B.Tech. ELECTRICAL AND ELECTRONICS ENGINEERING

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FOREWORD

The field of Electrical and Electronics Engineering is vast and diverse. It is a professional engineering discipline that deals with the study and application of electricity, electronics and electromagnetism. The field first became an identifiable occupation in the late nineteenth century with the commercialization of the electric telegraph and electrical power supply. The field now covers a range of sub-disciplines including those that deal with power, optoelectronics, digital electronics, analog electronics, computer science, artificial intelligence, control systems, electronics, signal processing and telecommunications. Electrical and Electronics Engineering is also deals with the problems associated with large-scale electrical systems such as power transmission, optimal control and utilization of electrical energy. Today the EEE contribute to the development of society, meet the needs of society, create new opportunities, and create new industries.

In the Department of Electrical and Electronics Engineering, a wide range of professional courses are offered to train electrical and electronics engineers. The curriculum has been updated and enriched not only in its core area but made more versatile through incorporation of computer knowledge, elective courses of student's choice, and some basic courses of science that form the bridge to technology, industry internship and project works. The new curriculum of R22 accomplishes multidisciplinary holistic education, continuous assessment along with multiple honorable exit options if a student fails to complete the requirements to earn the degree within the stipulated period including the permissible spill over period.

R22 curriculum comprises of:

- *Revision in tune with National Education Policy 2020*
- *Various exit options*
- *Regular Degree along with Honours / Minor Degree*
- *The reduction in total credits*
- *Module wise course syllabus*
- *Advanced courses like Green Energy Technologies, Electric Vehicles and EV Charging Inferastructure.*

The focus area of each unit in every course is clearly defined. Topics of contemporary relevance such as the Hardware, computing devices related to Smart Phones, Power Electronic Controllers, Home Appliances, Renewable Energy Sources are included. The Board of Studies consisting of eminent personalities along with experienced faculty members of the university have designed the curriculum to offer knowledge and skill of electrical engineering on the above mentioned areas. The curriculum includes concepts with skill based tasks through integrated laboratory and activities combined with theory. The department aims to make graduates ready for the industrial needs.

External BoS Members:

1. Dr. K.Siva Kumar, *Professor, Department of Electrical Engineering, IIT Hyderabad.*
2. Dr. Nagesh Vangala, CTO, Chirra Power Pvt. Ltd., Bangalore
3. Dr. B. Satish Babu, Sr. Staff Engineer, Infineon Technologies, Bangalore.
4. Dr. M. V. Rayudu, CEO, Chirra Power Pvt. Ltd., Bangalore

I thank all the BoS Members, Academic Council Members and University authorities for encouraging and supporting us in designing this innovative curriculum for our students.

Dr. G. Srinivasa Rao
HOD, EEE

VIGNAN'S
Foundation for Science, Technology & Research
(Deemed to be UNIVERSITY)
-Estd. u/s 3 of UGC Act 1956

VISION

To evolve into a Centre of Excellence in Science & Technology through creative and innovative practices in teaching – learning, towards promoting academic achievement and research excellence to produce internationally accepted, competitive and world class professionals who are psychologically strong & emotionally balanced, imbued with social consciousness & ethical values.

MISSION

To provide high quality academic programmes, training activities, research facilities and opportunities supported by continuous industry - institute interaction aimed at promoting employability, entrepreneurship, leadership and research aptitude among students and contribute to the economic and technological development of the region, state and nation.

Department of ELECTRICAL AND ELECTRONICS ENGINEERING

VISION of the department

To prepare the students to meet the demands of changing industrial needs and to mould them into successful and ethical professionals, globally accepted in Electrical and Electronics Engineering and allied fields contributing to nation's building.

MISSION of the department

M_1: Offering state of art curriculum with innovative practices in teaching learning to pursue career in Electrical and allied fields.

M_2: Providing advanced laboratory facilities and conducive research environment to make them industry ready and equip to carry out higher education.

M_3: Transforming into responsible professionals with leadership qualities, managerial ability, team spirit, social consciousness, human values and ethics.

B.Tech in Electrical and Electronics Engineering

Program Educational Objectives (PEOs)

PEO1: Pursue career in electrical and allied fields in private/ public sector (or) as an entrepreneur.

PEO2: Design, invent and develop novel technology and find creative, innovative solutions to engineering problems through interdisciplinary approach.

PEO3: Apply professional knowledge to solve technical and social problems in economical way by following ethics.

Program Specific Outcomes (PSOs)

PSO1: Design and analyse circuit components, systems that effectively generate, transmit, distribute and utilize electrical power.

PSO2: Apply the appropriate analog, digital techniques and modern engineering software tools in electrical engineering to engage in lifelong learning.

Program Outcomes (POs)

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

R22 B.Tech.
4 YEAR
DEGREE PROGRAMME

COURSE STRUCTURE - R22

I Year I Semester

Course Code	Course Title	L	T	P	C
22MT102	Linear Algebra	3	2	0	4
22PY105	Semiconductor Physics and Electromagnetics	2	0	2	3
22EE101	Basics of Electrical & Electronics Engineering	2	0	2	3
22EE102	IT Workshop and Electrical Engineering Products	1	0	4	3
22TP103	Programming in C	2	0	4	4
22EN102	English Proficiency and Communication Skills	0	0	2	1
22SA101	Physical Fitness, Sports & Games-I	0	0	3	1
22TP101	Constitution of India	0	2	0	1
Total		**10**	**4**	**17**	**20**
		31 Hrs			

I Year II Semester

Course Code	Course Title	L	T	P	C
22MT111	Multivariate Calculus	3	2	0	4
22CT103	Engineering Chemistry	2	0	2	3
22ME101	Engineering Graphics	2	0	2	3
22TP104	Basic Coding Competency	0	1	3	2
22EN104	Technical English Communication	2	0	2	3
22EE103	Electrical Circuits and Networks	3	0	2	4
22SA103	Physical Fitness, Sports & Games – II	0	0	3	1
22SA102	Orientation Session	0	0	6	3
Total		**12**	**3**	**20**	**23**
		35 Hrs			

Department Subject is extension of Basic sciences

COURSE STRUCTURE - R22

R22 B.Tech.
4 YEAR
DEGREE PROGRAMME

II Year I Semester

Course Code	Course Title	L	T	P	C
22EE201	Probability Theory and Statistics for Machine Learning	3	2	0	4
22CT201	Environmental Studies	1	1	0	1
22TP201	Data Structures	2	2	2	4
22EE202	Power Transmission and Distribution	2	0	2	3
22EE203	DC Machines and Transformers	3	0	2	4
22EE204	Analog Electronics	3	0	2	4
22EE205	Digital Electronic Circuits	2	2	0	3
22SA201	Life Skills-I	0	0	2	1
	Total	16	7	10	24
	NCC / NSS / SAC / E-cell / Student Mentoring/ Social activities/ Publication	0	0	0	1
	Total	**16**	**7**	**10**	**25**
		33 Hrs			

II Year II Semester

Course Code	Course Title	L	T	P	C
22TP203	Advanced Coding Competency	0	0	2	1
22TP204	Professional Communication	0	0	2	1
22EE207	Induction and Synchronous Machines	3	0	2	4
22EE208	Power Electronic Devices and Circuits	3	0	2	4
22MS201	Management Science	2	2	0	3
	Department Elective – 1	3	0	0	3
	Open Elective – 1	3	0	0	3
22SA202	Life Skills-II	0	0	2	1
	Total	**14**	**2**	**10**	**20**
	Minor / Honours - 1	3	0	2	4
		17	**2**	**12**	**24**
	Total	**31 Hrs**			

R22 B.Tech.
4 YEAR
DEGREE PROGRAMME

COURSE STRUCTURE - R22

III Year I Semester

Course Code	Course Title	L	T	P	C
22TP301	Soft Skills Lab	0	0	2	1
22EE301	Linear Control Systems	3	0	2	4
22EE302	Electrical Measurements & Instrumentation	3	0	2	4
22EE303	Analysis and Operation of Power Systems	3	0	2	4
	Department Elective – 2	3	0	0	3
	Open Elective – 2	3	0	0	3
22EE306	Industry interface course (Modular course)	1	0	0	1
22EE305	Inter-Disciplinary Project – Phase-I	0	0	2	0
	Total	**16**	**0**	**10**	**20**
	NCC/ NSS/ SAC/ E-cell/ Student Mentoring/ Social activities/ Publication with good impact factor (Only 2 students can claim 1 paper/patent). These credits maybe earned on or before the end of VI semester	0	0	0	1
	Minor / Honours - 2	3	0	2	4
	Total	**19**	**0**	**12**	**25**
		31 Hrs			

III Year II Semester

Course Code	Course Title	L	T	P	C
22TP302	Quantitative Aptitude & Logical Reasoning	1	2	0	2
22EE307	Microprocessors & Microcontrollers	3	0	2	4
22EE308	Digital Signal Processing	2	2	0	3
	Department Elective – 3	3	0	0	3
	Department Elective – 4	3	0	0	3
	Open Elective – 3	3	0	0	3
22EE309	Inter-Disciplinary Project – Phase-II	0	0	2	2
	Total	**15**	**4**	**4**	**20**
	Minor / Honours - 3	3	0	2	4
	Total	**18**	**4**	**6**	**24**
		28 Hrs			

COURSE STRUCTURE - R22

R22 B.Tech. 4 YEAR DEGREE PROGRAMME

IV Year I Semester

Course Code	Course Title	L	T	P	C
22EE402	Power System Protection	3	2	0	4
22EE401	Industrial Electric Drives	3	0	2	4
	Department Elective – 5	3	0	2	4
	Department Elective – 6	3	0	2	4
	Department Elective – 7	3	2	0	4
	Total	**15**	**4**	**6**	**20**
	Minor / Honours – 4	3	0	2	4
	Total	**18**	**4**	**8**	**24**
		30 Hrs			

IV Year II Semester

Course Code	Course Title	L	T	P	C
22EE403 / 22EE404	Project Work / Internship	0	2	22	12
	Total	**24**			**12**
	Minor / Honours – 5 (for project)	0	2	6	**4**
	Total	**32**			**16**

for interaction between Guide and students

R22 B.Tech. 4 YEAR DEGREE PROGRAMME

COURSE STRUCTURE - R22

Department Electives

Course Code	Course Title	L	T	P	C
	Odd Semester				
22EE801	Green Energy Technologies	2	2	0	3
22EE802	Electric Vehicles	2	2	0	3
22EE803	High Voltage Engineering	2	2	0	3
22EE804	Switch Mode Power Conversion	3	2	0	4
22EE805	Sensors and Transducers	3	2	0	4
22EE806	Special Electrical Machines	3	0	2	4
22EE807	Optimization Techniques	3	2	0	4
22EE808	Advanced Control Systems	3	0	2	4
22EE809	Advanced Power Electronics	3	2	0	4
22EE810	Power Quality	3	2	0	4
22EE811	Advanced Power System Analysis	3	0	2	4
	Even Semester				
22EE812	Energy Storage Technologies	2	2	0	3
22EE813	Energy Audit, Conservation and Management	2	2	0	3
22EE814	Smart Grid Technologies	2	2	0	3
22EE815	Energy System Economics	2	2	0	3
22EE816	Flexible of AC Transmission Systems	2	2	0	3
22EE817	SCADA Systems and Applications	2	2	0	3
22EE818	Plug-In Electric Vehicles in Smart Grid	2	2	0	3
22EE819	Soft Computing Techniques in Electrical Engineering	2	2	0	3
22EE820	Programmable Logic Controllers	2	2	0	3
22EE821	PV Technologies and Applications	2	2	0	3
22EE822	Utilization of Electrical Energy	2	2	0	3

Honours - Electric Vehicles

Course Code	Course Title	L	T	P	C
22EE951	Electric Vehicles Technology	3	2	0	4
22EE952	Energy Storage and Management System	3	2	0	4
22EE953	EV Charging Infrastructure and BMS	3	2	0	4
22EE954	Modelling and Simulation of Electric Vehicles	3	2	0	4
22EE955	Intelligent Transport Systems	3	2	0	4
	Total	**15**	**10**	**0**	**20**

I

YEAR

B.Tech.

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENTS

I SEM & II SEM

I SEMESTER

22MT102	-	Linear Algebra
22PY105	-	Semiconductor Physics and Electromagnetics
22EE101	-	Basics of Electrical and Electronics Engineering
22EE102	-	IT Workshop and Electrical Engineering Products
22TP103	-	Programming in C
22EN102	-	English Proficiency and Communication Skills
22SA101	-	Physical Fitness, Sports & Games-I
22TP101	-	Constitution of India

II SEMESTER

22MT111	-	Multivariate Calculus
22CT103	-	Engineering Chemistry
22ME101	-	Engineering Graphics
22TP104	-	Basic Coding Competency
22EN104	-	Technical English Communication
22EE103	-	Electrical Circuits and Networks
22SA103	-	Physical Fitness, Sports & Games – II
22SA102	-	Orientation Session

22MT102 LINEAR ALGEBRA

Image Source: https://thumbs.dreamstime.com/z/linear-algebra-complex-like-puzzle-pictured-as-word-linear-algebra-puzzle-pieces-to-show-linear-algebra-can-be-164220956.jpg

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Basics of matrices, Determinant, relations and functions.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the fundamental concepts of matrices and rank of a matrix using Echelon form, Normal forms. The methods for solving the system of linear equations using Cramer's rule, Gauss Elimination method and Gauss-Jordan method. To find the Eigen values and Eigen vectors of a square matrices and applications on it. To discuss vector space and its properties, Basis and Dimension and their applications.

MODULE-1

UNIT-1 **12L+8T+0P=20 Hours**

MATRICES:

Rank of a Matrix: Algebra of matrices, Types of matrices, Invertible matrices, Rank of a matrix, Echelon from, Normal form.

Solutions of Linear Equations: Consistency of System of linear equations, Cramer's Rule, Gauss Elimination method, Gauss-Jordan method.

UNIT-2 **12L+8T+0P=20 Hours**

APPLICATIONS OF MATRICES:

Eigen values and Eigen vectors: Introduction to Eigen values and Eigen vectors, Eigen values of diagonal matrix, Eigen values of triangular matrices, Properties of an Eigen values and Eigen vectors (without proofs).

Applications of Eigen Values and Eigen Vectors: Cayley-Hamilton theorem (without proof), Verification of Cayley-Hamilton theorem, Power of a square matrix, Spectral matrix, Diagonalization of a matrix.

PRACTICES:

- Determine the Rank of a matrix using the definition.
- Determine the rank of a matrix using Echelon form and Normal form.
- To find the solution of system of linear equations using Cramer's rule and Gauss Elimination method.
- To find the solution of system of linear equations (Homogeneous and Non-homogeneous) using Gauss-Jordan method.
- Determine the Eigen values and Eigen vectors of a square matrix which are either diagonal matrix or triangular matrix.
- Verification of Cayley-Hamilton theorem for square matrices.
- Examine the given square matrix is diagonalizable or not.
- Using Cayley-Hamilton theorem find the powers of a matrix.

SKILLS:

- ✓ *To discuss the solution of system of linear equations using other methods.*
- ✓ *Find Eigen Values and Eigen Vectors.*
- ✓ *Apply transformation to real world problems involving linear transformations.*
- ✓ *Analyze Quadratic forms and its applications.*

MODULE-2

UNIT-1 **12L+8T+0P=20 Hours**

VECTOR SPACES:

Vector Spaces, Bases and Dimension: Vector space, Subspace, Linear independence and dependence of vectors, Bases and Dimension.

