SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN (AUTONOMOUS)
BHIMAVARAM - 534202
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

B.Tech. EEE Course Structure – R23
(With effect from 2023-2024)

I Year - I Semester

S.No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	BS&H	UGBS1T0423	Chemistry	3	0	0	3	30	70	100
2	BS&H	UGBS1T0323	Linear Algebra & Calculus	3	0	0	3	30	70	100
3	ES	UGBS1T1323	Basic Electrical & Electronics Engineering	3	0	0	3	30	70	100
4	ES	UGME1T0123	Engineering Graphics	1	0	4	3	30	70	100
5	ES	UGCS1T0123	Introduction to Programming	3	0	0	3	30	70	100
6	BS&H	UGBS1P0923	Chemistry Lab	0	0	2	1	30	70	100
7	ES	UGBS1P1423	Electrical & Electronics Engineering Workshop	0	0	3	1.5	30	70	100
8	ES	UGCS1P0223	Computer Programming Lab	0	0	3	1.5	30	70	100
9	BS&H	UGBS1P1123	NSS/Community Service	0	0	1	0.5	100	-	100
			Total	**13**	**0**	**13**	**19.5**	**340**	**560**	**900**

I Year - II Semester

S.No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	BS&H	UGBS2T0323	Communicative English	2	0	0	2	30	70	100
2	BS&H	UGBS2T0423	Engineering Physics	3	0	0	3	30	70	100
3	BS&H	UGBS2T0223	Differential Equations and Vector Calculus	3	0	0	3	30	70	100
4	ES	UGBS2T1023	Basic Civil and Mechanical Engineering	3	0	0	3	30	70	100
5	PC	UGEE2T0123	Electrical Circuit Analysis - I	3	0	0	3	30	70	100
6	BS&H	UGBS2P0723	Communicative English Lab	0	0	2	1	30	70	100
7	BS&H	UGBS2P0823	Engineering Physics Lab	0	0	2	1	30	70	100
8	ES	UGME2P0223	Engineering Workshop	0	0	3	1.5	30	70	100
9	PC	UGEE2P0223	Electrical Circuits Lab	0	0	3	1.5	30	70	100
10	ES	UGCS2P0223	IT Workshop	0	0	2	1	30	70	100
11	BS&H	UGBS2P0923	Health and Wellness, Yoga and Sports	0	0	1	0.5	100	-	100
			Total	**14**	**0**	**13**	**20.5**	**400**	**700**	**1100**

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

II B.Tech. EEE Course Structure – R23

II Year-I Semester

S.No.	Category	Course code	Course Title	L	T	P	C	IM	EM	TM
1	BS&H	UGBS3T0323	Complex Variables & Numerical Methods	3	0	0	3	30	70	100
2	BS&H	UGBS3T0623	Universal human values – Understanding harmony and Ethical human conduct	2	1	0	3	30	70	100
3	ES	UGEE3T0123	Electromagnetic Field Theory	3	0	0	3	30	70	100
4	PC	UGEE3T0223	Electrical Circuit Analysis-II	3	0	0	3	30	70	100
5	PC	UGEE3T0323	DC Machines & Transformers	3	0	0	3	30	70	100
6	PC	UGEE3P0423	Electrical Circuit Analysis -II and Simulation Lab	0	0	3	1.5	30	70	100
7	PC	UGEE3P0523	DC Machines & Transformers Lab	0	0	3	1.5	30	70	100
8	SEC	UGEE3K0623	Data Structures Lab	0	1	2	2	30	70	100
9	AC	UGBS3A0723	Environmental Science	2	0	0	-	-	-	-
Total				**16**	**2**	**8**	**20**	**240**	**560**	**800**

II Year-II Semester

S.No.	Category	Subject code	Title	L	T	P	C	IM	EM	TM
1	MC-I	UGMB4T0123	Managerial Economics & Financial Analysis	2	0	0	2	30	70	100
2	ES/BS	UGEE4T0123	Analog Circuits	3	0	0	3	30	70	100
3	PC	UGEE4T0223	Power Systems-I	3	0	0	3	30	70	100
4	PC	UGEE4T0323	Induction and Synchronous Machines	3	0	0	3	30	70	100
5	PC	UGEE4T0423	Control Systems	3	0	0	3	30	70	100
6	PC	UGEE4P0523	Induction and Synchronous MachinesLab	0	0	3	1.5	30	70	100
7	PC	UGEE4P0623	Control Systems Lab	0	0	3	1.5	30	70	100
8	SEC	UGEE4K0723	Python Programming Lab	0	1	2	2	30	70	100
9	ES	UGME4P0623	Design Thinking & Innovation	1	0	2	2	30	70	100
Total				**15**	**1**	**10**	**21**	**270**	**630**	**900**
Mandatory Community Service Project Internship of 8 weeks duration during summer vacation										
Honors/Minor Course (3 or 4.5 Credits)										

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III B.Tech. EEE Course Structure – R23

III Year-I Semester

S.No.	Category	Course code	Course Title	L	T	P	C	IM	EM	TM
1	PC	UGEE5T0123	Power Electronics	3	0	0	3	30	70	100
2	PC	UGEE5T0223	Digital Circuits	3	0	0	3	30	70	100
3	PC	UGEE5T0323	Power Systems-II	3	0	0	3	30	70	100
4	PE-I	UGEE5T0423	Signals and Systems	3	0	0	3	30	70	100
		UGEE5T0523	Computer Architecture and Organization							
		UGEE5T0623	Communication systems							
		UGEEO0723	MOOCs (12 week Swayam/NPTEL course recommended by the BoS)							
5	OE-I	UGMB5T0123	Open Elective-I or Entrepreneurship Development & Venture Creation	3	0	0	3	30	70	100
6	PC	UGEE5P0823	Power Electronics Lab	0	0	3	1.5	30	70	100
7	PC	UGEE5P0923	Analog and Digital Circuits Lab	0	0	3	1.5	30	70	100
8	SEC	UGBS5K0123	Soft skills	0	1	2	2	30	70	100
9	ES	UGEE5P1023	Tinkering Lab	0	0	2	1	30	70	100
10	Internship	UGEE5I1123	Community Service Internship (Evaluation)	-	-	-	2	-	50	50
Total				**15**	**1**	**10**	**23**	**270**	**680**	**950**
Honors/Minor Course (3 or 4.5 Credits)										

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III B.Tech. EEE Course Structure – R23

III Year-II Semester

S.No.	Category	Course code	Course Title	L	T	P	C	IM	EM	TM
1	PC	UGEE6T0123	Electrical Measurements and Instrumentation	3	0	0	3	30	70	100
2	PC	UGEE6T0223	Microprocessors and Microcontrollers	3	0	0	3	30	70	100
3	PC	UGEE6T0323	Power System Analysis	3	0	0	3	30	70	100
4	PE-I	UGEE6T0423	Switchgear and Protection	3	0	0	3	30	70	100
		UGEE6T0523	Advanced Control Systems							
		UGEE6T0623	Renewable and Distributed Energy Technologies							
		UGEE6M0723	12 Week MOOC-Swayam/NPTEL course							
5	PE-III	UGEE6T0823	Electric Drives	3	0	0	3	30	70	100
		UGEE6T0923	Digital Signal Processing							
		UGEE6T1023	High Voltage Engineering							
6	OE-II		Open Elective – II	3	0	0	3	30	70	100
7	PC	UGEE6P1123	Electrical Measurements and Instrumentation Lab	0	0	3	1.5	30	70	100
8	PC	UGEE6P1223	Microprocessors and Microcontrollers Lab	0	0	3	1.5	30	70	100
9	SEC	UGEE6K1323	IoT Applications of Electrical Engineering Lab	0	1	2	2	30	70	100
10	AC	UGEE6A1423	Research Methodology	2	0	0	0	30	-	30
Total				**20**	**1**	**08**	**23**	**300**	**630**	**930**
Mandatory Industry Internship / Mini Project of 08 weeks duration during summer vacation										
Honors/Minor Course (3 or 4.5 Credits)										

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III B.Tech. EEE Course Structure – R23

OPEN ELECTIVES

The following courses are offered to other departments students.

S.No.	Category	Course code	Course Title	L	T	P	C	IM	EM	TM
1	OE-I (III-I)	UGEE0T0123	Renewable Energy Sources	3	0	0	3	30	70	100
		UGEE0T0223	Concepts of Energy Auditing & Management							
2	OE-II (III-II)	UGEE0T0323	Fundamentals of Electric Vehicles	3	0	0	3	30	70	100
		UGEE0T0423	Electrical Wiring Estimation and Costing							

Note: Each department will notify the list of Open Electives to be offered at the time of course registration.

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

III B.Tech. EEE Course Structure – R23

*Minor Engineering Courses offered by EEE Department for Other Branches

(Except EEE Branch)

Note:

1. *To obtain Minor degree, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.*
2. *At least THREE credits must be earned from NPTEL/SWAYAM MOOC Course*
3. *During Minor Course selection, there should not be any overlap with Regular/Major/Open Electives.*

S.No.	Course code	Course Title	L	T	P	C
1	UGEE0M0123	Concepts of Control Systems	3	0	3	4.5
2	UGEE0M0223	Fundamentals of Electrical Measurements and Instrumentation	3	0	0	3
3	UGEE0M0323	Concepts of Power System Engineering	3	0	0	3
4	UGEE0M0423	Fundamentals of Power Electronics	3	0	0	3
5	UGEE0M0523	Basics of Electric Drives and applications	3	0	3	4.5
6	UGEE0M0623	Fundamentals of utilization of Electrical Energy	3	0	0	3
7	UGEE0M0723	Basic Electrical Circuits	12 Week 3 credit NPTEL MOOC Courses			
8	UGEE0M0823	Applied Electromagnetics for Engineers				
9	UGEE0M0923	A Basic Course on Electric and Magnetic Circuits				
10	UGEE0M1023	Fundamentals of Electrical Engineering				
11	UGEE0M1123	Power Electronics Applications in Power Systems				
12	UGEE0M1223	Power System Protection				
13	UGEE0M1323	Optimization Theory and Algorithms				

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN
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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

III B.Tech. EEE Course Structure – R23

Honors(For EEE students)

Note:

1. *To obtain Honors degree, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.*
2. *At least SIX Credits (i.e..two courses of 3 credits each) must be earned from NPTEL/SWAYAM MOOC Courses*
3. *During Honors Course selection, there should not be any overlap with Regular/Major/Open Electives.*

POWER SYSTEMS

S.No.	Course code	Course Title	L	T	P	C
1	UGEE0H0123	Electric Power Quality	3	0	0	3
2	UGEE0H0223	Smart Grid Technologies	3	0	0	3
3	UGEE0H0323	Power System Deregulation	3	0	0	3
4	UGEE0H0423	Real Time Control of Power Systems	3	0	0	3
5	UGEE0H0523	Advanced Power Systems Protection	3	0	0	3
6	UGEE0H0623	Flexible AC Transmission Systems	3	0	0	3
7	UGEE0H0723	AI applications in Power Systems	3	0	0	3
8	UGEE0H0823	Power Systems Lab	0	0	3	1.5
9	UGEE0H0923	Advanced Power Systems Simulation Lab	0	0	3	1.5
10	UGEE0H1023	Electrical Distribution System Analysis	12 Week 3 credit NPTEL MOOC Courses			
11	UGEE0H1123	Economic Operations and Control of Power Systems				
12	UGEE0H1223	Design of Photovoltaic Systems				
13	UGEE0H1323	Modeling and TCAD Simulation of Solar PV Cell				
14	UGEE0H1423	Modeling, Analysis and Estimation of Three Phase Unbalanced Power Network				
15	UGEE0H1523	Advanced Distribution System Analysis and Operation				

POWER ELECTRONICS

S.No.	Course code	Course Title	L	T	P	C
1	UGEE0H1623	Special Electrical Machines	3	0	0	3
2	UGEE0H1723	Machine Modeling and Analysis	3	0	0	3
3	UGEE0H1823	Power Electronic Converters	3	0	0	3
4	UGEE0H1923	Power Quality and Custom Power Devices	3	0	0	3
5	UGEE0H2023	Power Electronics for Renewable Energy systems	3	0	0	3
6	UGEE0H2123	Industrial Applications of Power Electronic Converters	3	0	0	3
7	UGEE0H2223	Advanced Electrical Drives	3	0	0	3
8	UGEE0H2323	FACTS Controllers	3	0	0	3
9	UGEE0H2423	Power Converters Laboratory	0	0	3	1.5
10	UGEE0H2523	Electric Drives Laboratory	0	0	3	1.5
11	UGEE0H2623	Renewable Technologies Laboratory	0	0	3	1.5
12	UGEE0H2723	Electric Vehicles Laboratory	0	0	3	1.5
13	UGEE0H2823	Linear Systems Theory	12 Week 3 credit NPTEL MOOC Courses			
14	UGEE0H2923	Modeling and TCAD Simulation of Solar PV Cell				
15	UGEE0H3023	Charging Infrastructure				
16	UGEE0H3123	Power Electronics with Wide Band Gap Devices				
17	UGEE0H3223	Line Commutated and PWM Rectifiers				
18	UGEE0H3323	Control and Tuning Methods in Switched Mode Power Converters				
19	UGEE0H3423	Sliding Mode Control and Applications				
20	UGEE0H3523	Nonlinear Dynamical Systems and Control				

MOOCs courses list for Professional Electives

S.No.	Course code	Title	Duration
1	UGEE0O0123	Linear Systems Theory	12 weeks
2	UGEE0O0223	Applied Linear Algebra for Signal Processing, Data Analytics and Machine Learning	12 weeks
3	UGEE0O0323	Optimization Theory and Algorithms	12 weeks
4	UGEE0O0423	Design of Electric Motor	12 weeks
5	UGEE0O0523	Control and Tuning Methods in Switched Mode Power Converters	12 weeks
6	UGEE0O0623	Sliding Mode Control and Applications	12 weeks
7	UGEE0O0723	Nonlinear Dynamical Systems and Control	12 weeks
8	UGEE0O0823	Mathematics for Machine Learning	12 weeks
9	UGEE0O0923	Probability Foundations for Electrical Engineers	12 weeks
10	UGEE0O1023	Digital Image Processing	12 weeks

Note:

1. *During MOOCs Course selection, there should not be any overlap with Regular/Honors/Minor/Open Electives.*

I YEAR
I SEMESTER

CHEMISTRY
(Common to IT, ECE and EEE)

Subject Code: UGBS1T0423	**L**	**T**	**P**	**C**
I Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge in chemistry.

Course Objectives: This course helps students to acquire basic knowledge

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods for chemical analysis

Course Outcomes:

Upon completion of this course, the students will be able to

CO1: Apply molecular orbital theory to understand bonding between homo and hetero diatomic molecules.

CO2: Apply the principle of Band diagrams in the application of conductors and semiconductors.

CO3: Compare the materials of construction for battery and electrochemical sensors

CO4: Explain the preparation, properties, and applications of thermoplastics & thermosetting, elastomers& conducting polymers.

CO5: Summarize the concepts of Instrumental methods.

Syllabus:

UNIT I: (9 Hours)

Structure and Bonding Models: Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homo - and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II: (8 Hours)

Modern Engineering materials

Semiconductors: Introduction, basic concept, application

Super conductors: Introduction basic concept, applications.

Super capacitors: Introduction, Basic Concept - Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphene nanoparticles.

UNIT III: **(14 Hours)**

Electrochemistry and Applications: Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry - potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells – lithium-ion batteries - working of the batteries including cell reactions; Fuel cells, Hydrogen-Oxygen fuel cell – working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV: **(10 Hours)**

Polymer Chemistry:

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics – Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6 , carbon fibres.

Elastomers – Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – Polyacetylene, Polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Poly L Lactic Acid (PLA).

UNIT V: **(8 Hours)**

Instrumental Methods and Applications:

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	3	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	3	-	3	-	-	-	-	-	-	-

TEXT BOOKS:

1. Jain and Jain, Engineering Chemistry, 16th edition, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

REFERENCE BOOKS:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition.

LINEAR ALGEBRA & CALCULUS
(Common to All Branches)

Subject Code: UGBS1T0323	**L**	**T**	**P**	**C**
I Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of Matrices, Differentiation and Integration

Course Objectives: To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Course Outcomes:
At the end of this course, students will be able to:
CO1: Develop and use matrix algebra techniques that are needed by engineers for practical applications. (L4)
CO2: Calculate Eigen values and Eigen vectors and apply to Diagonalization, Cayley-Hamilton theorem, Quadratic forms and their canonical forms
CO3: Utilize mean value theorems to real life problems (L3)
CO4: Familiarize with functions of several variables and Learn important tools of calculus in higher dimensions which is useful in optimization (L3)
CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates. (L3)

Syllabus:

UNIT-I: (10 Hours)
Matrices: Rank of a matrix by Echelon form, Normal form. Cauchy–Binet formulae (without proof). Inverse of Non-singular matrices by Gauss-Jordan method
System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT-II: (8 Hours)
Eigen values, Eigenvectors and Orthogonal Transformation:
Eigen values, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: (8 Hours)
Calculus: Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem. Taylor's and

Maclaurin's theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT-IV: (8 Hours)

Partial Differentiation and Applications (Multivariable calculus):

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT-V: (8 Hours)

Multiple Integrals (Multivariable Calculus)

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 2017, 44th Edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, ohn Wiley & Sons, 2018, 10th Edition.

REFERENCE BOOKS:

1. Thomas Calculus, George B.Thomas, Maurice D. Weir and Joe Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R.K. Jain and S.R.K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Michael Greenberg, Pearson publishers, 9th Edition.
5. Higher Engineering Mathematics, H.K. Das, Er. Rajnish Varma, S. Chand Publications, 2014, Third Edition(Reprint 2021).

BASIC ELECTRICAL & ELECTRONICS ENGINEERING
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGBS1T1323	**L**	**T**	**P**	**C**
I Year / I Semester	**3**	**0**	**0**	**3**

PART-A: BASIC ELECTRICAL ENGINEERING

Course Objectives:
To expose to the field of electrical & electronics engineering, laws and principles of electrical/electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes:
After the completion of the course, students will be able to
CO1: Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.
CO2: Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.
CO3: Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.
CO4: Analyze different electrical circuits, performance of machines and measuring instruments.
CO5: Evaluate different circuit configurations, Machine performance and Power systems operation.

Syllabus:

UNIT I: DC & AC Circuits **(8 Hours)**
DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, Series, Parallel, Series - Parallel circuits, Super Position theorem, Simple numerical problems.
AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II: Machines and Measuring Instruments (8 Hours)

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone Bridge.

UNIT III: Energy Resources, Electricity Bill & Safety Measures (8 Hours)

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

CO – PO Mapping														
POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	3	-	-	-	-	3	-	-
CO3	3	-	3	-	-	-	2	-	-	-	-	2	-	-
CO4	3	3	-	-	-	-	3	-	-	-	-	3	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition.

2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013.

3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition.

REFERENCE BOOKS:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition.

2. Principles of Power Systems, V.K. Mehtha, S. Chand Technical Publishers, 2020.

3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017.

4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART-B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

Course Outcomes:

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

CO1: Analyze the operation and characteristics of diodes, transistor, rectifiers, power supplies, amplifier design and electronic instrumentation systems.

CO2: Demonstrate a comprehensive understanding of digital electronics, encompassing the application of concepts related to number systems, logic gates, Boolean algebra, truth tables, and the design of simple combinational and sequential circuits using flip-flops, registers and counters.

Syllabus:

UNIT I: Semiconductor Devices (8 Hours)

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II: Basic Electronic Circuits and Instrumentation (8 Hours)

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III: Digital Electronics (8 Hours)

Overview of Number Systems, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra. Truth Tables and Functionality of Logic Gates including Universal Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits – Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

CO-PO Mapping:

COs/POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

REFERENCE BOOKS:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

ENGINEERING GRAPHICS
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGME1T0123	**L**	**T**	**P**	**C**
I Year / I Semester	**1**	**0**	**4**	**3**

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions, and standards related to Engineering Drawing.
- To impart knowledge on the projection of points, lines and plane surfaces.
- To improve visualization skills for a better understanding of the projection of solids.
- To develop the imaginative skills of the students required to understand the Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

Course Outcomes:

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

CO1: Apply precise engineering drawing techniques and standards, including dimensioning, geometric constructions, and polygon construction, following industry norms.

CO2: Use orthographic projection for accurate 3D to 2D representation.

CO3: Project straight lines and planes proficiently.

CO4: Represent solids effectively, including revolution solids.

CO5: Apply sectioning techniques for accurate visualization and develop surfaces as needed for recreating 3D solids.

CO6: Convert between isometric and orthographic views, use AutoCAD for 2D/3D drawings, including PCB with transformations.

Syllabus:

UNIT I: (9 Hours)

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Constructing regular polygons by general methods.

Curves: Construction of ellipse, parabola, and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, Diagonal scales and Vernier scales.

UNIT II: (9 Hours)

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to the other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line inclined to both the reference planes.

Projections of Planes: Regular planes perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III: (9 Hours)

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT IV: (9 Hours)

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of the section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V: (9 Hours)

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using AutoCAD (Not for end examination).

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	3	3	-	-	-	-	2
CO2	3	3	-	-	-	3	-	-	-	-	-	-
CO3	3	3	-	-	-	3	-	-	-	-	-	-
CO4	3	3	-	-	-	3	-	-	-	-	-	-
CO5	3	3	3	-	-	3	-	-	-	3	-	-
CO6	3	3	3	-	3	3	-	-	-	3	-	3

TEXT BOOK:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

REFERENCE BOOKS:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B. Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

INTRODUCTION TO PROGRAMMING
(Common to All Branches)

Subject Code: UGCS1T0123	**L**	**T**	**P**	**C**
I Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge on Mathematics and problem solving skills.

Course Objectives:

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

Course Outcomes:

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

CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking.

CO2: Analyse a problem and develop an algorithm to solve it.

CO3: Implement various algorithms using the C programming language.

CO4: Understand more advanced features of C language.

CO5: Develop problem-solving skills and the ability to debug and optimize the code.

Syllabus:

UNIT I: Introduction to Programming and Problem Solving (12 Hours)

History of Computers, Basic organization of a Computer: ALU, Input-Output units, Memory, Program Counter. Introduction to Programming Languages, Basics of a Computer Program: Algorithms, Flowcharts (Using Dia Tool), Pseudo Code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion and Casting.

Problem solving techniques: Algorithmic approach, Characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and Space complexities of algorithms.

UNIT II: Control Structures (8 Hours)

Simple sequential programs, Conditional Statements (if, if-else, switch), Loops (for, while, do-while), Break and Continue.

UNIT III: Arrays and Strings (8 Hours)

Arrays indexing, Memory model, Programs with array of integers, Two dimensional arrays, Introduction to Strings.

UNIT IV: Pointers & User Defined Data types (8 Hours)

Pointers, Dereferencing and address operators, Pointer and address arithmetic, Array manipulation using pointers, User defined data types: Structures and Unions.

UNIT V: Functions & File Handling (10 Hours)

Introduction to Functions, Function Declaration and Definition, Function call, Return Types and Arguments, Modifying parameters inside functions using pointers, Arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling.

Note: The syllabus is designed with C Language as the fundamental language of implementation.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall, 1988.
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996.

REFERENCE BOOKS:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition.
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition.

CHEMISTRY LAB
(Common to IT, ECE and EEE)

Subject Code: UGBS1P0923	**L**	**T**	**P**	**C**
I Year / I Semester	**0**	**0**	**2**	**1**

Prerequisites: Basic knowledge in Chemical analysis.

Course Objectives: This course helps students to acquire basic knowledge to verify the fundamental concepts with experiments.

Course Outcomes:

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

CO1: Determine the EMF, cell constant, conductance and redox potentials of solutions.

CO2: Prepare advanced materials and to study its applications.

CO3: Measure the strength of an acid present in secondary batteries.

CO4: Understand the spectroscopic techniques and analyze the spectra of some organic compounds.

CO5: Ferrous iron in given sample by volumetric method.

List of Experiments:

1. Conductometric titration of strong acid vs. strong base
2. Conductometric titration of weak acid vs. strong base
3. Determination of cell constant and conductance of solutions
4. Potentiometry - determination of redox potentials and e.m.fs
5. Determination of Strength of an acid in Pb-Acid battery
6. Preparation of Bakelite
7. Verify Lambert-Beer's law
8. Identification of simple organic compounds by IR
9. Preparation of nanomaterials by precipitation method
10. Estimation of Ferrous Iron by Dichrometry

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	3	-	-	-	-	-	-	-
CO5	3	3	-		-	-	-	-	-	-	-	-

REFERENCE BOOKS:

1. "Vogel's Quantitative Chemical Analysis" 6th Edition, Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar.

ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGBS1P1423	**L**	**T**	**P**	**C**
I Year / I Semester	**0**	**0**	**3**	**1.5**

PART-A: ELECTRICAL ENGINEERING LAB

Course Objectives:
To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes:
After the completion of the course, students will be able to
CO1: Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
CO2: Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
CO3: Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
CO4: Analyze various characteristics of electrical circuits, electrical machines and measuring instruments.
CO5: Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

Activities:
1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.

- Provide some exercises so that hardware tools and instruments are learned to be used by the students.

2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.

- Provide some exercises so that measuring instruments are learned to be used by the students.

3. Components:

- Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
- Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments.

List of Experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Note: Minimum Six Experiments to be performed.

CO – PO Mapping														
POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	3	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	3	3	-	2	-	-
CO3	3	3	-	-	-	-	-	-	3	3	-	2	-	-
CO4	3	3	-	-	-	3	3	-	2	2	-	3	-	-
CO5	3	-	3	-	-	3	-	-	3	3	-	3	-	2

REFERENCE BOOKS:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition

2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013

3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

PART-B: ELECTRONICS ENGINEERING LAB

Course Objectives:

To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

Course Outcomes:

At the end of the course, the student will be able to

CO1 : Identify & testing of various electronic components.

CO2 : Understand the usage of electronic measuring instruments.

CO3 : Plot and discuss the characteristics of various electron devices.

CO4 : Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V-I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K & D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

CO-PO Mapping :

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

REFERENCE BOOKS:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

COMPUTER PROGRAMMING LAB
(Common to All Branches)

Subject Code: UGCS1P0223	**L**	**T**	**P**	**C**
I Year / I Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Basic knowledge on Mathematics and problem solving skills.

Course Objectives:
The course aims to give students hands on experience and train them on the concepts of the C - programming language.

Course Outcomes:
Upon completion of this course, the students will be able to:
CO1: Read, understand and trace the execution of programs written in C language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.
CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

List of Experiments:

UNIT I

WEEK 1
Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:
Tutorial 1: Problem-solving using Computers.
Lab 1: Familiarization with programming environment
i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2
Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:
Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 2: Converting algorithms/flow charts into C Source code. Developing the algorithms/flowcharts for the following sample programs

i) Sum and Average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT II

WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial 4: Operators and the precedence and associativity:

Lab 4: Simple computational problems using the operator precedence and associativity.

i) Evaluate the following expressions.
   a. A+B*C+(D*E) + F*G
   b. A/B*C-B+A*D/3
   c. A+++B---A
   d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, null else, if - else if - else, switch and nested-if including in what scenario each

one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab 5: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

WEEK 6
Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:
Tutorial 6: Loops, while and for loops
Lab 6: Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

UNIT III

WEEK 7:
Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:
Tutorial 7: 1 D Arrays: searching.
Lab 7:1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on 1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.

WEEK 8:
Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 8: Matrix problems, String operations, Bubble sort
i) Addition of two matrices
ii) Multiplication of two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

UNIT IV

WEEK 9:
Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C.

Suggested Experiments/Activities:
Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Pointers and structures, memory dereference.
i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v) Write a C program to implement realloc()

WEEK 10:
Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures.

Suggested Experiments/Activities:
Tutorial 10: Bit fields, Self-Referential Structures, Linked lists
Lab10: Bit fields, linked lists
i) Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields.
ii) Create and display a singly linked list using self-referential structure.
iii) Demonstrate the differences between structures and unions using a C program.
iv) Write a C program to shift/rotate using bit fields.
v) Write a C program to copy one structure variable to another structure of the same type.

UNIT V

WEEK 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent

Lab 11: Simple functions using call by value, solving differential equations using Euler's theorem.

i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the LCM of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers.

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.

iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

i) Write a C program to read and write text into a file.
ii) Write a C program to read and write text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-line arguments.
v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	-	-	-	-	-	-	3	-	-	-
CO3	3	3	3	-	-	-	-	3	3	-	-	-
CO4	3	3	3	-	-	-	-	3	3	-	-	-

TEXT BOOKS:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, Cengage.

NSS/COMMUNITY SERVICE
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGBS1P1123	**L**	**T**	**P**	**C**
I Year / I Semester	**0**	**0**	**1**	**0.5**

Course Objectives:
The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes:
After completion of the course, the students will be able to
CO1: Understand the importance of discipline, character and service motto.
CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3: Explore human relationships by analyzing social problems.
CO4: Determine to extend their help for the fellow beings and downtrodden people.
CO5: Develop leadership skills and civic responsibilities.

Syllabus:

UNIT I: Orientation
General Orientation on NSS/Community Service activities and career guidance.
Activities:
i) Conducting ice breaking sessions - expectations from the course - knowing personal talents and skills
ii) Conducting orientations programs for the students - future plans - activities - releasing road map etc.
iii) Displaying success stories - motivational biopics - award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs - paintings - any other contribution

UNIT II: Nature & Care
Activities:
i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III: Community Service
Activities:
i) Conducting One Day Special Camp in a village - contacting village area

leaders - Survey in the village, identification of problems - helping them to solve via media – authorities – experts - etc.

ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS.

iii) Conducting consumer Awareness. Explaining various legal provisions etc.

iv) Women Empowerment Programmes - Sexual Abuse, Adolescent Health and Population Education.

v) Any other programmes in collaboration with local charities, NGOs etc.

Mapping of COs to POs:

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

REFERENCE BOOKS:

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. Red Book - National Cadet Corps – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defense, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi**.**

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

• Evaluated for a total of 100 marks.

• A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.

• A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

I YEAR
II SEMESTER

COMMUNICATIVE ENGLISH
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGBS2T0323	**L**	**T**	**P**	**C**
I Year / II Semester	**2**	**0**	**0**	**2**

Prerequisites: Students must possess basic knowledge in grammar and use of English for general purposes along with their understanding in various genres and LSRW skills for honing their oral and written communication.

Course Objectives: The main objective of introducing this course, Communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

Course Outcomes:
Upon completion of this course, the students will be able to:
CO1: Appreciate a piece of prose; employ suitable strategies for skimming and scanning to get the general idea of a text; learn the mechanics of writing; Parts of Speech- Nouns and Pronouns; Basic Sentence Structures and Vocabulary - Synonyms, Antonyms and Affixes.
CO2: Evaluate a piece of prose; write well-structured paragraphs and understand applying cohesive devices, use Articles and Prepositions, learn good Vocabulary - Homonyms, Homophones and Homographs.
CO3: Analyze a text in detail and summarize; employ Verbs, Tenses and Subject Verb Agreement appropriately; apply Vocabulary and Word Associations- Compound words and Collocations.
CO4: Understand a text, and learn and apply information transfer; use Voice and Reported Speech properly; write Formal Letters, Resume, emails, Covering Letter, SOP; Words Often Confused and Jargons.
CO5: Interpret ideas from Reading Comprehension; write essays; and edit short texts by correcting Common Errors and learn Vocabulary - Technical Jargons.

Syllabus:

UNIT I: **(9 Hours)**
Lesson: HUMAN VALUES: Gift of Magi (Short Story)

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as

home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces ofinformation.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II: (11 Hours)

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas afterlistening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

UNIT III: (11 Hours)

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed.

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations

UNIT IV: (11 Hours)

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts

(formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters, Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

UNIT V: (11 Hours)

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts

Reading: Reading comprehension.

Writing: Writing structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	2	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

TEXT BOOKS:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

REFERENCE BOOKS:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

WEB RESOURCES:

GRAMMAR

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

ENGINEERING PHYSICS
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGBS2T0423	**L**	**T**	**P**	**C**
I Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Ray optics, Basics of Mechanics, Properties of Matter

Course Objectives: To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes:

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

CO1: Analyze the intensity variation of light due to interference diffraction and polarization

CO2: Familiarize with the basics of crystals and their structures

CO3: Summarize various types of polarization of dielectrics and classify the magnetic materials

CO4: Apply the basic concepts of Quantum Mechanics to understand the free electron theory

CO5: Identify the type of semiconductor using Hall effect

Syllabus:

UNIT–I: (12Hours)

Wave Optics : Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index. Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT–II: (10Hours)

Crystallography and X-ray diffraction: Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

UNIT–III: (12Hours)

Dielectric and Magnetic Materials: Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT–IV: (10Hours)

Quantum Mechanics and Free electron Theory: Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT–V: (10Hours)

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K. Bhattacharya and Poonam Tandon, Oxford press (2015)

REFERENCE BOOKS:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources: https://www.loc.gov/rr/scitech/selected-internet/physics.html

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to All Branches)

Subject Code: UGBS2T0223	**L**	**T**	**P**	**C**
I Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of Differentiation and Integration.

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Solve First order differential equations and apply them to problems of Newton's Law of cooling, Law of Natural growth and Decay and Electrical circuits.

CO2: Solve linear differential equations of higher order and apply them to problems of Electrical circuits and Simple Harmonic Motion.

CO3: Identify solution methods for partial differential equations that model physical processes.

CO4: Interpret the physical meaning of different operators such as gradient, curl and divergence.

CO5: Estimate the work done against a field, circulation and flux using vector Integration.

Syllabus:

UNIT-I: (8Hours)

Differential equations of first order and first degree:

Linear differential equations – Bernoulli's equations - Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling – Law of natural growth and decay - Electrical circuits.

UNIT-II: (10Hours)

Linear differential equations of higher order(Constant Coefficients):

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT-III: **(8Hours)**

Partial Differential Equations:

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential Equations with constant coefficients.

UNIT-IV: **(8Hours)**

Vector Differentiation:

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions - Gradient, Directional derivative, del applied to vector point functions - Divergence and Curl, Vector identities.

UNIT-V: **(8Hours)**

Vector Integration

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), Volume integral, Divergence theorem (without proof) and related problems.

Mapping of COs to POs:

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

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna Publishers,2017,44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

REFERENCE BOOKS:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joe Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R.K. Jain and S.R.K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B.V. Ramana, McGraw Hill Education, 2017.

BASIC CIVIL AND MECHANICAL ENGINEERING
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGBS2T1023	**L**	**T**	**P**	**C**
I Year / II Semester	**3**	**0**	**0**	**3**

PART-A: BASIC CIVIL ENGINEERING

Prerequisites: Basic knowledge on Trigonometry and Science

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

Course Outcomes:

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

CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society and basic characteristics of Civil Engineering Materials.

CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.

CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.

CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.

Syllabus:

UNIT I: (7 Hours)

Basics of Civil Engineering: Role of Civil Engineers in Society - Various Disciplines of Civil Engineering - Structural Engineering - Geo-technical Engineering - Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering - Scope of each discipline - Building Construction and Planning - Construction Materials - Cement - Aggregate – Bricks - Cement concrete - Steel. Introduction to Prefabricated construction Techniques.

UNIT II: **(7 Hours)**

Surveying: Objectives of Surveying - Horizontal Measurements - Angular Measurements - Introduction to Bearings Levelling instruments used for levelling - Simple problems on levelling and bearings - Contour mapping.

UNIT III: **(9 Hours)**

Transportation Engineering: Importance of Transportation in Nation's economic development - Types of Highway Pavements - Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water - Quality of water – Specifications - Introduction to Hydrology – Rainwater Harvesting - Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	3	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	3	-	-	-	-	-	-
CO4	3	-	-	-	-	3	3	-	-	-	-	-

Textbooks:

1. Basic Civil Engineering, M.S. Palanisamy, Tata McGraw Hill publications (India) Pvt. Ltd. Fourth Edition.

2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.

3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.

2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016

3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.

4. Highway Engineering, S.K. Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.

5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART-B: BASIC MECHANICAL ENGINEERING

Prerequisites: Basic knowledge in Physics.

Course Objectives: The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes:

On completion of the course, the student should be able to

CO1: Apply the fundamentals of mechanical engineering to engineering application.

CO2: Explored to the applications of manufacturing and role of robots in manufacturing.

CO3: Differentiate the science of thermal engineering and design for power transmission.

Syllabus:

UNIT I: (8 Hours)

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society - Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials: Metals - Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II: (8 Hours)

Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering: Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air - conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III: (8 Hours)

Power Plants: Working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission: Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics: Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject.)

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	-	-	-	3	3	-	-	-	-	-	3
CO2	3	-	-	2	3	3	2	-	-	-	-	3
CO3	3	-	-	3	3	3	2	-	-	-	-	3

Textbooks:

1. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. Internal Combustion Engines by V. Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.

Reference Books:

1. G. Shanmugam and M.S. Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I

ELECTRICAL CIRCUIT ANALYSIS - I

Subject Code: UGEE2T0123	**L**	**T**	**P**	**C**
I Year / II Semester	**3**	**0**	**0**	**3**

Course Objectives:

To develop an understanding of the fundamental laws, elements of electrical circuits and to apply circuit analysis to DC and AC circuits.

Course Outcomes:

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

CO1: Remembering the basic electrical elements and different fundamental laws.

CO2: Understand the network reduction techniques, transformations, concept of self-inductance and mutual inductance, phasor diagrams, resonance and network theorems.

CO3: Apply the concepts to obtain various mathematical and graphical representations.

CO4: Analyse nodal and mesh networks, series and parallel circuits, steady state response, different circuit topologies (with R, L and C components).

CO5: Evaluation of Network theorems, electrical, magnetic and single-phase circuits.

Syllabus:

UNIT I :

INTRODUCTION TO ELECTRICAL CIRCUITS :

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchhoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources, node and mesh analysis.

UNIT II:

MAGNETIC CIRCUITS:

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.

UNIT III:

SINGLE PHASE CIRCUITS:

Characteristics of periodic functions, Average value, R.M.S. value, form factor, representation of a sine function, concept of phasor, phasor diagrams, node and mesh analysis. Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit, parallel RL circuit, parallel RC circuit.

UNIT IV:

RESONANCE AND LOCUS DIAGRAMS:

Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth; Locus diagram: RL, RC, RLC with R, L and C variables.

UNIT V:

NETWORK THEOREMS (DC & AC EXCITATIONS):

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.

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

Textbooks:

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.

2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

Reference Books:

1. Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill Education (India), 2013, Fifth Edition

2. Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2017, Fifth Edition.

3. Electric Circuits, David A. Bell, Oxford University Press, 2009, Seventh Edition.

4. Introductory Circuit Analysis, Robert L Boylestad, Pearson Publications, 2023, Fourteenth Edition.

5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, Seventh Revised Edition.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ee81/preview
2. https://nptel.ac.in/courses/108104139
3. https://nptel.ac.in/courses/108106172
4. https://nptel.ac.in/courses/117106108

COMMUNICATIVE ENGLISH LAB
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGBS2P0723	**L**	**T**	**P**	**C**
I Year / II Semester	**0**	**0**	**2**	**1**

Prerequisites: Students must possess basic knowledge in sounds of English and identification of sound symbols along with the ability to speak and write in English.

Course Objectives: The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

Course Outcomes:
Upon completion of this course, the students will be able to:
CO1: Articulate Vowels and Consonants properly, understand Non Verbal Communication and identify the topic, the context, specific questions and overall idea by listening to short audio texts and answering a series of questions and will also be able to introduce themselves and others.
CO2: Practice Neutralization/Accent Rules and answer a series of questions about main idea and supporting ideas after listening to audio texts.
CO3: Understand stress and listen for global comprehension and summarize what is listened to and will be able to participate in Group Discussions and Debates.
CO4: Make predictions while listening to conversations, videos, and enact Dialogues/Role Plays.
CO5: Build and practice topics from Science and Technology - using PPT Presentations/Poster Presentation.

LIST OF TOPICS:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/Poster Presentation
10. Interviews Skills

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	2	3	-	3
CO5	-	-	-	-	-	-	-	-	2	3	-	3

Suggested Software:

- Walden Infotech
- Young India Films

REFERENCE BOOKS:

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India,2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed),Kindle, 2013

WEB RESOURCES:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

ENGINEERING PHYSICS LAB
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGBS2P0823	**L**	**T**	**P**	**C**
I Year / II Semester	**0**	**0**	**2**	**1**

Prerequisites: Knowledge on optics, oscillations, electricity & magnetism

Course Objectives: To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes:

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

CO1: Operate optical instruments to estimate the optical parameters

CO2: Evaluate dielectric constant and magnetic parameters for dielectric and magnetic materials respectively

CO3: Measure the value of Planck's constant using photo electric effect

CO4: Calculate the electronic parameters of a given semiconductor

CO5: Estimate the frequency of vibrating bodies

CO6: Determine the physical parameters by observing oscillatory motion

Syllabus:

EXPERIMENT 1:

Determination of radius of curvature of a given Plano-convex lens by Newton's rings.

EXPERIMENT 2:

Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.

EXPERIMENT 3:

Verification of Brewster's law

EXPERIMENT 4:

Determination of dielectric constant using charging and discharging method.

EXPERIMENT 5:

Study the variation of B versus H by magnetizing the magnetic material (B-H curve).

EXPERIMENT 6:

Determination of wavelength of Laser light using diffraction grating.

EXPERIMENT 7:

Estimation of Planck's constant using photoelectric effect.

EXPERIMENT 8:

Determination of the resistivity of semiconductors by four probe methods.

EXPERIMENT 9:

Determination of energy gap of a semiconductor using p-n junction diode.

EXPERIMENT 10:

Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.

EXPERIMENT 11:

Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.

EXPERIMENT 12:

Determination of temperature coefficients of a thermistor.

EXPERIMENT 13:

Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.

EXPERIMENT 14:

Determination of magnetic susceptibility by Kundt's tube method.

EXPERIMENT 15:

Determination of rigidity modulus of the material of the given wire using Torsional pendulum.

EXPERIMENT 16:

Sonometer: Verification of laws of stretched string.

EXPERIMENT 17:

Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.

EXPERIMENT 18:

Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-	-

References:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

Web Resources:

1. www.vlab.co.in
2. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

ENGINEERING WORKSHOP
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGME2P0223	**L**	**T**	**P**	**C**
I Year / II Semester	**0**	**0**	**3**	**1.5**

Course Objectives:
To familiarize students with wood working, sheet metal operations, fitting, electrical house wiring skills and basic repairs of two-wheeler vehicle.

Course Outcomes:
CO1: Identify workshop tools and their operational capabilities.
CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
CO3: Apply fitting operations in various applications.
CO4: Apply basic electrical engineering knowledge for House Wiring Practice.

Syllabus:

1. **Demonstration**: Safety practices and precautions to be observed in the workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and making following joints.
a) Half–Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal jobs from GI sheets.
a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tire
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
a) Parallel and series b) Two-way switch c) Godown lighting
d) Tube light e) Three-phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for the same diameter and with reducer for different diameters.
9. **Basic repairs of Two-wheeler vehicle:** Demonstration of working of two-wheeler vehicle and its repairs.

Mapping of COs to POs:

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

TEXT BOOKS:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.

2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

REFERENCE BOOKS:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition

2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.

3. Wiring Estimating, Costing, and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

ELECTRICAL CIRCUITS LAB

Subject Code: UGEE2P0223	**L**	**T**	**P**	**C**
I Year / II Semester	**0**	**0**	**3**	**1.5**

Course Objectives:

To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics. It also gives practical exposure to the usage of different circuits with different conditions.

Course Outcomes:

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

CO1: Understand the concepts of network theorems, node and mesh networks, series and parallel resonance and Locus diagrams.

CO2: Apply various theorems to compare practical results obtained with theoretical calculations.

CO3: Determine self, mutual inductances and coefficient of coupling values, parameters of choke coil.

CO4: Analyse different circuit characteristics with the help of fundamental laws and various configurations.

CO5: Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.

List of Experiments:

1. Verification of Kirchhoff's circuit laws.
2. Verification of node and mesh analysis.
3. Verification of network reduction techniques.
4. Determination of cold and hot resistance of an electric lamp
5. Determination of Parameters of a choke coil.
6. Determination of self, mutual inductances, and coefficient of coupling
7. Series and parallel resonance
8. Locus diagrams of R-L (L Variable) and R-C (C Variable) series circuits
9. Verification of Superposition theorem
10. Verification of Thevenin’s and Norton’s Theorems
11. Verification of Maximum power transfer theorem
12. Verification of Compensation theorem
13. Verification of Reciprocity and Millman’s Theorems

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

Reference Books:

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.

2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

IT WORKSHOP
(Common to All Branches)

Subject Code:UGCS2P0223	**L**	**T**	**P**	**C**
I Year / II Semester	**0**	**0**	**2**	**1**

Prerequisites: Basic knowledge on Computers.

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables.
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning.
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes:

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

CO1: Perform Hardware troubleshooting.
CO2: Understand Hardware components and inter dependencies.
CO3: Safeguard computer systems from viruses/worms.
CO4: Document/ Presentation preparation.
CO5: Perform calculations using spreadsheets.

Syllabus:

1) PC Hardware & Software Installation:

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should

have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva.

2) Internet & World Wide Web:

Task1: **Orientation & Connectivity Boot Camp:** Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: **Web Browsers, Surfing the Web:** Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: **Cyber Hygiene:** Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

3) LaTeX and WORD:

Task 1 – **Word Orientation:** The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: **Using LaTeX and Word to create a project certificate**. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and

Time option in both LaTeX and Word.

Task 3: Creating project abstract: Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: **Creating a Newsletter:** Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

4) EXCEL:

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA - Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function

Task 3: LOOKUP/VLOOKUP, Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

5) POWER POINT:

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

6) AI TOOLS – ChatGPT:

Task 1: **Prompt Engineering:** Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	-	-	-	3	-	-	-
CO2	3	-	-	-	-	-	-	-	3	-	-	-
CO3	3	-	-	-	3	-	-	-	3	-	-	-
CO4	3	-	-	-	3	-	-	-	3	-	-	-
CO5	3	-	-	-	3	-	-	-	3	-	-	-

REFERENCE BOOKS:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003

2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition

3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition

4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)

5. LaTeX Companion, Leslie Lamport, PHI/Pearson.

6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition

7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

HEALTH AND WELLNESS, YOGA AND SPORTS
(Common to IT, ECE, EEE, ME and CE)

Subject Code: UGBS2P0923	**L**	**T**	**P**	**C**
I Year / II Semester	**0**	**0**	**1**	**0.5**

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes:

After completion of the course, the student will be able to

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.

CO2: Demonstrate an understanding of health-related fitness components.

CO3: Compare and contrast various activities that help enhance their health.

CO4: Assess current personal fitness levels.

CO5: Develop Positive Personality.

Syllabus:

UNIT I:

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity, relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II:

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas - Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III:

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
   Practicing general and specific warm up, aerobics
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Mapping of COs to POs:

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

REFERENCE BOOKS:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V. Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J. Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon, 3rd ed. Human Kinetics, Inc. 2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

• Evaluated for a total of 100 marks.
• A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
• A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN
(AUTONOMOUS)
BHIMAVARAM - 534202
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
Course Structure – R23

B.Tech. II Year-I Semester

S.No.	Category	Subject code	Title	L	T	P	C	IM	EM	TM
1	BS	UGBS3T0323	Complex Variables & Numerical Methods	3	0	0	3	30	70	100
2	HSMC	UGBS3T0623	Universal human values – understanding harmony and Ethical human conduct	2	1	0	3	30	70	100
3	Engineering Science	UGEE3T0123	Electromagnetic Field Theory	3	0	0	3	30	70	100
4	Professional Core	UGEE3T0223	Electrical Circuit Analysis-II	3	0	0	3	30	70	100
5	Professional Core	UGEE3T0323	DC Machines & Transformers	3	0	0	3	30	70	100
6	Professional Core	UGEE3P0423	Electrical Circuit Analysis -II and Simulation Lab	0	0	3	1.5	30	70	100
7	Professional Core	UGEE3P0523	DC Machines & Transformers Lab	0	0	3	1.5	30	70	100
8	Skill Enhancement Course	UGEE3P0623	Data Structures Lab	0	1	2	2	30	70	100
9	Audit Course	UGBS3A0723	Environmental Science	2	0	0	-	-	-	-
Total				**15**	**2**	**10**	**20**	**240**	**560**	**800**

B.Tech. II Year-II Semester

S.No.	Category	Subject code	Title	L	T	P	C	IM	EM	TM
1	Management Course- I	UGMB4T0123	Managerial Economics & Financial Analysis	2	0	0	2	30	70	100
2	Engineering Science / Basic Science	UGEE4T0123	Analog Circuits	3	0	0	3	30	70	100
3	Professional Core	UGEE4T0223	Power Systems-I	3	0	0	3	30	70	100
4	Professional Core	UGEE4T0323	Induction and Synchronous Machines	3	0	0	3	30	70	100
5	Professional Core	UGEE4T0423	Control Systems	3	0	0	3	30	70	100
6	Professional Core	UGEE4P0523	Induction and Synchronous Machines Lab	0	0	3	1.5	30	70	100
7	Professional Core	UGEE4P0623	Control Systems Lab	0	0	3	1.5	30	70	100
8	Skill Enhancement course	UGEE4P0723	Python Programming Lab	0	1	2	2	30	70	100
9	Engineering Science	UGME4P0623	Design Thinking & Innovation	1	0	2	2	30	70	100
Total				**15**	**1**	**10**	**21**	**270**	**630**	**900**

II-I

COMPLEX VARIABLES & NUMERICAL METHODS

Subject Code: UGBS3T0323	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives:

- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To familiarize the complex variables.
- To equip the students to solve application problems in their disciplines.

Course Outcomes:

1. Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)

2. Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3)

3. Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3)

4. Evaluate the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues. Make use of the Cauchy residue theorem to evaluate certain integrals (L3)

5. Explain properties of various types of conformal mappings (L5)

Syllabus:

UNIT – I:

Iterative Methods: Introduction – Solutions of algebraic and transcendental equations: Bisection method – Secant method – Method of false position – General Iteration method – Newton-Raphson method (Simultaneous Equations)

Interpolation: Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula

UNIT – II:

Numerical integration, Solution of ordinary differential equations with initial conditions: Trapezoidal rule– Simpson's 1/3rd and 3/8th rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method –Runge- Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.

UNIT – III:

Functions of a complex variable and Complex integration: Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method.

Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula– Generalized integral formula (all without proofs) and problems on above theorems.

UNIT – IV:

Series expansions and Residue Theorem: Radius of convergence – Expansion of function in Taylor's series, Maclaurin's series and Laurent series.

Types of Singularities: Isolated – Essential singularities –Pole of order m– Residues – Residue theorem (without proof) – Evaluation of real integral of the types $\int_{-\infty}^{\infty} \boldsymbol{f(x)dx}$ and $\int_{c}^{c+2\pi} \boldsymbol{f(cos\,\theta, sin\theta)d\theta}$

UNIT – V:

Conformal mapping: Transformation by e z , lnz, z2, zn (n positive integer), Sin z, cos z, z + a/z. Translation rotation, inversion and bilinear transformation – fixed point – cross ratio –properties – invariance of circles and cross ratio – determination of bilinear transformation mapping 3 given points.

CO – PO Mapping

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

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.

2. Micheael Greenberg, Advanced Engineering Mathematics, 2nd edition, Pearson edition.

Reference Books:

1. Erwin Kreyszig,Advanced Engineering Mathematics, 10th Edition, Wiley-India.

2. B. V. Ramana,Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

3. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and Science,Tata Mc. Graw Hill Education.

4. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.

5. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 9thedition,Mc-Graw Hill, 2013.

Universal human values – understanding harmony and Ethical human conduct

Subject Code: UGBS3T0623	**L**	**T**	**P**	**C**
II Year / I Semester	**2**	**1**	**0**	**3**

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1 hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

Syllabus:

UNIT I Introduction to session Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Models-Typical Case Studies Management
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V - Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO	PSO
CO1						2	2	3				3		
CO2						2	2	3				3		
CO3						3	3	3				3		
CO4						2	3	3				3		
CO5						2	2	3				3		
CO6						2	2	3				3		

READINGS:

Textbook and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b.The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
Tutorial hours are to be used for practice sessions.
While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self- self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life.
Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values. It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.
Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHV II%20Class%20Notes%20&%20Handouts/UHV%20Handout%2 01- Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%2 02- Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%2 03- Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%2 05- Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20 D3- S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%20 23- 25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

ELECTROMAGNETIC FIELD THEORY

Subject Code: UGEE3T0123	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Pre-requisite: Concepts of Differential Equations, Vector Calculus and Electrical Circuit Analysis.

Course Objectives:

- To study the properties of conductors and dielectrics, calculate the capacitance of different configurations. Understand the concept of conduction and convection current densities.
- To study the magnetic fields produced by currents in different configurations, application of Ampere's law and the Maxwell's second and third equations.
- To study the magnetic force and torque through Lorentz force equation in magnetic field environment like conductors and other current loops.
- To develop the concept of self and mutual inductances and the energy stored.
- To study time varying and Maxwell's equations in different forms and Maxwell's fourth equation for the induced EMF.

Course Outcomes:

At the end of the course, student will be able to,

CO1: Compute electric fields and potentials using Gauss law/ solve Laplace's or Poisson's equations for various electric charge distributions.

CO2: Analyse the behaviour of conductors in electric fields, electric diploe and the capacitance and energy stored in dielectrics.

CO3: Calculate the magnetic field intensity due to current carrying conductor and understanding the application of Ampere's law, Maxwell's second and third law.

CO4: Estimate self and mutual inductances and the energy stored in the magnetic field.

CO5:Understand the concepts of Faraday's laws, Displacement current, Poynting theorem and Poynting vector.

Syllabus:

UNIT I:

Vector Analysis: Vector Algebra: Scalars and Vectors, Unit vector, Vector addition and subtraction, Position and distance vectors, Vector multiplication, Components of a vector.

Coordinate Systems: Rectangular, Cylindrical and Spherical coordinate systems.

Vector Calculus: Differential length, Area and Volume. Del operator, Gradient of a scalar, Divergence of a vector and Divergence theorem (definition only). Curl of a vector and Stoke's theorem (definition only), Laplacian of a scalar

Electrostatics: Coulomb's law and Electric field intensity (EFI) – EFI due to Continuous charge distributions (line and surface charge), Electric flux density, Gauss's law (Maxwell's first equation, $\nabla.\vec{D}=\rho\_v$), Applications of Gauss's law, Electric Potential, Work done in moving a point charge in an electrostatic field (second Maxwell's equation for static electric fields, $\nabla\times\vec{E}=0$), Potential gradient, Laplace's and Poison's equations.

UNIT II:

Conductors – Dielectrics and Capacitance: Behaviour of conductor in Electric field, Electric dipole and dipole moment – Potential and EFI due to an electric dipole, Torque on an Electric dipole placed in an electric field, Current density-conduction and convection current densities, Ohm's law in point form, Behaviour of conductors in an electric field, Polarization, dielectric constant and strength, Continuity equation and relaxation time, Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial and spherical capacitors, Energy stored and density in a static electric field, Coupled and decoupled capacitors.

UNIT III :

Magneto statics, Ampere's Law and Force in magnetic fields: Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire – Magnetic flux density and Maxwell's second Equation ($\nabla.\vec{B}=0$), Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, toroidal current carrying conductor, point form of Ampere's circuital law, Maxwell's third equation ($\nabla\times\vec{H}=\vec{J}$).

Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, Magnetic dipole, Magnetic torque, and moment.

UNIT IV:

Self and mutual inductance: Self and mutual inductance – determination of self-inductance of a solenoid, toroid, coaxial cable and mutual inductance between a straight long wire and a square loop wire in the same plane – Energy stored and energy density in a magnetic field.

UNIT V:

Time Varying Fields: Faraday's laws of electromagnetic induction, Maxwell's fourth equation($\nabla \times \vec{E} = -(\partial \vec{B})/\partial t$), integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields, Poynting theorem and Poynting vector.

CO – PO Mapping

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

Textbooks:

1. "Elements of Electromagnetics" by Matthew N O Sadiku, Oxford Publications, 7th edition, 2018.
2. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill, 7th Editon.2006.

Reference Books:

1. "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 2nd edition.
2. "Electromagnetic Field Theory" by Yaduvir Singh, Pearson India, 1st edition, 2011.
3. "Fundamentals of Engineering Electromagnetics" by Sunil Bhooshan, Oxford University Press, 2012.
4. Schaum's Outline of Electromagnetics by Joseph A. Edminister, Mahamood Navi, 4th Edition,2014.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/106/108106073/
2. https://nptel.ac.in/courses/117103065

ELECTRICAL CIRCUIT ANALYSIS-II

Subject Code: UGEE3T0223	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Pre-requisite: Analysis of DC and Single phase AC Circuits, Concepts of differentiation and integration.

Course Objectives:

- To understand three phase circuits
- To analyse transients in electrical systems
- To evaluate network parameters of given electrical network
- To apply Fourier analysis to electrical s
- To understand graph theory for circuit analysis and to understand the behaviour of filters

Course Outcomes:

At the end of the course, student will be able to,
CO1: Analyse the balanced and unbalanced 3 phase circuits for power calculations.
CO2: Analyse the transient behaviour of electrical networks in different domains.
CO3: Estimate various Network parameters.
CO4: Apply the concept of Fourier series to electrical systems.
CO5: Analyse the filter circuit for electrical circuits.

Syllabus:

UNIT – I:
Analysis of three phase balanced circuits:
Phase sequence, star and delta connection of sources and loads, relation between line and phase quantities, analysis of balanced three phase circuits, measurement of active and reactive power.
Analysis of three phase unbalanced circuits:
Loop method, Star-Delta transformation technique, two-wattmeter method for measurement of three phase power.

UNIT – II:
Laplace transforms – Definition and Laplace transforms of standard functions– Shifting theorem – Transforms of derivatives and integrals, Inverse Laplace transforms and applications.
Transient Analysis: Transient response of R-L, R-C and R-L-C circuits (Series and parallel combinations) for D.C. and sinusoidal excitations – Initial conditions - Solution using differential equation approach and Laplace transform approach.

UNIT – III:
Network Parameters: Impedance parameters, Admittance parameters, Hybrid

parameters, Transmission (ABCD) parameters, conversion of Parameters from one form to other, Conditions for Reciprocity and Symmetry, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations- problems.

