Covey, "Habits of Highly Effective People", Pocket Books, ISBN-139781416502494.
[R9]	Dr. Joseph Murphy, "The Power of Your Subconscious Mind", MaanuGraphics, ISBN-13 9789381529560.
[R10]	Daniel Coleman, "The new Leaders", Sphere Books Ltd, ISBN-139780751533811.
[R11]	Richard Koch, "The 80/20 Principal", Nicholas Brealey Publishing , ISBN-13 9781857883992.
[R12]	Julie Morgenstern, "Time management from inside out", Owl Books (NY),ISBN-13 9780805075908.
[R13]	SharuRanganekar, "Wonderland of Indian Manageress", Vikas Publishing Houses, ISBN-13 9788125942603.
[R14]	Shiv Khera, "You can win", Macmillan, ISBN-139789350591932.
[R15]	Gopalaswamy Ramesh, Mahadevan Ramesh, "The Ace of Soft Skills: Attitude, Communication and Etiquette for Success".
Self-Learning Topics :	
Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback.	
Contents beyond Syllabus :	
1. How to appear for an interview 2. Interview skills	

Extra Experiments :

1. Discussion about positive thinking
2. Extempo
3. Mock interviews

Assignment Topics :

Term Work/Assignments:

Term work will consist the record of any 8 assignments of following exercises

1. SWOT analysis
2. Personal & Career Goal setting – Short term & Long term
3. Presentation Skill
4. Report writing
5. Letter/Application writing
6. Listening skills
7. Group discussion
8. Resume writing
9. Public Speaking
10. Stress management
11. Team Activity-- Use of Language laboratory

Presentations :

1. Self Awareness
2. Self esteem
3. SWOT analysis
4. Listening skills
5. Letter writing
6. Public speaking
7. Presentation skills
8. Resume writing
9. Group discussion
10. Team work
11. Time management
12. Stress management
13. One presentation by student on any topic of his choice

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Power System I

Course Name : Power Systems I **Course Number : 203145**		
Teaching Scheme **Theory : 4 Hrs. / week**	**Credits** **Th: 04**	**Examination Scheme [Marks]** **In Sem (Online) : 50 Marks** **End Sem : 50 Marks**
Designation of the Course : Professional-Core		
Prerequisites :		
Power Generation, Various insulating materials and properties, knowledge of fundamental of electrical circuit components.		

Course Objectives:	
1.	To learn basic structure of electrical power systems, various electrical terms related with power system and understand various types of tariffs.
2.	To understand specifications and applications of major electrical equipment present in power plant.
3.	To get knowledge of mechanical & electrical design of overhead and underground transmission system.
4.	To learn representation of transmission lines for performance evaluation

Course Outcomes: **At the end of the course, a graduate will be able to –**	
CO1.	Define and compute various terms related with generating station
CO2.	Identify various categories of consumers and select tariff structure
CO3.	Describe function of electrical equipment's used in power plant
CO4.	Explain the structure of overhead transmission lines and compute sag
CO5.	Calculate various electrical parameters of overhead transmission lines and underground cables
CO6.	Identify transmission lines and estimate performance indices of it.

Course Contents :

Unit 1 :	**Structure of Electrical Power Systems and tariff**	**[8Hrs]**

Structure of Electrical Power Systems: Structure of Electrical Power System**,** Different factors associated with generating stations such as Connected load, Maximum Demand, Demand Factor, average load, load factor, diversity factor, plant capacity factor, reserve capacity, plant use factor, Load curve, load duration curve, concept of base load and peak load stations, Interconnected grid system. Fitting of available generating stations into the area load duration curve.

B) Tariff : Introduction of Tariff, Tariff setting principles, desirable characteristics of Tariff, various consumer categories and implemented tariff such as two part, three part, Time of Day tariff for H.T. & L.T. industrial and commercial consumers along with current electricity charges, Introduction to Availability Based Tariff (ABT), Interruptible tariff, Incentives and penalties applied to various consumers.