Linear Transformation: Linear transformations, Representation of linear transformations by matrices, Null space, Rank-nullity theorem.

UNIT-2 **12L+8T+0P=20 Hours**

INNER PRODUCT SPACES:

Inner Product Space: Inner product spaces, Cauchy-Schwarz's inequality, Orthogonal basis, Gram-Schmidt orthogonalization process.

Quadratic Forms: Introduction to Quadratic forms, Reduction of Quadratic form to symmetric matrix form and vice-versa, Positive, negative and semi definite matrices.

PRACTICES:

- Verify the given set of vectors is linearly dependent or not.
- Verify the given set of vectors is a basis or not.
- Examine the given transformation is a linear transformation or not.
- Verify Rank-Nullity theorem for given set problems.
- To discuss the applications of Orthogonal vectors and linearly independent.
- Find the Orthonormal basis to the given set of vectors using Gram-Schmidt Orthogonalization process.
- Discuss the Quadratic forms.
- Determine the nature of the Quadratic form.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of matrices and the methods to solve the system of equations.	Apply	1	1, 2, 4, 9, 10, 12
2	Apply the concepts of vector spaces, subspaces, bases, dimension.	Apply	2	1, 2, 4, 9, 10, 12
3	Evaluate inverse and power of a matrix by Caley Hamilton theorem.	Evaluate	1	1, 2, 4, 9, 10, 12
4	Determine orthogonality in inner product spaces.	Evaluate	2	1, 2, 4, 9, 10, 12

TEXT BOOKS:

1. Gilbert Strang, "Linear Algebra", 5th edition, Wellesley-Cambridge Press, 2016
2. V. Krishnamurthy, V. P. Mainra ,J.I. Arora, "An introduction to linear algebra", Chaukhamba Auriyantaliya, 2018.

REFERENCE BOOKS:

1. N. P. Bali, K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", Universal Science Press, New Delhi, 2018, 2nd Edition.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44 Edition, 2018.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, Inc, 2015.
4. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", S. Chand and Co., Third revised edition, 2015.

22PY105 SEMICONDUCTOR PHYSICS AND ELECTROMAGNETICS

Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of vectors and semiconductors.

COURSE DESCRIPTION AND OBJECTIVES:

This course ensures commensurable understanding of electrostatics and magneto statics. It enunciates the electron dynamics in solids through the conceptual grasp of principles of quantum mechanics. This embark perspective outlook on optoelectronic devices and optical fibres in the backdrop of semiconductor physics.

MODULE-1

UNIT-1 **10L+0T+10P = 20 Hours**

ELECTROSTASTICS AND MAGNETOSTASTICS:

Electrostatics: Introduction to Vector analysis, Computation of electric field and potential due to Point charge, linear charge density, surface charge density, bulk charge density, Coulomb's law, Electric field due to line of charges, Gauss law, Differential Form of Gauss law, Applications, Electric field due to a charged sphere – inside, on the surface, and outside, Electric field due to a spherical shell- inside and outside.

Magnetostatics: Introduction to magnetic force – Lorentz force, Biot-Savart's law, Magnetic field due to a linear conductor – magnetic field due to a circular loop –Ampere's law, Faraday's law in integral form; Lenz's law, Maxwell's equations – correction to Ampere's law.

UNIT-2 **6L+0T+6P = 12 Hours**

QUANTUM MECAHNICS AND FREE ELECTRON THEROY:

Quantum mechanics: Introduction to Quantum mechanics; Concepts of wave and particle duality of radiation; de Broglie's concepts of matter waves, Schrödinger's time-independent wave equation – Eigen values and Eigen functions; Particle confined in a one-dimensional infinite Potential square well.

Free electron theory of solids: Classical and Quantum free electron theory of metals; Fermi- Dirac distribution; Density of states – derivation -Bloch's Theorem (Qualitative); Classification of solids based on energy bands.

PRACTICES:

- Photoelectric effect-Determination of plancks constant.
- Stewart & Gee's Experiment- Study of magnetic field along the axis of a current carrying coil.
- Melde's Experiment - determination of the frequency of tuning fork.
- Hall Effect - Determination of Hall coefficient.

MODULE-2

UNIT-1 **8L+0T+8P = 16 Hours**

SEICONDUCTOR PHYSICS AND OPTOELECTRONICS:

Introduction, Classification of Semiconductors, Direct and indirect band gap semiconductors, Intrinsic semiconductors; Variation of Intrinsic carrier concentration with temperature, Fermi level, and conductivity; Extrinsic semiconductor, the effect of temperature on carrier concentration in extrinsic semiconductors, Band diagrams of extrinsic semiconductors; Hall effect, Classification of optoelectronic devices; Photo voltaic cell, LED.

SKILLS:

- ✓ *Able to compute the electric and magnetic field and potentials in different applications*
- ✓ *Apply the quantum laws to understand the electron dynamics of solids*
- ✓ *Realizing the importance of optoelectronic devices*

UNIT-2 **8L+0T+8P = 16 Hours**

LASERS AND OPTICAL FIBERS:

Introduction to lasers, Population inversion & pumping processes, Semiconductor diode laser, Applications of lasers. Optical fiber-Numerical Aperture, types of optical fibres, Fiber optic communication system.

PRACTICES:

- Laser - Determination of wavelength.
- Optical fibre - Determination of Numerical aperture – Acceptance angle.
- Determination of Energy Band gap of p-n junction diode.
- LED - Determination of Threshold Voltage of LED.
- Solar cell – Determination of Fill factor & efficiency.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply Maxwell's equations to unravel electron dynamics in amidst of electric and magnetic fields.	Apply	1	1, 2, 4, 5, 9, 10
2	Comprehend the knowledge of Lasers and optical fibers to conceive their applications in vivid domains.	Apply	2	1, 2, 3, 5, 9, 10
3	Discriminate solids based on principles of quantum mechanics.	Analyse	1	1, 2, 3, 4, 9, 10
4	Assessment of semiconductors in the perspective of optoelectronic devices.	Evaluate	2	1, 3, 4, 5, 6, 9, 10

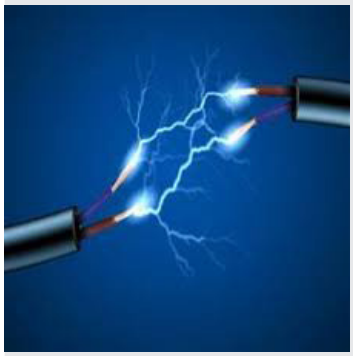
TEXT BOOKS:

1. S.O. Pillai, "Solid State Physics", New age International publishers, 8th edition, 2018.
2. H.C. Varma, "Classical Electromagnetism", Bharathi Bhavan Publication, 2022.

REFERENCEBOOKS:

1. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics", 6th edition, John Wiley and Sons, New York, 2001.
2. M.N. Avadhanulu, "Engineering Physics", S. Chand publications 2010.
3. Charles Kittel, "Introduction to Solid State Physics", 7th edition, Wiley, Delhi, 2007.
4. Donald A. Neamen, "Semiconductor Physics and Devices: Basic Principle", 4th edition, McGraw-Hill, New York, 2012.
5. David J. Griffiths, "Introduction to Electrodynamics", 3rd edition, Prentice Hall of India, New Delhi, 2012.
6. N.W. Ashcroft and N.D. Mermin, "Solid State Physics", International student edition, Brooks Cole, 2008.

22EE101 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING



Source : https://vita.vision.org.in/emerging-technologies-in-electrical-engineering/

Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Electrostatics and Electromagnetism.

COURSE DESCRIPTION AND OBJECTIVES:

This course provides an insight into the functioning of basic electrical components like resistor, inductor and capacitor. It deals with the constructional and operational details of AC machines. It also deals with the basic electronic components like P-N junction diode, Zener diode, Transistor and their characteristics.

MODULE–1

UNIT-1 **8L+0T+8P=16 Hours**

FUNDAMENTALS OF ELECTRIC CIRCUITS:

DC Circuits: Concept of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Ohm's Law, Kirchhoff's Laws, Application to simple series, Parallel circuits, Mesh and nodal analysis of resistive circuits with DC source.

AC circuits: Generation of AC voltage, Frequency, Average value, R.M.S. value, Form factor, Peak factor for sinusoidal only.

UNIT-2 **8L+0T+8P=16 Hours**

SEMICONDUCTOR DEVICES:

Classification of semiconductors, P-N junction diode -operation and its characteristics, Half wave rectifier - operation, efficiency; Full wave rectifiers -types, operation, efficiency; Zener diode and its characteristics, Zener diode as Voltage regulator.

Bi polar junction transistor- operation, types (NPN & PNP).

PRACTICES:

- Verification of Ohm's law.
- Verification of Kirchhoff's current law.
- Verification of Kirchhoff's voltage law.
- Determination of R.M.S. Values of sinusoidal waveform.
- Verification of PN junction diode characteristics under both forward and reverse bias.
- Verification of Zener diode characteristics under reverse bias.

MODULE–2

UNIT-1 **8L+0T+8P=16 Hours**

ANALYSIS OF AC CIRCUITS:

Analysis of single- phase ac circuits consisting of R, L, C, RL, RC (series and parallel) (simple numerical problems). Introduction to three phase system, Relation between phase and line quantities of voltages and currents in star and delta connected systems (Elementary treatment only).

SKILLS:

- ✓ *Distinguish between linear and nonlinear elements by looking at VI characteristics.*
- ✓ *Develop a simple loop generator.*
- ✓ *Design a voltage regulator using Zener diode.*
- ✓ *Design a half wave rectifier using PN junction diode.*
- ✓ *Design a full wave rectifier using PN junction diodes.*

UNIT-2 **8L+0T+8P=16 Hours**

AC MACHINES:

Electromagnetism: Concepts of Magneto motive force, Reluctance, Flux and flux density, Concept of self-inductance and mutual inductance, Coefficient of coupling.

Static & Rotating AC Machine: Principle of operation of single phase transformer, Constructional features, EMF equation (simple numerical problems).

Rotating AC Machine Principle of operation of three phase induction motor, Slip ring and squirrel cage motors, Torque equation; Constructional details of synchronous machine.

PRACTICES:

- Transformation ratio of a single phase transformer at different loads.
- Measurement of Energy in single phase resistive load circuit.
- Measurement of Power in single phase resistive load circuit
- Determination of impedance in complex AC circuits.
- Verification of line and phase quantities in a balanced three phase system.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Solve the AC (single and three phase) and DC circuits using different methods.	Apply	1,2	1,2,9,12
2	Apply the concepts of electromagnetism for its applications.	Apply	2	1,2,3,9,12
3	Analyze the resistive circuits with independent sources and find its solution.	Analyze	1,2	1,2,6,9
4	Examine the different electrical equipment.	Evaluate	2	1,2,9,12
5	Acquire the knowledge of semiconductor devices to create circuits.	Create	1	1,2,3,9,12

TEXT BOOKS:

1. V. K. Mehta, “Principles of Electrical Engineering and Electronics”, S.Chand& Co., Publications, New Delhi, 2019.
2. D.P. Kothari, “Basic Electrical and Electronics Engineering”, TMH, New Delhi, 2017.

REFERENCE BOOKS:

1. Millman and Halkias, “Electronic Devices and Circuits”, Mc Graw Hill, 2006.
2. A.K. Thereja and B.L.Thereja, “Electrical Technology”, Vol.–II, S. Chand & Co., Publications, 2020.
3. U. Bakshi and A. Bakshi, “Basic Electrical Engineering”, 1st edition, Technical Publications, Pune, Nov 2020.

22EE102 IT WORKSHOP AND ELECTRICAL ENGINEERING PRODUCTS

sOURCE : https://bright-industry.com/electrical-engineering

Hours Per Week :

L	T	P	C
1	0	4	3

PREREQUISITE KNOWLEDGE: Basics of Computer and Physics.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with different IT tools, Mechanical trades and Electrical engineering basics. The objective of this course is giving hands on practice on assembling and disassembling, productivity tools like Latex, word, spreadsheets and presentations and to develop models using Carpentry, Fitting, Tinsmith, House wiring, Electrical power generation, protection of equipment's and applications of motors.

MODULE - 1

UNIT-1 **4L+0T+16P=20 Hours.**

COMPUTER HARDWARE AND TOOLS FOR REPORT WRITING AND PRESENTATION:

Computer Hardware: peripherals of a computer, components in a CPU and its functions, block diagram of the CPU.

Tools for Report writing and Presentation: Overview and Installation of Microsoft Word, Excel and PowerPoint Presentation.

UNIT-2 **4L+0T+16P=20 Hours.**

COMPUTER HARDWARE AND TOOLS FOR REPORT WRITING AND PRESENTATION:

Computer Hardware: Disassemble and Assemble the PC back to working condition.

Tools for Report writing and Presentation: Creating project, creating a Newsletter using Microsoft Word and LaTeX.

Creating a Scheduler, Calculating GPA, Performance Analysis, Conditional Formatting, Charts and Pivot Tables using MS Excel; Power Point utilities and tools, Master Layouts, Design Templates, Background and textures using Power Point Presentation.

PRACTICES

- Troubleshooting of a computer Hardware.
- Assembly and Disassembly of a Computer.
- Creation of projects and Newsletter using MS Word and LaTeX.
- Spreadsheet basics, modifying worksheets, formatting cells, formulas and functions, sorting and filtering, charts using MS Excel.
- Power point screen, working with slides, add content, work with text, working with tables, graphics, slide animation, reordering slides, adding sound to a presentation using MS PPT.

MODULE - 2

UNIT-1 **4L+0T+16P=20 Hours.**

ENGINEERING MATERIALS AND TRADES:

Engineering Materials: Introduction, Classification, Ferrous & non-ferrous metals and alloys.

Trades: Introduction and Materials used in Carpentry, Fitting, Tin smithy and House Wiring. Cutting Tools, Holding Tools, Marking Tools used and types of joints made in Carpentry, Fitting, Tin smithy and House Wiring.

SKILLS:

- ✓ *Design and develop various sheet metal products.*
- ✓ *Analyse the functioning & troubleshoots of household appliances.*
- ✓ *Create products by using different trades for Industrial applications.*
- ✓ *Analyse the electrical power generation.*

UNIT-2 **4L+0T+16P=20 Hours.**

PROTECTION SCHEMES, GENERATING STATIONS AND MOTOR:

Protection schemes: Earthing procedure, Switch fuse unit (SFU), MCB.

Generating stations: Thermal power station and Wind power station.

Motor: Motors used in domestic applications, Mixer grinder, Ceiling fan, Washing machine, Air coolers, and Electric vehicle.