UNIT – IV:

Analysis of Electric Circuits with Periodic Excitation: Fourier series and evaluation of Fourier coefficients, Trigonometric and complex Fourier series for periodic waveforms, Application to Electrical Systems – Effective value and average value of non-sinusoidal periodic waveforms, power factor, effect of harmonics

UNIT – V:

Filters: Classification of filters-Low pass, High pass, Band pass and Band Elimination filters, Constant-k filters -Low pass and High Pass, Design of Filters.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO
CO1	3	3		2	2									
CO2	3	3		3	2									
CO3	3	3		2	2									
CO4	3	3		2	2									
CO5	3	3		2	3									

Textbooks:

1. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, 8th Edition McGraw-Hill, 2013
2. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N. O. Sadiku, 3rd Edition, Tata McGraw-Hill, 2019

Reference Books:

1. Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI, 2019.
2. Network Theory, N. C. Jagan and C. Lakshminarayana, 1st Edition, B. S. Publications, 2012.
3. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan S. Palli, 5th Edition, Tata McGraw-Hill, 2017.
4. Engineering Network Analysis and Filter Design (Including Synthesis of One Port Networks)- Durgesh C. Kulshreshtha Gopal G. Bhise, Prem R. Chadha ,Umesh Publications 2012.
5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, 7th Revised Edition.

Online Learning Resources:

1.https://archive.nptel.ac.in/courses/117/106/117106108/
2.https://archive.nptel.ac.in/courses/108/105/108105159/

DC MACHINES & TRANSFORMERS

Subject Code: UGEE3T0323	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Pre-requisite: Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis.

Course Objectives:

Students will get exposure to

- Understand the characteristics and applications of DC Machines.
- Develop problem solving skills about the starting, speed control and testing of DC Machines.
- Understand the concepts of efficiency and regulation of a transformer by obtaining equivalent circuit.
- Analyze the performance of single-phase transformers and to understand the connection diagrams of three-phase transformers.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Understand the process of voltage build-up in DC generators and characteristics.

CO2: Understand the process of torque production, starting and speed control of DC motors and illustrate their characteristics.

CO3: Obtain the equivalent circuit of single-phase transformer and determine its efficiency & regulation.

CO4: Analyse various configurations of three-phase transformers.

Syllabus:

UNIT – I:

DC Generators: Construction and principle of operation of DC machines – EMF equation for generator – Excitation techniques – characteristics of DC generators – applications of DC Generators, Back-emf and torque equations of DC motor – Armature reaction and commutation.

UNIT – II:

Starting, Speed Control and Testing of DC Machines: Characteristics of DC motors – losses and efficiency – applications of DC motors. Necessity of a starter – starting by 3-point and 4-point starters – speed control by armature voltage and field current control – testing of DC machines – brake test, Swinburne's test – Hopkinson's test–Field Test.

UNIT – III:

Single-phase Transformers: Introduction to single-phase Transformers (Construction and principle of operation)–emf equation – operation on no-load and

on load –lagging, leading and unity power factors loads
–phasor diagrams– equivalent circuit –regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency.

UNIT –IV:
Testing of Transformers: Open Circuit and Short Circuit tests – Sumpner's test – separation of losses–– Parallel operation with equal and unequal voltage ratios– auto transformer – equivalent circuit – comparison with two winding transformers.

UNIT – V:
Three-Phase Transformers: Polyphase connections- Y/Y, Y/Δ, Δ/Y, Δ/Δ, open Δ and Vector groups – third harmonics in phase voltages– Parallel operation–three winding transformers- transients in switching –off load and on load tap changers– Scott connection.

CO – PO Mapping

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

Textbooks:

1.Electrical Machinery by Dr. P S Bimbhra, 7th edition, Khanna Publishers, New Delhi,1995.
2.Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1.Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition
2.Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2011.
3.Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021.
4.Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons,2007.
5.Electric Machinery by Fitzgerald, A.E.,Kingsley, Jr.,C.,& Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

Web Resources:

1.nptel.ac.in/courses/108/105/108105112
2.nptel.ac.in/courses/108/105/108105155

ELECTRICAL CIRCUIT ANALYSIS-II AND SIMULATION LAB

Subject Code: UGEE3P0423	**L**	**T**	**P**	**C**
II Year / I Semester	**0**	**0**	**3**	**1.5**

Course Objectives:

- To measure three phase Active and Reactive power
- To analyse transient behaviour of circuits
- To determine 2-port network parameters
- To analyse electrical circuits using simulation tools

Course Outcomes:

At the end of the course, student will be able to,
CO1: Understand the power calculations in three phase circuits.
CO2: Evaluate the time response of given network.
CO3: Evaluate two port network parameters.
CO4: Simulate and analyse electrical circuits using suitable software.

List of Experiments

Any 10 of the following experiments are to be conducted:

1. Measurement of Active Power and Reactive Power for balanced loads.
2. Measurement of Active Power and Reactive Power for unbalanced loads.
3. Determination of Z and Y parameters.
4. Determination of ABCD and hybrid parameters
5. Verification of Kirchhoff's current law and voltage law using simulation tools.
6. Verification of mesh and nodal analysis using simulation tools.
7. Verification of super position and maximum power transfer theorems using simulation tools.
8. Verification of Reciprocity and Compensation theorems using simulation tools.
9. Verification of Thevenin's and Norton's theorems using simulation tools.
10. Verification of series and parallel resonance using simulation tools.
11. Simulation and analysis of transient response of RL, RC and RLC circuits.
12. Verification of self inductance and mutual inductance by using simulation tools.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			2				2					
CO2	3	3			2				2					
CO3	3	3			2				2					
CO4	2	2			3				2					

DC MACHINES & TRANSFORMERS LAB

Subject Code: UGEE3P0523	**L**	**T**	**P**	**C**
II Year / I Semester	**0**	**0**	**3**	**1.5**

Course Objectives:

The objectives of this course is

•To conduct the experiment and plot the characteristics and applications of DC machines.
•To perform the starting, speed control and testing methods of DC Machines.
•To determine/Predetermine efficiency and regulation of the transformer through equivalent circuit.

Course Outcomes:

At the end of the course, the student will be able to,
CO1: Demonstrate starting and speed control methods of DC Machines.
CO2: Apply theoretical concepts in analysing the performance characteristics of DC Machines.
CO3: Determine the performance characteristics of DC machines using different testing methods.
CO4: Determine the performance parameters of single-phase transformer.

List of Experiments
Any 10 of the following experiments are to be conducted:

1.Speed control of DC shunt motor by Field Current and Armature Voltage Control.
2.Brake test on DC shunt motor- Determination of performance curves.
3.Swinburne's test - Predetermination of efficiencies as DC Generator and Motor.
4Hopkinson's teston DC shunt Machines.
5.Load test on DC compound generator-Determination of characteristics.
6.Load test on DC shunt generator-Determination of characteristics.
7.Fields test on DC series machines-Determination of efficiency.
8.Brake test on DC compound motor-Determination of performance curves.
9.OC & SC tests on single phase transformer.
10.Sumpner's test on single phase transformer.
11.Scott connection of transformers.
12.Parallel operation of Single-phase Transformers.
13.Separation of core losses of a single-phase transformer.

Online Learning Resources:

1. https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		3	3								3		
CO2	3		3	3								3		
CO3	3		3	3								3		
CO4	3		3	3								3		

DATA STRUCTURES LAB

Subject Code: UGEE3P0623 **L T P C**
II Year / I Semester **0 1 2 2**

Pre-requisite:

Course Objectives:

•To provide the knowledge of basic data structures and their implementations.
•To understand importance of data structures in context of writing efficient programs.
•To develop skills to apply appropriate data structures in problem solving.

Course Outcomes: At the end of the course, Student will be able to

CO1: Identify the role of data structures in organizing and accessing data.
CO2: Design, implement, and apply linked lists for dynamic data storage.
CO3: Develop applications using stacks and queues.
CO4: Design and implement algorithms for operations on binary trees and trees. binary search
CO5: Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.

Syllabus:

UNIT I
Introduction to Data Structures: Definition and importance of Data structures, Abstract data types (ADTs) and its specifications, **Arrays:** Introduction, 1-D, 2-D Arrays, accessing elements of array, Row Major and Column Major storage of Arrays, **Searching Techniques:** Linear & Binary Search, **Sorting Techniques:** Bubble sort, Selection sort, Quick sort.

Sample experiments:
1.Program to find min & max element in an array.
2.Program to implement matrix multiplication.
3.Find an element in given list of sorted elements in an array using Binary search.
4.Implement Selection and Quick sort techniques.

UNIT II
Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

Sample experiments:
1.Write a program to implement the following operations.
a. Insert b. Deletion c. Traversal

2.Write a program to store name, roll no, and marks of students in a class using circular double linked list.
3.Write a program to perform addition of given two polynomial expressions using linked list.

UNIT III

Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

Sample experiments:

1.Implement stack operations using
a. Arrays b. Linked list
2.Convert given infix expression into post fix expression using stacks.
3.Evaluate given post fix expression using stack.
4.Write a program to reverse given linked list using stack.

UNIT IV

Queues: Introduction to queues: properties and operations, Circular queues, implementing queues using arrays and linked lists, Applications of queues scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

Sample experiments:

1.Implement Queue operations using
a. Arrays b. Linked list
2.Implement Circular Queue using
a. Arrays b. Linked list
3.Implement Dequeue using linked list.

UNIT V

Trees: Introduction to Trees, Binary trees and traversals, Binary Search Tree – Insertion, Deletion & Traversal

Sample experiments:

1.Implement binary tree traversals using linked list.
2.Write program to create binary search tree for given list of integers. Perform in-order traversal of the tree. Implement insertion and deletion operations.

CO – PO Mapping

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

Textbooks:

1.Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2.Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson- Freed, Silicon Press, 2008

Reference Books:

1.Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders.
2.C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft.
3.Problem Solving with Algorithms and Data Structures by Brad Miller and David Ranum.
4.Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
5.Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick.

ENVIRONMENTAL SCIENCE

Subject Code: UGBS3A0723	**L**	**T**	**P**	**C**
II Year / I Semester	**2**	**0**	**0**	**-**

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes:

CO1: Grasp multi-disciplinary nature of environmental studies and various renewable and non-renewable resources. (L2)
CO2: Understand flow and bio-geo- chemical cycles and ecological pyramids. (L2)
CO3: Understand various causes of pollution and solid waste management and related preventive measures. (L2)
CO4: Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation. (L2)
CO5: Illustrate the causes of population explosion, value education and welfare programmes. (L3)

Syllabus:

UNIT – I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.
Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies –Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:
a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

CO – PO Mapping

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

Textbooks:

1.Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses,Universities Press (India) Private Limited, 2019.
2.Palaniswamy, Environm ntal Studies, 2/e, Pearson education, 2014.
3.S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1.Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2.M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.
3.J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4.J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5.G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6.Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-838 -1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental- science
- http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science- I/Data%20Files/pdf/lec07.pdf
- https://www.youtube.com/watch?v=5QxxaVfgQ3k

II-II

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Subject Code: UGMB4T0123	**L**	**T**	**P**	**C**
II Year / II Semester	**2**	**0**	**0**	**2**

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input output relationship for optimizing production and cost.
- To Know the Various types of market structure and pricing methods and strategy.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes:

- Define the concepts related to Managerial Economics, financial accounting and management(L2)
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
- Apply the Concept of Production cost and revenues for effective Business decision(L3)
- Analyze how to invest their capital and maximize returns (L4)
- Evaluate the capital budgeting techniques. (L5)
- Develop the accounting statements and evaluate the financial performance of business entity (L5)

Syllabus:

UNIT – I:

Managerial Economics: Introduction – Nature, meaning, significance, functions, and advantages. Demand- Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT – II:

Production and Cost Analysis: Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination – Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT – III:

Business Organizations and Markets: Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly- Price-Output Determination - Pricing Methods and Strategies.

UNIT – IV:

Capital Budgeting: Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems).

UNIT - V :

Financial Accounting and Analysis: Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1														
CO2														
CO3														
CO4														
CO5														
CO6														

Textbooks:

1.Varshney & Maheswari: Managerial Economics, Sultan Chand.
2.Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1.Ahuja Hl Managerial economics Schand.
2.S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3.Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4.Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396 https://www.slideshare.net/ashu1983/financial-accounting

ANALOG CIRCUITS

Subject Code: UGEE4T0123	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Pre-requisite: Knowledge of electronic components and semiconductor devices, number systems, binary arithmetic, Boolean or switching algebra, and logic gates.

Course Objectives:

- To acquire the basic knowledge on clippers, clampers & biasing circuits.
- To determine the h-parameters of a transistor circuit & understand the concepts of feedback amplifiers.
- To know the operation of oscillators and operational amplifier.
- To understand the applications of operational amplifier.
- To acquire the knowledge on IC 555 timer and their applications.
- To know the operation of Analog to Digital Converters and Digital to Analog Converters.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Analyze diode clipping and clamping circuits. Understand different types of biasing circuits of a transistor.

CO2: Use small signal modeling for transistor circuit analysis and illustrate the operation of feedback amplifiers.

CO3: Understand operation of oscillators, operational amplifier and their applications.

CO4: Use 555 timers in multi-vibrators, Schmitt Trigger and PLL applications.

CO5: Describe the operation of different ADC's and DAC's.

Syllabus:

Unit – I:

Diode clipping and clamping circuits: Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation.

DC biasing of BJTs: Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in VBE and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.

Unit – II:

Small Signals Modelling of BJT: Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.

Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.

Unit – III:

Oscillator Circuits: Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.

Operational Amplifiers: Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.

Unit – IV:

OP-AMPS Applications: Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.

Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.

Unit – V:

Timers and Phase Locked Loop: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).

Digital to Analog And Analog to Digital Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

CO – PO Mapping

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

Textbooks:

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2nd Edition, 2010.

2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003.

Reference Books:

1.Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021.

2.Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017. 27.
3.Electronic Devices and Circuits – David Bell, Oxford, 5thEdition, 2008.
4.Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
5.Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Prentice Hall India, 2002.
6.Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria& Sons, 2ndEdition, 2010.

Online Learning Resources:

1.https://nptel.ac.in/courses/122106025.
2.https://nptel.ac.in/courses/108102112.

POWER SYSTEMS-I

Subject Code:UGEE4T0223	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Pre-requisite: Electrical Circuit Analysis

Course Objectives:

•To study principle of operation of different components of a hydro and thermal power stations.
•To study principle of operation of different components of a nuclear power stations.
•To study constructional and operation of different components of an Air and Gas Insulated substations.
•To study different types of cables and distribution systems.
•To study different types of load curves and tariffs applicable to consumers.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Understand the different types of power plants, operation of power plants.
CO2: Describe the different components of air and gas insulated substations.
CO3:Discuss the construction of single core and three core cables and describe distribution system configurations.
CO4: Analyse different economic factors of power generation and tariffs.

Syllabus:

Unit I:
Hydroelectric Power Stations: Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation
Thermal Power Stations: Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.

Unit II:
Nuclear Power Stations: Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.

Unit III:
Substations:
Air Insulated Substations – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment. Bus bar

arrangements in the sub- stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breaker , main and transfer bus bar system with relevant diagrams.
Gas Insulated Substations (GIS) – advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.

Unit IV:
Underground Cables: Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.

Distribution Systems: Classification of Distribution systems, A.C Distribution, Overhead versus Underground system, Connection schemes of Distribution system, Requirements of Distribution system, requirements of a Distribution system, Design considerations in Distribution system.

UNIT V:
Economic Aspects & Tariff:
Economic Aspects – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants.

Tariff Methods– Costs of generation and their division into fixed, semi-fixe and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block- rate, two-part, three–part, and power factor tariff methods.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												

Text Books:

1.S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010
2.J.B.Gupta, Transmission and Distribution of Electrical Power, S.K.Kataria and sons,10th Edition, 2012

Reference Books:

1.I.J. Nagarath & D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3rd Edition, 2019.
2.C.L.Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers, 6th Edition, 2018.
3.V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand , 4th Edition, 2005.
4.Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985.
5.Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

Online Learning Resources:

1. https://nptel.ac.in/courses/108102047

INDUCTION AND SYNCHRONOUS MACHINES

Subject Code:UGEE4T0323	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Pre-requisite: Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis.

Course Objectives:

Students will get exposure to understand the concepts of
•characteristics, starting and testing methods of Induction Motor
•torque production and performance of Induction Motor.
•In determining the performance parameters of Induction Motor.
•working of synchronous machines

Course Outcomes:

At the end of the course, the student will be able to,
CO1: Explain the construction and operation of three-phase induction motor.
CO2: Analyse the performance of three-phase induction motor.
CO3: Describe the working of single-phase induction motors.
CO4: Analyse the performance of Synchronous generators and motors.

Syllabus:

UNIT-I:
3-phase induction motors: Construction of Squirrel cage and Slipring induction motors– production of rotating magnetic field – principle of operation – rotor emf and rotor frequency – rotor current and power factor at standstill and during running conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship –equivalent circuit – phasor diagram.

UNIT-II:
Performance of 3-Phase induction motors: Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors –No load, Brake test and Blocked rotor tests– circle diagram for predetermination of performance- methods of starting –starting current and torque calculations -speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique –crawling and cogging – induction generator operation.

UNIT – III:
Single Phase Motors: Single phase induction motors–constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, AC series motor.

UNIT–IV:

Synchronous Generator: Constructional features of non-salient and salient pole type alternators- armature windings – distributed and concentrated windings – distribution& pitch factors – E.M.F equation – armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method –two reaction analysis of salient pole machines -methods of synchronization- Slip test – Parallel operation of alternators.

UNIT–V:

Synchronous Motor: Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power developed –hunting and its suppression – methods of starting.

CO – PO Mapping

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

Text Books:

1.Electrical Machinery, Dr. P.S. Bhimbra, Khanna Publishing, 2021,First Edition.
2.Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1.Electrical machines, D.P. Kothari and I.J. Nagrath, McGraw Hill Education, 2017, Fifth Edition.
2.Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons, 2007.
3.Electric Machinery, A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, McGraw-Hill, 2020, Seventh edition.

Online Learning Resources:

1. nptel.ac.in/courses/108/105/108105131
2. https://nptel.ac.in/courses/108106072

CONTROL SYSTEMS

Subject Code:UGEE4T0423	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Pre-requisite: Basic Engineering Mathematics

Course Objectives:

•To obtain the mathematical models of physical systems and derive transfer function.
•To determine the time response of systems and analyse system stability.
•To analyse system stability using frequency response methods.
•To design compensators using Bode diagrams.
•To obtain the mathematical models of physical systems using state space approach and determine the response.

Course Outcomes:

At the end of the course, the student will be able to,
CO1:Derive the transfer function of physical systems and determine overall transfer function using block diagram algebra and signal flow graphs.
CO2: Obtain the time response of first and specifications of second order systems and determine error constants. Analyze the absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.
CO3: Analyze the stability of LTI systems using frequency response methods.
CO4: Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode Diagrams.
CO5: Apply state space analysis concepts to represent physical systems as state models, derive transfer function and determine the response. Understand the concepts of controllability and observability.

Syllabus:

UNIT - I
Mathematical Modelling Of Control Systems: Classification of control systems - open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks- translational and rotational mechanical systems – transfer function of Armature voltage controlled DC servo motor - block diagram algebra – representation by signal flow graph – reduction using Mason's gain formula.

UNIT - II
Time Response Analysis: Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) proportional integral derivative (PID) systems.

Stability And Root Locus Technique: The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function.

UNIT - III
Frequency Response Analysis

Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram –Polar plots, Nyquist stability criterion- stability analysis using Bode plots (phase margin and gain margin).

UNIT - IV
Classical Control Design Techniques: Lag, lead, lag-lead compensators - physical realisation - design of compensators using Bode plots.

UNIT - V
State Space Analysis of LTI Systems: Concepts of state - state variables and state model - state space representation of transfer function: Controllable Canonical Form - Observable Canonical Form - Diagonal Canonical Form - diagonalization using linear transformation - solving the time invariant state equations State Transition Matrix and its properties- concepts of controllability and observability.

CO – PO Mapping

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

Text Books:

1.Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India, 2010.
2.Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

Reference Books:

1.Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4th Edition.
2.Control Systems Engineering by Norman S. Nise, Wiley Publications, 7th edition.
3.Control Systems by Manik Dhanesh N, Cengage publications.

4.Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition.
5.Control Systems Engineering by S.Palani, Tata Mc Graw Hill Publications.

Online Learning Resources:

1.https://archive.nptel.ac.in/courses/107/106/107106081/
2.https://archive.nptel.ac.in/courses/108/106/108106098/
3.https://nptelvideos.com/video.php?id=1423&c=14

INDUCTION AND SYNCHRONOUS MACHINES LAB

Subject Code:UGEE4P0523	**L**	**T**	**P**	**C**
II Year / II Semester	**0**	**0**	**3**	**1.5**

Course Objectives:

The objectives of this course is

•To apply the concepts of speed control methods in 3-phase Induction Motor.
•To experimentally develop circle diagram and obtain equivalent circuit to analyse the performance of 3-phase induction motor
•To apply the concepts of power factor improvement on single phase Induction Motor
•To perform various testing methods on alternators for experimentally predetermine the regulation

Course Outcomes:

At the end of the course, the student will be able to,
CO1: Aanalyse the speed control methods on 3-phase Induction Motor.
CO2: Evaluate the performance of 3-phase Induction Motor by obtaining the locus diagram and equivalent circuit of 3-phase Induction Motor
CO3: Adapt the power factor improvement methods for single phase Induction Motor
CO4: Pre-determine the regulation of 3-phase alternator
CO5: Determine the synchronous machine reactance of 3-phase alternator.

List of Experiments

Any 10 experiments of the following are required to be conducted

1.Brake test on three phase Induction Motor.
2.Circle diagram of three phase induction motor.
3.Speed control of three phase induction motor by V/f method.
4.Equivalent circuit of single-phase induction motor.
5.Power factor improvement of single-phase induction motor by using capacitors.
6.Load test on single phase induction motor.
7.Regulation of a three -phase alternator by synchronous impedance &MMF methods.
8.Regulation of three-phase alternator by Potier triangle method.
9.V and Inverted V curves of a three-phase synchronous motor.
10.Determination of Xd, Xq& Regulation of a salient pole synchronous generator.
11.Determination of efficiency of three phase alternator by loading with three phase induction motor.
12.Parallel operation of three-phase alternator under no-load and load conditions.
13.Determination of efficiency of a single-phase AC series Motor by conducting Brake test.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		3	3								3		
CO2	3		3	3								3		
CO3	3		3	3								3		
CO4	3		3	3								3		

Online Learning Resources:

1. https://em-coep.vlabs.ac.in/List%20of%20experiments.html

CONTROL SYSTEMS LAB

Subject Code:UGEE4P0623	**L**	**T**	**P**	**C**
II Year / II Semester	**0**	**0**	**3**	**1.5**

Course Objectives:

•To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, A.C. Servo motors and Synchros.
•To understand time and frequency responses of control system with and without controllers and compensators.
•To know the different logic gates and boolean expressions using PLC.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Analyze the performance of Magnetic amplifier, D.C and A.C. servo motors and synchros.
CO2: Design of PID controllers and compensators.
CO3: Evaluate temperature control of an oven using PID controller
CO4: Determine the transfer function of D.C Motor and examine the truth table of logic gates using PLC.
CO5: Judge the stability in time and frequency domain and Kalman's test for controllability and observability.

List of Experiments

Any 10 of the following experiments are to be conducted:

1.Analysis of Second order system in time domain
2.Characteristics of Synchros
3.Effect of P, PD, PI, PID Controller on a second order systems
4.Design of Lag and lead compensation – Magnitude and phase plot
5.Transfer function of DC motor
6.Root locus, Bode Plot and Nyquist Plot for the transfer function of systems up to 5th orderusing MATLAB.
7.Kalman's test of Controllability and Observability using MAT LAB.
8.Temperature controller using PID
9.Characteristics of magnetic amplifiers
10.Characteristics of AC servo motor
11.Characteristics of DC servo motor
12.Study and verify the truth table of logic gates and simple Boolean expressions using PLC.

CO – PO Mapping

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

SKILL ENHANCEMENT COURSE: PYTHON PROGRAMMING LAB

Subject Code:UGEE4P0723	**L**	**T**	**P**	**C**
II Year / II Semester	**0**	**1**	**2**	**2**

Course Objectives:

The main objectives of the course are to

•Introduce core programming concepts of Python programming language.
•Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
•Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

Course Outcomes:
Upon completion of the course, the students will be able to:
CO1 Understand the Python syntax, semantics, basic programming constructs to be used to write the programs.[L2]
CO2 Utilize the methods of various data structures to manipulate the data. [L3]
CO3 Apply the appropriate Object-Oriented Programming principle for a given scenario.[L3]
CO4 Understand different libraries and choose suitable one for a given problem. [L3]

UNTI-I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers

6. Write a program to print multiplication table of a given number.

UNIT-II:

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in

String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

1.Write a program to define a function with multiple return values.
2.Write a program to define a function using default arguments.
3.Write a program to find the length of the string without using any library functions.
4.Write a program to check if the substring is present in a given string or not.
5.Write a program to perform the given operations on a list:
    i. addition ii. insertion iii. slicing
6.Write a program to perform any 5 built-in functions by taking any list.

UNIT-III:

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozen set.

Sample Experiments:

1.Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2.Write a program to count the number of vowels in a string (No control flow allowed).
3.Write a program to check if a given key exists in a dictionary or not.
4.Write a program to add a new key-value pair to an existing dictionary.
5.Write a program to sum all the items in a given dictionary.

UNIT-IV:

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

1.Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2.Python program to print each line of a file in reverse order.
3.Python program to compute the number of characters, words and lines in a file.
4.Write a program to create, display, append, insert and reverse the order of the items in the array.
5.Write a program to add, transpose and multiply two matrices.
6.Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V:

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

1.Python program to check whether a JSON string contains complex object or not.
2.Python Program to demonstrate NumPy arrays creation using array () function.
3.Python program to demonstrate use of ndim, shape, size, dtype.
4.Python program to demonstrate basic slicing, integer and Boolean indexing.
5.Python program to find min, max, sum, cumulative sum of array
6.Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
7.Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2		2	2						2			2
CO2	3	2		2	2						2			2
CO3	3	2		2	2						2			2
CO4	3	2		2	2						2			2

Reference Books:

1.Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2.Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3.Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1.https://www.coursera.org/learn/python-for-applied-data-science-ai
https://www.coursera.org/learn/python?specialization=python#syllabus

DESIGN THINKING & INNOVATION

Subject Code: UGME4P0623	**L**	**T**	**P**	**C**
II Year / II Semester	**1**	**0**	**2**	**2**

Course Objectives: The objectives of the course are to

•Bring awareness on innovative design and new product development.
•Explain the basics of design thinking.
•Familiarize the role of reverse engineering in product development.
•Train how to identify the needs of society and convert into demand.
•Introduce product planning and product development process.

Course Outcomes:

CO1: Define the concepts related to design thinking.
CO2: Explain the fundamentals of Design Thinking and innovation.
CO3: Apply the design thinking techniques for solving problems in various sectors.
CO4: Analyse to work in a multidisciplinary environment.
CO5: Evaluate the value of creativity.

UNIT – I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development.

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and Innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT – V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

CO – PO Mapping

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

Textbooks:

1.Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2.Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1.David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2.Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3.William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4.Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

•https://nptel.ac.in/courses/110/106/110106124/
•https://nptel.ac.in/courses/109/104/109104109/
•https://swayam.gov.in/nd1_noc19_mg60/preview
•https://onlinecourses.nptel.ac.in/noc22_de16/preview

POWER ELECTRONICS

Subject Code: UGEE5T0123	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Electrical Circuit Analysis, Semiconductor Physics, Control Systems

Course Objectives:

- To know the characteristics of various power semiconductor devices.
- To learn the operation of single phase controlled converters and perform harmonic analysis of input current
- To learn the operation of three phase controlled converters and AC/AC converters
- To learn the operation of different types of DC-DC converters and control techniques
- To learn the operation of PWM inverters for voltage control and harmonic mitigation

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Illustrate the static and dynamic characteristics of SCR, Power-MOSFET and Power-IGBT.

CO2: Analyse the operation of Phase-controlled rectifiers

CO3: Analyse the operation of three-phase full–wave converters, AC Voltage Controllers and Cyclo-Converters

CO4: Examine the operation and design of different types of DC-DC converters

CO5: Analyse the operation of Square wave inverters and PWM inverters for voltage control

Syllabus:

UNIT I: (12 Hours)

Power Semi-Conductor Devices: Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics – Turn on and Turn off Methods - Triggering Methods (R, RC and UJT) – Snubber circuit design. Static and Dynamic Characteristics of Power MOSFET and Power IGBT-Numerical problems.

UNIT II: (12 Hours)

Single-phase AC-DC Converters : Single-phase half-wave controlled rectifiers - R and RL loads with and without freewheeling diode - Single-phase fully controlled mid-point and bridge converter with R load, RL load and RLE load - Continuous and Discontinuous conduction - Effect of source inductance in Single-phase fully controlled bridge rectifier – Expression for output voltages – Single-phase Semi-Converter with R load-RL load and RLE load – Continuous and Discontinuous conduction - Dual converter and its mode of operation - Numerical Problems.

UNIT III: (12 Hours)

Three-phase AC-DC Converters & AC – AC Converters: Three-phase half-wave Rectifier with R and RL load - Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage - Numerical

Problems. Single-phase AC-AC power control by phase control with R and RL loads - Expression for rms output voltage – Single-phase step down and step up Cycloconverter - Numerical Problems.

UNIT IV: (12 Hours)

DC–DC Converters: Operation of Basic Chopper – Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple – control techniques – Introduction to PWM control -Numerical Problems.