Unit 2 :	Major Electrical Equipment's in Power Stations and Overhead line insulators	[8 Hrs]

A) Major Electrical Equipment's in Power Stations : Descriptive treatment of ratings of various equipment used in power station, Special features, field of use of equipment like alternators, necessity of exciters, various excitation systems such as dc excitation, ac excitation and static excitation systems, transformers, voltage regulators, bus-bars, current limiting reactors, circuit breakers, protective relays, current transformers, Potential transformers, Lightning arresters, Earthing switches, isolators, carrier current equipment (P.L.C.C.), Control panels, battery rooms,

B) Overhead Line Insulators: Types of insulators & their applications such as pin type, suspension type, strain type, Silicon Rubber insulators, post insulators, Shackle insulators, bushings, voltage distribution along string of suspension insulators, string efficiency, equalization of potential across each unit, method of improving stringefficiency, insulator failure.

Unit 3 :	Mechanical Design of Overhead Lines and Underground Cables	[8Hrs]

Mechanical Design of Overhead Lines: Main components of overhead lines, Line supports, conductor spacing, length of span, calculation of sag for equal and unequal supports and effect of ice and wind loadings.

B) Underground Cables: Classification, Construction of cable, XLPE cables, insulation resistance, dielectric stress in single core cable, capacitance of single core and three core cable, cables used for HVDC transmission. Grading of cables, inter sheath grading, capacitance grading.

Unit 4 :	Resistance and Inductance of Transmission Line	[9Hrs]

Resistance of transmission line, skin effect and its effects, proximity effect, internal & external flux linkages of single conductor, inductance of single phase two wire line, inductance of three phase line with symmetrical and unsymmetrical spacing, concept of G.M.R. and G.M.D, necessity of transposition, inductance of three phase double circuit line with symmetrical and unsymmetrical spacing, inductance of bundled conductors.

Unit 5 :	Capacitance of Transmission Line	[7Hrs]

Electric potential at single charged conductor, potential at conductor in a group of charged conductors, capacitance of single phase line, Capacitance of single phase line with effect of earth's surface on electric field, Concept of G.M.R. and G.M.D for capacitance calculations, capacitance of three phase line with symmetrical and unsymmetrical spacing, capacitance of double circuit three phase line with symmetrical and unsymmetrical spacing.

Unit 6 :	Performance of Transmission Lines	[8 Hrs]

Classification of lines based on length and voltage levels such as short, medium and long lines. Performance of short transmission line with voltage current relationship and phasor diagram, Representation of medium lines as 'Nominal Pi' and 'Nominal Tee' circuits using R, L and C parameters. Ferranti effect, Representation of 'Tee' and 'Pi' models of lines as two port networks, evaluation and estimation of generalized circuit constants (ABCD) for short and medium lines, Estimation of Efficiency & regulation of short & medium lines.

Text Books:

[T1]	J. B. Gupta, "Transmission and Distribution", S. K. Kataria& Sons, New Delhi.
[T2]	V. K. Mehta, Rohit Mehta, "Principles of Power System", S. Chand Publication

[T3]	J. B. Gupta, "Generation and Economic Considerations", S. K. Kataria& Sons, New Delhi.
[T4]	Dr. B. R. Gupta, "Generation of Electrical Energy", S. Chand Publication
[T5]	A Chakraborty, M. L. Soni, P. V. Gupta, U.S. Bhatnagar, "A text book on Power System Engineering", Dhanpatrai& Co., Delhi.
[T6]	S. N. Singh, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India.
Reference Books:	
[R1]	Nagrath& Kothari, "Power System Engineering", Tata McGraw Hill Publications.
[R2]	D. Das, "Electrical Power System", New Age Publication.
[R3]	W.D. Stevenson, "Power System Analysis", Tata McGraw Hill Publications.
[R4]	"Know your Power – citizen's primer" – Prayas energy group
[R5]	www.mahadiscom.in
[R6]	www.mercindia.org.in
Self-Learning Topics :	
End condenser method of medium transmission line	
Industrial Visit :	
An Industrial Visit is arranged to HV or EHV Substation.	
Contents beyond Syllabus :	
How to read electricity bill	
Assignment Topics :	
1. Factors associated with generating station, Tariff 2. Major electrical equipment's in power plants & overhead line insulators 3. Inductance and capacitance calculations of transmission lines 4. Performance of transmission line	
Presentations :	
1. Overhead line insulators 2. Underground cables	