PRACTICES

- Fabrication of T-lap joint using carpentry tools.
- Fabrication of V-fit using fitting tools.
- Fabrication of truncated cylinder using tin smith tools.
- Performance of 1 lamp controlled by one way switch using house wiring.
- Performance of 2 lamp controlled by one way switch using house wiring.
- Demonstration of plate earthing.
- Demonstration of pipe earthing.
- Demonstration of mixer grinder.
- Demonstration of washing machine.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Assemble and disassemble of a computer	Apply	1	1, 2
2	Create documents, spread sheets and presentations using LaTeX and MS Tools	Apply	1	1, 2, 5, 6, 12
3	Develop methodology for fabrication as per specifications of the product.	AnalyZe	2	1, 3, 8, 9, 10
4	Analyse the protection technics in sub study industries.	Analyze	2	1, 6, 7

TEXT BOOKS:

1. Peter Norton, “Introduction to Computers”, Tata Mc Graw Hill Publishers, 7th Edition, 2017.
2. Felix W “Basic Workshop Technology: Manufacturing Process”, 1st Edition, 2019.

REFERENCES:

1. T.V.Gopal, T.Kumar and G. Murali, “A first Course on Workshop Practice: Theory, Practice and Work Book”, Suma Publication, 2005.
2. K.V.N.Pakirappa, “Workshop Technology”, 5 th edition, Radiant Publishing House, 2011.
3. S.K Hazra Choudhury, “Elements of Work Shop Technology”, 11th edition, Media Promoters, 1997.
4. C.L. Wadhwa, “Electrical Power Systems”, 5th edition, New Age International, 2009.
5. V. K mehta and Rohit mehta “Principles of Power System”, 1st Edition, S. Chand, 2005.

22TP103 PROGRAMMING IN C

✓ Techgig.com

Hours Per Week :

L	T	P	C
2	0	4	4

PREREQUISITE KNOWLEDGE: Fundamentals of Problem Solving.

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed to impart knowledge on basic concepts of C programming language and problem solving through programming. It covers basic structure of C program, data types, operators, decision making statements, loops, functions, strings, pointers, and also file manipulations. At the end of this course, students will be able to design, implement, test and debug complex problems using features of C.

MODULE- 1

UNIT-1 **8L+0T+16P=24 Hours**

INTRODUCTION TO ALGORITHMS AND PROGRAMMING LANGUAGES:

Introduction to Algorithms: Basics of algorithms; Flow charts; Generations of programming languages. Introduction to C: Structure of a C program - pre-processor statement, inline comments, variable declaration statements, executable statements; C Tokens - C character set, identifiers and keywords, type qualifiers, type modifiers, variables, constants, punctuations and operators.

Data Types and Operators: Basic data types; Storage classes; Scope of a variable; Formatted I/O; Reading and writing characters; Operators - assignment, arithmetic, relational, logical, bitwise, ternary, address, indirection, sizeof, dot, arrow, parentheses operators; Expressions - operator precedence, associative rules.

Control Statements: Introduction to category of control statements; Conditional branching statements - if, if– else, nested-if, if – else ladder, switch case; Iterative statements - for, while, do - while, nested loops; Jump statements - break, jump, goto and continue.

UNIT-2 **8L+0T+16P=24 Hours**

ARRAYS & STRINGS:

Arrays: Introduction; Types of arrays; Single dimensional array - declaration, initialization, usage, reading, writing, accessing, memory representation, operations; Multidimensional arrays.

Strings: Character array, Reading string from the standard input device, Displaying strings on the standard output device, Importance of terminating a string, Standard string library functions.

PRACTICES:

Questions on Data Handling – Level 1:

- Write a program to accept a character as input from the user and print it.
- Write a program to accept a number as input from the user and print it.
- Write a program to accept a float value from the user and print it.
- Write a program to accept a message as input from the user and print it.
- Write a program to accept a message from the user as input and print it in 3 different lines.
- Write a program to accept 2 numbers from the user as input and print their sum.
- Write a program to accept 2 numbers from the user as input and print their product.
- Write a program to accept a number as input from the user which denotes the temperature in Celsius, convert it to Fahrenheit reading and print it.

SKILLS:

- ✓ *Analysis of the problem to be solved.*
- ✓ *Select static or dynamic data structures for a given problem and manipulation of data items.*
- ✓ *Application of various file operations effectively in solving real world problems.*
- ✓ *Develop C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt.*

- Write a program to accept a number as input from the user which denotes the radius and print the area of the circle.
- Write a program to accept a character as input from the user and print it's corresponding ASCII value.

Questions on Control Statements - Looping – Level 1:

- Write a C program to print all the characters from a to z once.
- Write a C program to print all the characters from Z to A once.
- Write a C program to print all the characters from A to Z 3 times.
- Write a C program to print the first N natural numbers, where N is given as input by the user.
- Write a C program to print the first N natural numbers and their sum, where N is given as input by the user.
- Write a C program to print all the odd numbers between 1 and N where N is given as input by the user.
- Write a C program to print all the even numbers between I and N where N is given as input by the user.
- Write a C program to print the squares of the first N natural numbers between 1 and N, where N is given as input by the user.
- Write a C program to print the cubes of the first N natural numbers between 1 and N, where N is given as input by the user.
- Write a C program to print the squares of every 5th number starting from 1 to N, where N is given as input by the user.

Questions on Control Statements – Decision Making – Level 1:

- Write a program to accept two numbers as input check if they are equal.
- Write a program to accept two characters as input and check if they are equal.
- Write a program to accept two numbers as input and print the greater of the 2 numbers.
- Write a program to accept two numbers as input and print the lesser of the 2 numbers.
- Write a program to accept 3 numbers as input and print the maximum of the 3.
- Write a program to accept 3 numbers as input and print the minimum of the 3.
- Write a program to accept a number as input and print EVEN if it is an even number and ODD if it is an odd number.
- Write a program to accept a number as input and check if it is divisible by 3. If it is divisible by 3 print YES else print NO.
- Write a program to accept a number as input and check if it is divisible by both 3 & 5. If it is divisible print YES else print NO.
- Write a program to accept a number as input and check if it is positive, negative or zero.

Questions on Patterns – Level 1:

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

```
*****
*****
*****
*****
*****
```

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

```
*****
*   *
*   *
*   *
*****
```

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

```
*
**
***
****
*****
```

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

```
    *
   **
  ***
 ****
*****
```

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

```
1
12
123
1234
12345
```

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

```
1
22
333
4444
55555
```

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

```
54321
4321
321
21
1
```

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

```
12345
2345
345
45
5
```

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

```
A
AB
ABC
ABCD
ABCDE
```

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

  A

  BC

  DEF

  GHIJ

  KLMNO

Questions on Number Crunching – Level 1:

- Write a program to accept a number as input and print the number of digits in the number.
- Write a program to accept a number as input print the sum of its digits.
- Write a program to accept a number as input, reverse the number and print it.
- Write a program to accept a number and digit as input and find the number of occurrences of the digit in the number.
- Write a program to accept a number as input and check if it is an Armstrong number.
- Write a program to accept a number as input and check if it is an Adam number.
- Write a program to accept a number as input and check if is a prime number.
- Write a program to accept 2 numbers as input and check if they are amicable or not.
- Write a program to accept a number as input and check if it is a power of 2.
- Write a program to accept 2 numbers as input and find their LCM.

Questions on Arrays – Level 1:

- Print the contents of an array from the left to the right.
- Print the contents of an array from the right to the left.
- Find the sum of the elements of an array.
- Find the maximum element in an unsorted array.
- Find the minimum element in an unsorted array.
- Find the average of the elements in an unsorted array.
- Count the number of 0s and 1s in an array having 0s and 1s in random order.
- Count the number of elements in an array whose elements are lesser than a key element in an unsorted array.
- Print all the elements in an array whose values are lesser than a key element in an unsorted array.
- Find the repeated elements in a sorted array.

Questions Number crunching – Level 2:

- Write a program to accept a number as input and print the product of its digits.
- Write a program to accept a number as input and check if it is a palindrome.
- Write a program to accept a number as input and print the frequency of occurrence of each digit.
- Write a program to accept a number as input and print its factors.
- Write a program to accept a number as input and print its prime factors.
- Write a program to accept a number as input and check if it is a perfect square of not.
- Write a program to accept 2 numbers as input and check if they are betrothed numbers or not.
- Write a program to accept 2 numbers as input and print their HCF.
- Write a program to accept a number as input and check if is a strong number.
- Write a program to generate prime numbers between two intervals given as input.

Questions on Arrays – Level 2:

- Find the sum of the maximum and minimum numbers of an unsorted array.
- Replace every element in an array with the sum of its every other element.
- Replace every element in an array with the sum of its right side elements.
- Replace every element in an array with the sum of its left side elements.
- Reverse the elements of an array (in place replacement).
- Reverse the first half of an array.

- Reverse the second half of an array.
- Write a program to find the second largest element in an unsorted array.
- Write a program to find the second smallest element in an unsorted array.
- Write a program to print the number of odd and even numbers in an unsorted array.

Questions on Strings – Level 1:

- Write a program to accept a string as input and print it.
- Write a program to accept a string as input and count the number of vowels in it.
- Write a program to accept a string as input and count the number of consonants in it.
- Write a program to accept a string as input and print its length.
- Write a program to accept a string as input and print the reversed string.
- Write a program to accept 2 strings as input and check if they are the same.
- Write a program to accept a string as input and copy the contents into a second string and print the second string.
- Write a program to accept 2 strings as input and concatenate them into a third string and print the third string.
- Write a program to accept a string as input and check if it is a palindrome.
- Write a program to accept two strings as input and check if the second string is a substring of the first.

Questions on Strings – Level 2:

- Implement the string length function.
- Implement the string copy function.
- Implement the string concatenate function.
- Implement the string compare function.
- Implement the vowel count function.
- Implement the consonant count function.
- Implement the count words function.
- Implement the string reverse function.
- Implement the strstr function.
- Complete the code snippet to implement the is Palindrome function that checks if a given string is a palindrome. You will need to use the 3 functions string Copy, str Reverse and string Compare functions provided to accomplish this.

MODULE-2

UNIT-1 **8L+0T+16P=24 Hours**

FUNCTIONS & POINTERS:

User-defined functions: Function declaration - definition, header of a function, body of a function, function invocation; Call by value; Call by address; Passing arrays to functions; Command line arguments; Recursion; Library Functions.

Pointers: Declaration, Initialization, Multiple indirection, Pointer arithmetic, Relationship between arrays and pointers, Scaling up - array of arrays, array of pointers, pointer to a pointer and pointer to an array; Dynamic memory allocation functions.

UNIT- 2 **8L+0T+16P=24 Hours**

STRUCTURES, UNIONS & FILES:

Structures: Defining a structure, Declaring structure variable, Operations on structures, Pointers to structure - declaring pointer to a structure, accessing structure members using pointer; Array of structures, Nested structures, Passing structures to functions - passing each member of a structure as a separate argument, passing structure variable by value, passing structure variable by reference/ address; Typedef and structures.

Unions: Defining a union - declaring union variable, operations on union; Pointers to union - declaring pointer to a union, accessing union members using pointer; Array of union, Nested union, Typedef and union, Enumerations, Bit-fields.

Files: Introduction to files, Streams, I/O using streams – opening a stream, closing stream; Character input, Character output, File position indicator, End of file and errors, Line input and line output, Formatted I/O, Block input and output, File type, Files and command line arguments.

PRACTICES:

Questions on Strings – Level 3:

- Write a program to swap two given strings and print the swapped strings.
- Write a program to swap two given words of the given sentence and print the altered string.
- Return the maximum occurring character in the string.
- Write a program to print the character in the string with the count where count is the occurrence of the character.
- Write a program to print the duplicate characters in the given string.
- Write a program to remove the duplicate characters in the given string.
- Write a program to remove the vowels from a given string.
- Write a program to rotate a given string N number of times.
- Write a program to check if 2 strings are rotations of each other.
- Write a program to remove the characters from the first string that are present in the second string.

Questions on 2D Arrays – Level 1:

- Print the contents of a 2D array row-wise.
- Print the contents of a 2D array column-wise.
- Print the contents of a 2D array in a zig-zag order.
- Print the contents of a 2D array diagonal-wise.
- Print the contents of a 2D array right-diagonal order.
- Print the contents of a 2D array left-diagonal order.
- Print the contents of a 2D array in the upper triangular order – left top to right bottom.
- Print the contents of a 2D array in the lower triangular order.
- Find and print the maximum element along with its position in a matrix.
- Find and print the minimum element along with its position in a matrix.

Questions on 2D Arrays – Level 2:

- Find and print the maximum element of each row of a matrix.
- Find and print the minimum elements of each row of a matrix.
- Find and print the maximum element of each column of a matrix.
- Find and print the minimum element of each column of a matrix.
- Find the lowest value in the upper triangle area and the largest value in the lower triangular area of a matrix and print their product.
- Find the sum of the elements of each row and each column of a matrix and print the minimum row sum and maximum sum column.
- Write a program to find the row with the maximum number of 1’s in a matrix consisting of only 0’s and 1’s.
- Write a program to print the quotient and remainder on dividing sum of left-top to right-bottom diagonal by sum of right-top to left-bottom diagonal.
- Write a program to print the absolute difference of the sum of major diagonal elements and the sum of minor diagonals of the given matrix.
- Write a program to search a given element in a row-wise and column-wise sorted 2D array.

Questions on 2D Arrays – Level 3:

- Write a program to find the Kth smallest element in the given matrix.
- Write a program to find the Kth largest element in the given matrix.

- Write a program to check whether the given two two-dimensional array of same dimensions are equal or not.
- Write a program to add the given two two-dimensional array of same dimensions.
- Write a program to subtract the given two two-dimensional array of same dimensions.
- Write a program to multiply the given two two-dimensional array of same dimensions.
- Write a program to sort each row of a matrix.
- Write a program to find the sum of the elements in 'Z' sequence of the given 2D array.
- Write a program to print the unique rows of the given two-dimensional array consisting of only 0's and 1's.
- Write a program to print the unique columns of the given two-dimensional array consisting of only 0's and 1's.

Questions on Files, Structures & Unions:

- Write a C program to create a struct, named Student, representing the student's details as follows: first_name, last_name, Age and standard.

  Example

  Read student data

  john

  carmack

  15

  10

  Display the data in the following format

  First Name: john

  Last Name: carmack

  Age: 15

  Standard: 10

- Declare a structure POINT. Input the coordinates of point variable and write a C program to determine the quadrant in which it lies. The following table can be used to determine the quadrant.

Quadrant	X	Y
1	Positive	Positive
2	Negative	Positive
3	Negative	Negative
4	Positive	Negative

  Example

  Input the values for X and Y coordinate: 7 9

  The coordinate point (7,9) lies in the First quadrant.

- Bob and Alice both are friends. Bob asked Alice how to store the information of the books using Structures. Then Alice written a c program to store the information of books using book structure by taking different attributes like book_name, author, book_id, price. Write a C program to read and display the attributes of the books using structures.

  Sample Input:

  Enter number of books: 1

  Enter the book name: c Programming

  Enter the author name: balaguruswamy

  Enter the book ID: 23413

  Enter the book price: 500

  Sample Output:

  The details of the book are:

  The book name is: c Programming

The author name is: balaguruswamy

The book ID is: 23413

The book price is: 500.00

- Ramesh wants to do addition on complex numbers. He did it with regular practice but Charan asked him to do with the help of structures by following below Criteria.

  Write a C program that defines a structure named 'Complex' consisting of two floating point members called "real and imaginary". Let c1 and c2 are two Complex variables; compute the sum of two variables.