UNIT V: (12 Hours)

DC-AC Converters: Introduction - Single-phase half-bridge and full-bridge inverters with R and RL loads – Phase Displacement Control – PWM with bipolar voltage switching, PWM with unipolar voltage switching - Three-phase square wave inverters - 120^0 conduction and 180^0 conduction modes of operation - Sinusoidal Pulse Width Modulation - Current Source Inverter (CSI) - Numerical Problems.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	-	3	-	-	-	-	-	-	-	-	-	3
CO2	3	-	3	-	-	-	-	-	-	-	-	-	3
CO3	3	-	3	-	-	-	-	-	-	-	-	-	3
CO4	3	-	3	-	-	-	-	-	-	-	-	-	3
CO5	3	-	3	-	-	-	-	-	-	-	-	-	3

Textbooks:

1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore M Undeland, William P Robbins, John Wiley & Sons, 2002.
2. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 2017.
3. Power Electronics: Essentials & Applications by L. Umanand, Wiley, Pvt. Limited, India, 2009.

Reference Books:

1. Elements of Power Electronics–Philip T.Krein. Oxford University Press; Second edition, 2014.
2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.
4. Power Electronics: by Daniel W. Hart, Mc Graw Hill, 2011.

Online Learning Resources:

1. https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007
2. https://archive.nptel.ac.in/courses/108/101/108101126

DIGITAL CIRCUITS

Subject Code: UGEE5T0223	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Knowledge of Electronic components and semiconductor devices, number systems, binary arithmetic, Boolean or switching algebra and logic gates.

Course Objectives:

- To know the simplification methods of Boolean functions
- To understand the realization of arithmetic, data routing and memory logic circuits.
- To know the operation and design of various counters and registers.
- To understand the analysis and design of synchronous sequential circuits.
- To understand the basic concepts of digital integrated circuits.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Understand the fundamentals of Digital logic circuits and able to design the arithmetic combinational circuits.

CO2: Realize different types of data routing combinational circuits and PLDs.

CO3: Apply knowledge of flip-flops in designing of registers and counters.

CO4: Analyze synchronous sequential circuits and apply different methods for the design of synchronous sequential circuits.

CO5: Analyze the logic families in the form of digital integrated circuits.

Syllabus:

UNIT I: (12 Hours)

Combinational logic circuits – I

Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, simplification of logic functions using Boolean theorems, NAND and NOR implementations, Karnaugh maps – 3,4 variables, Incompletely specified functions (Don't care terms), Simplifying Max term equations, Quine-McCluskey minimization technique, General approach to combinational logic design, Look ahead carry adder, Cascading full adders, 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder, Binary comparators (1 bit & 2 bit).

UNIT II: (12 Hours)

Combinational logic circuits – II

Decoders, BCD decoders, 7 segment decoder, higher order decoder, multiplexer, higher order multiplexing, de-multiplexers, higher order de-multiplexing, realization of Boolean functions using decoders, multiplexers, encoders, priority encoder, Read only and Read/Write Memories, Programmable ROM, PAL, PLA-Basics structures, programming tables of PROM, PAL, PLA, realization of Boolean functions.

UNIT III: **(12 Hours)**

Sequential logic circuits

Timing considerations of flip-flops, Flip Flops – SR, JK,T, D, Master-slave flip-flop operation and excitation tables, conversion from one flip-flop to another flip-flop, design of asynchronous and synchronous counters, design of modulus-N counters, Johnson counter, ring counter, design of registers - buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.

UNIT IV: **(10 Hours)**

Sequential Circuit Design

Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, Analysis of clocked sequential circuits, realization of sequence detector circuit, state reduction and assignments, design procedure.

UNIT V: **(10 Hours)**

Digital integrated circuits:

Logic levels, propagation delay time, power dissipation, fan-out and fan-in, noise margin, logic families – RTL and DTL Circuits, TTL, Emitter-Coupled Logic, Metal-Oxide Semiconductor, Complementary MOS, CMOS Transmission Gate Circuits.

Mapping of COs to POs:

POs / Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	PSO 1	PSO2
CO1	3	3	-	-	3	-	-	3	-	-	-	3	-
CO2	3	3	-	-	3	-	-	3	-	-	-	3	-
CO3	3	3	-	-	3	-	-	3	-	-	-	3	-
CO4	3	3	-	-	3	-	-	3	-	-	-	3	-
CO5	3	3	-	-	3	-	-	3	-	-	-	3	-

Textbooks:

1. Switching and finite automata theory Zvi. Kohavi, 3rd edition, Cambridge University Press, 2010.

2. M. Morris Mano and M. D. Ciletti, "Digital Design", 4th Edition, Pearson Education,2006

Reference Books:

1.Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers, 5th Edition, 1992.

2.Switching Theory and Logic Design by A. Anand Kumar, Prentice Hall India Pvt., Limited, Third Edition, 2016.

Online Learning Resources:

1. https://nptel.ac.in/courses/117106086.
2. https://nptel.ac.in/courses/108105113.

POWER SYSTEMS-II

Subject Code: UGEE5T0323	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Power systems-I, Electrical circuit Analysis.

Course Objectives:

- To understand the concepts of GMD&GMR to compute inductance & capacitance of transmission lines.
- To distinguish the models of short, medium and long length transmission lines and analyze their performance.
- To learn the effect of travelling waves on transmission lines with different terminal conditions.
- To learn the concepts of corona, the factors effecting corona and effects of transmission lines.
- To design the sag and tension of transmission lines as well as to learn the performance of line insulators.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Determine the parameters of transmission line for different circuit configurations

CO2: Analyze the performance of short, medium and long length transmission lines

CO3: Analyze the effect of travelling waves on transmission lines

CO4: Analyze the effects of corona in transmission lines.

CO5: Calculate sag and tension of transmission lines and design the line insulators.

Syllabus:

UNIT I: (10 Hours)

Transmission Line Parameters Calculations: Calculation of resistance for solid conductors – Calculation of inductance for Single-phase and Three-phase single and double circuit lines– Concept of GMR and GMD–Symmetrical and asymmetrical conductor configuration with and without transposition–Bundled conductors, Skin and Proximity effects. Calculation of capacitance for 2 wire and 3 wire systems – Effect of ground on capacitance

UNIT II: (10 Hours)

Performance Analysis of Transmission Lines: Classification of Transmission Lines – Short, medium, long lines and their model representation –Nominal-T, Nominal-π and A, B, C, D Constants for symmetrical Networks.Rigorous Solution for long line equations – Representation of Long lines – Equivalent T and Equivalent π network models - Surge Impedance and Surge Impedance Loading of Long Lines - Regulation and efficiency for all types of lines – Ferranti effect.

UNIT III: **(8 Hours)**

Power System Transients : Types of System Transients – Propagation of Surges – Attenuation–Distortion– Reflection and Refraction Coefficients.

Termination of lines with different types of conditions: Open Circuited Line–Short Circuited Line, Line terminated through a resistance and line connected to a cable. Reflection and Refraction at a T-Junction.

UNIT IV: **(7 Hours)**

Corona& Effects of transmission lines : Description of the phenomenon – Types of Corona - critical voltages and power loss – Advantages and Disadvantages of Corona - Factors affecting corona - Radio Interference

UNIT V: **(10 Hours)**

Sag and Tension Calculations and Overhead Line Insulators: : Sag and Tension calculations with equal and unequal heights of towers–Effect of Wind and Ice weight on conductor – Stringing chart and sag template and its applications. Types of Insulators – Voltage distribution in suspension insulators–Calculation of string efficiency and Methods for String efficiency improvement – Capacitance grading and Static Shielding.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	-

Textbooks:

1. Electrical Power Systems – by C.L.Wadhwa, New Age International (P) Limited, 1998.
2. Power System Engineering by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 3rd Edition, 2019.

Reference Books:

1. Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4th edition
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar A.Chakrabarthy, DhanpatRai Co Pvt. Ltd.2016.
4. Electrical Power Systems by P.S.R. Murthy, B.S. Publications, 2017.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105104
2. https://archive.nptel.ac.in/courses/108/102/108102047

SIGNALS AND SYSTEMS

Subject Code: UGEE5T0423	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Transform calculus & complex variables

Course Objectives:

- Introduce mathematical representations of continuous- and discrete-time signals.
- Develop frequency-domain tools (Fourier Series/Transform).
- Analyze Linear Time-Invariant (LTI) systems via convolution and frequency response.
- Explain sampling, reconstruction and spectral estimation concepts.
- Apply Laplace and Z-transforms to differential/difference-equation models.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Classify signals & systems and perform basic signal operations.

CO2: Derive Fourier representations; interpret magnitude/phase spectra.

CO3: Compute LTI system response in time & frequency domains.

CO4: Apply sampling theorem; evaluate aliasing and perform reconstruction

CO5: Use Laplace and Z transforms (with ROC) to solve continuous & discrete system

Syllabus:

UNIT I: Introduction (10 Hours)

Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems, Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function.

UNIT II: Fourier Series & Fourier Transform (10 Hours)

Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of standard signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Related problems

UNIT III: Sampling, Reconstruction & Correlation Analysis (8 Hours)

SAMPLING THEOREM: Graphical and analytical proof or Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Aliasing, Related problems.

CORRELATION: Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation.

UNIT IV: LAPLACE TRANSFORMS (7 Hours)

Introduction, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis

UNIT V: Z–TRANSFORMS (10 Hours)

Concept of Z-Transform of a discrete sequence. Region of convergence in Z- Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms, Distinction between Laplace, Fourier and Z transforms.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	-	-	2	-	-	-	-	-	2	-	2
CO2	3	3	2	2	2	-	-	-	-	-	2	-	2
CO3	3	3	2	2	2	-	-	-	-	-	2	-	2
CO4	3	3	-	2	2	-	-	-	-	-	2	-	2
CO5	3	3	2	2	2	-	-	-	-	-	2	-	2

Textbooks:

1. Signals, Systems & Communications-B.P. Lathi, BSPublications, 2003.
2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn, 1997
3. Signals & Systems-Simon Haykin and Van Veen, Wiley,2ndEdition, 2007

REFERENCE BOOKS:

1. Principles of Linear Systems and Signals–B. P. Lathi, Oxford University Press, 2015
2. Signals and Systems–TK Rawat, Oxford University press, 2011.

COMPUTER ARCHITECTURE AND ORGANIZATION

Subject Code: UGEE5T0523	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge in digital electronics, fundamentals of computers.

Course Objectives:

- To explain the basic working of a digital computer.
- To understand the register transfer language and micro operators.
- To learn various addressing modes supported by the processors.
- To be familiar with peripheral interfacing with processors.
- To understand memory hierarchy in computers.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Demonstrate the instruction cycle of a computer and interrupt mechanisms

CO2: Analyze various micro operations and register transfer language.

CO3: Describe CPU organization, parallel processing and pipelining.

CO4: Interface different peripherals with processors.

CO5: Analyze memory hierarchy and evaluate memory management hardware and techniques.

Syllabus:

UNIT I **(10 Hours)**

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description, Design of Basic Computer.

UNIT II **(10 Hours)**

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit. Micro programmed Control: Control Memory, Address Sequencing, Micro program Example.

UNIT III **(8 Hours)**

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC) Pipeline and Vector Processing.

UNIT IV **(7 Hours)**

Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

UNIT V **(10 Hours)**

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	3	-	-	-	-	-
CO2	3	-	-	-	-	-	-	3	-	-	-	-	-
CO3	3	-	-	-	-	-	-	3	-	-	-	-	-
CO4	3	-	-	-	-	-	-	3	-	-	-	-	-
CO5	3	-	-	-	-	-	-	3	-	-	-	-	-

Textbooks:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., 3rd Edition, Sept. 2008.

REFERENCE BOOKS:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.
2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN 81- 7319-609-5
3. Computer System Organization by John. P. Hayes.

COMMUNICATION SYSTEMS

Subject Code: UGEE5T0623	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge in digital electronics, fundamentals of computers.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Analyze the performance of analog modulation schemes in time and frequency domains.

CO2: Analyze the performance of angle modulated signals.

CO3: Characterize analog signals in time domain as random processes and noise

CO4: Characterize the influence of channel on analog modulated signals

CO5: Determine the performance of analog communication systems in terms of SNR

CO6: Analyze pulse amplitude modulation, pulse position modulation, pulse code modulation and TDM systems.

Syllabus:

UNIT I **(10 Hours)**

Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parsevals Relation, Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, Modulation Index.

UNIT II **(10 Hours)**

Double Sideband Suppressed Carrier (DSB-SC) Modulation, Demodulation, Costas Receiver, Single Sideband Modulation (SSB), Hilbert Transform, Complex Pre-envelope/ Envelope, Demodulation of SSB, Vestigial Sideband Modulation (VSB)

UNIT III **(8 Hours)**

Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency, Spectrum of FM Signals, Carsons Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation.

UNIT IV **(7 Hours)**

Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation,Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, , Non uniform Quantizers, Delta Modulation, Differential Pulse Code Modulation (DPCM).

UNIT V **(10 Hours)**

Basics of Probability, Conditional Probability, MAP Principle, Random Variables, Probability Density Functions, Applications in Wireless Channels, Basics of Random Processes ,Gaussian Random Process, Noise.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	3	-	-	-	-	-
CO2	3	-	-	-	-	-	-	3	-	-	-	-	-
CO3	3	-	-	-	-	-	-	3	-	-	-	-	-
CO4	3	-	-	-	-	-	-	3	-	-	-	-	-
CO5	3	-	-	-	-	-	-	3	-	-	-	-	-

Textbooks:

1. Simon Haykin, Communications Systems, 4th Edition. John Wiley and Sons, Inc
2. Fundamentals of Wireless Communication by David Tse

POWER ELECTRONICS LAB

Subject Code: UGEE5P0823	**L**	**T**	**P**	**C**
III Year / I Semester	**0**	**0**	**3**	**1.5**

Course Objectives:

- To learn the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR.
- To analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads.
- To understand the operation of AC voltage regulator with resistive and inductive loads.
- To understand the working of Buck converter and Boost converter.
- To understand the working of single-phase & three-phase inverters.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Analyse characteristics of various power electronic devices and design firing circuits for SCR

CO2: Analyse the performance of single–phase dual, three–phase full–wave bridge converters and dual converter with both resistive and inductive loads

CO3: Examine the operation of Single-phase AC voltage regulator and Cyclo converter with resistive and inductive loads

CO4: Differentiate the working and control of Buck converter and Boost converter

Syllabus:

Any 10 of the Following Experiments are to be conducted

1. Characteristics of SCR - Power MOSFET & Power IGBT.
2. R, RC & UJT firing circuits for SCR.
3. Single -Phase semi-converter with R & RL loads.
4. Single -Phase full-converter with R & RL loads.
5. Three- Phase full-converter with R & RL loads.
6. Single-phase dual converter in circulating current & non circulating current mode of operation.
7. Single-Phase AC Voltage Regulator with R & RL Loads.
8. Single-phase step down Cycloconverter with R & RL Loads.
9. Boost converter in Continuous Conduction Mode operation.

10. Buck converter in Continuous Conduction Mode operation.
11. Single -Phase square wave bridge inverter with R & RL Loads.
12. Single - Phase PWM inverter.
13. Three-phase bridge inverter with 120^0 and 180^0 conduction mode.
14. SPWM control of Three-phase bridge inverter

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3

ANALOG AND DIGITAL CIRCUITS LAB

Subject Code: UGEE5P0923	**L**	**T**	**P**	**C**
III Year / I Semester	**0**	**0**	**3**	**1.5**

List of Experiments

Section A: ANALOG CIRCUITS (Any 5 Experiments)

1. Analysis of clipper and clamper circuits.
2. Analysis of self-bias to a transistor.
3. Analysis of voltage series and current series feedback amplifiers.
4. Analysis of Wien Bridge oscillator and RC-phase shift oscillator.
5. Analysis of Integrator and Differentiator Circuits using IC 741.
6. Analysis of Monostable and Astable multivibrator operation using IC 555 Timer.
7. Analysis of Schmitt Trigger Circuits using IC 741 and IC 555.
8. Verify the PLL characteristics using IC 565.
9. Analysis of 8 bit A to D and D to A circuits

SECTION B: DIGITAL CIRCUITS (Any 5 Experiments)

1. Design of Full adder and Full Subtractor using logic gates.
2. Realization of parallel adder/subtractor using IC 7483.
3. Implementation of 3 to 8 line decoder using logic gates and IC 7445.
4. Implementation of 8 to 1 multiplexer using logic gates and IC 74151.
5. Verify the operation of master-slave JK flip-flop using IC7476.
6. Realization of the following shift registers using IC7495.
    a) SISO
    b) SIPO
    c) PISO
    d) PIPO
7. Implementation ofMod-10 ripples counter using flip-flops and IC 7490.
8. Implementation of Mod-8 synchronous up/down counters using flip-flops.
9. Implementation of 4 bit Ring Counter and Johnson Counter using D flip-flops/J-K flip-flops.

Course Outcomes: At the end of this course students will be able to

CO1: Analyze diode clipper/clamper circuits and transistor biasing.

CO2: Illustrate the operation of feedback amplifiers and oscillator circuits.

CO3: Analyze the applications of linear IC's.

CO4: Understand the fundamentals of Digital logic circuits and able to design the arithmetic combinational circuits.

CO5: Design and implementation of combinational and sequential logic circuits.

CO6: Demonstrate the operation of digital circuits such as registers and counters.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO4	3	3	-	-	3	-	-	3	-	-	-	3	-
CO5	3	3	-	-	3	-	-	3	-	-	-	3	-
CO6	3	3	-	-	3	-	-	3	-	-	-	3	-

TINKERING LAB

Subject Code: UGEE5P1023	**L**	**T**	**P**	**C**
III Year / I Semester	**0**	**0**	**2**	**1**

Prerequisites: Basic Electrical and Electronics Engineering, Programming for Problem Solving, and Digital Logic Design.

Course Objectives: To

- Encourage Innovation and Creativity
- Provide Hands-on Learning
- Impart Skill Development
- Foster Collaboration and Teamwork
- Enable Interdisciplinary Learning
- Impart Problem-Solving mind-set
- Prepare for Industry and Entrepreneurship

Course Outcomes:

At the end of the course, the student will be able to

CO1: Demonstrate basic circuit-building skills using breadboards, sensors, and actuators

CO2: Apply embedded programming skills using Arduino and ESP32 platforms.

CO3: Utilize design thinking principles to develop innovative prototypes and models.

CO4: Operate basic simulation and 3D printing tools for engineering prototyping.

CO5: Collaborate effectively in teams to build and present functional engineering models.

List of experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Demonstrate a traffic light circuit using breadboard.
3) Build and demonstrate automatic Street Light using LDR.
4) Simulate the Arduino LED blinking activity in Tinkercad.
5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6) Interfacing IR Sensor and Servo Motor with Arduino.
7) Blink LED using ESP32.
8) LDR Interfacing with ESP32.
9) Control an LED using Mobile App.

10) Design and 3D print a Walking Robot
11) Design and 3D Print a Rocket.
12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13) Demonstrate all the steps in design thinking to redesign a motor bike.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	-	3	-	3	-	-	-	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	-	3	-	3
CO3	-	3	3	3	3	3	-	-	-	-	-	3	-
CO4	-	-	3	-	3	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	3	3	3	3	-	-

Online Learning Resources:

1) https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2) https://atl.aim.gov.in/ATL-Equipment-Manual/
3) https://aim.gov.in/pdf/Level-1.pdf
4) https://aim.gov.in/pdf/Level-2.pdf
5) https://aim.gov.in/pdf/Level-3.pdf

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Subject Code: UGEE6T0123	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of Electrical and Electronics Engineering

Course Objectives:

- To understand and analyze the factors that affect the various measuring units.
- To choose the appropriate meters for measuring of voltage, current, power, power factor and energy qualities and understand the concept of standardization.
- Describe the operating principle of AC & DC bridges for measurement of resistance, inductance and capacitance.
- To understand the concept of the transducer and their effectiveness in converting from one form to the other form for the ease of calculating and measuring purposes.
- To understand the operating principles of basic building blocks of digital systems, record and display units.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Describe the construction and working of various types of Analog instruments.

CO2: Utilize the Wattmeters and Power factor meters in real time situations

CO3: Experiment the working of various bridges for the measurement of resistance, inductance and capacitance.

CO4: Distinguish the operational concepts of various transducers

CO5: Interpret various Digital meters

Syllabus:

UNIT I: (10 Hours)

Analog Ammeter and Voltmeters

Classification – deflecting, control and damping torques – PMMC, moving iron type and electrostatic instruments – Construction – Torque equation – Range extension – Errors and compensations – advantages and disadvantages. Instrument transformers: Current Transformer and Potential Transformer – theory –Ratio and phase angle errors–Numerical Problems.

UNIT II: (10 Hours)

Analog Wattmeters and Power Factor Meters

Electrodynamometer type wattmeter (LPF and UPF) – Power factor meters: Dynamometer and M.I type (Single phase and Three phase) – Construction – torque equation – advantages and disadvantages. Potentiometers: Principle and operation of D.C Crompton's potentiometer – Standardization –Applications –AC Potentiometer (Polar and coordinate types) –Standardization – Applications – Numerical Problems.

UNIT III: (8 Hours)

Measurements of Electrical parameters

DC Bridges: Method of measuring low, medium and high resistance –Wheat stone's bridge for measuring medium resistance– Kelvin's double bridge for measuring low resistance – Loss of charge method for measurement of high resistance – Megger – measurement of earth resistance – Numerical Problems.

AC Bridges: Measurement of inductance and quality factor – Maxwell's bridge – Hay's bridge – Anderson's bridge. Measurement of capacitance and loss angle – Desauty's bridge – Schering Bridge – Wien's bridge –Numerical Problems.

UNIT IV: (7 Hours)

Transducers

Definition – Classification – Resistive, Inductive and Capacitive Transducer – LVDT – Strain Gauge – Thermistors – Thermocouples – Piezo electric and Photo Diode Transducers – Hall effect sensors – Numerical Problems.

UNIT V: (10 Hours)

Digital meters

Digital Voltmeters – Successive approximation DVM – Ramp type DVM and Integrating type DVM – Digital frequency meter – Digital multimeter – Digital tachometer – Digital Energy Meter – Q meter. CRO – measurement of phase difference and Frequency using lissajious patterns – Numerical Problems.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-

Textbooks:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C. Widdis - 5th Edition - Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5th Edition - 2002.

Reference Books:

1. Electrical & Electronic Measurement & Instruments by A.K. Sawhney Dhanpat Rai & Co. Publications - 19th revised edition - 2011.
2. Electrical and Electronic Measurements and instrumentation by R.K.Rajput- S. Chand - 3rd edition.
3. 3. Electrical Measurements by Buckingham and Price - Prentice – Hall
4. 4. Electrical Measurements by Forest K. Harris. John Wiley and Sons

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105153

MICROPROCESSORS AND MICROCONTROLLERS

Subject Code: UGEE6T0223	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge in digital electronics, fundamentals of computers.

Course Objectives:

- To understand the organization and architecture of Microprocessor
- To understand addressing modes to access memory
- To understand 8051 micro controller architecture
- To understand the programming principles for 8086 and 8051
- To understand the interfacing of Microprocessor with I/O as well as other devices
- To understand how to develop cyber physical systems

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Understand the fundamental concepts and capabilities of microprocessors and explore the evolution of microprocessor technology.

CO2: Analyze the instruction sets - addressing modes - minimum and maximum modes operations of 8086 Microprocessors

CO3: Design and demonstrate interfacing techniques of I/O devices, memory, and peripheral controllers (8255, 8257) with the 8086 microprocessor.

CO4: Describe the architecture and interfacing of 8051 controller.

CO5: Explain the programming concepts of a PIC microcontroller.

Syllabus:

UNIT - I

Introduction to Microprocessor Architecture (10 Hours)

Introduction and evolution of Microprocessors – Architecture of 8086 – Memory Organization of 8086 – Register Organization of 8086– Introduction to 80286 - 80386 - 80486 and Pentium (brief description about architectural advancements only).

UNIT - II

Minimum and Maximum Mode Operations (10 Hours)

Instruction sets of 8086 - Addressing modes – Assembler directives –Simple Programs- General bus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.

UNIT - III

Microprocessors I/O interfacing (10 Hours)

8255 PPI– Architecture of 8255–Modes of operation– Interfacing I/O devices to 8086 using 8255–Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086 – Architecture and interfacing of DMA controller (8257).

UNIT - IV

8051 Microcontroller (10 Hours)

Overview of 8051 Microcontroller – Architecture– Memory Organization – Register set – Instruction set – Simple Programs - I/O ports and Interrupts – Timers and Counters – Serial Communication – Interfacing of peripherals.

UNIT - V

PIC Architecture (10 Hours)

Block diagram of basic PIC 18 micro controller – registers I/O ports – Programming in C for PIC: Data types - I/O programming - logical operations - data conversion.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-	-

Text Books:

5. Ray and Burchandi - "Advanced Microprocessors and Interfacing"- Tata McGraw–Hill - 3rd edition - 2006.
6. Kenneth J Ayala - "The 8051 Microcontroller Architecture- Programming and Applications" - Thomson Publishers - 2nd Edition.
7. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18 - Muhammad Ali Mazidi - RolindD.Mckinay - Danny causey -Pearson Publisher 21st Impression.

Reference Books:

1. Microprocessors and Interfacing - Douglas V Hall - Mc–Graw Hill - 2nd Edition.
2. R.S. Kaler -"A Text book of Microprocessors and Micro Controllers" -I.K. International Publishing House Pvt. Ltd.
3. Ajay V. Deshmukh - "Microcontrollers – Theory and Applications" - Tata McGraw–Hill Companies –2005.
4. Ajit Pal - "Microcontrollers – Principles and Applications" - PHI Learning Pvt Ltd - 2011.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105102
2. https://archive.nptel.ac.in/courses/108/103/108103157
3. https://nptel.ac.in/courses/106108100

POWER SYSTEM ANALYSIS

Subject Code: UGEE6T0323	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Concepts of electrical circuits and power systems-II

Course Objectives:

- To develop the impedance diagram (p.u) and formation of Ybus
- To learn the different load flow methods.
- To learn short circuit calculation for symmetrical faults
- To learn the effect of unsymmetrical faults and their effects.
- To learn the stability of power systems and method to improve stability.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Draw impedance diagram for a power system network and calculate per unit quantities

CO2: Apply the load flow solution to a power system using different methods

CO3: Determine the symmetrical fault current

CO4: Apply symmetrical component theory to determine unsymmetrical fault currents

CO5: Analyse the stability concepts of a power system.

Syllabus:

UNIT I: (10 Hours)

Circuit Topology

Graph theory definitions – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Ybus matrix by singular transformation and direct inspection methods.

Per Unit Representation

Per Unit Quantities–Single line diagram – Impedance diagram of a power system – Numerical Problems.

UNIT II: (10 Hours)

Power Flow Studies

Necessity of power flow studies – Derivation of static power flow equations –Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) – Decoupled and Fast Decoupled methods – Algorithmic approach – Numerical Problems on 3–bus system only.

UNIT III: (8 Hours)

Symmetrical Fault Analysis

Reactance's of Synchronous Machine – Three Phase Short Circuit Currents - Short circuit MVA calculations for Power Systems – Numerical Problems.

UNIT IV: **(7 Hours)**

Symmetrical Components

Definition of symmetrical components – symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances and Sequence networks of Synchronous generator, Transformers and Transmission line-Numerical Problems.

Unsymmetrical Fault analysis

Various types of faults: LG– LL– LLG and LLL on unloaded alternator- Numerical problems.

UNIT V:

Power System Stability Analysis **(10 Hours)**

Elementary concepts of Steady state – Dynamic and Transient Stabilities – Swing equation – Steady state stability – Equal area criterion of stability – Applications of Equal area criterion – Factors affecting transient stability – Methods to improve steady state and transient stability – Numerical problems

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-	-

Textbooks:

1. Power System Analysis by Grainger and Stevenson - Tata McGraw Hill.2003
2. Modern Power system Analysis – by I.J.Nagrath & D .P.Kothari: Tata McGraw–Hill Publishing Company - 3rd edition - 2007.

Reference Books:

1. Power System Analysis – by A.R.Bergen - Prentice Hall - 2nd edition - 2009.
2. Power System Analysis by HadiSaadat – Tata McGraw–Hill 3rd edition - 2010.
3. Power System Analysis by B.R.Gupta - A H Wheeler Publishing Company Limited - 1998.
4. Power System Analysis and Design by J.Duncan Glover - M.S.Sarma - T.J.Overbye – Cengage Learning publications - 5th edition – 2011

Online Learning Resources:

1.https://archive.nptel.ac.in/courses/117/105/117105140

2.https://archive.nptel.ac.in/courses/108/105/108105104

SWITCHGEAR AND PROTECTION

Subject Code: UGEE6T0423	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic concepts of Electrical Machines and Power Systems.

Course Objectives:

- To explain the working principles and applications of circuit breakers in power systems, including MCBs, oil, SF6, and vacuum breakers.
- To provide an understanding of electromagnetic protection mechanisms, particularly relays used in fault detection and system protection (overcurrent, under voltage, directional, differential).
- To analyze protection techniques for generators and transformers, including fault protection schemes like percentage differential protection and Buchholz relays.
- To explore feeder and busbar protection methods using advanced relay systems such as distance and static relays.
- To study over-voltage protection systems including lightning arresters and neutral grounding methods to safeguard the power system.
-

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Understand and describe the operation of circuit breakers, including their ratings, principles of arc interruption, and types.