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Electrical Machines I

Course Name : Electrical Machines I **Course Number : 203146**		
Teaching Scheme **Theory : 4 Hrs. / week** **Practical : 2 Hrs. / week**	**Credits** **Th / Tut : 04** **PR : 01**	**Examination Scheme [Marks]** **In Sem (Online) : 50 Marks** **End Sem : 50 Marks** **Practical : 50 Marks** **Term Work : 25 Marks**
Designation of the Course : Professional-Core / Elective / Humanities		
Prerequisites :		
Magnetic circuit, mutual induced EMF, Dynamically induced EMF, Direction of magnetic field in current carrying conductor, Flemings LHR & RHR, Electromechanical energy conversion.		
Course Objectives :		
1.	Understand concept of working, equivalent circuit parameters, efficiency and percentage regulation of transformer.	
2.	Understand concept of load sharing between parallel connected transformers and various tests.	
3.	Understand the construction, principle of operation of DC Machine & Induction Machine.	
4.	Test & analyze the performance of machine.	
5.	Selection of particular electrical machine for a specific application by studying various characteristics for DC motors and 3ϕ induction motors.	
Course Outcomes :At the end of the course, a graduate will be able to –		
CO1.	Identify and selection of the transformers by studying their construction and working principles.	
CO2.	Perform the various test and operate the transformer for parallel load sharing.	
CO3.	Describe the standard connections of three phase transformer and their suitability for various applications.	
CO4.	Compare the different methods of starting for DC and AC machines.	
CO5.	Test the various machine for performance calculation	
CO6.	Select machine for specific applications.	
Course Contents :		
Unit 1 :	**Transformers:**	**[8 Hrs]**
Single phase Transformer: Concept of ideal transformer. Corrugated core transformer. Toroidal core Transformer Useful and leakage flux, its effects. Resistance, leakage reactance and leakage impedance of transformer windings & their effects on voltage regulation and efficiency. Exact and approximate equivalent circuits referred to L.V. and H. V. side of the transformer. Phasor diagrams for no-load and on load conditions. Transformer ratings. Losses in a transformer, their variation with load, voltage & Frequency on no load losses Efficiency and condition for maximum efficiency. All day Efficiency. Open circuit and short circuit tests, determination of equivalent circuit parameters from the test data and determination of voltage regulation and efficiency. Autotransformers, their ratings and applications. Comparison with two winding transformer with respect to saving of copper and size.		
PR/Tut :	O.C. and S.C. test on single phase Transformer.	

Unit 2 :	**Transformers:**	**[8 Hrs]**
Polarity test. Parallel operation of single phase transformers, conditions to be satisfied, load sharing under various conditions. & Welding Transformer **Three Phase Transformers**: Standard connections of three phase transformers and their suitability for various applications, voltage Phasor diagrams and vector groups. Descriptive treatment of Parallel operation of three phase transformers, Scott connection and V connections. Three winding (tertiary windings) transformers.		
PR/Tut :	1. Polarity test on single phase and three phase transformer 2. Parallel operation of two single phase transformers and study of their load sharing under various conditions of voltage ratios and leakage impedances.	
Unit 3 :	**D.C. Machines:**	**[8 Hrs]**
Construction, main parts, magnetic circuits, poles, yoke, field winding, armature core, Armature windings: Simple lap and wave winding, commutator and brush assembly. Generating action, E.M.F equation, magnetization curve, Flashing of Generator. Motoring action. Types of DC motors, significance of back E.M.F torque equation, working at no-load and on-load. Losses, power flow diagram and efficiency. Descriptive treatment of armature reaction.		
PR/Tut :		
Unit 4 :	**D.C. Machines:**	**[8 Hrs]**
Characteristics and applications of D.C. Shunt and Series Motors, Starting of DC motors, study of starters for series and shunt motor, solid state starters, speed control of various types of DC motors. **Commutation:** Process of commutation, time of commutation, reactance voltage, straight line commutation, commutation with variable current density, under and over commutation, causes of bad commutation and remedies, inter poles, compensating windings. (Descriptive treatment only).		
PR/Tut :	1. Speed control of D.C. Shunt motor and study of starters. 2. Brake test on D.C. Shunt motor. 3. Load characteristics of D.C. series motor.	
Unit 5 :	**Three Phase Induction Motor:**	**[8 Hrs]**
Production of rotating mmf by 3-phase balanced voltage fed to a symmetrical 3-phase winding. Construction: Stator, Squirrel cage & wound rotors. Principle of working, simplified theory with constant air gap flux; slip, frequency of rotor emf and rotor currents, mmf produced by rotor currents, its speed w.r.t. rotor and stator mmf. Production of torque, torque-slip relation, condition for maximum torque, torque-slip Characteristics, effect of rotor resistance on torque-slip characteristics. Relation between starting torque, full load torque and maximum torque. Losses in three phase induction motor, power-flow diagram. Relation between rotor input power, rotor copper loss & gross mechanical power developed, efficiency.		
PR/Tut :	Load test on 3-phase induction motor.	
Unit 6 :	**Three Phase Induction Motor:**	**[8 Hrs]**
Induction motor as a generalized transformer; phasor diagram. Exact & approximate equivalent circuit. No load and blocked rotor tests to determine the equivalent circuit parameters and plotting the circle diagram. Computation of performance characteristics from the equivalent circuit and circle diagram. Performance curves. Necessity of starter for 3-phase induction motors. Starters for slip-ring and cage		