  Example:

  c1= 2 8
  c2= 6 4
  Sum= 8.000000+12.000000i

- Customer Payment Details is a structure with members as customers_name, address, account_number, payment_status(paid(1)/ not_paid(0)), due_date, and amount. In this example, payment_date is another structure with month, day and year as integer members. So, every customer record can be considered as an array of structures.

  Write a C program that displays the amount to be paid by each customer along with their names. If payment_status is 1, display NIL for such customers.

  Input Format:

  First line of input contains 'n' number of customers, followed by 8 lines of input for each customer. Each line represents (customers_name, address, account_number, amount payment_status(paid(1)/ not_paid(0)), and due_date).

  Output Format:

  First line of output is Amount to be paid by each customer as on date: followed by n lines of output. Each line contains name of the customer followed by tab space, and amount to be paid.

  Hint: Use nested structure to represent date.

  Write a 'C' program to accept customer details such as: Account_no, Name, Balance using structure. Assume 3 customers in the bank. Write a function to print the account no. and name of each customer whose balance < 100 Rs.

- Write a C program to accept details of 'n' employee(eno, ename, salary) and display the details of employee having highest salary. Use array of structure.

- Write a C program to print the bill details of 'N' number of customers with the following data: meter number, customer name, no of units consumed, bill date, last date to deposit and city. The bill is to be calculated according to the following conditions:

No. of units	**Charges**
For first 100 units	Rs.0.75 per unit
For the next 200 units	Rs.1.80 per unit
For the next 200 units	Rs.2.75 per unit

  Sample Input

  Enter no. of customers

  1

  Enter Meter Number AP01213

  Enter Customer Name: Karthik

  Enter No. of units consumed: 200

  Enter Bill date:22/01/2021

  Enter Last date: 12/2/2021

  Enter City: Guntur

  Sample Output

  Meter Number AP01213

  Customer Name: Karthik

No. of units consumed: 200

Bill date:22/01/2021

Last date: 12/2/2021

City: Guntur

Total Amount: 255.000000

- Write a C program that creates a student file containing {Roll No, Student Name, Address, Stream}, where the data will be inserted and display the list of students who are in CSE (Stream=CSE).

  Input: A file name

  Output: The attributes such as Roll_No, Student_Name, Stream, Address.

  Sample Input

201fa4200	Raja	CSE	Guntur
201fa4201	Bala	IT	Tenali

  Sample Output

201fa4200	Raja	CSE	Guntur

- Write a C program that reads content from an existing text file and write the same in a new file by changing all lowercase alphabetic character to upper case. (Existing file may contain digit and special characters).

  Example:

  Input: Enter the file name.

  Output: New file with updated content.

- Write a C program to count the occurrences of the given string in a file.

  Example:

  Input: Enter the File name to read the string to be counted.

  Output: Display the count of occurrences of the string.

- Write a C Program to transfer the data from one location to another location without changing the order of the content.

  Example:

  Read the file name from the user. If the source file exists, Transfer the data and display the message as “Data is transferred successfully” otherwise display the message “No such file is existing in the directory.”

- Write a C program that reads numbers and write them into a text-file. Also find odd and even numbers in that file and store it in 2 separate files named odd.txt and even.txt. All the values should be in ascending order.

  Input: Enter the values.

  Output: Creates a separate file for Even and Odd numbers.

  Sample Input:

  4 43 2 53 45

  Sample Output:

  Even.txt: 2 4

  Odd.txt: 43 45 53

- Write a C program to replace the content in the given text file.

  Input: Enter the file name, line number to be replaced and the new content

  Output: New file with replaced lines.

  Example:

  Sample Input: Enter the file name: abc.txt

  Enter the line no to replace: 3

  Enter the content: Files stores data presently.

Sample Output:

Line no 3 is replaced with the given content.

The content of the file abc.txt contains:

test line 1

test line 2

Files stores data presently

test line 4

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify suitable data type for operands and design of expressions having right precedence.	Apply	1,2	1
2	Apply decision making and iterative features of C Programming language effectively.	Apply	1,2	1
3	Select problem specific data structures and suitable accessing methods.	Analyze	1,2	1,2
4	Develop C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt.	Evaluate	1,2	3,4
5	Design and develop non- recursive and recursive functions and their usage to build large modular programs and also able to design string manipulation functions.	Create	1,2	3

TEXT BOOKS:

1. Behrouz A. Forouzan, Richard F.Gilberg, “Programming for Problem Solving”, 1st edition, Cengage publications, 2019.
2. Ajay Mittal, “Programming in C - A Practical Approach”, 1st edition, Pearson Education, India, 2010.

REFERENCE BOOKS:

1. Reema Thareja, “Computer Fundamentals and Programming in C”, 1st edition, Oxford University Press, India, 2013.
2. Herbert Schildt, “C: The Complete Reference”, 4th edition, Tata McGraw-Hill, 2017.
3. Byron S Gottfried, “Programming with C”, 4th edition, Tata McGraw-Hill, 2018.

22EN102 ENGLISH PROFICIENCY AND COMMUNICATION SKILLS

Hours Per Week :

L	T	P	C
0	0	2	1

PREREQUISITE KNOWLEDGE: Basics of grammar, Read and understand for global context, Cultural sensitivity and Basic writing skills.

COURSE DESCRIPTION AND OBJECTIVES:

English Proficiency and Communication Skills seeks to develop the students' abilities in grammar, speaking, reading, writing and overall comprehension skills. The course will provide students an exposure on a wide range of language use in everyday situations. It will make the students to equip with functional English and make them use it confidently in their professional and social contexts. Finally, students will strengthen their reading, writing, listening and speaking skills in English

MODULE-1

UNIT-1 **0L+0T+8P=8 Hours**

MY LIFE AND HOME – MAKING CHOICES – HAVING FUN:

Reading: Understanding main message, factual information global meaning, specific information and paraphrasing.
Writing: Developing hints based mail, Writing short messages/paragraphs.
Listening: Understanding short monologues or dialogues and choose the correct visual.
Speaking: Express simple opinions /cultural matters in a limited way.
Vocabulary: Discerning use of right word suiting the context, B1 Preliminary word list.
Grammar: Frequency Adverbs, State Verbs, AFV and Prepositions.

UNIT-2 **0L+0T+8P=8 Hours**

ON HOLIDAY - DIFFERENT FEELINGS – THAT'S ENTERTAINMENT!:

Reading: Longer text for detailed comprehension, gist and inference.
Writing: Developing notes and responding to penfriends or 'e-pals'.
Listening: Understand straightforward instructions or public announcements.
Speaking: Describing people, things and places in a photograph.
Vocabulary/Grammar:
Comparatives and Superlatives, Gradable and non-gradable adjectives, Cloze tests.

PRACTICES:

- Developing hints based mail.
- Writing short message.
- Writing paragraphs.
- Expressing opinions and cultural matters.
- Understanding short monologues.
- Understanding straightforward instructions and public announcements.
- Describing people, things and places in a photograph.

MODULE-2

UNIT-1 **0L+0T+8P=8 Hours**

GETTING AROUND – INFLUENCES - STAY FIT AND HEALTHY:

Reading: Reading for understanding coherence of the text and drawing inferences.
Writing: Reading an announcement from a magazine or website for preparing an article.

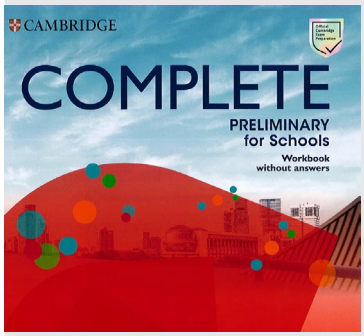


Image source: https://www.scribd.com/document/502301821/Cambridge-Complete-B1-Preliminary-for-Schools-Workbook-2020-Edition

SKILLS:

- ✓ *Use of appropriate grammar and vocabulary with syntactic patterns in short texts.*
- ✓ *Read and extract the main message, global meaning, specific information, detailed comprehension, understanding of attitude, opinion and writer purpose and inference.*
- ✓ *Listen to understand key information, specific information, gist and detailed meaning and to interpret meaning.*
- ✓ *Understand questions and make appropriate responses and talk freely on everyday topics.*

Listening: Discussion activities and listening to understand the gist of each short dialogue.

Speaking: Snap Talks, Make and respond to suggestions, discuss alternatives and negotiate agreement.

Vocabulary / Grammar: Punctuation, Prepositions, Phrasal Verbs, B1 Preliminary word list.

UNIT-2 **0L+0T+8P=8 Hours**

LOOKS AMAZING! – THE NATURAL WORLD – EXPRESS YOURSELF!:

Reading: Content, Communicative Achievement, Organisation and Language.

Writing: Developing a story with clear links to the given opening sentence.

Listening: An interview for a detailed understanding of meaning and to identify attitudes and opinions.

Speaking: Discuss likes, dislikes, experiences, opinions, habits, etc.

Vocabulary/Grammar: Modals, Conditionals, Verb forms (Time and Tense).

PRACTICES:

- Listening to understand the gist of each short dialogue.
- Listening to an interview for a detailed understanding of meaning and to identify attitudes and opinions.
- Preparing an article.
- Discuss for alternatives and negotiate agreement.
- Discussion on likes, dislikes, experiences, opinions, habits, etc.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply to read and grasp content on a range of topics/ texts related to their everyday life like notifications, advertisements, travel brochures, news reports, articles.	Apply	1	7, 8, 9, 10, 12
2	Apply suitable strategies to achieve comprehension, like listening for main points and checking comprehension using contextual clues etc.	Apply	1	7, 8, 9, 10, 12
3	Demonstrate vocabulary beyond that of the familiar subjects.	Analyze	1, 2	7, 8, 9, 10, 12
4	Show sufficient control of English grammar and sentence variety to coherently organise information at sentence and discourse levels.	Evaluate	2	7, 8, 9, 10, 12
5	Use functional English to communicate and interact effectively in everyday situations.	Create	2	7, 8, 9, 10, 12

TEXT BOOKS:

1. Emma Heyderman and Peter May, “Complete Preliminary”, Student’s Book with Answers, 2nd edition, Cambridge University Press, 2019.

REFERENCE BOOKS:

1. Annette Capel and Rosemary Nixon, “Introduction to PET”, Oxford University Press, 2009.
2. Adrian Doff and Craig Thaine, “Empower Pre intermediate”, Cambridge University Press, 2015.
3. Louise Hashemi and Barbara Thomas, “Objective PET”, Cambridge University Press, 2010.

22TP101 CONSTITUTION OF INDIA

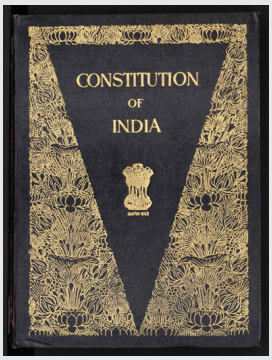


Image: https://commons.wikimedia.org/wiki/File:Constitution_india.jpg

Hours Per Week :

L	T	P	C
0	2	0	1

PREREQUISITE KNOWLEDGE: High School-level Civics and Social Studies.

COURSE DESCRIPTION AND OBJECTIVES:

To provide students with a basic understanding of Indian Polity and Constitution and make students understand the functioning of government at the center and state level besides local self-government. This course also equips students with knowledge pertaining to fundamental rights and fundamental duties of a citizen in a democracy such as India.

MODULE-1

UNIT-1 **0L+8T+0P=8 Hours**

HISTORICAL BACKGROUND TO THE INDIAN CONSTITUTION:

Meaning of the constitution law and constitutionalism; Historical perspective of the Constitution of India; Salient features and characteristics of the Constitution of India.

UNIT-2 **0L+8T+0P=8 Hours**

FUNDAMENTAL RIGHTS, DUTIES, DIRECTIVE PRINCIPLES, AND AMENDMENT:

Scheme of the fundamental rights - scheme of the Fundamental Right to Equality; scheme of the Fundamental Right to certain Freedom under Article 19; scope of the Right to Life and Personal Liberty under Article 21; Scheme of the Fundamental Duties and its legal status; Directive Principles of State Policy – its importance and implementation; Amendment of the Constitution - Powers and Procedure.

PRACTICES:

- Enactment of Constituent Assembly debates to further understand the rationale for the provisions of the constitution.
- Fundamental Rights in our popular culture - discussion in the movie Jai Bhim.

MODULE-2

UNIT-1 **0L+8T+0P=8 Hours**

STRUCTURE AND FORM OF GOVERNMENT:

Federal structure and distribution of legislative and financial powers between the Union and the States; Parliamentary Form of Government in India – The constitution powers and status of the President of India; Emergency Provisions: National Emergency, President Rule, Financial Emergency.

UNIT-2 **0L+8T+0P=8 Hours**

LOCAL SELF GOVERNMENT:

Local Self Government – Constitutional Scheme in India – 73rd and 74th Amendments.

PRACTICES:

- Debate on federalism in India.
- Collect news published in the local papers about panchayats in the nearby areas.

SKILLS:

- ✓ *Understanding the basics of the Indian constitution.*
- ✓ *Know the fundamental rights, fundamental duties, and Directive Principles of State Policy.*
- ✓ *Fair knowledge about the functioning of various institutions in a democracy.*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyse major articles and provisions of the Indian constitution.	Analyze	1	6
2	Appreciation for the constitution and safeguarding individual rights.	Apply	1	6
3	Evaluating functions of various organs of the State in a democracy.	Evaluate	2	6

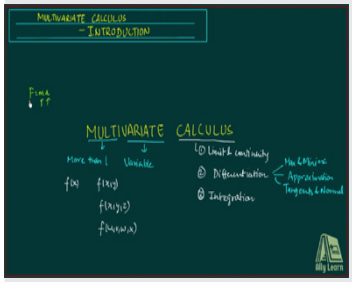
TEXTBOOK:

1. PM Bhakshi, “Constitution of India”, 15th edition, Universal Law Publishing, 2018.

REFERENCE BOOKS:

1. B. R. Ambedkar, “The Constitution of India” Educreation Publishing, India, 2020.
2. Subhash Kashyap, “Our Constitution” 2nd edition, National Book Trust, India, 2011.
3. Arun K. Thiruvengadam, “The Constitution of India: A Contextual Analysis”, Hart Publishing India, 2017.

22MT111 MULTI VARIATE CALCULUS



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Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Basic set theory and determinants.

COURSE DESCRIPTION AND OBJECTIVES:

The course covers the fundamental concept of vector and multivariate calculus. The primary focus of the course will be to study the basic concepts of limit, continuity and differentiability. Students will learn some important theorems (Mean value theorem, Taylor's theorem, Green's theorem, Gauss divergence theorem, Stokes' theorem), multiple integrals and convergence of sequence and series which will be helpful to understand the optimization problems, the motion of race cars, the mass of a wire or a spring and various applications arise on science and engineering.

MODULE-1

UNIT-1 **12L+8T+0P=20 Hours**

SEQUENCE, SERIES AND DIFFERENTIABILITY:

Real number system, Sequence, Convergence of a sequence, Monotone sequence Infinite series, Convergence of series, Testing of convergence by ratio test, nth root test, p-test Real functions of one variable, Limits, Continuity, Differentiability Functions of several variables, Partial differentiation.

UNIT-2 **12L+8T+0P=20 Hours**

APPLICATIONS:

Mean value theorems, Bolzano-Weierstrass theorem (without proof), Taylor's theorem, Leibnitz theorem. Maxima and Minima of a function of two variables, Conditions for extreme values, Lagrange method of undetermined multipliers.