CO2: Analyze relay-based protection systems, identifying and explaining their roles in overcurrent, undervoltage, and fault detection.

CO3: Design protection schemes for generators and transformers, addressing faults like restricted earth faults and inter-turn faults.

CO4: Implement feeder and busbar protection using advanced relays such as distance, impedance, and static relays.

CO5: Evaluate over-voltage protection strategies, including the use of lightning arresters, and understand various neutral grounding techniques.

Syllabus:

UNIT-I **(10 Hours)**

Circuit Breakers

Miniature Circuit Breaker (MCB)– Elementary principles of arc interruption– Restriking Voltage and Recovery voltages– Restriking phenomenon - RRRV– Average and Max. RRRV– Current chopping and Resistance switching– Concept of oil circuit breakers– Description and operation of Air Blast– Vacuum and SF6 circuit breakers– Circuit Breaker ratings and specifications– Concept of Auto reclosing.

UNIT-II **(10 Hours)**

Electromagnetic Protection

Relay connection – Balanced beam type attracted armature relay - induction disc and induction cup relays–Torque equation - Relays classification–Instantaneous– DMT and IDMT types– Applications of relays: Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays– Universal torque equation– Distance relays: Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.

UNIT-III **(8 Hours)**

Generator Protection

Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples.

Transformer Protection

Percentage differential protection– Design of CT's ratio– Buchholz relay protection Numerical examples.

UNIT-IV **(7 Hours)**

Feeder and Bus bar Protection & Static Relays

Over current Protection schemes – PSM - TMS – Numerical examples – Carrier current and three zone distance relay using impedance relays. Protection of bus bars by using Differential protection. Static relays: Introduction – Classification of Static Relays – Basic Components of Static Relays.

UNIT-V **(10 Hours)**

Protection against over voltage and grounding

Generation of over voltages in power systems– Protection against lightning over voltages– Valve type and zinc oxide lighting arresters. Grounded and ungrounded neutral systems – Effects of ungrounded neutral on system performance – Methods of neutral grounding: Solid–resistance–Reactance–Arcing grounds and grounding Practices.

Mapping of COs to POs:

POs / Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	-

Textbooks:

1. Power System Protection and Switchgear by Badri Ram and D.N Vishwakarma - Tata McGraw Hill Publications - 2nd edition - 2011.
2. Power system protection- Static Relays with microprocessor applications by T.S.Madhava Rao - Tata McGraw Hill - 2nd edition.

Reference Books:

1. Fundamentals of Power System Protection by Paithankar and S.R.Bhide. - PHI - 2003.
2. Art & Science of Protective Relaying – by C R Mason - Wiley Eastern Ltd.

Online Learning Resources:

1.https://archive.nptel.ac.in/courses/108/107/108107167
2. https://archive.nptel.ac.in/courses/108/105/108105167

ADVANCED CONTROL SYSTEMS

Subject Code: UGEE6T0523	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic concepts of Control Systems.

Course Objectives:

- To understand the concept of controllability, observability, and their tests for continuous-time systems, as well as the principle of duality in state-space analysis.
- To understand the state-space methods to assess controllability, observability, and design state feedback controllers via pole placement.
- To know the stability of nonlinear systems using phase-plane analysis, describing functions, and Lyapunov's stability theorems.
- Learn optimal control strategies using the calculus of variations, including constrained minimization and the minimum principle.
- To learn Optimal control and state regulator problems.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Design state feedback and observer-based control systems using pole placement techniques.

CO2: Analyze nonlinear systems through phase plane and describing function methods.

CO3: Assess stability of linear and nonlinear systems using Lyapunov methods.

CO4: Use calculus of variations to derive optimal conditions for control.

CO5: Formulate and solve different classes of optimal control problems

Syllabus:

UNIT I: Controllability - Observability and Design of Pole Placement (10 Hours)

General concepts of controllability and observability -Tests for controllability and observability for continuous time systems - Principle of duality - Effect of state feedback on controllability and observability - Design of state feedback control through pole placement, full order and reduced order observers.

UNIT II: Nonlinear Systems (10 Hours)

Introduction to nonlinear systems - Types of nonlinearities. Introduction to phase plane analysis, construction of phase trajectories-Analytical and Isocline method, Describing function - Describing functions of on-off nonlinearity, on-off nonlinearity with hysteresis, and relay with dead zone.

UNIT III: Stability analysis by Lyapunov Method (8 Hours)

Stability in the sense of Lyapunov – Lyapunov's stability and Lyapunov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.

UNIT IV: Calculus of Variations **(7 Hours)**

Minimization of functionals - functionals of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints.

UNIT V: Optimal Control **(10 Hours)**

Necessary conditions for optimal control, Formulation of the optimal control problem, minimum time problem, minimum energy problem, minimum fuel problem, state regulator problem, output regulator problem.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	3	2	2	-	-	-	-	-	-	2	2
CO2	3	3	2	2	2	-	-	-	-	-	-	2	2
CO3	3	2	2	2	2	-	-	-	-	-	-	2	2
CO4	3	2	2	2	2	-	-	-	-	-	-	2	2
CO5	3	3	3	2	2	-	-	-	-	-	-	2	3

Textbooks:

1. Modern Control Engineering – by K. Ogata - Prentice Hall of India - 3rd edition - 1998.
2. Automatic Control Systems by B.C. Kuo - Prentice Hall Publication.

REFERENCE BOOKS:

1. Modern Control System Theory – by M. Gopal - New Age International Publishers - 2nd edition – 1996.
2. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.
3. Control Systems Engineering by I.J. Nagarath and M.Gopal - New Age International (P) Ltd.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/103/108103007
2. https://archive.nptel.ac.in/courses/108/107/108107115

RENEWABLE AND DISTRIBUTED ENERGY TECHNOLOGIES

Subject Code: UGEE6T0623	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Power system I

Course Objectives:

- To understand the basic concepts on wind energy systems.
- To understand the various relations between speed, power and energy in the wind systems.
- To analyze the solar energy systems, various components of solar thermal systems, applications in the relevant fields and design of PV systems.
- To design the Hydel system components and to get an idea on different other sources like tidal, geothermal and gas-based units.
- To understand the concepts of hybrid renewable energy systems.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Describe the renewable sources like Wind energy systems- Wind Potential, Mechanical and location aspects

CO2: Discuss Wind energy conversion systems- Structure, Characteristics, operation & Control

CO3: Model PV systems and analyse MPPT Techniques

CO4: Illustrate the concept of Energy Production from Hydro - Tidal and Geothermal

CO5: Design hybrid renewable energy systems and its power electronic interface to grid and loads

Syllabus:

UNIT I: (10 Hours)

Introduction and Wind energy systems : Brief idea on renewable and distributed sources - their usefulness and advantages. Wind Energy Systems: Estimates of wind energy potential-wind maps- Aerodynamic and mechanical aspects of wind machine design - Conversion to electrical energy - Aspects of location of wind farms.

UNIT II: (10 Hours)

Wind power and energy : Wind speed and energy - Speed and power relations - Power extraction from wind - Tip speed ratio (TSR) - TSR characteristics- Functional structure of wind energy conversion systems - Pitch and speed control - Power vs speed characteristics - Fixed speed and variable speed wind turbine control - Power optimization - Electrical generators - Self-Excited and Doubly-Fed Induction Generators operation and control.

UNIT III: (8 Hours)

Solar PV Systems : Introduction to single-phase Transformers (Construction and principle of operation), emf equation, operation on no-load and on load, lagging, leading and unity power factor loads, phasor diagrams, equivalent circuit, regulation, losses and efficiency, effect of variation of frequency and supply voltage on losses, all day efficiency.

UNIT IV: **(7 Hours)**

Small Hydro and other sources : Hydel: Small-Mini-Medium -Plant layouts Water power estimates -use of hydrographs -hydraulic turbine - characteristics and part load performance - design of wheels - draft tubes and penstocks. Other sources**:** Tidal - geothermal - gas-based generations.

UNIT V: **(10 Hours)**

Hybrid Renewable systems : Requirements of hybrid/combined use of different renewable and distributed sources -Need of energy storage- Control of frequency and voltage of distributed generation in Stand-alone and Grid-connected mode - use of energy storage and power electronics interfaces for the connection to grid and loads - Design and optimization of size of renewable sources and their storages

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	-

Textbooks:

1. Math J. Bollen - Fainan Hassan 'Integration of Distributed Generation in the Power System' - IEEE Press - 2011.
2. G.D.Rai 'Non-Conventional Energy Sources' KHANNA PUBLISHERS.

Reference Books:

1. Studies' Craig Anderson and Rudolf I. Howard 'Wind and Hydropower Integration: Concepts - Considerations and Case - Nova Publisher - 2012.
2. Amanda E. Niemi and Cory M. Fincher 'Hydropower from Small and Low-Head Hydro Technologies' - Nova Publisher - 2011.
3. D. YogiGoswami - Frank Kreith and Jan F. Kreider 'Principles of Solar Engineering' - Taylor & Francis 2000.
4. Math J. Bollen - Fainan Hassan 'Integration of Distributed Generation in the Power System' - IEEE Press - 2011.
5. S. Heier and R. Waddington 'Grid Integration of Wind Energy Conversion Systems' – Wiley - 2006.
6. Loi Lei Lai and Tze Fun Chan 'Distributed Generation: Induction and Permanent Magnet Generators' - Wiley-IEEE Press - 2007.
7. G.N. Tiwari 'Solar Energy Technology' - Nova Science Publishers - 2005.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/103/103/103103206
2. https://archive.nptel.ac.in/courses/103/107/103107157

ELECTRIC DRIVES

Subject Code: UGEE6T0823	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Electrical Circuit Analysis, Power electronics, Electrical Machines and Control Systems.

Course Objectives:

- To learn the fundamentals of electric drive and different electric braking methods.
- To analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
- To discuss the DC-DC converter control of dc motors.
- To understand the concept of speed control of induction motor by using AC voltage controllers, voltage source inverters and slip power recovery scheme.
- To learn the speed control mechanism of synchronous motors

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Understand and analyze the fundamental components and dynamics of electric drives, including load torque characteristics, steady-state stability, braking methods, and four-quadrant operation.

CO2: Apply and evaluate the performance of separately and self-excited DC motors when fed by single and dual converter circuits

CO3: Design and analyze chopper-fed DC motor drive systems for single, two, and four-quadrant operation

CO4: Analyze and compare various control techniques for 3-phase induction motor drives such as stator voltage control, V/f control, slip power recovery methods, and assess their performance using speed–torque characteristics.

CO5: Evaluate the control strategies of synchronous motor drives including load commutated inverter and PMSM operation, along with their practical applications.

Syllabus:

UNIT-I **(12 Hours)**

Fundamentals of Electric Drives

Electric drive and its components– Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Load equalization– Four quadrant operation of drive (hoist control) – Braking methods: Dynamic Braking, Plugging and Regenerative Braking –Numerical problems.

UNIT-II **(14 Hours)**

Converter Fed DC Motor Drives

3-phase half and fully-controlled converter fed separately and self-excited DC motor drive – Output voltage and current waveforms – Speed-torque characteristics and expressions – 3-phase Dual converter fed DC motor drives – Numerical problems.

UNIT III: **(8 Hours)**

DC–DC Converter Fed DC Motor Drives

Single quadrant, two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous Current Mode of operation - Output voltage and current waveforms – Speed-torque characteristics and expressions – Closed loop operation (qualitative treatment only) – Numerical problems.

UNIT IV: **(10 Hours)**

Control of 3-phase Induction motor Drives

Stator voltage control using 3-phase AC voltage regulators – Waveforms –Speed torque characteristics– Variable Voltage Variable Frequency control of induction motor by PWM voltage source inverter – Closed loop V/f control of induction motor drives (qualitative treatment only). Static rotor resistance control – Slip power recovery schemes – Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics– Numerical problems.

UNIT V: **(8 Hours)**

Control of Synchronous Motor Drives

Separate control of synchronous motor – self-control of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive (qualitative treatment only)– PMSM: Basic operation and advantages – Numerical problems.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3

Textbooks:

8. Fundamentals of Electric Drives – G K Dubey - Narosa Publications - 2nd edition – 2002.
9. Power Semiconductor Drives - S.B.Dewan - G.R.Slemon - A.Straughen - Wiley India - 1984.

Reference Books:

1. Electric Motors and Drives Fundamentals - Types and Apllications - by Austin Hughes and Bill Drury - Newnes.4th edition - 2013.
2. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications - 1987.
3. Power Electronic Circuits - Devices and applications by M.H.Rashid - PHI - 3rd edition - 2009.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104140
2. https://nptel.ac.in/courses/108104011

DIGITAL SIGNAL PROCESSING

Subject Code: UGEE6T0923	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Laplace Transforms, Z- Transforms, Fourier series and transforms.

Course Objectives:

- To explore the basic concepts of digital signal processing.
- To connect the time domain signal to frequency domain signals using Fourier transform.
- To understand the basic structures of IRR systems.
- To understand and design FIR Digital filters.
- To explore the concepts of multiple sampling rates for DSP.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Understand the concepts of Digital signal processing - frequency domain representation & z- transform

CO2: Compute discrete Fourier transform and fast Fourier transforms for different sequences.

CO3: Design IIR filters through analog filter approximation and basic structure of IIR filters

CO4: Design FIR filters with window techniques and basic structure of FIR filters.

CO5: Analyze the concepts of Multirate Signal Processing

Syllabus:

UNIT I: (10 Hours)

Introduction to Digital Signal Processing

Discrete time signals & sequences - Classification of Discrete time systems - stability of LTI systems - Invertability - Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms - solution of difference equations using Z-transforms - System function.

UNIT II: (10 Hours)

Discrete Fourier Transforms and FFT Algorithms

Discrete Fourier Series representation of periodic sequences -Properties of Discrete Fourier Series - Discrete Fourier transforms: Properties of DFT - linear filtering methods based on DFT - Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms - Inverse FFT.

UNIT III: (8 Hours)

Design and Realizations of IIR Digital Filters

Analog filter approximations – Butterworth and Chebyshev filters - Design of IIR Digital filters from analog filters withexamples. Analog and Digital frequency transformations.

Basic structures of IIR systems – Direct-Form Structures - Transposed Structures - Cascade-Form Structures - Parallel-Form Structures Lattice and Lattice-Ladder Structures.

UNIT IV: **(7 Hours)**

Design and Realizations of FIR Digital Filters

Characteristics of FIR Filters with Linear Phase - Frequency Response of Linear Phase FIR Filters - Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique - Comparison of IIR & FIR filters.

Basic structures of FIR systems – Direct-Form Structure - Cascade-Form Structures Linear Phase Realizations - Lattice structures.

UNIT V: **(10 Hours)**

Multirate Digital Signal Processing

Decimation –Interpolation-Sampling Rate Conversion by a Rational Factor–Implementation of sampling rate converters–Applications of Multirate Signal Processing-Digital Filter Banks.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-

Text Books:

1. Digital Signal Processing – Principles Algorithms and Applications: John G. Proakis - Dimitris G.Manolakis - 4th Edition - Pearson Education / PHI - 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer - PHI.
3. Digital Signal Processing: A Computer based approach. Sanjit K Mitra - 4th Edition - TMH - 2014.

Reference Books:

1. Digital Signal Processing: Andreas Antoniou - TATA McGraw Hill - 2006.
2. Digital Signal Processing: MH Hayes - Schaum's Outlines - TATA Mc-Graw Hill - 2007.
3. DSP Primer - C. Britton Rorabaugh - Tata McGraw Hill - 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling - Sandra L.Harris - Thomson - 2007.
5. Digital Signal Processing – Alan V. Oppenheim - Ronald W. Schafer - PHI Ed. - 2006.
6. Digital Signal Processing – K Raja Rajeswari - 1st edition - I.K. International Publishing - House - 2014.

Online Learning Resources:

1. https://nptel.ac.in/courses/117102060
2. https://archive.nptel.ac.in/courses/108/101/108101174

HIGH VOLTAGE ENGINEERING

Subject Code: UGEE6T1023	**L**	**T**	**P**	**C**
III Year II Semester	**3**	**0**	**0**	**3**

Pre-requisite:
Material Science, Electromagnetic Fields and Basics of Transient Circuits.

Course Objectives:

- To understand HV breakdown phenomena in gases.
- To understand the breakdown phenomenon of liquids and solid dielectrics.
- To acquaint with the generating principle of operation and design of HVDC, AC voltages.
- To understand the generating principles of Impulse voltages & currents.
- To understand various techniques for AC, DC and Impulse measurements of high voltages and currents.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Recognize the dielectric properties of gaseous materials used in HV equipment.
CO2: Differentiate the break down phenomenon in liquid and solid dielectric materials.
CO3: Acquaint with the techniques of generation of high AC and DC voltages
CO4: Acquaint with the techniques of generation of high Impulse voltages and currents.
CO5: Interpret the measurements of high AC - DC - Impulse voltages and currents

Syllabus:

UNIT - I

Break down phenomenon in Gaseous and Vacuum: (10 Hours)

Insulating Materials: Types, properties and its applications. Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases and its limitations – Streamers Theory of break down – time lag – Paschen's law- Paschen's curve, Penning Effect. Breakdown mechanisms in Vacuum.

UNIT II: (10 Hours)

Break down phenomenon in Liquids:

Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquids- Mechanisms.

Break down phenomenon in Solids: Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown –Breakdown of composite solid dielectrics.

UNIT - III

Generation of High DC voltages: (10 Hours)

Voltage Doubler Circuit - Voltage Multiplier Circuit – Vande- Graaff Generator.

Generation of High AC voltages:

Cascaded Transformers – Resonant Transformers –Tesla Coil

UNIT - IV

Generation of Impulse voltages: (10 Hours)

Specifications of impulse wave – Analysis of RLC circuits - Marx Circuit.

Generation of Impulse currents:

Definitions – Circuits for producing Impulse current waves – Wave shape control - Tripping and control of impulse generators

UNIT - V

Measurement of High DC & AC Voltages: (08 hours)

Resistance potential divider - Generating Voltmeter - Capacitor Voltage Transformer (CVT) - Electrostatic Voltmeters – Sphere Gaps.

Measurement of Impulse Voltages & Currents:

Potential dividers with CRO - Hall Generator - Rogowski Coils.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	2	3	3	-	-	-	-	-	-	-	-
CO2	3	3	-	3	3	-	-	-	-	-	-	-	-
CO3	3	3	-	3	3	-	-	-	-	-	-	-	-
CO4	3	3	-	3	3	-	-	-	-	-	-	-	-
CO5	3	3	2	3	3	-	-	-	-	-	-	-	

Text Books:

1. High Voltage Engineering: Fundamentals by E. Kuffel - W.S. Zaengl - J. Kuffel by Elsevier - 2nd Edition.
2. High Voltage Engineering by M.S. Naidu and V. Kamaraju – TMH Publications - 3rd Edition.

Reference Books:

1. High Voltage Engineering and Technology by Ryan - IET Publishers - 2nd edition.
2. High Voltage Engineering by C.L. Wadhwa - New Age Internationals (P) Limited – 1997.
3. High Voltage Insulation Engineering by Ravindra Arora - Wolfgang Mosch - New Age International (P) Limited - 1995

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104048
2. https://bharatsrajpurohit.weebly.com/high-voltage-engineering-course.html

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB

Subject Code: UGEE6P1123	**L**	**T**	**P**	**C**
III Year / II Semester	**0**	**0**	**0**	**1.5**

Course Objectives:

- To understand students how different types of meters work and their construction
- To make the students understand how to measure resistance, inductance and capacitance by AC & DC bridges
- To understand the testing of C.T
- To understand and the characteristics of LVDT, Capacitor transducer and choke coil parameters
- To study the procedure for calibration of various methods

List of Experiments

Any 10 of the following experiments are to be conducted:

1. Measurement of resistance using Kelvin's double Bridge and Determination of its tolerance
2. Measurement of Capacitance using Schering Bridge
3. Measurement of Inductance using Anderson Bridge
4. Calibration of LPF Wattmeter by direct loading
5. Measurement of 3 phase reactive power using single wattmeter method for a balanced load
6. Testing of C.T. using mutual inductor – Measurement of % ratio error and phase angle of given C.T. by Null deflection method
7. Determination of the characteristics of a LVDT
8. Measurement of Choke coil parameters and single-phase power using three voltmeter and three ammeter methods
9. Calibration of single-phase Induction Type Energy Meter
10. Calibration of DC ammeter and voltmeter using Crompton DC Potentiometer
11. Calibration of DC ammeter and voltmeter using Crompton DC Potentiometer
12. Determination of the characteristics for a capacitive transducer

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Measure resistance, capacitance, and inductance using different types of bridge circuits

CO2: Calibrate electrical instruments such as Wattmeters, Energy meters, and DC meters

CO3: Measure power in single-phase and three-phase electrical systems using standard methods

CO4: Test current transformers and calculate their errors using simple techniques

CO5: Interpret the characteristics of the sensors like LVDT and capacitive transducer

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-

MICROPROCESSORS AND MICROCONTROLLERS LAB

Subject Code: UGEE6P1223	**L**	**T**	**P**	**C**
III Year / II Semester	**0**	**0**	**3**	**1.5**

List of Experiments

Any 10 of the following experiments are to be conducted:

8086 Microprocessor Programs

1. Arithmetic operations – Two 16-bit numbers and multibyte numbers :addition - subtraction - multiplication and division – Signed and unsigned arithmetic operations - ASCII – Arithmetic operations.
2. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD - BCD to ASCII conversion – BCD numbers addition.
3. Arrange the given array in ascending and descending order
4. Determine the factorial of a given number
5. By using string operation and Instruction prefix: Move block - Reverse string Sorting - Inserting - Deleting - Length of the string - String comparison.
6. Find the first and nth number of 'n' natural numbers of a Fibonacci series.
7. Find the number and sum of even and odd numbers of a given array
8. Find the sum of 'n' natural numbers and squares of 'n' natural numbers
9. Arithmetic operations on 8051
10. Conversion of decimal number to hexa equivalent and hexa equivalent to decimal number
11. Find the Sum of elements in an array and also identify the largest & smallest number of a given array using 8051.

Programs on Interfacing

12. Interfacing 8255–PPI with 8086.
13. Stepper motor control using 8253/8255.
14. Reading and Writing on a parallel port using 8051
15. Timer in different modes using 8051
16. Serial communication implementation using 8051
17. Understanding three memory areas of 00 – FF Using 8051 external interrupts.
18. Traffic Light Controller using 8051.

Course Outcomes: At the end of this course students will be able to

CO1: Write an assembly language program using 8086 micro-processor based on arithmetic – logical number systems and shift operations.
CO2: Write an assembly language programs for numeric operations and array handling problems.
CO3: Write an assembly program on string operations.
CO4: Write an assembly program on string operations.
CO5: Do parallel and serial communication using 8051.
CO6: Program microprocessors and microcontrollers for real world applications.

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO2
CO1	3	3	-	-	3	-	-	3	-	-	-	-	-
CO2	3	3	-	-	3	-	-	3	-	-	-	-	-
CO3	3	3	-	-	3	-	-	3	-	-	-	-	-
CO4	3	3	-	-	3	-	-	3	-	-	-	-	-
CO5	3	3	-	-	3	-	-	3	-	-	-	-	-
CO6	3	3	3	3	3	-	-	3	-	-	-	-	-

IOT APPLICATIONS OF ELECTRICAL ENGINEERING LAB

Subject Code: UGEE6K1323	**L**	**T**	**P**	**C**
III Year / II Semester	**0**	**1**	**2**	**2**

Prerequisites: Concepts of Computer Organization, Computer Networks

Course Objectives:

- To understand the working of Arduino.
- To learn the programming of Raspberry PI.
- To know various sensors with Arduino/Raspberry Pi.
- To interface various displays with Arduino/Raspberry Pi.
- To connect with various wireless communication devices.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Operate the Arduino Integrated Development Environment with embedded c.

CO2: Program the embedded Python in Raspberry Pi OS.

CO3: Interface various sensors with Arduino/Raspberry Pi in the IoT environment.

CO4: Connect different displays with Arduino/Raspberry Pi

CO5: Interconnect with wireless communication technologies

Topics to be covered in Tutorials

Module–1: Programming Arduino: (3 hrs)

Arduino - Classification of Arduino Boards - Pin diagrams – Arduino Integrated Development Environment (IDE) – Programming Arduino.

Module–2: Sensors: (5 hrs)

Working of temperature sensor, proximity sensor, IR sensor, Light sensor, ultrasonic sensor, PIR Sensor, Colour sensor, Soil Sensor, Heart Beat Sensor, Fire Alarms etc. Actuators: Stepper Motor, Servo Motor and their integration with Arduino/Raspberry Pi.

Module–3: Raspberry Pi: (2 hrs)

Introduction, Classification of Rasperberry Pi Series - Pin diagrams – Programming Rasperberry Pi.

Module–4: Display: (2 hrs)

Working of LEDs, LED, OLED display, LCDs, Seven Segment Display, Touch Screen etc. Analog Input and Digital Output Converter etc. and their integration with Arduino/Raspberry Pi.

Module–5: Wireless Communication Devices: (4 hrs)

Working of Bluetooth, Wi-Fi, Radio Frequency Identification (RFID), GPRS/GSM Technology, ZigBee, etc and their integration with Arduino/Raspberry Pi. Features of Alexa.

List of Experiments

Any 10 of the following experiments are to be conducted

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. Interfacing of LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. Interfacing of Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. Interfacing of temperature sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. Interfacing of Organic Light Emitting Diode (OLED) with Arduino/Raspberry Pi
6. Interfacing of Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
7. Interfacing of Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
8. Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to thingspeak cloud.
9. Interfacing of 7 Segment Display with Arduino/Raspberry Pi
10. Interfacing of Joystick with Arduino/Raspberry Pi
11. Interfacing of Analog Input & Digital Output with Arduino/Raspberry Pi
12. Night Light Controlled & Monitoring System
13. Interfacing of Fire Alarm Using Arduino/Raspberry Pi
14. IR Remote Control for Home Appliances
15. A Heart Rate Monitoring System
16. Alexa based Home Automation System

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	-	-	-	3	-	-	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	-	-	3	-	-
CO3	-	3	3	3	3	-	-	-	-	-	-	-	3
CO4	-	-	3	-	3	-	-	-	-	-	-	-	3
CO5	-	3	3	-	3	-	-	-	-	-	3	-	3

Textbooks:

1. Exploring Arduino: Tools and Techniques for Engineering Wizardry, Jeremy Blum, Wiley, 2nd Edition, 2019.
2. Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, Derek Molloy, Wiley, 1st Edition, 2016
3. Internet of Things with Arduino and Raspberry Pi, Rajesh Singh, Anita Gehlot, Bhupendra Singh, CRC Press, 1st Edition, 2020.

Reference Books:

1. Arduino Cookbook, Michael Margolis, O'Reilly Media, 2nd Edition, 2012.
2. Raspberry Pi Cookbook, Simon Monk, O'Reilly Media, 3rd Edition, 2022..
3. Make: Sensors: A Hands-On Primer for Monitoring the Real World with Arduino and Raspberry Pi, Tero Karvinen, Kimmo Karvinen, Ville Valtokari, Maker Media, 1st Edition, 2014.

Online Learning Resources:

1. http://nptel.ac.in/courses/106/105/106105166
2. http://nptel.ac.in/courses/106/105/106105159

RESEARCH METHODOLOGY

Subject Code: UGEE6A1423	**L**	**T**	**P**	**C**
III Year / II Semester	**2**	**0**	**0**	**-**

Course Objectives:

- Understand research problem formulation.
- Analyze research related information, Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understand the Sampling process
- Understand the Data Analysis
- Understand the Interpretation of Data and Paper Writing

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Identify and formulate a research problem by understanding its scope, sources, and criteria, and analyze various approaches for its investigation including data collection and instrumentation.

CO2: Demonstrate effective techniques for literature review, understand and apply research ethics, plagiarism norms, and technical writing skills to prepare and present a research proposal.

CO3: Explain and differentiate various research paradigms, and formulate and test hypotheses with proper understanding of their characteristics and forms.

CO4: Collect, analyze, and interpret research data, identify sources of error, and formulate valid conclusions and generalizations using logical reasoning and proper interpretation techniques.

CO5: Compose and structure a research paper effectively, evaluate journals based on impact factor and scope, and examine ethical issues such as plagiarism in publishing.

Syllabus:

UNIT – I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT – II

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT – III

Paradigms of Research; Methods, Hypothesis, Formulation of hypothesis, Characteristics of usable hypothesis, Different Forms of hypothesis, testing the hypothesis.

UNIT – IV

Collecting Data, Process & Displaying data, Meaning and need of Interpretation, Pre-requisites of Interpretation, Sources of Errors, Conclusions and Generalizations, Some Common Fallacies of Reasoning, Hints in formulation Generalization.

UNIT – V

Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Electrical & Electronics Engineering, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Text Books:

1. Research Methodology: Ranjit Kumar, 3rd Edition.
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
3. Mayall , "Industrial Design", McGraw Hill,1992.
4. Research Methodology – C.R.Kothari.
5. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'".

Reference Books:

6. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
7. Research Methodology and Statistics Techniques- Santosh Gupta, Deep & Deep Publications.
8. Practical Physics- G.L. Squires, Cambridge University Press.
9. Handbook of Science Communication- compiled by Anthony Wilson, Jane Gregony, Steve Miller, Shirley, Earl, Overseas press India Pvt. Ltd.