rotor induction motors; stator resistance starter, auto transformer starter, star delta starter and rotor resistance starter. D.O.L. starter and soft starting, with their relevant torque and current relations. Comparison of various starters. , testing of three phase induction motor as per IS 325 & IS 4029.	
PR/Tut :	1. No load & blocked-rotor test on 3-phase induction motor : a) Determination of parameters of equivalent circuit. b) Plotting of circle diagram. 2. Calculation of motor performance from (a) & (b) above.
Text Books :	
[T1]	Edward Hughes "Electrical Technology", ELBS, Pearson Education.
[T2]	Ashfaq Husain, "Electrical Machines", DhanpatRai& Sons.
[T3]	S. K. Bhattacharya, "Electrical Machine", Tata McGraw Hill publishing Co. Ltd, 2nd Edition.
[T4]	Nagrath& Kothari, "Electrical Machines", Tata McGraw Hill.
[T5]	Bhag S Guru, Husein R. Hiziroglu, "Electrical Machines", Oxford University Press.
[T6]	K Krishna Reddy, "Electrical Machines- I and II", SCITECH Publications (India) Pvt. Ltd. Chennai.
Reference Books :	
[R1]	A.E. Clayton and N. N. Hancock, "Performance and Design of Direct Current Machines", CBS Publishers, Third Edition.
[R2]	A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electrical Machines", Tata McGraw Hill Publication Ltd., Fifth Edition.
[R3]	A.S. Langsdorf, "Theory and performance of DC machines", Tata McGraw Hill.
[R4]	M.G. Say, "Performance and Design of AC. Machines", CBS Publishers and Distributors.
[R5]	Smarajit Ghosh, "Electrical Machines", Pearson Education, New Delhi.
[R6]	Charles I Hubert, "Electrical Machines Theory, Application, & Control", Pearson Education, New Delhi, Second Edition.
Self-Learning Topics :	
1. Toroidal core 2. Welding Transformer	
Contents beyond Syllabus :	
• Winding for DC machines.	
Extra Experiments :	
1. Measurements of non-sinusoidal current waveform of transformer at no load. **2.** Determination of sequence impedance of the transformer **3.** To study Sumpner's test. **4.** Hopkinson's test on D.C. shunts machines. **5.** Swinburne Test on DC shunt Motor.	
Bridging Courses :	
• Actual winding of transformer /induction motor.	
Assignment Topics :	
• Theory & numerical based on OC, SC tests and parallel operation of 1ϕ transformers. • Theory & numerical based on DC machines. • Numerical based on Torque, Power stages on DC machines and AC machines. • Circle diagram on three phase Induction motor.	

Presentations :
• Diagram of Construction of DC machines and function of each part. • Starters for DC and AC machines. • Comparison of various starters. , testing of three phase induction motor as per IS 325 & IS 4029.

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Network Analysis

Course Name : Network Analysis **Course Number : 203147**		
Teaching Scheme **Theory : 4 Hrs. / week** **Practical : 2 Hrs. / week**	**Credits** **Th : 04** **PR : 01**	**Examination Scheme [Marks]** **In Sem (Online) : 50 Marks** **End Sem : 50 Marks** **Term Work : 50 Marks**

Designation of the Course : Professional-Core

Prerequisites :

Terminology of electrical networks, Laplace transforms linear differential equations.