PRACTICES:

- Calculate whether the sequence or series is convergent or not.
- Derive the partial differentiation of a function.
- Apply mean value theorem.
- Approximation of function by Taylor's series.
- Find extreme value.

MODULE-2

UNIT-1 **12L+8T+0P=20 Hours**

VECTOR CALCULUS:

Introduction to vectors, Vector algebra (review), Scalar and vector point functions, Gradient, Divergence and Curl.

Introduction to Multiple integrals (review), Line integral, Surface integral, Volume integral

UNIT-2 **12L+8T+0P=20 Hours**

APPLICATIONS OF VECTOR CALCULUS:

Normal vector, Directional Derivate, Solenoidal and Irrotational vectors, Scalar potential Green's theorem for plane, Gauss divergence theorem, Stokes' theorem.

SKILLS:

- ✓ *Understanding of sequence and series of real numbers.*
- ✓ *Ability to compute the maximum and minimum of a function.*
- ✓ *Approximation of Taylor series of a function.*
- ✓ *Fluency in vector operation and understanding of gradient, divergence and curl.*
- ✓ *Ability to compute multiple integrals and to change variables in multiple integrals.*

PRACTICES:

- Apply Gradient, Divergence and Curl.
- Calculate Line, Surface and Volume integral.
- Find Directional derivative.
- Check whether a vector is Solenoidal or Irrotational.
- Apply Green's theorem, Gauss divergence theorem, Stokes' theorem.

COURSEOUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of convergence, continuity and differentiability.	Apply	1	1, 2, 9, 10, 12
2	Apply vector integration to find areas and volumes.	Apply	2	1, 2, 9, 10, 12
3	Evaluate the extreme values	Evaluate	1	1, 2, 9, 10, 12
4	Evaluate the gradient, curl and directional derivatives	Evaluate	2	1, 2, 9, 10, 12

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", 44 Edition, Khanna Publishers, 2018.
2. E. Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, Inc, 2015.

REFERENCE BOOKS:

1. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", Third revised edition, S. Chand and Co., 2015
2. B. V. Ramana, "Engineering Mathematics", TMH Publishers, 2015.
3. N. P. Bali, K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", Universal Science Press, New Delhi, 2018
4. E. Herman, G. Strang, "Calculus Volume 3", Openstax, 2016.

22CT103 ENGINEERING CHEMISTRY

Image source: https://www.rsc.org/journals-books-databases/about-journals/reaction-chemistry-engineering/

Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Concept of bonding, chemical reactions and electrochemical cell

COURSE DESCRIPTION AND OBJECTIVES:

The course aims to cover the importance of chemistry and its applications in engineering disciplines particularly focusing on developing new engineering materials (such as polymers, nanomaterials etc.) and understanding their property for scientific and engineering applications. In addition, the students are also expected to acquire knowledge on electrochemistry and construction of batteries and fuel cells.

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

POLYMERS:

Introduction, classification, molecular weight determination, (Mw & Mn), types of polymerization, preparation, properties and applications of PE, PMA, Nylon-6,6; Rubber-vulcanization, synthetic rubbers – Neoprene, Introduction to polymer composites, glass fiber and metal oxide/metal composites.

UNIT-2 **8L+0T+8P=16 Hours**

NANOMATERIALS & ENGINEERING MATERIALS:

Nanomaterials: Introduction, classification, properties, Top-down (Ball Milling) and Bottom-up (Sol-Gel) synthetic methods; Synthesis, properties and applications of Carbon Nanotubes and Graphene.

Engineering Materials: Lubricants – classification, viscosity, viscosity index, flash and fire points, cloud and pour points and mechanical stability; Refractories – classification, refractoriness RUL, chemical & thermal stability.

PRACTICES:

- Synthesis of Nanoparticles.
- Synthesis of Bakelite.
- Determination of viscosity of oil (Biodiesel, castor oil and coconut oil).
- Water Analysis.
- Synthesis of Iron oxide nanoparticles.
- Synthesis of Au/Ag nanoparticles using plant extract.
- Preparation of Nylon-6,6.
- Preparation of Polystyrene.

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

ELECTROCHEMISTRY & CORROSIONS:

Electrochemical Cells: Galvanic and electrolytic cells; Redox reactions; Electrode potential; Electrochemical series, EMF of an electrochemical cell; Nernst equation - applications and significances; Reference electrodes – Standard hydrogen electrode.

Corrosion: Introduction, dry & wet corrosion; Galvanic series; Corrosion prevention by cathodic protection.

SKILLS:

- ✓ *Synthesize various polymers.*
- ✓ *Synthesize nanomaterials.*
- ✓ *Identify the properties of different industrially relevant engineering materials.*
- ✓ *Understand the different components of an electrochemical cell.*
- ✓ *Design electrochemical cell such as battery.*
- ✓ *Identify the types of energy conversion/storage systems.*

UNIT-2 **8L+0T+8P=16 Hours**

BATTERIES & FUEL CELLS:

Batteries: Introduction and importance; Classification of batteries - Lead-acid storage cell and Lithium-ion batteries.

Fuel Cells: Classification of Fuel Cells; Construction, working principle and applications of Hydrogen-Oxygen fuel cell, Biofuel cells - Microbial fuel cells.

PRACTICES:

- Determination of EMF and ΔG of an electrochemical cell.
- Determination of rate of corrosion by weight loss method.
- Construction of Batteries.
- Determination of Molecular weight by viscometer.
- Determination of Fe (II) by dichrometry method.
- Determination of available chlorine in bleaching powder.
- Determination of strength of Weak acid by pH-method.
- Determination of concentration of mixture of acids by conductometry.
- Electroplating of Copper and Zinc on metallic objects.
- Determination of rate of corrosion by weight loss method.
- Construction of galvanic cell and measure the EMF.

COURSEOUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply various synthetic methods for preparing polymers for engineering applications.	Apply	1	1, 2, 4, 9, 10, 11, 12
2	Analyze characteristics in different engineering nanomaterials for the applications of electronic engineering.	Analyze	1	1, 2, 3, 5, 9, 10, 11, 12
3	Distinguish different types of electrochemical cells and corrosions for the real time analysis.	Analyze	2	1, 2, 3, 5, 6, 7, 9, 10, 11, 12
4	Analyze possible corrosion types and their different protection methods.	Analyze	2	1, 2, 3, 5, 6, 7, 9, 10, 11, 12
5	Recommend the principle of electrochemistry for designing various batteries and fuel cells.	Evaluate	2	1, 2, 3, 5, 6, 7, 9, 10, 11, 12

TEXT BOOKS:

1. S. Chawala, “A Textbook of Engineering Chemistry Engineering Materials and Applications”, Dhanpat Rai Publications, 3rd Edition, 2015.
2. P.C. Jain and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publications, 17th Edition, 2015.

REFERENCE BOOKS:

1. K. S. Maheswaramma and M. Chugh, “Engineering Chemistry”, Pearson, 1st Edition, 2015.
2. B. S. Bahl, Arun Bahl and B. D. Tuli, “Essentials of Physical Chemistry”, S. Chand and Co. Ltd., 2007.
3. G. Raj and C. Anand, “Instrumental Methods of Analysis”, Himalaya Publications, 5th edition, 2007.
4. T. Pradeep, “Nano: The Essentials; Understanding of Nano Science and Technology” Tata McGraw-Hill, New Delhi, 2012.
5. J. Mendham, R. C. Denney, J. D. Bares, M. Thomas and B. Siva Sankar, “Vogel’s Textbook of Qualitative Chemical Analysis” (vol. 1), Pearson Publications, 2009.

22ME101 ENGINEERING GRAPHICS

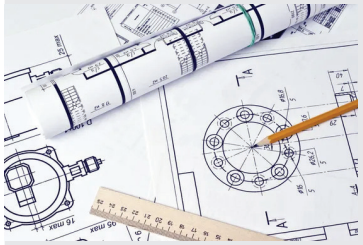

Image source: https://depositphotos.com/5087383/stock-photo-the-engineering-drawing.html
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Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of Geometry

COURSE DESCRIPTION AND OBJECTIVES:

Engineering graphics is the language of engineers and is the most effective way of communicating and sharing technical ideas in the form of pictures/drawings. The objective of this course is to familiarize the students with the conventional concepts of engineering drawing and computer aided drawing.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

ENGINEERING CURVES:

Types of lines; Lettering, Dimensioning, Geometric constructions - lines, polygons (Angle, ARC, General and Inscribe in circle method), Conical curves (General method), Ellipse by Oblong method.

UNIT-2 **10L+0T+10P=20 Hours**

ORTHOGRAPHIC PROJECTIONS OF POINTS, LINES & PLANES:

Principles of projection; Projections of points; Projection of straight lines - Inclined to one plane, inclined to both planes; Projection of planes - Inclined to one plane.

PRACTICES:

- Construction of polygons using different methods (i.e. ARC, Angle, General).
- Inscribe a regular hexagon & pentagon in a circle of the given diameter.
- Tracing of conical curves (Ellipse, Parabola, Hyperbola) by using General Method.
- Draw the projections of the points situated in all the 4 quadrants.
- Draw the projections of a line when it is inclined to one plane (HP or VP).
- Draw the projections of a line when it is inclined to both the planes (HP &VP).
- Draw the projections of a plane when it is inclined to one plane (HP or VP).

MODULE-2

UNIT-1 **6L+0T+6P=12 Hours**

PROJECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES:

Projections of Solids: Projection of solids axis inclined to one reference plane - Prisms, pyramids, Cylinder and cone.

Development of Surfaces: Development of lateral surfaces of simple solids - Prisms, Pyramids, Cylinder and cone.

UNIT-2 **10L+0T+10P=20 Hours**

ORTHOGRAPHIC VIEWS AND DRAFTING USING COMPUTER PACKAGE:

Orthographic Views: Conversion of pictorial views into orthographic views.

Drafting Using Computer Package: Introduction to 2D modelling software - AutoCAD; Conversion of Isometric view into Orthographic views of simple castings; Conversion of Orthographic views into Isometric view of simple solids - Prisms, Pyramids, Cylinders and cones.

SKILLS:

- ✓ *Convert iso-metric views of objects into orthographic views and vice versa.*
- ✓ *Visualize the shape of the 3D components.*
- ✓ *Create pictorial views by using AutoCAD.*
- ✓ *Understand projections by visualization.*

PRACTICES:

- Draw the projections of Prisms, when they are inclined to one reference plane (HP or VP).
- Draw the projections of Pyramids, when they are inclined to one reference plane (HP or VP).
- Draw the projections of cylinder & cone, when they are inclined to one reference plane (HP or VP).
- Draw the complete surface development of prisms & pyramids with the given dimensions.
- Draw the complete surface development of cylinder & cone with the given dimensions.
- Draw the orthographic view's (i. e. front view, top view, and side view) of the given pictorial view of the sketches by using AutoCAD.
- Draw the Isometric view of simple solids (Prisms & Pyramids) by using AutoCAD.
- Draw the Isometric view of simple solids (Cylinder & Cone) by using AutoCAD.

COURSEOUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Communicate the technical ideas in the form of drawings.	Apply	1	1,2,3,5
2	Apply the drawing skills in representing various geometrical features.	Apply	1	1,2,3,5
3	Develop orthographic projections and isometric views of various objects.	Apply	1	1,2,3,5
4	Estimate the lateral surface area of regular geometrical solids.	Analyze	2	1,2,3,5
5	Sketch simple objects and their pictorial views using AutoCAD.	Analyze	2	1,2,3,5

TEXT BOOKS:

1. J Hole, "Engineering Drawing", 2nd edition, Tata McGraw-Hill, 2019.
2. N D Bhatt, "Engineering Drawing", 53rd edition, Charotar Publication, 2014.

REFERENCE BOOKS:

1. Basant Agrawal and C.M. Agrawal "Engineering Drawing", 2nd edition, Tata Mc Graw- Hill, 2018.
2. K L Narayana, "Engineering drawing", 3rd edition, SciTech Publications, 2011.
3. Colin H. Simmons, Dennis E. Maguire, Manual of Engineering Drawing, 2nd edition, 2003.

22TP104 BASIC CODING COMPETENCY

Source: https://www.geeksforgeeks.org/best-way-to-start-with-competitive-programming-geeksforgeeks-cp-live-course/

Hours Per Week :

L	T	P	C
0	1	3	2

PREREQUISITE KNOWLEDGE: Programming in C.

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed to impart knowledge on advanced concepts of C programming language and problem solving. At the end of this course, students will be able to design, implement, test and debug complex problems using features of C.

MODULE-1

UNIT-1 **0L+4T+12P=16 Hours**

NUMBER CRUNCHING :

PRACTICES:

Problems On Number Crunching

- Write a program to check if a given number is perfect or not.
- Write a program to check if a given number is deficient or not.
- Write a program to check if 2 given numbers are amicable or not.
- Write a program to check if 2 given numbers are betrothed or not.
- Write a program to check whether a given number is an Armstrong number or not.
- Write a program to print the series of prime numbers in the given range.
- Write a program to print all the perfect numbers in a given range.
- Write a program to generate all deficient numbers in a given range.
- Write a program to generate all the amicable numbers in a given range.
- Write a program to generate all the betrothed numbers in a given range.
- Write a program to find the largest prime factor of a given number.
- Write a program to check whether the given number is a palindrome or not.
- Write a program to calculate sum of the individual digits for the given number.
- Write a program to find the first number that has more than ‘n’ factors, excluding 1 and that number.
- Write a program to accept a number as input and print its factorial.
- Write a program to accept a number n, print first N Fibonacci numbers.
- Write a program to check if an input number is Armstrong number or not.
- Write a program that takes input a,b. Print a power b.
- Write a program that takes input a number n, check if it a perfect square or not.
- Print array in spiral format.
- Print sum of each row in a matrix.
- Print sum of each column in matrix.
- Print left->right and right->left diagonals in a matrix.
- Initially you are at (0,0) find the shortest path count to reach the (n, n) block in matrix.
- Remove all the elements present in row and column of unsafe elements. An element is called unsafe if it is equal to smallest or largest value. Count number of remaining elements.
- Write a program to check if the string contains all the letters of alphabet.

SKILLS:

- ✓ *Analysis of the problem to be solved.*
- ✓ *Application of various file operations effectively in solving real world problems.*
- ✓ *Develop C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt.*

- Check if a string is matching password requirements.
- Check if String A contains String B (String searching).
- Check if a number is harshad number or not.
- Write a program to get 3 numbers as input. The first is the number num1 and second is the digit that needs to be replaced. The third is the digit that is to replace the 2nd digit. Print the number after performing this operation.
- Write a program to accept a number and swap its alternate digits. Print the number generated.
- Write a program to accept a number and choice as input. If the choice is 0 rearrange the number such that the odd digits are ordered first followed by the even digits. If the choice is 1 rearrange the number such that the even digits are ordered first followed by the odd digits. Print the rearranged number. The order of occurrence of the digits is to be preserved.
- Write a program to determine that whether the given quadrilateral is cyclic or not. You are given the sizes of angles of a simple quadrilateral (in degrees) A, B, C and D, in some order along its perimeter.