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN
(AUTONOMOUS)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

III B.Tech. EEE Course Structure – R23

OPEN ELECTIVES

S.No.	Category	Course code	Course Title	L	T	P	C	IM	EM	TM
1	OE-I (III-I)	UGEE0T0123	Renewable Energy Sources	3	0	0	3	30	70	100
		UGEE0T0223	Concepts of Energy Auditing & Management							
2	OE-II (III-II)	UGEE0T0323	Fundamentals of Electric Vehicles	3	0	0	3	30	70	100
		UGEE0T0423	Electrical Wiring Estimation and Costing							

RENEWABLE ENERGY SOURCES

Subject Code: UGEE0T0123	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Pre-requisite: Basic Electrical Engineering

Course Objectives:

- To study the solar radiation data, equivalent circuit of PV cell and its I-V & P-V characteristics.
- To understand the concept of Wind Energy Conversion & its applications.
- To study the principles of biomass, hydel and geothermal energy.
- To understand the principles of ocean Thermal Energy Conversion, waves and power associated with it.
- To study the various chemical energy sources such as fuel cell and hydrogen energy along with their operation and equivalent circuit.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy storage

CO2: Illustrate the components of wind energy systems.

CO3: Illustrate the working of biomass, hydel plants and Geothermal plants.

CO4: Demonstrate the principle of Energy production from OTEC, Tidal and wave

CO5: Understand the concept and working of Fuel cells & MHD power generation

Syllabus:

UNIT–I **(10 Hours)**

Solar Energy : Introduction - Renewable Sources - prospects, solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.

UNIT–II **(10 Hours)**

Wind Energy: Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.

UNIT–III **(10 Hours)**

Biomass, Hydel and Geothermal Energy :Biomass: Introduction - Biomass conversion technologies- Photosynthesis. Factors affecting Bio digestion. **Hydro plants:** Basic working principle – Classification of hydro systems**:** Large, small, Micro Hydel plants.**Geothermal Energy**: Introduction, Geothermal Sources – Applications - operational and Environmental problems.

UNIT–IV **(10 Hours)**

Energy From oceans, Waves & Tides: Oceans: Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India. **Waves:** Introduction - Energy and Power from the waves - Wave Energy conversion devices. **Tides:** Basic principle of Tide Energy -Components of Tidal Energy.

UNIT–V **(10 Hours)**

Chemical Energy Sources: Fuel Cells: Introduction - operation of Fuel cell - types of Fuel Cells - Applications. **Hydrogen Energy:** Introduction - Methods of Hydrogen production - Storage and Applications. **Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation - Types.

Text Books:

1. G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.
2. John Twidell& Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

Reference Books:

1. S.P.Sukhatme&J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011.
2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013.
3. ShobaNath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/103/103/103103206
2. https://archive.nptel.ac.in/courses/103/107/103107157

CONCEPTS OF ENERGY AUDITING & MANAGEMENT

Subject Code: UGEE0T0223	**L**	**T**	**P**	**C**
III Year I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of Conservation of Electrical Energy

Course Objectives:

- To understand basic concepts of Energy Audit & various Energy conservation schemes.
- To design energy an energy management program.
- To understand concept of Energy Efficient Motors and lighting control efficiencies.
- To estimate/calculate power factor of systems and propose suitable compensation techniques.

To calculate life cycle costing analysis and return on investment on energy efficient technologies.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Understand the principles of energy audit along with various Energy related terminologies

CO2: Asses the role of Energy Manager and Energy Management program

CO3: Design a energy efficient motors and good lighting

CO4: Analyse the methods to improve the power factor and identify the energy instruments for various real time applications

CO5: Evaluate the computational techniques with regard to economic aspects

Syllabus:

UNIT I: **(10 Hours)**

Basic Principles of Energy Audit

Energy audit- definitions - concept - types of Energy audit - energy index - cost index - pie charts - Sankey diagrams and load profiles - Energy conservation schemes- Energy audit of industries- energy saving potential - energy audit of process industry, thermal power station - building energy audit - Conservation of Energy Building Codes (ECBC-2017)

UNIT II:

Energy Management **(10 Hours)**

Principles of energy management - organizing energy management program - initiating - planning - controlling - promoting - monitoring - reporting. Energy manager - qualities and functions - language - Questionnaire – check list for top management.

UNIT III: **(8 Hours)**

Energy Efficient Motors and Lighting

Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics – variable speed - RMS - voltage variation-voltage unbalance-over motoring-motor energy audit. lighting system design and practice - lighting control - lighting energy audit.

UNIT IV: **(7 Hours)**

Power Factor Improvement and Energy Instruments

Power factor – methods of improvement - location of capacitors - Power factor with non-linear loads - effect of harmonics on power factor - power factor motor controllers – Energy Instruments- watt meter - data loggers - thermocouples - pyrometers - lux meters - tongue testers.

UNIT V: **(10 Hours)**

Economic Aspects and their Computation

Economics Analysis Depreciation Methods - time value of money - rate of return - present worth method - replacement analysis - lifecycle costing analysis – Energy efficient motors. Calculation of simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO2
CO1	3	3	-	3	3	-	-	-	-	-	-	-	-
CO2	3	3	-	3	3	-	-	-	-	-	-	-	-
CO3	3	3	-	3	3	-	-	-	-	-	-	-	-
CO4	3	3	-	3	3	-	-	-	-	-	-	-	-
CO5	3	3	-	3	3	-	-	-	-	-	-	-	

Text Books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth - Heinemann publications - 1982.
2. Energy management hand book by W.C Turner - John wiley and sons - 1982.

Reference Books:

1. Energy efficient electric motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd edition - 1995
2. Energy management by Paul o' Callaghan - Mc-graw Hill Book company-1st edition - 1998
3. Energy management and good lighting practice: fuel efficiency- booklet12-EEO

Online Learning Resources:

1. https://nptel.ac.in/courses/108106022
2. https://archive.nptel.ac.in/courses/108/106/108106022

FUNDAMENTALS OF ELECTRIC VEHICLES

Subject Code: UGEE0T0323	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge in Physics, Chemistry and Basics of Electrical and Electronics.

Course Objectives:

- To familiarize the students with the need and advantages of electric and hybrid electric vehicles.
- To understand various power converters used in electric vehicles.
- To be familiar all the different types of motors suitable for electric vehicles.
- To know various architecture of hybrid electric vehicles.
- To have knowledge on latest developments in batteries and other storage systems

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Illustrate the use and advantages of different types of electric vehicles.
CO2: Use suitable power converters for EV application.
CO3: Select suitable electric motor for EV power train.
CO4: Design HEV configuration for a specific application.
CO5: Analyze various storage systems and battery management system for EVs.

Syllabus:

UNIT-I **(8 Hours)**

Introduction

Fundamentals of vehicles – Vehicle model – Calculation road load and tractive force – Components of conventional vehicles – Drawbacks of conventional vehicles – Need for electric vehicles– Advantages and applications of Electric Vehicles – History of Electric Vehicles – EV Market in India and outside India –Types of Electric Vehicles.

UNIT-II **(10 Hours)**

Components of Electric Vehicles

Main components of Electric Vehicles – Electric Traction Motor and Controller – Power Converters – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.

UNIT III: **(12 Hours)**

Motors for Electric Vehicles

Characteristics of traction drive – requirements of electric machines for EVs – Comparison of Different motors for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only).

UNIT IV: **(10 Hours)**

Hybrid Electric Vehicles

Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs – Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples – Merits and Demerits.

UNIT V: **(10 Hours)**

Energy Sources for Electric Vehicles

Batteries– Types of Batteries – Lithium-ion – Nickel-metal hydride – Lead-acid – Comparison of Batteries – Battery Charging – Fast Charging –Battery Management System – Ultra capacitors – Flywheels – Compressed air energy storage (CAES)– Fuel Cell – it's working.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3

Textbooks:

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.
2. Tom Denton, Hayley Pells - Electric and hybrid vehicles, Third Edition, 2024.

Reference Books:

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020.
2. Chau - Kwok Tong. Electric vehicle machines and drives: design - analysis and application. John Wiley & Sons - 2015.
3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015.

Online Learning Resources:

1. MOOC at https://www.edx.org/learn/electric-cars
2. https://archive.nptel.ac.in/courses/108/106/108106170

ELECTRICAL WIRING ESTIMATION AND COSTING

Subject Code: UGEE0T0423	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Electrical Circuits, Basics of Power Systems and Electrical Machines.

Course Objectives:

- Introduce the electrical symbols and simple electrical circuits.
- Able to learn the design of electrical installations.
- Able to learn the design of electrical installation for different types of buildings and small industries.
- Learn the basic components of electrical substations.
- Familiarize with the motor control circuits.

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Demonstrate the various electrical apparatus and their interconnections.

CO2: Examine various components of electrical installations.

CO3: Estimate the cost for installation of wiring for different types of building and small industries.

CO4: Illustrate the components of electrical substations.

CO5: Design suitable control circuit for starting of three phase induction motor and synchronous motor.

Syllabus:

UNIT-I **(10 Hours)**

Electrical Symbols and Simple Electrical Circuits

Identification of electrical symbols - Electrical wiring Diagrams - Methods of representation of wiring diagrams - introduction to simple light and fan circuits - system of connection of appliances and accessories.

UNIT-II **(10 Hours)**

Design Considerations of Electrical Installations

Electric supply system - Three-phase four wire distribution system - protection of electric installation against overload - short circuit and earth fault - earthing - neutral and earth wire - types of loads - systems of wiring - permissible of voltage drops and sizes of wires - estimating and costing of electrical installations.

UNIT III: **(8 Hours)**

Electrical Installation for Different Types of Buildings and Small Industries

Electrical installations for electrical buildings - estimating and costing of material - simple examples on electrical installation for residential buildings - electrical installations for commercial buildings - electrical installation for small industries case study.

UNIT IV: **(7 Hours)**

Substations

Introduction - types of substations - outdoor substations-pole mounted type - indoor substations-floor mounted type - simple examples on quantity estimation case study.

UNIT V: **(10 Hours)**

Motor control circuits

Introduction to AC motors - starting of three phase squirrel cage induction motors - starting of wound rotor motors - starting of synchronous motors - contractor control circuit components - basic control circuits - motor protection – Schematic and wiring diagrams for motor control circuits.

Mapping of COs to POs:

POs/ Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3

Textbooks:

1. Electrical Design and Estimation Costing - K. B. Raina and S.K.Bhattacharya – New Age International Publishers - 2007.

Reference Books:

1. Electrical wiring estimating and costing – S.L.Uppal and G.C.Garg – Khanna publishers - 6th edition - 1987.
2. A course in electrical installation estimating and costing – J.B.Gupta Kataria SK & Sons - 2013.

Online Learning Resources:

1. https://onlinecourses.swayam2.ac.in/nou25_ec07/preview

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN (AUTONOMOUS)
BHIMAVARAM - 534202
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

EEE Course Structure – R23
(With Effect from 2023-24)

Minor (for Other Branches)

S.No.	Course Code	Subjects	L	T	P	C
1	23EEMT01	Concepts of Control Systems	3	0	0	3
2	23EEMT02	Fundamentals of Electrical Measurements and Instrumentation	3	0	0	3
3	23EEMT03	Concepts of Power System Engineering	3	0	0	3
4	23EEMT04	Fundamentals of Power Electronics	3	0	0	3
5	23EEMT05	Basics of Electric Drives and applications	3	0	0	3
6	23EEMT06	Fundamentals of utilization of Electrical Energy	3	0	0	3
Total			18	**0**	0	18

Minor Engineering	L	T	P	C
	3	0	0	3

CONCEPTS OF CONTROL SYSTEMS

Pre-requisite:

Basic Engineering Mathematics

Course Objectives:

- To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function
- To analyze the time response of first and second order systems and improvement of performance using PI, PD, PID controllers.
- To investigate the stability of closed loop systems using Routh's stability criterion and root locus method.
- To learn Frequency Response approaches for the analysis of LTI systems using Bode plots, polar plots and Nyquist stability criterion.
- To learn state space approach for analysis of LTI systems and understand the concepts of controllability and observability.

Course Outcomes:

After the completion of the course the student should be able to:

CO1: Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.

CO2: Determine time response specifications of second order systems and to determine error constants.

CO3: Analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method.

CO4: Analyze the stability of LTI systems using frequency response methods.

CO5: Represent physical systems as state models and determine the response. Understanding the concepts of controllability and observability.

UNIT – I

Mathematical Modeling of Control Systems

Classification of control systems - open loop and closed loop control systems and their differences - transfer function of linear system - differential equations of electrical networks - translational and rotational mechanical systems – block diagram algebra – Feedback characteristics.

UNIT-II

Time Response Analysis

Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants – P, PI , PD &PID Controllers.

UNIT–III

Stability and Root Locus Technique

The concept of stability – Routh-Hurwitz Criteria – limitations of Routh-Hurwitz criterion-Root locus concept – construction of root loci (simple problems).

UNIT–IV

Frequency Response Analysis

Introduction to frequency domain specifications – Bode diagrams – Transfer function from the Bode diagram – phase margin and gain margin.

UNIT–V

State Space Analysis of Linear Time Invariant (LTI) Systems

Concepts of state - state variables and state model - state space representation of transfer function - State Transition Matrix and it's properties.

Text Books:

1. Modern Control Engineering by Kotsuhiko Ogata - Prentice Hall of India.
2. Automatic control systems by Benjamin C.Kuo - Prentice Hall of India - 2nd Edition.

Reference Books:

1. Control Systems principles and design by M.Gopal - Tata Mc Graw Hill education Pvt Ltd. - 4th Edition.
2. Control Systems by ManikDhanesh N - Cengage publications.
3. Control Systems Engineering by I.J.Nagarath and M.Gopal - Newage International Publications - 5th Edition.
4. Control Systems Engineering by S.Palani - Tata Mc Graw Hill Publications.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/107/106/107106081
2. https://archive.nptel.ac.in/courses/108/106/108106098
3. https://nptelvideos.com/video.php?id=1423&c=14

Minor Engineering	L	T	P	C
	3	0	0	3

FUNDAMENTALS OF ELECTRICAL MEASUREMENTS and INSTRUMENTATION

Pre-requisite:

Basics of Electrical and Electronics Engineering.

Course Objectives:

- Interpret the working principles of various analog measuring instruments.
- Understand the concepts behind power and energy measurement procedures.
- Calculate resistance, inductance, and capacitance using various bridges.
- Evaluate the importance of and understand the concepts of various transducers.
- Comprehend the types of digital meters and their functionalities.

Course Outcomes:

After completing the course, the student will be able to:

CO1: Choose the appropriate instrument for the measurement of AC and DC voltage and current.
CO2: Analyse the operation of wattmeters and energy meters.
CO3: Differentiate between the operations of AC and DC bridges.
CO4: Describe the working principles of various transducers.
CO5: Recognize the importance of digital meters and explain their working principles.

UNIT – I: Fundamentals of Analog Measurement

Analog Ammeter and Voltmeter: Classification of instruments – Deflecting, controlling, and damping torques.Types of Instruments: PMMC and Moving Iron type – Construction, working principle, advantages, and disadvantages.Applications and simple numerical problems.

UNIT – II: Measurement of Power and Energy

Analog Wattmeter: Electrodynamometer type wattmeters – Low Power Factor (LPF) and Unity Power Factor (UPF) designs, advantages, and disadvantages. Energy Meters: Induction type Energy Meter – Construction and working principle Simple numerical problems.

UNIT – III: Measurement of Electrical Parameters

DC Bridges: Measurement of resistance – Low (Kelvin's double bridge), medium (Wheatstone bridge), and high resistance (Loss of charge method).

AC Bridges: Measurement of inductance (Maxwell's Bridge) and capacitance (Schering Bridge), Numerical problems.

UNIT – IV: Transducers and Sensors

Classification of Transducers: Basics and applications.Resistive: Strain Gauge. Inductive: Linear Variable Differential Transformer (LVDT). Capacitive: Piezoelectric – Applications

UNIT – V: Introduction to Digital Measurement

Digital Instruments:Digital Voltmeters (Successive approximation type),Digital Frequency Meters and Multimeters, Digital Tachometers and Energy Meters, – Overview and applications.

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney, DhanpatRai& Co. Publications – 19th revised edition - 2011.
2. Electronic Instrumentation by H.S.Kalsi - THM.

Reference Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5 th Edition - Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5th Edition - 2002.
3. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3rdedition.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105153

Minor Engineering	L	T	P	C
	3	0	0	3

CONCEPTS OF POWER SYSTEM ENGINEERING

Pre-requisite: Basic Electrical Engineering

Course Objectives:

- To understand the types of electric power plants and their working principles.
- To understand the concepts of electric power transmission and distribution.
- To gain the knowledge of protection and grounding of power system components.
- To learn the economic aspects of electrical energy.
- To learn the importance of power factor improvement and voltage control.

Course Outcomes:

After the completion of the course the student should be able to:

CO1: Know the concepts of power generation by various types of power plants.

CO2: Learn about short transmission line parameters and distribution systems schemes.

CO3: Learn about protection equipment and grounding methods of power system.

CO4: Calculate the tariff by applying the economic aspects of electrical energy.

CO5: Know the importance of power factor improvement and voltage control in power systems.

UNIT - I

Electrical power Generation Concepts & Types

Sources for Generation of Electrical Energy – working principle and Schematic diagram approaches of Thermal Power Plant – Hydro Power Plant - Nuclear Power Plant – Gas Power Plants – Comparison between Power Plants. Importance of Renewable energy sources.

UNIT - II

Transmission and Distribution Concepts

Types of Conductors Materials – Parameters of Transmission Line – Classification of Overhead Transmission Lines – Performance of Short Transmission Lines – Simple Problems.

Basic concepts of Sub Station – Distribution Systems – Connection Schemes of Distribution Systems – Structure of Cables – Differences between Overhead & Underground systems.

UNIT - III

Protection and Grounding

List of Faults – Basic concepts of fuse – Circuit Breakers – Relays – SF_6 Circuit Breakers – Vacuum Circuit Breakers – Operation of Lightning Arrester – Grounding and its advantages - Methods of Neutral Grounding: Resistance - Reactance and Resonant Grounding – Numerical Problems.

UNIT - IV

Economic Aspects

Definitions of Load – Load curves& Load Duration Curves - Load Factor - Demand Factor – Utilization Factor – Types of Tariff - Cost of Electrical Energy – Expression for Cost of Electrical Energy – Numerical Problems.

UNIT - V

Power Factor Improvement and Voltage Control

Power Factor – Effects and Causes of low Power Factor- Shunt & Series Capacitor Compensation - Numerical Problems – Need of Voltage Control – Types of Voltage regulating Devices.

Text Books:

1. Principles of Power System,V K Mehta and Rohit Mehta, S.Chand Publishers, 2022.

Reference Books:

1. Electrical Power Systems, C.L.Wadhwa, NewAge International Publishers, 2012.

Online Learning Resources:

1. https://nptel.ac.in/courses/108102047

Minor Engineering	L	T	P	C
	3	0	0	3

FUNDAMENTALS OF POWER ELECTRONICS

Pre-requisite:

Basic concepts of Electrical and Electronic Circuits and Semiconductor Physics.

Course Objectives:

- To know the characteristics of various power semiconductor devices.
- To learn the operation of single phase full–wave converters.
- To learn the operation of three phase full–wave converters and AC/AC converters.
- To learn the operation of different types of DC-DC converters.
- To learn the operation of PWM inverters for voltage control.

Course Outcomes:

After the completion of the course the student should be able to:

CO1: Illustrate the static and dynamic characteristics SCR - Power MOSFET and Power IGBT.

CO2: Analyse the operation of phase controlled rectifiers.

CO3: Analyse the operation of Three-phase full–wave converters - AC Voltage Controllers.

CO4: Examine the operation and design of different types of DC-DC converters.

CO5: Analyse the operation of PWM inverters for voltage control.

UNIT – I

Power Semi-Conductor Devices

Power Diode – Characteristics –Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics– Turn-on Methods.

Static and Dynamic Characteristics of Power MOSFET and Power IGBT.

UNIT – II

Single-phase AC-DC Converters

Single-phase half wave-controlled rectifiers - R load and RL load with and without freewheeling diode - Single-phase fully controlled bridge converter with R load and RL load - Continuous conduction - Expression for output voltages – Single-phase Semi-Converter with R load and RL load– Continuous conduction.

UNIT – III

Three-phase AC-DC Converters & AC – AC Converters

Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage.

AC power control by phase control with R and RL loads - Expression for rms output voltage.

UNIT – IV

DC–DC Converters

Basic Chopper Operation with R and RL load–Step-up chopper –Classification of Choppers –Time Ratio Control –Current Limit Control.

UNIT - V

DC–AC Converters

Introduction - Single-phase half bridge and full bridge inverters with R and RL loads – Voltage control of Single-phase inverters –PWM inverters - Sinusoidal Pulse Width Modulation.

Text Books:

1. Power Electronics – by P.S.Bhimbra - Khanna Publishers.
2. Power Electronics: Essentials & Applications by L.Umanand - Wiley - Pvt. Limited - India - 2009.

Reference Books:

1. Power Electronics: Converters - Applications and Design by Ned Mohan - Tore M Undeland - William P Robbins - John Wiley & Sons.
2. Power Electronics: Circuits - Devices and Applications – by M. H. Rashid - Prentice Hall of India - 2nd edition - 1998
3. Power Electronics: by Daniel W.Hart - Mc Graw Hill.

Online Learning Resources:

1. https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007
2. https://archive.nptel.ac.in/courses/108/101/108101126

Minor Engineering	L	T	P	C
	3	0	0	3

BASICS OF ELECTRIC DRIVES AND APPLICATIONS

Pre-requisite:

Electrical Machines, Control Systems and Fundamentals of Power Electronics.

Course Objectives:

To make the students learn about:

- To learn the fundamentals of electric drive and different electric braking methods.
- To analyze the operation of single phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
- To discuss the DC-DC converter control of dc motors in various quadrants.
- To understand the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
- To understand the speed control mechanism of synchronous motors

Course Outcomes: After the completion of the course the student should be able to:

CO1: Explain the fundamentals of electric drive and different electric braking methods.

CO2: Analyze the operation of single-phase converter fed dc motors and four quadrant operations of dc motors using dual converters.

CO2: Describe the converter control of DC motors in various quadrants of operation

CO3: Know the concept of speed control of induction motor by using AC voltage controllers.

CO5: Explains the speed control mechanism of synchronous motors

UNIT - 1

Fundamentals of Electric Drives

Electric drive and its components– Fundamental torque equation – Load torque components – Classification of load torques –Load equalization– Four quadrant operation of drive (hoist control).

UNIT - 2

Controlled Converter Fed DC Motor Drives

1-phase half and fully-controlled converter fed separately and self-excited DC motor drive – Output voltage and current waveforms and their expressions – Speed-torque characteristics.

UNIT - 3

DC–DC Converters Fed DC Motor Drives

Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous current operation -Output voltage and current waveforms – Speed–torque characteristics.

UNIT - 4

Control of 3-phase Induction motor Drives

Stator voltage control using 3-phase AC voltage regulators – Waveforms –Speed torque characteristics– Variable Voltage Variable Frequency control. Static rotor resistance control– Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics.

UNIT - 5

Control of Synchronous Motor Drives

Separate control of synchronous motor – self-control of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive (qualitative treatment only).

Text Books:

1. Fundamentals of Electric Drives, G. K. Dubey, Narosa Publications, 2002.
2. Power Semiconductor Drives, S.B.Dewan,G.R.Slemon, A.Straughen, WileyIndia, 2009.

Reference Books:

1. Electric Motors and Drives Fundamentals- Types and Apllications - by Austin Hughes and Bill Drury - Newnes.4th edition - 2013.
2. Thyristor Control of Electric drives – VedamSubramanyam Tata McGraw Hill Publications- 1987.
3. Power Electronic Circuits- Devices and applications by M.H.Rashid - PHI - 3rd edition - 2009.
4. Power Electronics handbook by Muhammad H.Rashid- Elsevier - 2nd edition - 2010.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104140
2. https://nptel.ac.in/courses/108104011

Minor Engineering	L	T	P	C
	3	0	0	3

FUNDAMENTALS OF UTILIZATION OF ELECTRICAL ENERGY

Pre Requisites:
Electrical Machines, Power Electronics and Drives and Power Systems –II.

Course Objectives:
To make the students learn about:

- Able to maintain electric drives used in an industries.
- Able to identify a heating/ welding scheme for a given application.
- Able to maintain/ Trouble shoot various lamps and fittings in use.
- Able to figure-out the different schemes of traction schemes and its main components.
- Able to design a suitable scheme of speed control for the traction systems.

Course Outcomes:
After learning the course, the students should be able to

CO1: Get knowledge of electric drives used in an industries
CO2: Get knowledge of principle of electric heating, welding and its applications and design simple resistance furnaces.
CO3: Design residential illumination schemes.
CO4: Get knowledge of electric braking methods, control of traction motors
CO5: Calculate tractive effort, power, acceleration and velocity of traction.

UNIT – I
Electric Drives
Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise – cooling and heating time constant, applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT – II
Electric Heating and Welding
Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating. Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT – III
Fundamentals of Illumination
Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere,sources of light. Discharge lamps, MV and SV lamps – comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT – IV

Electric Traction – I

System of electric traction and track electrification, Review of existing electric traction systems in India, Special features of traction motor, methods of electric braking-plugging,rheostatic braking and regenerative braking.

UNIT – V

Electric Traction –II

Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves. Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight, braking retardation, and coefficient of adhesion.

Text Books:

1. Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai & Co., 2004.
3. Utilization of Electrical Power including Electric drives and Electric traction – byJ.B.Gupta, S.K. Kataria& Sons.

Reference Books:

1. Generation, distribution and utilization of electrical energy, C.L Wadhwa, Wiley Eastern Limited,1993.
2. Electrical Power, S. L. Uppal, Khanna pulishers,1988.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104140
2. https://nptel.ac.in/courses/108105060

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN (AUTONOMOUS)
BHIMAVARAM - 534202
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

EEE Course Structure – R23

Honors (For EEE Students)

Power Systems

S.No.	Course Code	Subjects	L	T	P	C
1	23EEHT01	Electric Power Quality	3	0	0	3
2	23EEHT02	Smart Grid Technologies	3	0	0	3
3	23EEHT03	Power System Deregulation	3	0	0	3
4	23EEHT04	Real Time Control of Power Systems	3	0	0	3
5	23EEHT05	Advanced Power Systems Protection	3	0	0	3
6	23EEHT06	Flexible AC Transmission Systems	3	0	0	3
7	23EEHT07	AI applications in Power Systems	3	0	0	3
8	23EEHL01	Power Systems Lab	0	0	3	1.5
9	23EEHL02	Advanced Power Systems Simulation Lab	0	0	3	1.5

Power Electronics

S.No.	Course Code	Subjects	L	T	P	C
1	23EEHT08	Special Electrical Machines	3	0	0	3
2	23EEHT09	Machine Modeling and Analysis	3	0	0	3
3	23EEHT10	Power Electronic Converters	3	0	0	3
4	23EEHT11	Power Quality and Custom Power Devices	3	0	0	3
5	23EEHT12	Power Electronics for Renewable Energy systems	3	0	0	3
6	23EEHT13	Industrial Applications of Power Electronic Converters	3	0	0	3
7	23EEHT14	Advanced Electrical Drives	3	0	0	3
8	23EEHT15	FACTS Controllers	3	0	0	3
9	23EEHL03	Power Converters Laboratory	0	0	3	1.5
10	23EEHL04	Electric Drives Laboratory	0	0	3	1.5
11	23EEHL05	Renewable Technologies Laboratory	0	0	3	1.5
12	23EEHL06	Electric Vehicles Laboratory	0	0	3	1.5

Honors Engineering (Power Systems)	L	T	P	C
	3	0	0	3

ELECTRIC POWER QUALITY

Pre-requisite: Power systems, Power Electronics.

Course Objectives:

- To learn effects responsible to power quality phenomena.
- To learn about the transient over voltages and over voltage protection.
- To identify sources for long duration over voltages and understand the working of voltage regulating equipment.
- Learn the effects of harmonic distortion on different electrical equipment.
- To explain the relationship between distributed generation and power quality and importance of monitoring.

Course Outcomes:

After the completion of the course the student should be able to:

CO 1: Differentiate between different types of power quality problems.
CO 2: Explain the sources transient over voltages and over voltage protection.
CO 3: Explain the principles long duration over voltages and voltage regulation improvement methods.
CO 4: Analyze voltage distortion and current distortion and their indices.
CO 5: Know the concepts of inter facing the distributed generation technologies and power quality monitoring.

UNIT - I

Introduction

Overview of power quality – Concern about the power quality – General classes of power quality and voltage quality problems – Transients – Long–duration voltage variations – Short–duration voltage variations – Voltage unbalance – Waveform distortion – Voltage fluctuation – Power frequency variations – Voltage Sag – Voltage Swell.

UNIT - II

Transient over Voltages and over voltage protection

Sources of Transient over voltages - Principles of over voltage protection- Devices for over voltage protection – Utility Capacitor Switching Transients - Utility System Lightning Protection – Managing Ferro resonance – Switching Transient Problems with Loads.

UNIT - III

Long – Duration Voltage Variations and voltage regulation

Principles of regulating the voltage – Devices for voltage regulation – Utility voltage regulator application – Capacitor for voltage regulation – End user capacitor application – Regulating utility voltage with distributed resources – voltage flicker.