Course Objectives :

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

Course Outcomes :
At the end of the course, a graduate will be able to –

CO1.	Identify different types of networks and analyze them by using various laws and methods.
CO2.	Solve different networks by applying various theorems such as Superposition, Thevenin's, Norton, Reciprocity, Maximum power transfer and Millman's theorems.
CO3.	Solve differential equations of electric network using classical method and Laplace transform method.
CO4.	Evaluate and analyze Laplace transforms of various series and parallel circuits.
CO5.	Obtain various parameters of two port network and their conversion.
CO6.	Calculate network functions and understand restrictions on poles and zeros locations for transfer functions.

Course Contents :

Unit 1 :	**Basics of Network:**	**[8 Hrs]**

Source transformation: voltage and current sources, mesh analysis, nodal analysis, Concept of super node and super mesh, coupled circuits and dot conventions. Concept of network graphs (incidence, tie set and cut set matrix), Concept of duality and dual networks.

Practical :

Unit 2 :	**Network Theorems**	**[8 Hrs]**

Superposition, Thevenin, Norton, Maximum Power Transfer Theorem, Reciprocity theorem, Millman theorems applied to both ac/dc circuits.

Practicals :
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 Maximum Power Transfer theorem in A.C. circuits 5. These theorems are verified using MATLAB simulation software.

Unit 3 :	**Analysis of Transient Response in Circuits-Classical Method**	**[8 Hrs]**
Initial and Final Condition of network, General and Particular Solution, time constant. Transient response of R-L, R-C and R-L-C network in time domain.		
Practical :	1. Determination of time response of R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor) 2. Determination of time response of R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit) 3. Determination of time response of R-L-C series circuit to a step D.C. voltage input	

Unit 4 :	**Analysis of Transient Response in Circuits: Laplace Transform Approach**	**[8 Hrs]**
Standard test inputs: Step, Ramp, Impulse, Their Laplace transform, Representation of R,L,C in S domain, transformed network, Application of Laplace transform to solve series and parallel R-L, R-C and R-L-C circuits (Source free, Source driven).		
Practical :		

Unit 5 :	**Two Port Network and Network Functions**	**[8 Hrs]**
Two port parameters: Z, Y, H and Transmission parameters Network Functions for 1 and 2 port, calculation of network functions, Poles and zeros of network functions, Restrictions on poles and zeros, Time–domain behavior from the pole and zero location, Necessary conditions for stable driving point function and Transfer function.		
Practical :	Determination of parameter of Two Port Network.	

Unit 6 :	**Filters**	**[8 Hrs]**
Classification of filters: Low pass, High Pass, Band pass, Band stop, Symmetrical networks : characteristic impedance , propagation constant, Design of constant K- low pass and constant K- high pass filters using symmetrical networks.		
Practical :	1. Frequency response of constant K- low pass filters 2. Frequency response of constant K- high pass filters	

Text Books :

[T1]	M. E. Van Valkenburg, "Network Analysis", Prentice Hall of India Private Limited, Third Edition
[T2]	D Roy Choudhary, "Network and Systems", New age international publishers
[T3]	Abhijit Chakroborty, "Circuit Theory", Dhanpat Rai and Company, 7th edition
[T4]	Ravish R Singh, "Network Analysis and synthesis", McGraw Hill education (India) Pvt. Ltd, 3rd edition 2015

Reference Books :	
[R1]	William H. Hayt, Jr. Jack E. Kemmerly, "Engineering Circuit Analysis" McGraw Hill Publication
[R2]	N.C. Jagan, "Network Analysis", BS Publication, Hyderabad, Second Edition
[R3]	G. K. Mittal, "Network Analysis and Synthesis", Khanna Publication.
Self-Learning Topics :	
• Revision of network basics e.g. classification • Laplace transform definitions, properties	
Contents beyond Syllabus :	
Study of time and frequency response of R-L-C series and parallel circuit.	
Extra Experiments :	
Study of filter and its application in the circuit.	
Assignment Topics :	
Solution of network problems by applying network theorems, Solution of network-by classical method and by Laplace method, Two port network	

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Numerical Methods and Computer Programming

Course Name : Numerical Methods and Computer Programming **Course Number : 203148**		
Teaching Scheme **Theory : 4 Hrs. / week** **Practical : 2 Hrs. / week** **Tutorial : 1 Hr. / week**	**Credits** **Th : 04** **Tut : 01** **PR : 01**	**Examination Scheme [Marks]** **In Sem (Online) : 50 Marks** **End Sem : 50 Marks** **Practical : 50 Marks** **Term Work : 25 Marks**
Designation of the Course : Professional-Core		
Prerequisites : Differentiation and integration of a single real variable, ordinary differential equations. Fundamentals of Programming languages and Linear Algebra.		