  Note: A quadrilateral is cyclic if and only if the sum of opposite angles is 180^0.
- Chef is a very lazy person. Whatever work is supposed to be finished in x units of time, he finishes it in m*x units of time. But there is always a limit to laziness, so he delays the work by at max d units of time. Given x,m,d, find the maximum time taken by Chef to complete the work.
- Suppose Chef is stuck on an island and currently he has x units of food supply and y units of water supply in total that he could collect from the island. He needs xr units of food supply and yr units of water supply per day at the minimal to have sufficient energy to build a boat from the woods and also to live for another day. Assuming it takes exactly D days to build the boat and reach the shore, tell whether Chef has the sufficient amount of supplies to be able to reach the shore by building the boat? Read five integers x,y,xr,yr,D from the user and display “YES” if Chef can reach the shore by building the boat and “NO” if not (without quotes).
- There are 3 problems in a contest namely A,B,C respectively. Alice bets Bob that problem C is the hardest while Bob says that problem B will be the hardest.

  You are given three integers SA,SB,SC which denotes the number of successful submissions of the problems A,B,C respectively. It is guaranteed that each problem has a different number of submissions. Determine who wins the bet.

  1) If Alice wins the bet (i.e. problem C is the hardest), then output Alice.

  2) If Bob wins the bet (i.e. problem B is the hardest), then output Bob.

  3) If no one wins the bet (i.e. problem A is the hardest), then output Draw.

  Note: The hardest problem is the problem with the least number of successful submissions.

  Input Format

  - The first line of input contains a single integer T denoting the number of test cases. The description of T test cases follows.
  - The first and only line of each test case contains three space-separated integers SA,SB,SC, denoting the number of successful submissions of problems A,B,C respectively.

  Output Format

  For each test case, output the winner of the bet or print Draw in case no one wins the bet.

  Sample Input 1

  3

  1 4 2

  16 8 10

  14 15 9

  Sample Output 1

  Draw

  Bob

  Alice

- In a season, each player has three statistics: runs, wickets, and catches. Given the season stats of two players A and B, denoted by R, W, and C respectively, the person who is better than the other in the most statistics is regarded as the better overall player. Tell who is better amongst A and B. It is known that in each statistic, the players have different values.

  Input

  The first line contains an integer T, the number of test cases. Then the test cases follow.

  Each test case contains two lines of input.

  The first line contains three integers R1, W1, C1, the stats for player A.

  The second line contains three integers R2, W2, C2, the stats for player B.

  Output

  For each test case, output in a single line "A" (without quotes) if player A is better than player B and "B" (without quotes) otherwise.

- Write a program to find the direction.

  Chef is currently facing the north direction. Each second he rotates exactly 90 degrees in clockwise direction. Find the direction in which Chef is facing after exactly X seconds.

  Note: There are only 4 directions: North, East, South, West (in clockwise order). Initially chef is at 0th second i.e., facing North direction.

  Input Format

  - First line will contain T, number of testcases. Then the testcases follow.
  - Each testcase contains of a single integer X.

  Output Format

  For each testcase, output the direction in which Chef is facing after exactly X seconds.

  Sample Input 1

  3

  1

  3

  6

  Sample Output 1

  East

  West

  South

- Chef is playing in a T20 cricket match. In a match, Team A plays for 20 overs. In a single over, the team gets to play 6 times, and in each of these 6 tries, they can score a maximum of 6 runs. After Team A's 20 overs are finished, Team B similarly plays for 20 overs and tries to get a higher total score than the first team. The team with the higher total score at the end wins the match.

  Chef is in Team B. Team A has already played their 20 overs, and have gotten a score of R. Chef's Team B has started playing, and have already scored C runs in the first O overs. In the remaining 20−O overs, find whether it is possible for Chef's Team B to get a score high enough to win the game. That is, can their final score be strictly larger than R?

  Input: There is a single line of input, with three integers, R, O, C.

  Output: Output in a single line, the answer, which should be "YES" if it's possible for Chef's Team B to win the match and "NO" if not.

- Make Array Zeros using pointers

  You are given an array A of length N (size should be created using Dynamic memory allocation) and can perform the following operation on the array:

  Select a subarray from array A having the same value of elements and decrease the value of all the elements in that subarray by any positive integer x.

  Find the least possible number of operations required to make all the elements of array A equal to zero.

The first line contains an integer N denoting the number of elements in the array.

The next line contains space-separated integers denoting the elements of array A.

Print the least possible number of operations required to make all the elements of array A equal to zero.

Sample Test case

Input:

5

2 2 1 3 1

Output:

4

UNIT-2 **0L+4T+12P=16 Hours**

PATTERNS:

PRACTICES:

Problems on Number Patterns

- Write a program to generate Floyd triangle. Sample input N= 4.
  1
  2 3
  4 5 6
  7 8 9 10
- Write a program to generate the following pattern. Sample input N=5.
  13579
  3579
  579
  79
  9
- Write a program to generate the following pattern. Sample input N=4.
  1111111
  222222
  33333
  4444
  333
  22
  1
- Write a program to generate the following pattern. Sample input N=5.
  5432*
  543*1
  54*21
  5*321
  *4321
- Write a program to generate the following pattern. Sample input N=5.
  12 21
  123 321
  1234 4321
  123454321

- Write a program to generate the following pattern. Sample input N=5.

  1
  2*2
  3*3*3
  4*4*4*4
  4*4*4*4
  3*3*3
  2*2
  1
- Write a program to generate the following pattern. Sample input N=4.

  1
  212
  32123
  4321234
- Write a program to generate the following pattern. Sample input N=5.

  *
  * *
  * * * *
  * *
  *
- Write a program to print Pascal triangle for the given number of rows. Sample input N=5.

```
                1
            1       1
        1       2       1
    1       3       3       1
1       4       6       4       1
```

- Write a program to generate the following pattern. Sample input N=4.

  1234
  2341
  3421
  4321
- Print Hollow Diamond pattern.
- Print pascals triangle.
- Print Floyds triangle.
- Print Butterfly Pattern.
- Print palindromic pattern.
- Print full inverted number triangle.
- Check if a number is prime or not (Efficient Approach).
- Find sum of all the digits of the number.
- Print transpose of given matrix.
- Rotate a two dimensional matrix by 90, 180, 270 degrees.

MODULE-2

UNIT-1 **0L+4T+12P=16 Hours**

ARRAYS:

PRACTICES:

Problems On Arrays

- Given an unsorted array of size N, and the array elements are in the range of 1 to N. There are no duplicates, and the array is not sorted. One of the integers is missing. Write a program to find the missing number.
- Given an array consisting of only 0s and 1s in random order rearrange the array such that all the 0s are to the left of the array and 1s to the right.
- Give an array consisting of odd and even numbers in random order, rearrange the array such that all the odd numbers are to the left of the array and even numbers are to the right of the array.
- Write a program to find all the unique elements in an array.
- Write a program to merge two arrays of the same size sorted in descending order.
- Write a program to count the frequency of each element in an array of integers.
- Write a program to find the second largest element in an array.
- Write a program to find the second smallest element in an array.
- Write a program to find that one element in array that occurs odd number of times, where every other element appears even number of times.
- Create a jagged array (adjacency list representation of a graph) with no of rows and no of columns in each row as specified by the user.
  Hint: Use Dynamic memory allocation (malloc() or calloc())

  Input:

  Enter no of rows: 3

  Enter no of columns Row in 1: 3

  Enter no of columns Row in 2: 5

  Enter no of columns Row in 3: 2

  Enter the elements row wise:

  8 6 5

  8 4 6 9 7

  9 2

  Output:

  8 6 5

  8 4 6 9 7

  9 2
- Write a program to find second largest number in the array.
- Write a program to find first repeating element in the array.
- Write a program to left rotate the array.
- Write a program to right rotate the array.
- Write a program to find the largest continuous sum.
- Write a program to print the sum of 2nd largest and 2nd smallest elements.
- Write a program to find the maximum product of two numbers multiplies in array (same index should not be used twice).
- Rearrange an array consisting of 1s and 0s such that they are alternatively arranged. Print minimum number of moves required.
- In a given array, find two numbers whose sum equal k.
- Find the difference between positive and negative elements in the array.
- Implement sorting algorithms (Insertion, selection, bubble).

UNIT-2 **0L+4T+12P=16 Hours**

STRINGS:

PRACTICES:

Problems on Strings:

- Write a program to reverse a given string word by word.
- Write a program to find the first occurrence of non-repeating character in the given string.
- Write a program to compress the string as provided in the example.
- Write a program to expand a string as provided in the example.
- Write a program to reverse those words of a string whose length is odd.
- Write a program to check if a given matrix is symmetric or not.
- Write a program to convert all the cases of letter (Lower case -> Upper Case, Upper Case-> Lower Case).
- Write a program to reverse all the words (Not the entire sentence but individual words).
- Find the longest palindrome in a given string.
- Check if two strings are anagrams or not.
- Find minimum number of changes to be done to make a string palindrome.
- Convert Excel sheet name to number (A-1, B-2, Z-26, AA-27).
- Find number of possible palindromes present in a string.
- Write a C program to read a string s, and determine the number of words in s.
  Example : s=oneTwoThree
  There are 3 words in the string: ‘one’, ‘Two’, ‘Three’.
- Write a C program that reads a string S and remove all duplicates characters from the given string S.
  NOTE: 1) Order of characters in output string should be same as given in input string.
  2) String S contains only lowercase characters [‘a’-’z’].
  Example: S = Vignanuniversity
  The program should generate the output as: Vignauersty
- Today Ron is reading the book. Due to some reason, he started hating the word ‘are’ (without quotes). So he decided to replace the substring ‘are’ with ‘R’. Write a C program that reads a line of message ‘s’ and replace the substring ‘are’ with ‘R’. Example: s= Howareyou.
  The program should generate the output as: HowRyou
- Write a program to concatenate the characters of the two given strings alternatively.
- Given a string S consisting of uppercase and lowercase letters, change the case of each alphabet in this string. That is, all the uppercase letters should be converted to lowercase and all the lowercase letters should be converted to uppercase.
  Input: Vignan University
  Output: vIGNAN uNIVERSITY
- Write a program to insert a given character at the beginning and end of the given string.
- Given two Strings A and B. They are said to be friends if ASCII sum of the each individual string is divisible by 4 else they are not friends. You need to find whether given two strings are friends or not.
  Sample Test case:
  Input:
  man nam
  vignan university
  Output:
  YES
  NO

- Write a program to find the frequency of each digit in the given string.

  Input Format

  The first line contains a string, which is the given number.

  Output Format

  Print ten space-separated integers in a single line denoting the frequency of each digit, indicate that the integers are from 0 to 9.

  Sample Input 0

  a11472o5t6

  Sample Output 0

  0 2 1 0 1 1 1 1 0 0

  Explanation 0

  In the given string:

  · 1 occurs two times.
  · 2,4,5,6 and 7 occur one time each.
  · The remaining digits and don't occur at all.

- Sherlock considers a string to be valid if all characters in the given string appear the same number of times. It is also valid if he can remove just 1 character at 1 index in the string, and the remaining characters will occur the same number of times.

  Write a C program that reads a string s and determine whether it is valid or not. If valid, return YES, otherwise return NO.

  Example: S=abc
  This is a valid string because frequencies are {a:1,b:1,c:1}
  S=abcc
  This is a valid string because we can remove one c and have 1 of each character in the remaining string.
  S=abccc
  This string is not valid as we can only remove 1 occurrence of c. That leaves character frequencies of {a:1,b:1,c:2}

- Read a string containing characters A and B only. Your task is to change it into a string such that there are no matching adjacent characters. To do this, you are allowed to delete zero or more characters in the string.

  Write a C program that finds the minimum number of deletions required.

  Example: S=AABAAB

  Remove A at positions 0 and 3 to make S=ABABA in 2 deletions.

  Input Format

  The first line contains an integer (the number of queries).

  The next q lines each contain a string s to analyze.

  Sample Input:

  5

  AAAA

  BBBBB

  ABABABAB

  BABABA

  AAABBB

  Sample Output:

  3
  4
  0
  0
  4

- Write a C program that reads a string 's' and it is said to be complete if it contains all the characters from a to z.
  Input Format
  First line of the input contains the number of strings N. It is followed by N lines each contains a single string.
  Output Format
  For each test case print "YES" if the string is complete, else print "NO"
  Constraints 1 <= N <= 10
  The length of the string is at max 100 & the string contains only the characters a to z.
- Write a C program that reads two strings and determine whether they share a common substring or not. A substring may be as small as one character.
  Example;
  S1=and
  S2=art
  The common substring in these two strings: a.
  Sample Input
  2
  hello
  world
  hi
  world
  Sample Output
  YES
  NO

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Write simple, but complete, C programs.	Apply	1,2	1
2	Identify suitable data type for operands and design of expressions having right precedence.	Apply	1,2	1
3	Apply decision making and iterative features of C Programming language effectively.	Apply	1,2	1
4	Select problem specific data structures and suitable accessing methods.	Analyze	1,2	1,2
5	Design and develop non- recursive and recursive functions and their usage to build large modular programs and also able to design string manipulation functions.	Create	1,2	3
6	Develop C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt.	Create	1,2	3,4

TEXT BOOKS:

1. Behrouz A. Forouzan, Richard F.Gilberg, "Programming for Problem Solving", 1st edition, Cengage publications, 2019.
2. Ajay Mittal, "Programming in C - A Practical Approach", 1st edition, Pearson Education, India, 2010.

REFERENCE BOOKS:

1. Reema Thareja, "Computer Fundamentals and Programming in C", 1st edition, Oxford University Press, India, 2013.
2. Herbert Schildt, "C: The Complete Reference", 4th edition, Tata McGraw-Hill, 2017.
3. Byron S Gottfried, "Programming with C", 4th edition, Tata McGraw-Hill, 2018.

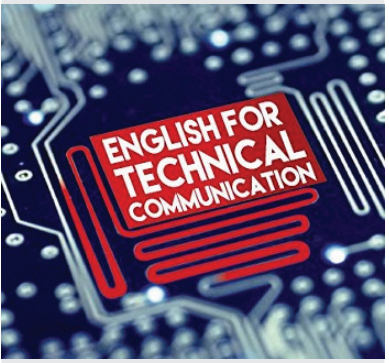


Image source: https://www.abebooks.com/9781316640081/English-Technical-Communication-Students-Book-1316640086/plp

22EN104 TECHNICAL ENGLISH COMMUNICATION

Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basic sentence formation, understanding contextual meanings, basic writing skills and moderate fluency in English.

COURSE DESCRIPTION AND OBJECTIVES:

In this course students will read, analyze, and interpret material from technical and general fields, and practice reading, writing, listening and speaking skills to gain exposure and functional English on a variety of contemporary topics. The overall course objective is to provide English for Specific Purposes(ESP) instruction to enhance students' reading, writing, listening and speaking skills through a practice in the language. It will aim to build students' confidence and motivation through exposure to academic skills like Note making/taking, Paraphrasing, Summarizing, Report Writing, Making Presentations etc., so as to generate interest in the language from an ESP perspective. Finally, students are expected through the course to gain key strategies and expression for communicating with professionals and non-specialists.

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

GENETICS:

Reading: Reading for Note Making Sub skills: Reading for global understanding (skimming), specific information (scanning), understanding main ideas and supporting ideas, guessing contextual meanings from the text. -Vocabulary building: commonly used roots, prefixes, and suffixes.