UNIT - IV

Harmonic distortion and solutions

Voltage distortion verses current distortion –Harmonic indices: THD - TDD and True Power Factor– Sources of harmonics – Effect of harmonic distortion – Impact on capacitors, transformers, motors and meters – Concept of Point of common coupling – Passive and active filtering – Numerical problems.

UNIT - V

Distributed Generation and Monitoring

Resurgence of distributed generation – DG technologies – Interface to the utility system – Power quality issues and operating conflicts – DG on low voltage distribution networks.

Monitoring

Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data.

Textbooks:

1. Electrical Power Systems Quality - Dugan R C - McGranaghan M F - Santoso S - and Beaty H W - Second Edition - McGraw–Hill - 2012 - 3rd edition.
2. Electric power quality problems –M.H.J.Bollen IEEE series-Wiley india publications - 2011.
3. Power Quality Primer - Kennedy B W - First Edition - McGraw–Hill - 2000.

Reference Books:

1. Understanding Power Quality Problems: Voltage Sags and Interruptions - Bollen M HJ - First Edition - IEEE Press; 2000.
2. Power System Harmonics - Arrillaga J and Watson N R - Second Edition -John Wiley& Sons - 2003.
3. Electric Power Quality control Techniques - W. E. Kazibwe and M. H. Sendaula - Van Nostrad Reinhold - New York.
4. Power Quality C.Shankaran - CRC Press - 2001
5. Harmonics and Power Systems –Franciso C.DE LA Rosa–CRC Press (Taylor & Francis)
6. Power Quality in Power systems and Electrical Machines–EwaldF.fuchs-Mohammad A.S.Masoum–Elsevier.

Online Learning Resources:

1. https://nptel.ac.in/courses/108102179
2. https://nptel.ac.in/courses/108107157

Honors Engineering (Power Systems)	L	T	P	C
	3	0	0	3

SMART GRID TECHNOLOGIES

Pre-requisite: Basic Electrical Engineering, Power Systems, Signals & Systems

Course Objectives:

- To introduce students to the architecture, functions, and components of smart grids.
- To explore the communication and control technologies integral to smart grids.
- To examine the integration of renewable energy and distributed generation.
- To understand demand-side management and smart grid applications.
- To highlight challenges related to security, privacy, and regulation in smart grid implementation.

Course Outcomes: At the end of the course, student will be able to

CO 1: Understand the structure and benefits of smart grids.
CO 2: Analyze communication technologies and protocols in smart grids.
CO 3: Evaluate smart grid components like smart meters, energy storage, and distributed generation.
CO 4: Apply concepts in demand response and load management.
CO 5: Identify and address cyber security challenges in smart grids

UNIT – 1

Introduction to Smart Grids

Evolution of Power Grids: Traditional Grids vs. Smart Grids-Key Characteristics of Smart Grids: Efficiency, Reliability, Flexibility-Smart Grid Architecture: Components and Functions-Generation, Transmission, Distribution, and Consumption Sectors-Smart Grid Vision, Goals, and Benefits-Economic, Environmental, and Operational Benefits-Role of ICT in Smart Grids: Data Management and Communication Infrastructure.

UNIT – 2

Smart Grid Communication and Networking:

Communication Technologies for Smart Grids:Wired (Ethernet, Fiber Optics) and Wireless (Zigbee, Wi-Fi, Cellular)-Power Line Communication (PLC) for Smart Metering and Control-Smart Metering Systems: Functionality and Communication Protocols: Advanced Metering Infrastructure (AMI)-Protocols in Smart Grids: IEC 61850, Modbus, DNP3, and others-Data Acquisition and Control Systems in Smart Grids-Integration of Internet of Things (IoT) in Smart Grid Communication.

UNIT – 3

Smart Grid Components and Technologies

Smart Meters: Role, Functionality, and Types-Energy Storage Systems: Batteries, Supercapacitors, Flywheels, and Their Role in Grid Stability-Distributed Generation and Renewable Energy Integration: Solar, Wind, and Microgrids-Energy Management Systems

(EMS): Load Flow Analysis and Optimization Techniques-Smart Grid Automation: SCADA Systems, Automated Metering, and Fault Detection-Real-Time Monitoring and Control: Techniques and Technologies.

UNIT – 4

Integration of Renewable Energy and Demand-Side Management

Challenges in Integrating Renewable Energy into the Grid: Variability, Intermittency, and Storage Solutions-Role of Smart Grids in Renewable Energy Integration: Grid Stability and Power Quality, Wind and Solar Power Forecasting Techniques-Demand-Side Management (DSM) and Smart Appliances: Load Shifting, Load Shedding, and Peak Demand Reduction, Role of Consumers in Grid Optimization (Smart Home Technologies)-Electric Vehicle (EV) Integration and Smart Charging Infrastructure.

UNIT – 5

Security, Privacy, and Policy Issues in Smart Grids

Cyber security in Smart Grids: Threats, Vulnerabilities, and Risks :Cyber Attacks on Critical Infrastructure-Privacy Concerns and Data Protection in Smart Grid Systems: Consumer Data, Smart Meters, and Privacy Regulations-Authentication, Authorization, and Secure Communication Protocols: IEC 62351 Security Standards-Smart Grid Regulations and Policies: Global Standards and Frameworks.

NIST, IEC, IEEE Standards, Policy Challenges in Grid Modernization and Renewable Energy Adoption-Future Trends and Challenges in Smart Grid Development.

Textbooks:

1. "Smart Grids: Infrastructure, Technology, and Solutions" by Stuart Borlase
2. "Smart Grid: Fundamentals of Design and Analysis" by James A. Momoh
3. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
4. Smart Grid Security: An End-to-End View of Security in the New Electric Grid" by Tony Flick and Justin Morehouse

Reference Books:

1. "Smart Grid: Technology and Applications" by JanakaEkanayake, KithsiriLiyanage, Jiangzhou Wang, Nick Jenkins, and Xiangyu Zhang
2. "The Smart Grid: Enabling Energy Efficiency and Demand Response" by Galina P. L. P. Shapiro.
3. "The Smart Grid: Enabling Energy Efficiency and Demand Response" by Clark W. Gellings.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/107/108107113

Honors Engineering (Power Systems)	L	T	P	C
	3	0	0	3

POWER SYSTEM DEREGULATION

Pre-requisite: Power System Analysis, Power System Operation and Control.

Course Objectives:

- To familiarize the students with concepts and need for deregulated power systems.
- To impart the knowledge of power market development in India and across the world.
- To understand the key factors in equipment specification and system design.
- To learn about Ancillary Services Management
- To familiarize with the Electric Energy Trading.

Course Outcomes: At the end of the course, student will be able to

CO 1: Illustrate the operation of deregulated electricity market systems and typical issues in electricity markets

CO 2: Analyze various types of electricity market operational and control issues using new mathematical models.

CO 3: Summarize power wheeling transactions and congestion management.

CO 4: Analyze impact of ancillary services.

CO 5: Understand the Power market scenarios and Electric Energy Trading in the World.

UNIT – 1

Deregulation of The Electric Supply Industry

Introduction, concept of Deregulation, Different entities in deregulated electricity markets; Independent System Operator (ISO), Market Operator; Background to Deregulation and the Current Situation Around the World; Benefits from a Competitive Electricity Market; After-Effects of Deregulation.

UNIT – 2

Power System Operation in Competitive Environment

Introduction, Role of the Independent System Operator; Operational planning activities of ISO – in Pool and Bilateral Markets; Operational planning activities of a Genco – in Pool Markets, Bilateral Markets; Market participation issues; Unit Commitment in Deregulated Environment; Competitive Bidding.

UNIT – 3

Transmission Open Access and Pricing Issues

Introduction, Power Wheeling; Transmission Open Access; Cost components in transmission; Pricing of Power Transactions – Embedded Cost Based and Incremental Cost Based Transmission Pricing. Security Management in Deregulated Environment; Congestion Management in Deregulation.

UNIT – 4

Ancillary Services Management

General description of some ancillary services; Ancillary Service Management in various countries; Check-List of Ancillary Services Recognized by Various markets; Reactive Power as an Ancillary service.

UNIT – 5

Electric Energy Trading

Introduction, Essence of Electric Energy Trading, Energy Trading Framework, Derivative Instruments of Energy Trading, Portfolio Management, Energy Trading Hubs, Brokers in Electricity Trading, Green Power Trading.

Text Books:

1. Operation of restructured power systems – K. Bhattacharya, M.H.J. BollenandJ.E. Daalder, Springer(For Units – 1,2.3, and 4)
2. Market operations in electric power systems – M. Shahidehpour, H. YaminandZ. Li,Wiley(For Units – 1 and 5)

Reference Books:

1. Power System Economics: Designing markets for electricity – S. Stoft, wiley.
2. LoiLeiLai, "PowerSystemRestructuringandDeregulation", 1st edition, JohnWiley & SonsLtd., 2012.

Online Learning Resources:

1. https://nptel.ac.in/courses/108101005

Honors Engineering (Power Systems)	L	T	P	C
	3	0	0	3

REAL TIME CONTROL OF POWER SYSTEMS

Pre-requisite: Power systems, Power System Analysis and Protection

Course Objectives:

- To understand the importance of state estimation in power systems.
- To know the importance of security and contingency analysis.
- To understand SCADA, its objectives and its importance in power systems.
- To know the significance of voltage stability analysis.
- To provide an in-depth understanding of the operation of deregulated electricity market systems.

Course Outcomes:

At the end of the course, students will be able to:

CO 1: Illustrate different types of state estimations
CO 2: Describe security and contingency evaluation
CO 3: Demonstrate the computer control of power systems
CO 4: To classify and compare the voltage stability issues.
CO 5: Describe the various conditions of deregulation

UNIT – I:

State Estimation: Different types of State Estimations, Theory of WLS state estimation, sequential and non-sequential methods to process measurements. Observability, Pseudo measurements, Bad data detection, identification and elimination.

UNIT – II:

Security and Contingency Evaluation : Security concept, Security Analysis and monitoring, Contingency Analysis for Generator and line outages by iterative linear power flow method, Fast Decoupled model, and network sensitivity methods.

UNIT – III:

Computer Control of Power Systems: Need for real time and computer control of power systems, operating states of a power system, Supervisory Control And Data Acquisition (SCADA) systems implementation considerations, energy control centers, software requirements for implementing the above functions.

UNIT – IV:

Voltage Stability, voltage collapse, and voltage security, relation of voltage stability to rotor angle stability. Voltage stability analysis Introduction to voltage stability analysis `P-V' curves and `Q-V' curves, voltage stability in mature power systems, long-term voltage stability, power flow analysis for voltage stability, voltage stability static indices and Research Areas.

UNIT – V:

Need and conditions for deregulation. Introduction of Market structure, Market Architecture, Spot market, forward markets and settlements. Review of Concepts marginal cost of generation, least-cost operation, incremental cost of generation. Power System Operation.

Text Books:

1. Allen J. Wood and Bruce F. Wollenberg: Power Generation operation and control, John Wiley & Sons, 1984.
2. John J.Grainger and William D.Stevenson, Jr.: Power System Analysis, McGraw-Hill, 1994, International Edition
3. PrabhaKundur: Power System Stability and Control -, McGraw Hill, 1994.
4. Steven stoft: Power System Economics-Designing Markets for Electricity, IEEE Press and Wiley – Interscience -2002.

Reference Books:

1. R.N.Dhar : Computer-Aided Power Systems Operation and Analysis, Tata McGraw Hill, 1982.
2. L.P.Singh: Advanced Power System Analysis and Dynamics, Wiley Eastern Ltd. 1986.

Online Learning Resources:

1. https://nptel.ac.in/courses/108104191

Honors Engineering (Power Systems)	L	T	P	C
	3	0	0	3

ADVANCED POWER SYSTEMS PROTECTION

Pre-requisite: Basic Concepts of Power Electronics, Electronic circuits, and Power Systems.

Course Objectives:

- To analyze the static relay components and understand the role of components in static relay operation.
- To understand the fundamentals of amplitude and phase comparators and study the different types of comparators and apply comparator techniques in static relays.
- To explore the different types of static relays and understand the working mechanisms of each type in power system protection.
- To explain the importance and working principles of Pilot Relaying Schemes and study the various pilot relaying methods.
- To study the working of microprocessor-based relays and numerical relays and analyze the architecture and components of numerical relays

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the fundamentals of static relays and analyze the working of static relay components.

CO2: Analyze and compare the operation of comparators and select suitable comparator techniques.

CO3: Explain the principles of static over current relays and apply in power system protection.

CO4: Apply pilot relaying in power system protection and evaluate the performance of pilot relaying schemes.

CO5: Illustrate the microprocessor and numerical relay protection

UNIT – 1

Static Relays classification and Tools: Comparison of Static with Electromagnetic Relays, Basic classification, Level detectors and Amplitude and phase Comparators – Duality – Basic Tools – Schmitt Trigger Circuit, Multivibrators, Square wave Generation – Polarity detector – Zero crossing detector – Thyristor and UJT Triggering Circuits. Phase sequence Filters – Speed and reliability of static relays.

UNIT – 2

Amplitude and Phase Comparators (2 Input): Generalized equations for Amplitude and Phase comparison – Derivation of different characteristics of relays – Rectifier Bridge circulating and opposed voltage type amplitude comparators – Averaging & phase splitting type amplitude comparators – Principle of sampling comparators.

Phase Comparison: Block Spike and phase Splitting Techniques – Transistor Integrating type, phase comparison, Rectifier Bridge Type Comparison – Vector product devices.

UNIT – 3

Static over current (OC) relays – Instantaneous, Definite time, Inverse time OC Relays, static distance relays, static directional relays, static differential relays, measurement of sequence impedances in distance relays, multi input comparators, elliptic & hyperbolic characteristics, switched distance schemes, Impedance characteristics during Faults and Power Swings.

UNIT – 4

Pilot Relaying Schemes: Wire Pilot Protection: Circulating current scheme – Balanced voltage scheme – Transley scheme – Half-wave comparison scheme - Carrier Current Protection Schemes, relative merits & demerits: Phase comparison protection – Carrier aided distance protection – transfer scheme, blocking schemeand acceleration scheme.

UNIT – 5

Microprocessor based relays andNumerical Protection: Over current relays – impedance relay – directional relay – reactance relay.

Numerical Protection: Numerical relay - numerical relaying algorithms -mann-morrison technique - Differential equation technique and discrete fourier transform technique - numerical over current protection - numerical distance protection.

Text Books:

1. Power System Protection with Static Relays – by TSM Rao, TMH.
2. Power system protection & switchgear by Badri Ram & D N viswakarma, TMH.

Reference Books:

1. Protective Relaying Vol-II Warrington, Springer.
2. Art & Science of Protective Relaying - C R Mason, Willey.
3. Power System Stability KimbarkVol-II, Willey.
4. Electrical Power System Protection –C.Christopoulos and A.Wright- Springer
5. Protection & Switchgear –BhaveshBhalaja, R.PMaheshwari, NileshG.Chothani-Oxford publisher

Online Learning Resources:

https://nptel.ac.in/courses/108104191

Honors Engineering (Power Systems)	L	T	P	C
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FLEXIBLE AC TRANSMISSION SYSTEMS

Pre-requisite: Fundamentals of Electrical Engineering, Power systems, Power Electronics

Course Objectives:

- To understand the role of FACTS controllers and their impact on improving the performance, stability, and efficiency of transmission systems.
- To analyze Compensation Techniques to explore the effects of static shunt and series compensation techniques on voltage regulation, power flow control, and system stability.
- To study Shunt Compensation Devices for Investigating the working principles and applications of Static Var Compensator (SVC) and Static Synchronous Compensator (STATCOM) for reactive power compensation.
- To select FACTS Devices by assess various power system scenarios and determine the most suitable FACTS device for specific applications to enhance power transfer capability.
- To examine Advanced Controllers by understanding the principles of operation, control strategies, and applications of Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC) for comprehensive power flow management.

Course Outcomes:

After the completion of the course the student should be able to:

CO1: Know the performance improvement of transmission system with FACTS.
CO2: Demonstrate the effect of static shunt and series compensation.
CO3: Illustrate the use of SVC and STATCOM for Shunt Compensations
CO4: Determine an appropriate FACTS device for different types of applications.
CO5: Know the principle of operation and various controls of UPFC& IPFC

UNIT – I:

FACTS concepts, Transmission interconnections, power flow in an AC System, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS controllers.

UNIT – II:

Static shunt compensation: Objectives of shunt compensation, midpoint voltage regulation, voltage instability prevention, improvement of transient stability, Power oscillation damping, methods of controllable VAr generation, variable impedance type static VAr generation, switching converter type VAr generation, hybrid VAr generation. Basic concept of voltage and current source converters, comparison of current source converters with voltage source converters.

UNIT – III:

SVC and STATCOM: The regulation slope, Transfer function and dynamic performance, Transient stability enhancement and power oscillation damping, Operating point control and summary of compensation control.

UNIT – IV:

Static series compensation: Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, functional requirements. GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GSC, TSSC and TCSC.

UNIT – V:

Unified Power Flow Controller: Basic operating principle, Conventional transmission control capabilities, Independent real and reactive power flow control, Comparison of the UPFC to series compensators and phase angle regulators. Inter line Power Flow Controller (IPFC) - Introduction, operation and applications.

Text Books:

1. "Understanding FACTS Devices" N.G.Hingorani and L.Guygi, IEEE Press. Indian Edition is available:--Standard Publications

Reference Books:

1. Sang.Y.HandJohn.A.T, "Flexible AC Transmission systems" IEEE Press (2006).
2. HVDC & FACTS Controllers: applications of static converters in power systems- Vijay K.Sood- Springer publishers.

Online Learning Resources:

1. https://nptel.ac.in/courses/108107114
2. https://nptel.ac.in/courses/117103488

Honors Engineering (Power Systems)	L	T	P	C
	3	0	0	3

AI APPLICATIONS IN POWER SYSTEMS

Pre-requisites:

Fundamentals of Power systems, Artificial Intelligence, Optimization Techniques

Course Objectives:

- Understand the fundamentals of Artificial Neural Networks (ANN), including key terminologies, neuron models, activation functions, and learning strategies.
- Explore and apply advanced ANN paradigms such as Back Propagation, Radial Basis Function networks, and Kohonen's Self-Organizing Maps.
- Study classical and fuzzy sets, their properties, operations, and applications in handling uncertainty and decision-making.
- Design and implement Fuzzy Logic Controllers (FLC) for control systems using fuzzification, inference, and defuzzification techniques.
- Apply AI techniques like back propagation and fuzzy logic in real-world applications, such as load forecasting and load frequency control in power systems.

Course Outcomes: At the end of the course, student will be able to

CO 1: Describe the fundamental concepts and components involved in the functioning of ANN and Fuzzy Logic systems.

CO 2: Explain the functionality of different ANN models (e.g., perceptron, back propagation) and fuzzy set operations.

CO 3: Apply ANN algorithms and fuzzy logic techniques to solve practical problems like load forecasting and control systems.

CO 4: Analyze the performance and limitations of various ANN models and fuzzy controllers in different applications.

CO 5: Design and implement ANN-based solutions and fuzzy logic controllers for engineering applications, suchas power system control and frequency regulation.

UNIT– 1

Introduction

Artificial Neural Networks (ANN) – Humans and computers – Biological Neural Networks – ANN Terminology – Models of Artificial neuron – activation functions –typical architectures – biases and thresholds – learning strategy(supervised, unsupervised and reinforced) learning rules, perceptron training and classification using Discrete and Continuous perceptron algorithms, limitations and applications of perceptron training algorithm– linear separability and non-separability with examples.

UNIT– 2

ANN Paradigms

Generalized delta rule – Back Propagation algorithm- Radial Basis Function (RBF) network. Kohonen's self-organizing feature map (KSOFM), Learning Vector Quantization (LVQ) – Functional Link Networks (FLN) – Bidirectional Associative Memory (BAM) – Hopfield Neural Network.

UNIT– 3

Classical and Fuzzy Sets

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions

UNIT– 4

Fuzzy Logic Controller (FLC)

Fuzzy logic system components: Fuzzification, Inference engine (development of rule base and decision-making system), Defuzzification to crisp sets- Defuzzification methods.

UNIT– 5

Application of AI Techniques

Load forecasting using back propagation algorithm –load flow studies using back propagation algorithm, single area and two area load frequency control using fuzzy logic.

Text Books:

1. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.
2. Fuzzy logic with Fuzzy Applications – T.J Ross – McGraw Hill Inc, 1997.

Reference Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by RajasekharanandPai – PHI Publication.
2. Introduction to Neural Networks using MATLAB 6.0 by S N Sivanandam,SSumathi,S N Deepa TMGH.
3. Introduction to Fuzzy Logic using MATLAB by S N Sivanandam,SSumathi,S N Deepa Springer, 2007.

Online Learning Resources:

1. https://nptel.ac.in/courses/127105006

Honors Engineering (Power Systems)	L	T	P	C
	0	0	3	1.5

POWER SYSTEMS LAB

Course Objectives:

- To Understand and determine sequence impedances of an alternator using direct methods and fault analysis techniques, including the application of sequence voltages.
- To Measure sequence impedance of three-phase transformers, analyze poly-phase connections of single-phase transformers, and determine the equivalent circuit of a three-winding transformer.
- To Study the Ferranti effect, measure ABCD parameters, and evaluate the performance of long transmission lines with and without compensation, including shunt and reactor compensation techniques.
- To determine differential and percentage bias relay operations, analyze overcurrent relay characteristics, and understand relay-based protection schemes for generators and transformers.
- To Apply theoretical concepts to practical scenarios, conduct experiments to measure system parameters, and analyze the impact of different protection and compensation techniques on power system performance.

Course Outcomes:

After the completion of the course, the student should be able to:

CO 1: Calculate the sequence impedances of the synchronous machine.
CO 2: Calculate the sequence impedances and explain the connections of the transformer.
CO 3: Describe the Ferranti effect and compensation in transmission lines.
CO 4: Analyze the performance and importance of transmission line parameters.
CO 5: Analyze the operation of various protection relays.

List of experiments

Any 10 of the following experiments are to be conducted:

1. Determination of Sequence Impendences of an Alternator by direct method.
2. Determination of Sequence impedances of an Alternator by fault Analysis.
3. Measurement of sequence impedance of a three phase transformer
    a) By application of sequence voltage.
    b) Using fault analysis.
4. Poly-phase connection on three single phase transformers and measurement of phase angle.
5. Determination of equivalent circuit of 3-winding Transformer.

6. Study of Ferranti effect in long transmission line.
7. Measurement of ABCD parameters on transmission line.
8. Performance of long transmission line without compensation.
9. To determine and verify the reactor compensation of transmission line.
10. Performance of long transmission line with shunt compensation.
11. To study the differential and percentage bias integrated relay operations.
12. Performance characteristics of Over current relay
13. To study the protection of generator and transformer.

Honors Engineering (Power Systems)	L	T	P	C
	0	0	3	1.5

ADVANCED POWER SYSTEMS SIMULATION LAB

Course Objectives:

- To utilize advanced analytical and computational approaches to evaluate and enhance the stability of multi-machine power systems.
- To apply optimal power flow techniques to improve system efficiency and analyze unit commitment strategies for cost-effective power generation.
- To conduct load flow studies and assess contingency scenarios to ensure the reliability and resilience of power systems.
- To implement state estimation techniques and power quality improvement strategies to maintain system reliability and performance.
- To analyze the stability of Single Machine Infinite Bus (SMIB) systems under different conditions, with and without controllers, to improve system dynamics.

Course Outcomes:

After the completion of the course the student should be able to:

CO 1: Analyze the multi machine stability by advanced approaches.
CO 2: Calculate optimal power flows and analyze unit commitment by optimal methods.
CO 3: Analyze the load flow and contingency cases of power systems
CO 4: Illustrate the state estimations and power quality improvements
CO 5: Analyze the stability of SMIB with and without controllers

List of experiments

Any 10 of the following experiments are to be conducted:

1. Multi Machine Transient stability using modified Euler's method.
2. Multi Machine Transient stability using R-K 2nd order method.
3. Optimal Power Flow using Newton's method.
4. Unit Commitment using dynamic programming.
5. Optimal Power Flow using Genetic Algorithm.
6. Distribution system load flow solution using Forward-Backward sweep Method.
7. Contingency analysis of a Power System
8. State estimation of a power system using Weighted Least Squares Error Method
9. Stability Analysis of SMIB using State space approach without PSS controller
10. Stability Analysis of SMIB using State space approach with PSS controller
11. Power Quality improvement using D-STATCOM

Track-2: Power Electronics

Honors Engineering (Power Electronics)	L	T	P	C
	3	0	0	3

Special Electrical Machines

Pre-requisite:

Basic knowledge on magnetic circuits and electrical machines.

Course Objective:

- To describe the operation and characteristics of permanent magnet dc motor.
- To understand the performance and control of stepper motors, and their applications.
- To explain operation and control of switched reluctance motor.
- To distinguish between brush dc motor and brush less dc motor**.**
- To explain the theory of travelling magnetic field and applications of linear motors.

Course Outcomes:

After the completion of the course the student should be able to:

CO 1: Demonstrate the merits of PM motors.
CO 2: Choose best control scheme for stepper motors.
CO 3: Construct the various converter circuits for Switched Reluctance Motors.
CO 4: Analyse the characteristics of Brushless dc Motor.
CO 5: Understand the applications and operation of Linear Induction Motors.

UNIT - I

Permanent Magnet Materials and PMDC motors

Introduction - classification of permanent magnet materials used in electrical machines - minor hysteresis loop and recoil line - Stator frames of conventional dc machines - Development of electronically commutated dc motor from conventional dc motor – Permanent magnet materials and characteristics - B-H loop and demagnetization characteristics-high temperature effects-reversible losses - Irreversible losses - Mechanical properties - handling and magnetization - Application of permanent magnets in motors - power density - operating temperature range - severity of operation duty- Hysteresis - Eddy current Motors.

UNIT - II

Stepper Motors

Principle of operation of Stepper Motor – Constructional details - Classification of stepper motors – Different configuration for switching the phase windings - Control circuits for stepper motors – Open loop and closed loop control of two phase hybrid stepping motor.

UNIT - III

Switched Reluctance Motors

Construction and Principle of operation of Switched Reluctance Motor – Comparison of conventional and switched reluctance motors – Design of stator and rotor pole arcs.
Torque producing principle and torque expression – Different converter configurations for SRM – Drive and power circuits for SRM – Position sensing of rotor – Applications of SRM.

UNIT - IV

Permanent Magnet Brushless DC Motor

Principle of operation of BLDC motor - Types of constructions - Surface mounted and interior type permanent magnet BLDC Motors - Torque and EMF equations for Square wave & Sine wave for PMBLDC Motor – Torque - Speed characteristics of Square wave & Sine wave for PMBLDC Motor - Merits & demerits of Square wave & Sine wave for PMBLDC Motor - Performance and efficiency – Applications.

UNIT - V

Linear Induction Motors (LIM)

Construction– principle of operation – Double sided LIM from rotating type Induction Motor – Schematic of LIM drive for traction – Development of one sided LIM with back iron - equivalent circuit of LIM.

Text Books:

1. Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
2. Special electrical Machines, K.VenkataRatnam, University press, 2009, New Delhi.

Reference Books:

1. E. G. Janardhanan, 'Special Electrical Machines' PHI Learning Private Limited.
2. Krishnan, Ramu. Switched reluctance motor drives: modeling, simulation, analysis, design, and applications. CRC press, 2017.
3. Krishnan, Ramu. Permanent magnet synchronous and brushless DC motor drives. CRC press, 2017.

Online Learning Resources:

1. https://nptel.ac.in/courses/108102156

Honors Engineering (Power Electronics)	L	T	P	C
	3	0	0	3

Machine Modeling and Analysis

Pre-requisites: Electrical Circuits and Electrical Machines

Course Objectives:

- Analyze the performance of electrical machines under both steady-state and transient conditions
- Apply the transformation and derive the mathematical model of three phase Induction/synchronous motors
- Learn the dynamic modeling of special machines for the performance analysis

Course Outcomes:

At the end of the course, student will be able to

CO1: Develop mathematical modeling of DC machines for steady state & transient analysis.
CO2: Illustrate the phase/reference frame transformations and Develop mathematical modeling of three phase induction motor.
CO3: Interpret the knowledge of reference frame theory and obtain d-q axis modeling of induction Motorsin different reference frames.
CO4: Distinguish different inductances of a synchronous motor and obtain synchronous motor modeling inthe rotor's dq_0 reference frame.
CO5: Develop the mathematical models of special electrical machines.

UNIT– 1

DC Motor Modeling :

Importance of mathematical modeling of electrical machines, Mathematical model of separately excited D.C. motor and D.C. Series motor in state variable form – Mathematical model of D.C. shunt motor and D.C. Compound motor in state variable form, Steady state analysis – Transient state analysis, Transfer function of the D.C. motor, Sudden application of inertia load.

UNIT– 2

Reference Frame Theory & 3-phase Induction Motor dq model:

Linear transformation – Phase transformation (abc to αβ0) – Power equivalence, Active transformation (αβ0 to dq0), transformations in complex plane, Commonly used reference frames and transformation between reference frames, Circuit model of a 3 phase Induction motor – Flux linkage equation – dq transformation of flux linkages in the complex plane – voltage equations

UNIT– 3

Modeling of 3-phase Induction motor in various reference frames

Voltage equation transformation to a synchronous reference frame, dq model of induction motor in

the stator reference frame, rotor reference frame and arbitrary reference frame, power equation, electromagnetic torque equation, state space model in induction motor with flux linkages as variables and current-flux variables

UNIT– 4

Modeling of 3-phase Synchronous Motor

Synchronous machine inductances – Circuits model of a 3-phase synchronous motor – derivation of voltage equations in the rotor's dq0 reference frame electromagnetic torque – State space model with flux linkages as variables.