Course Objectives :

1.	Emphasize need of computational algorithms for solution of a mathematical problem and analyze errors involved in the computation.
2.	Analyze a mathematical problem and determine which numerical technique to use, to obtain its solution.
3.	Apply various numerical methods to obtain solution of transcendental equations, linear simultaneous equations and ordinary differential equations and also for interpolation and numerical integration and differentiation.
4.	Develop algorithms for various numerical methods and develop computer programs using 'C' programming language.

Course Outcomes :
At the end of the course, a graduate will be able to –

CO1.	Identify the mathematical problem and demonstrate the concept of solution of the same.
CO2.	Demonstrate types of errors in computation, their causes of occurrence and remedies to minimize them.
CO3.	Compare and apply various numerical methods for obtaining roots of transcendental equations and for solution of system of linear simultaneous equation.
CO4.	Compare and apply various numerical methods of interpolation, numerical integration and differentiation.
CO5.	Apply various numerical methods for obtaining solution of first and second order ordinary differential equations.
CO6.	Develop algorithms for various numerical methods and develop computer programs using 'C' programming language.

Course Contents :

Unit 1 :	**Basics of C Language:**	**[8 Hrs]**

Revision: Basics of 'C' language - Data types, Operators and its precedence. Control statements: 'if-else' and nested 'if-else', 'for, while and do-while'.
Arrays: Introduction, one and two dimensional arrays.

Functions: Types of functions User Defined Functions - declaration and prototypes, Local and Global variables. **Pointers:** Introduction, declaring and initializing pointers.		
Practical :	• Practice problems for revision of basic concepts in C.	
Tutorial :	• 'C' programs based on decision making, loops, arrays and user defined functions.	
Unit 2 :	**Numerical Methods , Errors and Concept of root of equation:**	**[8 Hrs]**
A) 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. B) **Concept of roots** of an equation. Descartes' rule of signs, Sturm's theorem, Intermediate value theorem. Synthetic division, Roots of Polynomial Equations using Birge-Vieta method.		
Practical :	• Solution of a polynomial equation using Birge-Vieta method.	
Tutorial :	• Sturm's Theorem and Birge Vieta method.	
Unit 3 :	**Solution of Transcendental and polynomial equation and Curve Fitting:**	**[8 Hrs]**
A) **Solution of Transcendental and polynomial equation:** Bisection, Secant, Regula-Falsi, Chebyeshev and Newton-Raphson methods, Newton-Raphson method for two variables. B) **Curve Fitting** using least square approximation – First order and second order.		
Practical :	• Solution of transcendental equation using Bisection method.	
Tutorial :	• Regula Falsi method, Newton Raphson method	
Unit 4 :	**Interpolation and Numerical Differentiation:**	**[8 Hrs]**
A) **Interpolation:** Difference operators, Introduction to interpolation - Newton's forward, backward interpolation formulae, Stirling's and Bessel's central difference formulae, Newton's divided difference formula, Lagrange's interpolation. B) **Numerical Differentiation** using Newton's forward and backward interpolation formulae.		
Practical :	• Program for interpolation using Newton's forward interpolation. • Program for interpolation using Lagrange's interpolation.	
Tutorial :	• Any two methods of interpolation with equal interval and unequal interval.	
Unit 5 :	**Solution of Ordinary Differential Equation(ODE) and Numerical Integration:**	**[8 Hrs]**
A) **Solution of First order Ordinary Differential Equation (ODE)** using Taylor's series method, Euler's, Modified Euler's methods. Runge-Kutta second and fourth order methods. **Solution of Second order ODE** using 4th order Runge-Kutta method. B) **Numerical Integration:** Trapezoidal and Simpson's rules as special cases of Newton-Cote's quadrature technique for single and double integrals.		
Practical :	• Solution of first order ODE using Modified Euler method. • Solution of Numerical Integration using Simpson's $(1/3)^{rd}$ rule.	
Tutorial :	• Numerical on 4^{th} order R-K method, Modified Euler method for first order ODE	
Unit 6 :	**Solution of linear simultaneous equation:**	**[8 Hrs]**

A) **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.
B) **Matrix Inversion** using Jordon method and Eigen values using Power method.

Practical :	• Solution of simultaneous equation using Jacobi iterative method. • To find largest Eigen value using Power method.
Tutorial :	• One direct and one iterative method for solution of linear simultaneous equations.