Writing: Note making, organising main points and sub points, numbering and sequencing, suggesting titles, paraphrasing and summarising.

Functional grammar: Common Errors in Articles and Prepositions (Handout).

Listening: Listening for Note Taking: top down and bottom up approach, listening for main ideas and supporting points.

Speaking: Presentation in teams - ideas on the topic summarised, making a PPT, effective introductions and conclusions, logical organisation of content, using appropriate structure and cohesive devices.

UNIT-2 **8L+0T+8P=16 Hours**

ALIENS:

Reading : Predicting, skimming, scanning, reading for inference, extrapolative reading

Vocabulary building: Academic vocabulary from the text: synonyms, antonyms, Words often confused.

Writing : Paragraph writing; writing a topic sentence, supporting sentences, effective introductions and conclusions, use of cohesive devices. Types of Paragraphs: Descriptive, narrative, argumentative and expository.

Functional grammar: Common Errors in Verb forms and Conditional sentences (Handout).

Listening : Listening for identifying parts from a description, listening to and sorting information, listening for specific information.

Speaking : Narrating/Retelling an incident, using suitable cohesive devices/discourse markers Speaking of past and present habits/ activities/events - Speaking of future plans.

PRACTICES:

- Note making.
- Summarizing.
- Paragraph Writing.
- Error correction and Restructuring.
- Vocabulary building.
- Listening comprehension.
- Note taking.

SKILLS:

- ✓ *Apply different sub skills like skimming, scanning, reading for information, reading for inference etc. to understand different kinds of text.*
- ✓ *Apply different sub skills like top down, bottom up approaches to listening.*
- ✓ *Use functional vocabulary relevant to engineering and technology to express ideas lucidly.*
- ✓ *Use appropriate sentence structure, cohesive devices to construct simple text in regular correspondence like e-mails and letters.*

MODULE-2

UNIT - 1 **8L+0T+8P=16 Hours**

SOCIAL MEDIA – HEALTH AND NUTRITION:

Reading : Reading for factual information researching for supporting evidence - skimming, scanning, Vocabulary building: One-word substitutes.

Writing : Letter Writing- E-mail writing – New age communication – Format, protocol, and style- WhatsApp, Facebook and Twitter Functional grammar: Common Errors in Sub-Verb Agreement and Modals.

Listening : Listening to a Business Presentation: Listening for deducing information, for abstract details and specific details, listening for taking a message.

Speaking : Making a presentation with a PPT on a topic assigned- organising the presentation using appropriate discourse markers - presenting a point of view - Extempore.

UNIT-2 **8L+0T+8P=16 Hours**

FASHION:

Reading : Reading for data interpretation and information transfer from graphical aids to text reports (pictograms. tables, graphs, pie charts, flow charts), deducing specific information and general information

Vocabulary building: Business vocabulary, collocations, idioms and phrasal verbs.

Writing: Writing a Report: Drafting general and factual reports - writing an overview - an effective introduction - organising information into paragraphs (Stages of writing: planning /organising /writing / editing /rewriting)

Functional grammar: Transformations and miscellaneous common errors.

Listening : Listening to a Ted talk and sorting information – taking notes from a discussion.

Speaking : Group Discussion – prerequisites -generating content - initiating a discussion - expressing one's opinion ~ leading a discussion - agreeing/ disagreeing to someone's view - cutting into a speech - body language and voice modulation.

PRACTICES:

- E-mail writing.
- Letter writing.
- Report writing.
- Messaging in Social media.
- Extempore.
- Making PPTs.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply a variety of strategies to interpret and comprehend spoken texts/ discourse using contextual clues.	Apply	1	6, 7, 8, 9, 10, 12
2	Apply appropriate reading strategies to interpret content / material related to engineering and technology domain.	Apply	1	6, 7, 8, 9, 10, 12
3	Possess an ability to write clearly on topics related to technology and workplace communication.	Analyze	2	6, 7, 8, 9, 10, 12
4	Choose functional language, grammar structures, cohesive devices and skills of organisation to express clearly in speaking.	Evaluate	2	6, 7, 8, 9, 10, 12
5	Participate in discussions and make short presentations on general and technical topics.	Create	2	6, 7, 8, 9, 10, 12

LANGUAGE LAB ACTIVITIES

Session - 1: Dictionary Skills

Session - 2: Introduction to Phonetics and Identifying Phonemes

Session - 3: Pronunciation Practice (Commonly mispronounced words)

Session - 4: Rosetta Stone (Exercises on LSRW)

Session - 5: Listening Comprehension (Summarising exercise on a Ted Talk)

Session - 6: Technical Presentations (Individual)

Session - 7: Technical Presentations (Team)

Session - 8: TOEFL Mastery

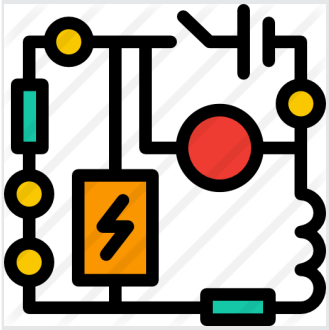
TEXT BOOK:

1. N P Sudharshana & C Savitha, “English For Technical Communication”, Cambridge University Press, 2016.

REFERENCE BOOKS:

1. Balasubramanian T,“A Text book of Phonetics for Indian Students”, Orient Longman, New Delhi, 1989.
2. Krishnaswamy, N and Sriraman, T, “Current English for Colleges”, Trinity publications, 2016.
3. Mohan Krishna and Meera Banerjee, “Developing Communication Skills”, Macmillan India Ltd. New Delhi, 1990.
4. Ashraf Rizvi M, “Effective Technical Communication”, 2nd Edition, McGraw Hill Education, 2017.
5. Narayana Swamy V R, “Strengthen your Writing”, Third Edition Orient Black Swan, New Delhi, 2005.

22EE103 ELECTRICAL CIRCUITS AND NETWORKS



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Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basics in Circuit Theory, Basic Mathematics.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the analysis of DC and AC circuits using methods like mesh, node and network theorems. It also introduces the concepts of Electrical Resonance, two port networks and coupled circuits. The objective of this course is to introduce the properties of network elements and methods of analysis for various electrical circuits and magnetic coupled circuits.

MODULE–1

UNIT-1 **20L+0T+0P=20 Hours**

CIRCUIT ANALYSIS, NETWORK THEOREMS AND 3-PHASE AC SYSTEM:

Circuit Analysis: Analysis of DC and AC circuits by Mesh and Nodal Analysis, Super mesh and super node analysis.

Network Theorems: Superposition, Thevenin's, Norton's, Reciprocity, Tellegen's, Maximum Power transfer and Millman's theorems for both DC and AC circuits.

3-Phase AC System : Three phase unbalanced systems, Measurement of Power in three phase circuits.

UNIT-2 **04 L+0T+16P=20 Hours**

TWO PORT NETWORKS:

Open circuit (impedance), Short circuit (admittance), Transmission (ABCD) and Inverse Transmission, Hybrid and Inverse hybrid parameters, Inter relation between them, Inter connection of 2-port networks.

PRACTICES:

- Verification of source transformation technique.
- Verification of Thevenin's, Norton's Theorem, Superposition and Maximum Power Transfer Theorem.
- Determination of Z, Y, h and ABCD Parameters in a Two-Port network.
- Measurement of 3-phase Power by two Wattmeter Method for balanced and unbalanced load (Star/Delta).

MODULE–2

UNIT-1 **20L+0T+0P=20 Hours**

COUPLED CIRCUITS AND RESONANCE:

Coupled Circuits: Concept of self and mutual inductance, Concept of mutual coupling, Calculation of equivalent inductance in complex coupled circuit, Coupled impedance.

Resonance: Series and Parallel Resonance, Different combinations, Quality factor, Bandwidth, Selectivity of different circuits.

UNIT-2 **04L+0T+16P=20 Hours**

TRANSIENTS:

Response of simple RL, R-C and R-L-C series and parallel circuits subjected to DC, Impulse, Pulse and Sinusoidal excitations using Laplace transforms method.

SKILLS:

- ✓ *Determine currents and voltages of all elements in any electrical network.*
- ✓ *Analyze a simple house wiring diagram.*
- ✓ *Calculate power, current and voltage in any three phase circuit.*
- ✓ *Select a suitable fuse for overcurrent protection.*
- ✓ *Analyze transient behaviour of various electrical networks.*

PRACTICES:

- Determination of mutual inductance for 2 or 3 inductive coils connected in series and parallel.
- Determination of Average and R.M.S. Values of various waveforms using MATLAB.
- Determination of impedance in complex AC circuits using MATLAB.
- Determination of Time-Response in simple series RL and RC network using MATLAB.

COURSE OUTCOMES:

Upon successful completion of this course, students will have to ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the knowledge of basic circuital law and simplify the network using reduction techniques.	Apply	1	1,2,6,9
2	Analyze the circuit using Kirchhoff's law and Network simplification theorems.	Analyze	1	1,2,9,12
3	Analyze the series resonant and parallel resonant circuit.	Analyze	2	1,2,3,9,12
4	Apply mathematical and analytical techniques to observe the transient behaviour of networks and verify using electrical simulation tools.	Evaluate	1,2	1,2,3,9,12
5	Synthesize two port networks.	Create	1	1,2,9,12

TEXT BOOKS:

1. A. Chakrabarti, "Circuit Theory Analysis & Synthesis, 7th revised edition, Dhanpat Rai & Co., 2018.
2. W.H. Hayt, J.E.Kimmerly and Steven. M. Durbin, "Engineering Circuit Analysis", 9th edition, Tata Mc Graw Hill, 2019.

REFERENCE BOOKS:

1. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", 5th edition, (Schaum's outline series) Tata Mc Graw Hill, 2017.
2. M.E. Van Valkenburg, "Network Analysis", 3rd edition, Prentice Hall of India, 2015.

II

YEAR

B.Tech.

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENTS

I SEM & II SEM

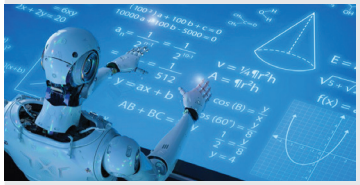
I SEMESTER

22EE201	-	Probability Theory and Statistics for Machine Learning
22CT201	-	Environmental Studies
22TP201	-	Data Structures
22EE202	-	Power Transmission and Distribution
22EE203	-	DC Machines and Transformers
22EE204	-	Analog Electronics
22EE205	-	Digital Electronic Circuits
22SA201	-	Life Skills-I

II SEMESTER

22TP203	-	Advanced Coding Competency
22TP204	-	Professional Communication
22EE207	-	Induction and Synchronous Machines
22EE208	-	Power Electronic Devices and Circuits
22MS201	-	Management Science
	-	Department Elective – 1
	-	Open Elective – 1
22SA202	-	Life Skills-II

22EE201 PROBABILITY THEORY AND STATISTICS FOR MACHINE LEARNING



Source: https://gnindia.dronacharya.info/blog/hashtag/probability-theory-and-statistics/

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Basic knowledge in statistics and mathematics.

COURSE DESCRIPTION AND OBJECTIVES:

This course is mainly deals with the essential components of Machine learning i.e probability theory and statistics. It also provides students with foundation in statistics and probability such as descriptive statistics, correlation, probability, random variables, correlation, and regression. The course emphasizes statistics to solve engineering and management problems.

MODULE-1

UNIT-1 **12L+8T+0P=20 Hours**

INTRODUCTION TO MACHINE LEARNING, BASIC PROBABILITY AND RANDOM VARIABLES:

Introduction to Machine Learning: Human learning and its types, Machine learning and its types, Applications of machine learning, Machine Learning activities, Data types in Machine Learning, structure of data, Central tendency, data spread, Measuring data value position.

Basic Probability: Random Experiments, The Concept of Probability, Axioms of Probability, Conditional Probability, Theorems on Probability, Conditional Probability, Independent Events, Bayes' Theorem, Combinatorial Analysis.

Random Variables: Random variables, Types of random variables, jointly distributed random variables, Independent random variables, Conditional distributions.

UNIT-2 **12L+8T+0P=20 Hours**

EXPECTATION AND PROBABILITY DISTRIBUTIONS:

Expectation: Expectation, expected value and variance of sums of random variables, Standard Deviation, Covariance and variance of sums of random variables, Moment generating functions, Chebyshev's inequality and the weak law of large numbers, Other measures of Central Tendency, Percentiles, Measures of Dispersion, Skewness and Kurtosis.

Probability Distributions: The Binomial Distribution and properties, The Law of Large Numbers for Bernoulli Trials, Normal Distribution and properties, Poisson Distribution and properties, Relationships among Binomial, Normal and Poisson Distributions, Central Limit Theorem. Multinomial, Hypergeometric, Uniform, Cauchy, Gamma, Beta.

PRACTICES:

- Compute different statistical measures for a given data.
- Analyse the sample data to accept or reject statements regarding population parameters.
- Identify the situations we can apply binomial, Poisson, and Normal distributions.

SKILLS:

- ✓ *Collect the data from newspapers and present it graphically*
- ✓ *Evaluate the various measures of central tendency and dispersion data collected from the various sources*
- ✓ *Analyse the data using measures of central tendency.*

MODULE - 2

UNIT-1 **12L+8T+0P=20 Hours**

SAMPLING THEORY:

Population and Sample, Statistical Inference, Random Samples, Sample Statistics Sampling Distributions, Sample Mean, Sampling Distributions - Means, Proportions, Differences and Sums, Sample Variance, Sampling Distribution of Variances, Sampling Distribution of Ratios of Variances, Chi-Square, Student's t, and F Distributions, Relationships among Chi-Square, t, and F Distributions. Frequency Distributions, Relative Frequency Distributions Computation of Mean, Variance, and Moments for Grouped Data.

UNIT-2 **12L+8T+0P=20 Hours**

CURVE FITTING, REGRESSION AND CORRELATION:

Curve Fitting, Regression, Method of Least Squares, Least-Squares Line, The Least-Squares Parabola, Multiple Regression, Standard Error of Estimate, Linear Correlation Coefficient, Generalized Correlation Coefficient, Rank Correlation, Probability Interpretation of Regression and Correlation, Sampling Theory of Regression and Correlation, Correlation and Dependence.

PRACTICES:

- Fit an appropriate curve for a given set of data.
- Multiple linear regression with two independent variables.
- Developing multiple regression model using excel.
- Conducting Correlation and regression analysis for a given data.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Familiarize with foundations of Human learning and Machine learning and Basic types of data in Machine Learning applications.	Apply	1	1, 2, 3, 4, 9, 12
2	Apply probability and statistical methods to discrete and continuous variables.	Apply	1	1, 2, 3, 4, 9, 12
3	Apply the concepts in probability distributions and mathematical expectation inmachine learning applications.	Analyze	2	1, 2, 3, 4, 9, 12
4	Execute concept of correlation analysis and least square method in fitting regression curves to machine learning problems.	Analyze	2	1, 2, 3, 4, 9, 12

TEXT BOOKS:

1. I.R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers", 9th Edition,Pearson, 2018.
2. Sheldon M. Ross, An Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Academic Press, Elsevier, 2014.

REFERENCE BOOKS:

1. Kishore S. Trivedi, "Probability and Statistics with Realiability, Queueing and Computer Science Applications", 2nd edition, Wiley Student edition, 2008.
2. A Singaravelu, "Probability and Statistics", 22nd edition, Meenakshi Agency, 2015.