UNIT– 5

Special Machines:

Modeling of Permanent Magnet Synchronous motors – Modeling of Brushless DC Motor, Analysis of Switch Reluctance Motors.

Text Books

1. Generalized theory of Electrical Machines - Fifth edition, Khanna Publishers P. S. Bimbhra, 1985.
2. AC Motor control and electric vehicle applications – KwangHee Nam – CRC press, Taylor & Francis Group, 2010

Reference Books:

1. Electric Motor Drives - Modeling, Analysis& control - R. Krishnan- Pearson Publications-1st edition -2002.
2. Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design, and Applications - R.Krishnan , CRC Press, Year: 2001
3. Analysis of Electric Machinery and Drive Systems, 3rd Edition-Wiley-IEEE Press- Paul Krause, Oleg Wasynczuk, Scott D. Sudhoff, Steven Pekarek, Junr2013..

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/106/108106023/

Honors Engineering (Power Electronics)	L	T	P	C
	3	0	0	3

Power Electronic Converters

Pre-requisite: Power Electronics

Course Objectives:

- To learn the characteristics of switching devices and use of gate driver circuits
- To understand the need of isolation and analyse the performance of different isolated switch mode converters
- To learn the working of different multilevel inverters and understand their merits and demerits
- To apply PWM techniques for controlling fundamental voltage and mitigate harmonics in inverters

Course Outcomes: After the completion of the course the student should be able to

CO 1: Illustrate the characteristics of Switching devices and use gate drive circuits. Illustrate the operation of multilevel inverters and compare their features.

CO 2: Analyze the performance of isolated switch mode converters.

CO 3: Investigate the PWM Control of single-phase and three-phase inverters and compare various PWM techniques.

CO 4: Investigate the PWM Control of CHB and diode clamped multilevel inverters.

UNIT– 1

Overview of Switching Devices

Power MOSFET, IGBT, GTO, GaN devices-static and dynamic characteristics, gate drive circuits for switching devices.

UNIT– 2

Isolated DC-DC Converters

Need for isolated converters, Forwarded converter, forward converter with demagnetizing winding, flyback converter, push-pull converter, half-bridge converter, full bridge converter, flux walking capacitors in half-bridge and full-bridge converters.

UNIT– 3

PWM Inverters

Voltage control of single-phase inverters employing phase displacement Control, Bipolar PWM, Unipolar PWM. Three-phase Voltage source inverters: Six stepped VSI operation-Voltage Control of Three-Phase Inverters employing Sinusoidal PWM, Third Harmonic PWM, Space Vector Modulation- Comparison of PWM Techniques- Three phase current source inverters.

UNIT– 4

Multilevel Inverters

Introduction, Multilevel Concept, Types of Multilevel Inverters, Diode-Clamped Multilevel Inverter, Principle of Operation, Features of Diode-Clamped Inverter, Improved Diode Clamped Inverter, Cascaded H-bridge Multilevel Inverter, Principle of Operation, Features of Cascaded H-bridge Inverter, Fault tolerant operation of CHB Inverter, Comparison of DCMLI & CHB, Modular multilevel converters, principle of operation.

UNIT– 5

PWM Multilevel Inverters

CHB Multilevel Inverter: Stair case modulation-SHE PWM- Phase shifted Multicarrier modulation-Level shifted PWM- Diode clamped Multilevel inverter: SHE PWM-Sinusoidal PWM- Space vector PWM-Capacitor voltage balancing.

Text Books

1. Power Electronics: Converters, Applications, and Design- Ned Mohan, Tore M. Undeland, ,William P. Robbins, John Wiley& Sons2nd Edition, 2003.
2. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First IndianReprint-2008.
3. High-power converters and AC drives -Wu, Bin, and Mehdi Narimani-John Wiley & Sons, 2017.

Reference Books:

1. Elements of Power Electronics – Philip T. Krein, Oxford University press, 2014.
2. Power Electronics Daniel W. Hart - McGraw-Hill,2011.

Online Learning Resources:

1. https://nptel.ac.in/courses/108105066
2. https://nptel.ac.in/courses/108102584
3. https://nptel.ac.in/courses/108101126

Honors Engineering (Power Electronics)	L	T	P	C
	3	0	0	3

Power Quality and Custom Power Devices

Pre-requisite:

Basic knowledge in power systems and power electronics.

Course Objectives:

- To be familiar with the causes and effects of power quality issues.
- To know the techniques for mitigation of power quality issues.
- To study the effect of harmonics and to design filters
- To understand the working of custom power devices.
- To use a suitable device for power quality improvement

Course Outcomes: At the end of the course, student will be able to

CO 1: Identify the issues related to power quality in power systems.
CO 2: Categorize short and long duration voltage variations in power systems.
CO 3: Analyze the effects of harmonics and study of different mitigation techniques.
CO 4: Illustrate the importance of custom power devices and their applications.
CO 5: Compare different compensation techniques to minimize power quality disturbances.

UNIT– 1

Introduction to power quality

Overview of Power Quality, Concern about the Power Quality, General Classes of Power Quality Problems, Voltage Unbalance, Waveform Distortion, Voltage fluctuation, Power Frequency Variations, Power Quality Terms, Voltage Sags, swells, flicker and Interruptions - Sources of voltage and current interruptions, Nonlinear loads.

UNIT– 2

Transient and Long Duration Voltage Variations

Source of Transient Over Voltages - Principles of Over Voltage Protection, Devices for Over Voltage Protection, Utility Capacitor Switching Transients, Utility Lightning Protection, Load Switching Transient Problems.

Principles of Regulating the Voltage, Device for Voltage Regulation, Utility Voltage Regulator Application, Capacitor for Voltage Regulation, End-user Capacitor Application, Regulating Utility Voltage with Distributed generation.

UNIT– 3

Harmonic Distortion and solutions

Voltage vs. Current Distortion, Harmonics vs. Transients - Power System Quantities under Non-sinusoidal Conditions, Harmonic Indices, Sources of harmonics, Locating Sources of Harmonics,

System Response Characteristics, Effects of Harmonic Distortion, Inter harmonics, Harmonic Solutions Harmonic Distortion Evaluation, Devices for Controlling Harmonic Distortion, Harmonic Filter Design, Standards on Harmonics.

UNIT– 4

Custom Power Devices

Custom power and custom power devices, voltage source inverters, reactive power and harmonic compensation devices, compensation of voltage interruptions and current interruptions, static series and shunt compensators, compensation in distribution systems, interaction with distribution equipment, installation considerations.

UNIT– 5

Application of custom power devices in power systems

Static and hybrid Source Transfer Switches, Solid state current limiter - Solid state breaker. P-Q theory – Control of P and Q, Dynamic Voltage Restorer (DVR): Operation and control, Distribution Static Compensator (D-STATCOM). Operation and control of Unified Power Quality Conditioner (UPQC).

Text Books:

1. Electrical Power Systems Quality, Dugan R C, McGranaghan M F, Santoso S, and Beaty H W, Second Edition, McGraw-Hill, 2002.
2. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M H J, First Edition, IEEE Press; 2000.
3. Guidebook on Custom Power Devices, Technical Report, Published by EPRI, Nov 2000
4. Power Quality Enhancement Using Custom Power Devices – Power Electronics and Power Systems, Gerard Ledwich, Arindam Ghosh, Kluwer Academic Publishers, 2002.

Reference Books:

1. Power Quality Primer, Kennedy B W, First Edition, McGraw-Hill, 2000.
2. Power System Harmonics, Arrillaga J and Watson N R, Second Edition, John Wiley & Sons, 2003.
3. Electric Power Quality control Techniques, W. E. Kazibwe and M. H. Sendaula, Van Nostrad Reinhold, New York.
4. Power Quality c.shankaran, CRC Press, 2001
5. Harmonics and Power Systems –Franciso C.DE LA Rosa-CRC Press (Taylor & Francis).
6. Power Quality in Power systems and Electrical Machines-EwaldF.fuchs, Mohammad A.S. Masoum-Elsevier
7. Instantaneous Power Theory and Application to Power Conditioning, H. Akagiet.al., IEEE Press, 2007.
8. Custom Power Devices - An Introduction, Arindam Ghosh and Gerard Ledwich, Springer, 2002.
9. A Review of Compensating Type Custom Power Devices for Power Quality Improvement, Yash Pal et.al., Joint International Conference on Power System Technology and IEEE Power India Conference, 2008. POWERCON 2008.

Online Learning Resources:

1. https://nptel.ac.in/courses/108107157
2. https://nptel.ac.in/courses/108102179
3. https://nptel.ac.in/courses/108106025

Honors Engineering (Power Electronics)	L	T	P	C
	3	0	0	3

Power Electronics for Renewable Energy systems

Pre-requisites:
Power Electronics, Electrical Machines Control Systems.

Course Objectives:

- To Illustrate the I-V characteristics of solar PV modules and use of blocking diodes and bypass diodes for shade mitigation
- To Understand MPPT, usage of power converters for PV and battery charging
- To Understand different Wind turbine technologies and converters for wind energy generation
- To Analyze PV and wind energy integratedsystems

Course Outcomes: At the end of the course, student will be able to

CO 1: Illustrate the I-V characteristics of solar PV modules and use of blocking diodes and bypass diodes
for shade mitigation

CO 2: Understand MPPT, usage of power converters for PV and battery charging

CO 3: Understand different Wind turbine technologies and converters for wind energy generation

CO 4: Analyze PV and wind energy integrated systems

UNIT – 1

Solar spectrum, PV materials, Equivalent Circuit for PV cell, effect of series and shunt resistance, fill factor, Cells to Modules to Arrays, I–V Curves, standard test condition, Impacts of Temperature and Insolation on I–V curves, series and parallel connection of PV modules, Shading impacts on I–V curves,Bypass diodes and Blocking diodes for shade mitigation, I–V Curves for different loads.

UNIT – 2

Perturb and observe MPPT method for solar PV inverter, Central inverters, String inverters, Micro inverters, leakage current issue, Transformer for leakage current elimination, Transformer less PV inverters. Battery charger, Characteristics of Batteries, Charge control, Battery charging using DC-DC converter, Dual Active Bridge converter for battery charging.

UNIT – 3

Wind turbine technologies- horizontal axis and vertical axis turbines, power in the wind, wind turbine power curves, Betz limit ratio, advantages and disadvantages of wind energy system. Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Doubly Fed Induction Generator, Permanent Magnet Synchronous Generators and their characteristics.

UNIT – 4

Converters for wind generators: AC-DC-AC converters, matrix converters, multilevel converter, Maximum power point tracking for wind turbines, fault ride through capabilities.

UNIT-5

Grid connection principle, Clarke's and Park's transformation, Grid connected photovoltaic system, Grid connected wind energy system, Filters, Grid synchronization & PLL, operation & control of hybrid energy systems,IEEE & IEC codes and standards for renewable energy grid integrations.

Text Books:

1. Renewable and Efficient Electric Power Systems, G. Masters, IEEE- John Wiley and Sons Ltd.Publishers, 2013, 2nd Edition.
2. Grid Converters for Photovoltaic and Wind Power Systems, Remus Teodorescu, Marco Liserre, Pedro Rodriguez, Wiley, 2011, 2nd Edition.
3. Integration and Control of Renewable Energy in Electric Power System, Ali Keyhani Mohammad Marwali and Min Dai, John Wiley publishing company, 2010, 2nd Edition.

Reference Books:

1. Solar Photovoltaic: Fundamentals, technologies & Applications, C. S. Solanki, PHI Publishers, 2019.
2. Integration of Renewable Sources of Energy, F. A. Farret, M. G. Simoes, Wiley, 2017, 2nd Edition.

Online resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee71/preview
2. https://nptel.ac.in/courses/103103206

Honors Engineering (Power Electronics)	L	T	P	C
	3	0	0	3

Industrial Applications of Power Electronic Converters

Course Objective: This course enables the student understanding different power converters and their operation in LED lighting, UPS, drives and micro-grid applications.

Course Outcomes: At the end of the course, student will be able to

CO1: Design and analyze drivers for efficient LED lighting.

CO2: Illustrate UPS, SMPS, Bi-directional DC-DC (BDC) converters operation and applications.

CO3: Explain the applications of inverters and rectifiers for high power and low power applications

CO4: Examine the operation and performance of various power converters.

CO5: Design and implement power converters for grid integration.

UNIT– 1

Power Converters for LED Driving: LED Characteristics, Driving LEDs, Converters (Buck, Boost & Buck-Boost) for LED lightning systems, PFC based LED drivers, Selecting Components for LED Drives, Applications of LEDs.

UNIT– 2

UPS and SMPS: Components of UPS, operation and applications of UPS, Basic operation and applications of SMPS, Difference between UPS and SMPS.

Bi-directional DC-DC (BDC) converters: Electric traction, Automotive Electronics, Battery charging converters, Line Conditioners and Solar Charge Controllers.

UNIT– 3

High Voltage Power Supplies - Power supplies for X-ray applications, Power supplies for radar applications, Power supplies for space applications.

Low Voltage High Current Power Supplies: Power converters for modern Microprocessor and Computer loads.

UNIT– 4

Power converters for AC Drives: Two-Level VSI-Based Medium Voltage (MV) drives, NPC/H-Bridge inverter fed drive, ANPC inverter fed drive, Modular Multi level inverter fed drive, and Multi-Module Cascaded Matrix Converter fed MV drive, power converters for PMSM & BLDC motors.

UNIT– 5

Power converters for micro-grid and grid connection of renewable energy sources: Design, control of converters, grid synchronization and filtering requirements, Solid State Transformers technologies in Distribution system.

Text Books:

1. Steve Winder, Power Supplies for LED Driving, Newnes, 2016, 2nd Edition.
2. Abraham I. Pressman, Keith Billings &Taylor Morey, Switching Power Supply Design, McGraw HillInternational, 2009, 3rd Edition.

3. Ali Emadi, A. Nasiri, and S. B. Bekiarov, Uninterruptible Power Supplies and Active Filters, CRCPress, 2004, 1st Edition.
4. Ali Keyhani Mohammad Marwali ,Min Dai, Integration and Control of Renewable Energy in Electric Power System, , John Wiley publishing company, 2010, 2nd Edition.

Reference Books:

1. Muhammad H. Rashid ,Power Electronics Handbook, Butterworth-Heinemann, 2023, 5th Edition
2. M Singh, K Khanchandani, Power Electronics, McGraw-Hill Education, 2006, 2nd Edition.
3. B.L. Theraja, A Textbook of Electrical Technology - Volume III, 2007,1st Edition.
4. William Ribbens, Understanding Automotive Electronics: An Engineering Perspective, ButterworthHeinemann, 2017, 8th Edition.
5. Paul C. Krause, Oleg W, Scott D. Sudhoff,Analysis of Electric Machinery & Drive systems, IEEE Press, 2013, 3rd Edition.
6. High-power Converters and AC Drives, Bin-Wu, Wiley-Blackwell, 2017, 2nd Edition.

Honors Engineering (Power Electronics)	L	T	P	C
	3	0	0	3

Advanced Electrical Drives

Pre-requisite: Knowledge of Power Electronics, Electrical Machines and Control Systems

Course Objectives:

- To provide a comprehensive understanding of advanced control schemes for induction motor drives.
- To familiarize students with control strategies for PMSM, BLDC, and SRM drives.
- To impart knowledge on minimizing torque ripple and improving performance in motor drives.

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

CO1: Understand the concepts of scalar and vector control methods for drive systems.
CO2: Select and implement proper control techniques for induction motor and Synchronous motor for specific applications.
CO3: Analyze and design control techniques and converters for SRM drives
CO4: Analyze and design controllers and converters for BLDC drives.

Unit I:

Vector Control of Induction Motor Drives

Principles of scalar and vector control, principle of direct vector control, indirect vector control, implementation-block diagram; estimation of flux, flux weakening operation.

UNIT-II

Direct Torque Control of Induction Motor Drives

Principle of Direct torque control (DTC), concept of space vectors, DTC control strategy of induction motor, comparison between vector control and DTC, applications, space vector modulation-based DTC of induction motors.

Unit III

Control of Synchronous Motor Drives

Synchronous motor and its characteristics- Control Strategies-Constant torque angle control-power factor control, constant flux control, flux weakening operation, load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams.

Unit-IV Control of Switched Reluctance Motor Drives

SRM Structure-Stator Excitation-techniques of sensor less operation-convertor topologies-SRM Waveforms-SRM drive design factors-Torque controlled SRM-Torque Ripple-Instantaneous Torque control -using current controllers-flux controllers.

Unit-V Control of BLDC Motor Drives

Principle of operation of BLDC Machine, Sensing and logic switching scheme, BLDM as

Variable Speed Synchronous motor-methods of reducing Torque pulsations -Three-phase full wave Brushless dc motor -Sinusoidal type of Brushless dc motor - current controlled Brushless dc motor Servo drive.

Text Books:

1. Bose B. K., "Power Electronics and Variable Frequency Drives‟, IEEE Press, Standard Publisher Distributors. 2001.
2. Krishnan R., “Electric Motor Drives – Modelling, Analysis and Control”, Prentice Hall of India Private Limited.

Reference Books:

1. Switched Reluctance Motors and Their Control-T. J. E. Miller, Magna Physics, 1993.
2. Power electronic converters applications and design-Mohan, Undeland, Robbins-Wiley Publications
3. De Doncker, Rik W., Pulle, Duco W.J., Veltman, Andre, “Advanced Electrical Drives”, Springer, 2020.
4. Ned Mohan, “Advanced Electric Drives: Analysis, Control, and Modeling Using MATLAB/Simulink®”, John Wiley & Sons, Inc, 2014.

Online Learning Resources:

1. https://nptel.ac.in/courses/108104011
2. https://nptel.ac.in/courses/108102046

Honors Engineering (Power Electronics)	L	T	P	C
	3	0	0	3

FACTS Controllers

Pre-requisite: Fundamentals of Electrical Engineering, Power systems, Power Electronics

Course Objectives:

- To understand the role of FACTS controllers and their impact on improving the performance, stability, and efficiency of transmission systems.
- To analyze Compensation Techniques to explore the effects of static shunt and series compensation techniques on voltage regulation, power flow control, and system stability.
- To study Shunt Compensation Devices for Investigating the working principles and applications of Static Var Compensator (SVC) and Static Synchronous Compensator (STATCOM) for reactive power compensation.
- To select FACTS Devices by assess various power system scenarios and determine the most suitable FACTS device for specific applications to enhance power transfer capability.
- To examine Advanced Controllers by understanding the principles of operation, control strategies, and applications of Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC) for comprehensive power flow management.

Course Outcomes:

After the completion of the course the student should be able to:

CO1: Know the performance improvement of transmission system with FACTS.
CO2: Demonstrate the effect of static shunt and series compensation.
CO3: Illustrate the use of SVC and STATCOM for Shunt Compensations
CO4: Determine an appropriate FACTS device for different types of applications.
CO5: Know the principle of operation and various controls of UPFC& IPFC

UNIT – I:

FACTS concepts, Transmission interconnections, power flow in an AC System, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS controllers.

UNIT – II:

Static shunt compensation: Objectives of shunt compensation, midpoint voltage regulation, voltage instability prevention, improvement of transient stability, Power oscillation damping, methods of controllable VAr generation, variable impedance type static VAr generation, switching converter type VAr generation, hybrid VArgeneration.Basic concept of voltage and current source converters, comparison of current source converters with voltage source converters.

UNIT – III:

SVC and STATCOM: The regulation slope, Transfer function and dynamic performance, Transient stability enhancement and power oscillation damping, Operating point control and summary of compensation control.

UNIT – IV:

Static series compensation: Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, functional requirements. GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GSC, TSSC and TCSC.

UNIT – V:

Unified Power Flow Controller: Basic operating principle, Conventional transmission control capabilities, Independent real and reactive power flow control, Comparison of the UPFC to series compensators and phase angle regulators. Inter line Power Flow Controller (IPFC) - Introduction, operation and applications.

Text Books:

1. "Understanding FACTS Devices" N.G.Hingorani and L.Guygi, IEEE Press. Indian Edition is available:--Standard Publications

Reference Books:

1. Sang.Y.HandJohn.A.T, "Flexible AC Transmission systems" IEEE Press (2006).
2. HVDC & FACTS Controllers: applications of static converters in power systems- Vijay K.Sood- Springer publishers.

Online Learning Resources:

1. https://nptel.ac.in/courses/108107114
2. https://nptel.ac.in/courses/117103488

Honors Engineering (Power Electronics)	L	T	P	C
	0	0	3	1.5

Power Converters Laboratory

Course Objectives:

- To illustrate the working of single and three-phase full converters and semi-converters.
- To analyze the performance of Square-wave inverters and PWM inverters.
- To analyze the performance of DC-DC converters.
- To analyze the performance of three level NPC and Five level CHB inverters.

Course Outcomes:

After the completion of the course the student should be able to:

CO1: Illustrate the working of single and three-phase full converters and semi-converters

CO2: Analyze the performance of Square-wave inverters and PWM inverters

CO3: Analyze the performance of DC-DC converters

CO4: Analyze the performance of Three level NPC and Five level CHB inverters

List of experiments

Any 10 of the following experiments are to be conducted:

1. Analysis of single-phase half-controlled bridge rectifier
2. Analysis of three-phase fully controlled rectifier.
3. Analysis of single-phase square wave inverter.
4. Analysis of three-phase inverter for 120ºmode of conduction.
5. Analysis of three-phase inverter for 180º mode of conduction.
6. Analysis of single-phase inverter with uni polar PWM switching.
7. Analysis of single-phase inverter with bipolar PWM switching.
8. Analysis of three-phase inverter for Sine-PWM method.
9. Analysis of three-phase inverter with SVPWM method.
10. Analysis of Buck DC-DC converter.
11. Analysis of Boost DC-DC converter.
12. Analysis of Buck-Boost DC-DC converter.
13. Analysis of Sine-PWM technique for 3-phase 3-level NPC inverter.
14. Analysis of single-phase 5-level cascaded H-bridge inverter with staircase modulation.
15. Analysis of Phase shift PWM techniques for 3-phase 5-level cascaded H-bridge inverter.
16. Analysis of Level shift PWM techniques for 3-phase 5-level cascaded H-bridge inverter.

Honors Engineering (Power Electronics)	L	T	P	C
	0	0	3	1.5

Electric Drives Laboratory

Course Objectives:

This course enables the student to get hands on experience in understanding different control methods of DC drives and advanced electric drives through experimentation.

Course Outcomes:

After the completion of the course the student should be able to:

CO1: Analyze the speed control of DC drive with converter circuits.

CO2: Examine the regenerative braking of DC drives.

CO3: Examine the performance of V/f and vector control methods of AC drives

List of experiments

Any 10 of the following experiments are to be conducted:

1. Armature control based speed control of separately excited DC drive with single-phase full converter.
2. Armature control based speed control of excited DC drive with three-phase full converter.
3. Study of regenerative braking of DC drive
4. Soft starting of three-phase induction motor.
5. Performance characteristics of a three-phase induction motor using V/f control.
6. Vector control based speed control of three-phase induction motor drive
7. Study of direct torque control of three-phase induction motor
8. Speed control of PMSM motor by voltage control method.
9. Speed control of BLDC motor by voltage control method.
10. Vector control based speed control of PMSM drive.
11. Vector control based speed control of BLDC motor drive.
12. Speed control of Switched Reluctance Motor with eddy current loads

Honors Engineering (Power Electronics)	L	T	P	C
	0	0	3	1.5

Renewable Technologies Laboratory

Course Objectives:

- To understand Solar PV Characteristics by developing and analyzing the mathematical model of a solar PV cell and study its characteristics under different operating conditions.
- To evaluate PV Cell Combinations by investigating the performance of solar PV modules in series and parallel configurations by analyzing their I-V and P-V characteristics.
- To explore Power Electronic Converters by examining the role of different power electronic converters in optimizing the performance of PV systems and improving energy conversion efficiency.
- To implement MPPT e efficiency of solar PV systems.
- To analyze Wind Energy Generation – Study the working principles of wind turbines, analyze wind turbine performance curves, and evaluate power generation characteristics.
- To model Uninterrupted Power Supply (UPS)by designing and analyzing of an Uninterrupted Power Supply (UPS) system to ensure continuous power delivery in renewable energy applications.

Course Outcomes:

After the completion of the course the student should be able to:

CO1: Analyze the mathematical model and understand its solar PV cell characteristics.

CO2: Demonstrate the effect of series and parallel combination of PV cells by I-V and P-V curves.

CO3: Analyze the effect of suitable power electronic converters for PV system.

CO4: Demonstrate the significance of various MPPT algorithms on PV System.

CO5: Demonstrate wind power generation and wind turbine curves.

CO6: Analyze the model of Uninterrupted Power Supply.

List of experiments

Any 10 of the following experiments are to be conducted:

Software Based Experiments:

1. Simulate the Mathematical Model of a PV cell using Single Diode model and Two Diode model equivalent circuits.
2. Simulate the performance curves (I-V & P-V) of a Solar cell and their variation with

change in temperature and irradiation.

3. Simulate the performance curves (I-V & P-V) for PV modules connect in series and their variation with temperature and irradiation.
4. Simulate the performance curves (I-V & P-V) for PV modules connect in parallel and their variation with temperature and irradiation.
5. Simulate the performance curves (I-V & P-V) for the effect of varying the series resistance on the fill factor of the PV cell.
6. Simulate the Buck-Boost Converter with Closed Loop control.
7. Simulate the Maximum Power Point tracking of PV module using INC Algorithm.
8. Simulate the Maximum Power Point tracking of PV module using P & O Algorithm.
9. Simulate the Wind Power Plant model.
10. Simulate the Uninterrupted Power Supply model.

Hardware Based Experiments

Using Solar PV Training System:

11. Single PV module I-V and P-V characteristics with radiation and temperature changing effect.
12. I-V and P-V characteristics with series and parallel combination of modules.
13. Effect of shading on PV Module.
14. Effect of tilt angle on PV Module.
15. Demonstration of bypass and blocking diode on a PV Module.

Using Wind Energy Training System:

16. Evaluation of cut-in speed of wind turbine.
17. Evaluation of Tip Speed Ratio (TSR) at different wind speeds.
18. Evaluation of Coefficient of performance of wind turbine.
19. Characteristics of turbine (power variation) with wind speed.
20. Power curve of turbine with respect to the rotational speed of rotor at fix wind speeds.
21. Power analysis at turbine output with AC load for a Wind Energy System.

Honors Engineering (Power Electronics)	L	T	P	C
	0	0	3	1.5

Electric Vehicles Laboratory

Course Objectives:

- To simulate Power Converters for EVs by analyzing and implementing isolated and non-isolated DC-DC converters for electric vehicle applications using simulation tools.
- To evaluate Motor Control Strategies by Studying and simulating advanced motor control techniques such as Field-Oriented Control (FOC), Direct Torque Control (DTC), and closed-loop control for different EV propulsion motors.
- To design and analyze EV Battery Systems by developing and fabricating a Li-ion battery pack for EV applications and perform controlled charging and discharging experiments.
- To implement Hardware-Based Motor Control with Operation of induction motor and analyze its performance using V/F control and four-quadrant operation modes for EV applications.
- To assess EV System Performance by measuring and analyzing key parameters such as voltage, current, speed, torque, and power flow in propulsion systems under different operating conditions.

Course Outcomes:

After the completion of the course the student should be able to:

CO 1: Simulate and analyze the performance of isolated and non-isolated DC-DC converters for electric vehicle applications.

CO 2: Implement and evaluate field-oriented and direct torque control (DTC) strategies for induction motor drives in EVs.

CO 3: Design and simulate a closed-loop control system for switched reluctance motor (SRM) and BLDC motor drives for EV applications.

CO 4: Construct and analyze a Li-ion battery pack (48V/72V, 3/5 kWh) and study its charging and discharging characteristics.

CO 5: Perform real-time analysis of propulsion motor speed, voltage, current, and power using throttle control.

CO 6: Demonstrate V/F control of induction motors and study the four-quadrant operation of propulsion motors, including motoring and braking modes.

List of experiments

Any 10 of the following experiments are to be conducted:

Software Based Experiments:

1. Simulation of isolated and non isolated DC-DC converters for EV application.
2. Simulation of Field oriented/DTC controlled Induction Motor drive for EV application.
3. Simulation of Closed loop control of SRM drive for electric vehicle application.
4. Simulation of Field oriented control of PMSM for electric vehicle application.
5. Simulation of closed loop control of BLDC motor drive for electric vehicle application.

Hardware Based Experiments

6. Running the propulsion motor by throttle paddle and analyze the Speed, voltage, current, power of the system.
7. Design and fabrication of 48V/72V, 3/5 kWh Li-ion battery pack.
8. Constant current mode of charging/discharging of EV Battery.
9. V/F Control of Induction motor drive for electric vehicle application.
10. Study of four quadrant operation of propulsion motor and analyze all the parameters like voltage, current, speed, toque, and power flow.
    a) Forward motoring mode
    b) Forward braking mode
    c) Reverse motoring mode
    d) Reverse braking mode