Text Books :

[T1]	M. K. Jain, S.R.K. Iyangar, R. K. Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Publications.
[T2]	T. Veerarajan and T. Ramchandran, "Numerical Methods with Programs in C and C++", Tata McGraw Hill Publication.
[T3]	P.P. Gupta & G.S Malik, "Calculus of Finite Difference and Numerical Analysis", Krishna Prakashan Media Ltd, Meerut**.**
[T4]	Dr. B. S. Grewal, "Numerical Methods in Engineering & Sciences", Khanna Publishers.
[T5]	E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill Publication.
[T6]	E. Balagurusamy, "Numerical Methods", Tata McGraw Hill Publication.

Reference Books :

[R1]	J. B. Scarborough, "Numerical Mathematical Analysis", Oxford & IBH, New Delhi.
[R2]	Steven Chapra, Raymond P. Canale, "Numerical Methods for Engineers", Tata McGraw Hill Publication.
[R3]	Yashwant Kanetkar, "Let us C", BPB Publications.
[R4]	S.S. Sastry, "Introductory methods of Numerical Analysis", PHI Learning Private Ltd.
[R5]	P. Thangaraj, "Computer oriented Numerical Methods", PHI Learning Private Ltd.

Self-Learning Topics :

- Secant method for solution of transcendental equation.
- Newton's Backward difference interpolation methods.
- Gauss Jordan method and Gauss Seidel method.
- Numerical integration using Simpson's 1/3 and 3/8 rule.

Extra Experiments :

Practice programs in C language e.g. –

- To find roots of quadratic equation.
- To find mean, median and standard deviation from given data.
- Matrix multiplication.

Assignment Topics :

- Algorithm and C program development for given problem.
- Comparison of various numerical methods.
- Solution of linear simultaneous equations.
- Numerical Integration

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Fundamentals of Microcontroller and Applications

Course Name : Fundamentals of Microcontroller and Applications **Course Number : 203149**		
Teaching Scheme **Theory : 4 Hrs. / week** **Practical : 2 Hrs. / week**	**Credits** **Th / Tut : 04** **PR :01**	**Examination Scheme [Marks]** **In Sem (Online) : 50 Marks** **End Sem : 50 Marks** **Oral : 50**

Designation of the Course : Professional-Core

Prerequisites :

- Knowledge of numbering systems and Boolean algebra.
- Knowledge of combinational and sequential logic circuits

Course Objectives :

1.	To understand the differences between microcontrollers and microprocessors learn microcontroller architecture & describe the features of a typical microcontroller.
2.	To use the 8051 addressing modes and instruction set and apply this knowledge to perform programs - arithmetic & logic operations, data & control transfer operations, input & output operations.
3.	To define the protocol for serial communication and understand the microcontroller development systems.
4.	To build and test a microcontroller based system; interface the system to switches, keypads, displays, A/D and D/A converters.
5.	To provide students with the concepts and techniques required in designing computer hardware interfaces embedded software for microcontrollers and measurement of various analog parameters.

Course Outcomes :
At the end of the course, a graduate will be able to –

CO1.	Describe the architecture and features of various types of microcontroller.
CO2.	Demonstrate programming proficiency using the various addressing modes and all types of instructions of the target microcontroller.
CO3.	Program using the capabilities of the stack, the program counter the internal and external memory, timer and interrupts and show how these are used to execute a programme.
CO4.	Write various assembly language programs such as data transfer, arithmetic & logical on training boards and execute.
CO5.	Interface various external I/O devices to microcontroller.
CO6.	Write assembly language programs for real-world control problems such as fluid level control, temperature control, and batch processes.

Course Contents :

Unit 1 :	**[8 Hrs]**

Introduction to concept of microcontroller, comparison of Microprocessor and microcontroller, Comparison of all 8 bit microcontrollers, Intel 8051 microcontroller architecture, Pin diagram, Memory organization of 8051, special function registers, Internal structure of I/O ports, operation of I/O ports. Interfacing of 8051 with external memory.

Unit 2 :	**[8 Hrs]**

Addressing modes of 8051, Instruction set of 8051, Stack and Stack Related instruction, Data exchange, byte level logical operations, bit level logical operations, rotate and swap operations, instruction affecting flags, incrementing, decrementing, arithmetic operations, jump and recall instruction, Call and return subroutines.

Unit 3 :	**[8 Hrs]**

Assembly language programming of 8051. Counters and timers in 8051, timer modes and its programming.

Practical's:

1. Study and use of 8051 Microcontroller trainer kit.
2. Assembly Language Program for arithmetic operation of 8 bit numbers.
3. Assembly Language Program for finding largest number and smallest number from a given array of 8 bit numbers.
4. Assembly Language program to arrange 8 bit numbers stored in array in ascending order and descending order.
5. Assembly Language Program for use of Timer/Counter for various applications.

Unit 4 :	**[8 Hrs]**

Interrupts- timer flag interrupt, serial port interrupt, external interrupts, software generated, Interrupt control and interrupt programming. Serial communication and its programming. Serial data input, output, Serial data modes, interfacing of 8051 with PC through RS232.

Unit 5 :	**[8 Hrs]**

Microcontroller development tools- study of simulator, emulator, assemblers, programmers, cross assembler for microcontrollers. Study, interfacing and programming of PPI 8255 - mode 0, 1, BSR mode. Interfacing of 8051 with 8255 for expanding of I/O. Programming and Interfacing of 8051 with 8 bit ADC (0809) and DAC (0808).

Practical's:

1. Interfacing of 8 bit DAC 0808 with 8051 to generate various waveforms.
2. Interfacing of 24-led kit with 8051 through 8255.

Unit 6 :	**[8 Hrs]**

Part A: (Theoretical Treatment only)

Measurement of parameters such as matrix (4 x 4) Keyboard pressure, temperature, flow, level, voltage, current, power (KW), power factor and frequency using 8051.

Part B: Interfacing and Programming

Interfacing of 8051 with single key, LED, Relay, voltage, current, speed control of dc motors, Stepper motor control (speed /position).

Practical's:

1. Blinking display of LED's interfaced with 8051
2. Stepper motor control by 8051 Microcontroller.
3. Stepper motor control by 8051 microcontroller through 8255 PPI.

Text Books :

[T1]	V Udayashankara and M S Mallikarjuna Swamy, "8051 Microcontroller, Hardware, software and applications", TATA McGraw Hill.
[T2]	Muhammad Ali Mazidi, J.G. Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearsons Publishers.
[T3]	Ajay Deshmukh, "Microcontroller 8051" –TATA McGraw Hill.
[T4]	Theagrajan," Microprocessor and Microcontroller", BS Publication.
[T5]	K. J. Ayala, "The 8051 Microcontrollers- Architecture, Programming and Applications", Peram International Publications.
[T6]	Subrata Ghoshal, "8051 microcontroller", Pearsons Publishers.

Reference Books :

[R1]	Scott Mackenzie, "8051 Microcontroller", Pearson Education.
[R2]	Intel Microcontroller data book.
[R3]	Intel Corporation 1990- 8 bit embedded controller handbook.

Self-Learning Topics :

Unit-V: Microcontroller development tools…..

a. Study of Simulator.
b. Study of Emulator.
c. Study of Assembler.
d. Study of Programmer.
e. Study of Cross-assembler.

Unit-VI: Measurement of following physical parameters using 8051 microcontroller.

a. Voltage
b. Current
c. Power (KW)
d. Power factor.
e. Frequency.

Assignment Topics :

1. Describe the architecture of 8051 Microcontroller.
2. Compare the features of various micro-controllers under 8051 family.
3. Explain the addressing modes of 8051 microcontroller in brief with an example.

4. Explain in brief about each group of 8051 instruction set with an example.
5. Programming Examples:

a. Write 8051 ALP to find the average of five 8-bit numbers stored at external memory location starting from 2000H and store the result at 2005 memory location.

b. Find the cube of an 8-bit number stored at internal memory location.

6. Explain in detail about Timer Mode (TMOD) & Timer Control (TCON) Special Function Registers.
7. Describe with a neat sketch, the 8051 microcontroller interrupt structure.
8. Explain in brief about serial data communication modes.
9. Explain in detail the pin configuration of 8255 programmable peripheral interface.
10. Explain in brief with a neat sketch about
    - 8-bit ADC- 0809
    - 8-bit DAC- 0808
11. Write an 8051 ALP to measure the temperature by using LM35 temperature sensor and display it on LCD.
12. Explain in brief about measurement of Electrical parameters Voltage & Current using 8051 microcontroller.

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