22CT201 ENVIRONMENTAL STUDIES

Image source: Biogas plant at VFSTR

Hours Per Week :

L	T	P	C
1	1	0	1

PREREQUISITE KNOWLEDGE: General awareness regarding environmental problems and importance of environmental protection.

COURSE DESCRIPTION AND OBJECTIVES:

It is a multidisciplinary subject where different aspects of society and environment are dealt using a holistic approach. It is evolving to be the education for sustainable and ethical development both at a local and global level. It helps to prepare the next generation for planning appropriate strategies to address environmental issues. It identifies and creates solutions that conserve to manage ecosystem and biodiversity and helps to eliminate pollutants, toxicants, preserve air, water and soil quality. Environmental education recognizes impacts of global issues, enhances the public awareness and helps to take decisions towards environmentally responsible actions.

MODULE-1

UNIT-1 **4L+4T+0P=8 Hours**

INTRODUCTION TO ENVIRONMENT: NATURAL RESOURCES, ECOSYSTEMS AND BIODIVERSITY:

Environment and sustainable development; Natural resources- forest, water, energy and land resources; Ecosystem – basic structural components, function and interactions in ecosystem, ecological succession.

UNIT-2 **4L+4T+0P=8 Hours**

BIODIVERSITY AND CONSERVATION:

Introduction to biodiversity, types of biodiversity- species, genetic and ecosystem diversity; Threats to biodiversity - natural and anthropogenic, species extinctions, man wildlife conflicts; Biodiversity conservation - principles and strategies; in-situ and ex-situ conservation.

PRACTICES:

- Visit to a Biogas plant, Solar Power plant.
- Visit to a local area: river / pond / lake / forest / grassland / hill / mountain and study of different types of ecosystems, biodiversity study and documentation (herbarium sheet preparation).
- Set up an aquarium.
- Case study: Renewable energy use.

MODULE-2

UNIT-1 **4L+4T+0P=8 Hours**

ENVIRONMENTAL POLLUTION AND CLIMATE CHANGE:

Air, water, soil, radioactive and noise pollution; Study of different pollutants (SOx, NOx, PAN, PAH etc.); Toxicity study; Climate change - greenhouse effect, acid rain, ozone layer depletion.

UNIT-2 **4L+4T+0P=8 Hours**

POLLUTION CONTROL DEVICES AND WASTEWATER TREATMENT TECHNOLOGIES:

Air pollution control devices - Gravitational settling chambers, cyclonic separators, electrostatic precipitators, fabric filters and bio filters, Wastewater management.

SKILLS:

- ✓ *Create a bio-diversity map of any habitat/ ecosystem.*
- ✓ *Strategize different ways of using renewable energy resources.*
- ✓ *Design novel strategies and approaches for pollution control and waste management.*

PRACTICES:

- Visit to a sewage treatment plant and wastewater analysis.
- Case study: Recycling Technologies.
- Case study: Effects of contaminants on microorganisms.
- Report writing: 12 principles of green chemistry for environmental sustainability.
- Report writing: Environmental Impact Analysis, Local Disaster Management Plan.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the basic concepts of sustainable development, natural resource utilization and ecology for the purpose of environmental protection	Apply	1	1,6,7, 9, 10, 11, 12
2	Design remediation technologies for their abatement	Apply	2	1, 3,6,7, 9, 10, 11, 12
3	Analyze the biodiversity of different ecosystems and formulate various conservation approaches	Analyze	1	1, 7, 8, 9, 10, 11, 12
4	Analyze the presence of various environmental pollutants	Analyze	2	1, 6,7,9, 10, 11, 12
5	Recommend various waste management approaches and their implementation strategies	Evaluate	2	1,2, 7,8,9,10,11, 12

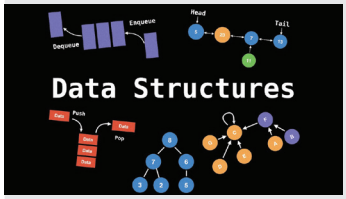
TEXT BOOKS:

1. A. Kaushik and C. P. Kaushik, “Perspectives in Environmental Studies”, New Age International Publishers, 5th Edition, 2016.
2. Y. Anjaneyulu, “Introduction to Environmental Science”, B. S. Publications, 2015.

REFERENCE BOOKS:

1. B. Joseph, “Environmental Studies”, Mc Graw Hill Education, 2nd Edition, 2015.
2. S. Subash Chandra, “Environmental Science”, New Central Book Agency, 2011.
3. M. Basu and S. Xavier, “Fundamentals of Environmental Studies”, Cambridge University Press, 2016.
4. K. Mukkanti, “A Textbook of Environmental Studies”, S. Chand Company Ltd., 2009.
5. M. Anji Reddy, “A Textbook of Environmental Science and Technology”, B. S. Publications, 2008.

22TP201 DATA STRUCTURES



Source: https://www.youtube.com/watch?v=Qmt0QwzEmh0

Hours Per Week :

L	T	P	C
2	2	2	4

PREREQUISITE KNOWLEDGE: Programming in C.

COURSE DESCRIPTION & OBJECTIVES:

This course is aimed at offering fundamentals concepts of data structures and explains how to implement them. It begins with the basic concepts of data, data structures and then introduces the primitive and non-primitive data structures in detail. It forms the basis for understanding various ways of representing data and its usage in different computing applications.

MODULE-1

UNIT-1 **5L+6T+6P = 17 Hours**

DATA STRUCTURES BASICS:

Basic Terminology – data, information, datatype; Data Structures – Introduction, storage structures-sequential and linked storage representations; classification of data structures; Applications of data structures.

Sorting: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort and Merge Sort.

Searching: Linear Search and Binary Search.

UNIT-2 **11L+10T+10P = 31 Hours**

LINKED LISTS AND STACKS, QUEUES:

Linked List: Introduction, Types of linked list – Singly linked list, doubly linked list and circular linked list, representation of linked list, Operations of linked list: Traverse forward/ reverse order, searching, insertion and deletion; Applications of linked lists.

Stack – Introduction, array and linked representations, implementation and their applications; Queue – Introduction, array and linked representations, implementation; Types – Linear, circular and doubly ended queues – operations; Applications of Queues.

PRACTICES:

Problems on Recursion – Level 1

- Find the product of 2 numbers using recursion.
- Find the sum of natural numbers using recursion.
- Find the factorial of a number using recursion.
- Find the Nth term of Fibonacci series using recursion.
- Calculate the power using recursion.
- Write a recursive program for checking if a given number is a prime number.
- Given two integers write a function to sum the numbers without using any arithmetic operators.
- Convert a decimal to binary using recursion.
- Print all factors using recursion.
- Find the maximum product of digits among numbers less than or equal to N.

SKILLS:

- ✓ *Experienced to Store data and various types of data to handle.*
- ✓ *Ordering and sorting of data.*
- ✓ *Indexing and Searching of required data from large data sequences.*
- ✓ *Exposed to various characteristics such as Linear or non-linear, Homogeneous or heterogeneous and Static and Dynamic.*

Problems Recursion – Level 2

- Implement insertion sort recursively.
- Write a program to find the numbers less than N that are product of exactly 2 distinct prime numbers - using recursion.
- Implement selection sort recursively.
- Find the middle of a singly linked list using recursion.
- Find the sum of even numbers of an array using recursion.
- Check if a given array is in sorted order using recursion.
- Print alternate nodes of a linked list using recursion.
- Reverse a doubly linked list using recursion.
- Write a recursive function that returns all permutations of a given list.
- Implement bubble sort recursively.

Problems on Sorting and Searching – Level 1

- Implement the insertion sort function.
- Implement the bubble sort function.
- Implement the quick sort function.
- Implement the merge sort function.
- Implement the selection sort function.
- Implement linear search function.
- Implement binary search function.

Problems on SLL – Level 1

- Implement the insert function to insert nodes into a singly linked list (ascending order).
- Implement the insert function to insert nodes into a singly linked list (descending order).
- Implement the search node function.
- Implement the delete node function.
- Display forwards function.
- Display backwards function.
- Count the number of nodes in a singly linked list.
- Swap alternate nodes of a singly linked list.
- Move last node to the front of the linked list.
- Move first node to the last of the linked list.

Problems on Stacks – Level 1

- Implement two stacks using a single array.
- Given an array replace every element with nearest greater element on the right.
- Given a stack reverse the elements using only push and pop functions.
- Postfix evaluation using stack.
- Balance symbols.
- Find middle element in a stack.
- Remove middle element from a stack.
- Implement push and pop using linked list.
- Given an array of characters with the middle marked by X, check if the string is a palindrome.
- Maximum sum in sliding window.

Problems on Queues – Level 1

- Write a program to accept two numbers as input check if they are equal.
- Write a program to accept two characters as input and check if they are equal.
- Write a program to accept two numbers as input and print the greater of the 2 numbers.
- Write a program to accept two numbers as input and print the lesser of the 2 numbers.
- Write a program to accept 3 numbers as input and print the maximum of the 3.
- Write a program to accept 3 numbers as input and print the minimum of the 3.
- Write a program to accept a number as input and print EVEN if it is an even number and ODD if it is an odd number.
- Write a program to accept a number as input and check if it is divisible by 3. If it is divisible by 3 print YES else print NO.
- Write a program to accept a number as input and check if it is divisible by both 3 & 5. If it is divisible print YES else print NO.
- Write a program to accept a number as input and check if it is positive, negative or zero.

Problems on DLL – Level 1

- Implement insert function.
- Implement display forward function.
- Implement display backward function.
- Implement search function.
- Implement delete function.
- Reverse a doubly linked list from M to N.
- Find the sum of the odd and even nodes.
- Count odd keys of the linked list.
- Merge two sorted lists.
- Delete adjacent duplicate nodes.

Problems on CLL – Level 1

- Insert function (circular doubly linked list).
- Search function.
- Display forward.
- Display backward.
- Delete node (circular doubly linked list).
- Print the middle N nodes of a circular singly linked list.
- Move the last node of a circular singly linked list to the beginning.
- Delete adjacent duplicate nodes of a circular singly linked list.
- Delete nodes greater than a value from a circular doubly linked list.
- Find the sum of the nodes of a circular linked list.

Problems on Linked List – Level 2

- Given 2 sorted linked lists, print the common elements.
- Reverse a list (using Stack).
- Given a pointer to a node (not the last node), delete the node.
- Reverse a list (Recursive).
- Reverse a list (Iterative).
- Reverse a singly linked list in pairs (recursive).
- Reverse a singly linked list in pairs (iterative).
- Check if a singly linked list is a palindrome or not.
- Remove the loop if exists.
- Given 2 linked lists with data in the ascending order, merge them into a single list.

MODULE-2

UNIT-1 **8L+8T+8P=24 Hours**

TREES:

Trees: Basic Terminology, Types of Trees, Binary Tree – Introduction, properties, array and linked representations; Tree traversals and their implementation; Expression trees; BST – definition and operations, AVL trees – definition and construction; Applications of binary trees.

UNIT-2 **8L+8T+8P=24 Hours**

GRAPHS & HASHING:

Graphs: Basic Terminology, Types of Graphs, Graphs representations – adjacency matric, adjacency list; Traversals - breath first search and depth first search; Applications of graphs.

Hashing: Introduction, Different hash functions, collision: avoidance and handling methods.

PRACTICES:

Problems on BST – Level 1

- Insert function.
- Insert function (recursive).
- Search function.
- Pre order traversal.
- Post order traversal.
- In order traversal.
- Level order traversal.
- Delete child node.
- Delete parent node.
- Delete nodes greater than a value from a circular doubly linked list.

Problems on Priority Queues – Level 1

- Meeting rooms problem.
- Ugly number.
- Find median from data stream.
- Find the top K frequent elements.
- Find K Pairs with smallest sums.
- Find the Kth smallest element in a sorted matrix.
- Trapping Rain Water.
- Rearrange String k distance apart.
- Sort characters by frequency.
- Solve the maze problem.

Problems on Graphs – Level 1

- Implement Graph data structure.
- Implement BFS - iterative solution.
- Implement BFS - recursive solution.
- Implement DFS - iterative solution.
- Implement DFS - recursive solution.
- Check if given graph is strongly connected or not.
- Check if given graph is strongly connected or not - using DFS.
- Given a graph find the arrival and departure time of its vertices in DFS. Arrival time is the time when the vertex was explored for the first time, and departure time is the time at which all the neighbours are explored and are ready to backtrack.
- Given a directed acyclic graph and a source vertex, find the cost of the shortest path from source vertex to all other vertices present in the graph. If a vertex cannot be reached from given source vertex that distance may be printed as infinite.
- Given an undirected graph, check if the graph is 2 edge connected or not.

Problems on Hashing – Level 1

- Print a binary tree in vertical order.
- Find whether an array is subset of another array.
- Given an array A [] and a number x, check for pair in A [] with sum as x.
- Minimum operation to make all elements equal in array.
- Maximum distance between two occurrences of same element in array.
- Check if a given array contains duplicate elements within k distance from each other.
- Find duplicates in a given array when elements are not limited to a range.
- Most frequent element in an array.
- Smallest subarray with all occurrences of a most frequent element.
- First element occurring k times in an array.

Problems on Graphs – Level 2

- Find the shortest graph distances between every pair vertex in a given path. Assume that the graph does not have any negative edges.
- Find the shortest graph distances between every pair of vertices in a given path. The graph can have negative edges.
- Detect cycle in DFS.
- Count the number of connected components of a graph represented in the adjacent matrix.
- Count the number of connected components of a graph represented in the adjacent matrix - using DFS.
- Find a spanning tree - not necessarily a minimum spanning tree.
- Detect cycle in an undirected graph.
- Given an undirected graph, find its depth.
- Determine if a directed graph has a unique topological ordering.
- Given a directed acyclic graph and two vertices v and w, find the lowest common ancestor.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

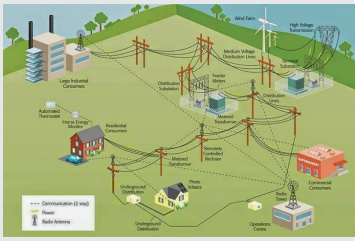
CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Explore the organization of several ADTs and the manipulation (searching, insertion, deletion, traversing) of data stored in various data structures.	Apply	1,2	1
2	Apply different data structures to solve a given problem.	Apply	1,2	1
3	Analyze the efficiency of using different data structures and choose the efficient data structure for solving a given problem.	Analyze	1,2	2
4	Develop new algorithms to solve various problems.	Create	1,2	3,4

TEXT BOOKS:

1. Reema Thareja, “Data Structures Using C”, 2nd Edition, Oxford University Press, 2014.
2. Seymour Lipschutz, “Data Structures with C”, 1st Edition, McGraw Hill Education, 2017.

REFERENCE BOOKS:

1. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures”, illustrated edition, Computer Science Press, 2006.
2. Richard F. Gilberg and Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, 2nd Edition, CENAGE Learning, 2005.
3. R G Dromey and Pearson, “How to solve it by Computer”, 2nd edition, Impression edition, 1998.



Source: https://www.pinterest.com/pin/power-generationtransmissionand-distribution-by-smart-grids-electrical-eng--104075441365330046/

22EE202 POWER TRANSMISSION AND DISTRIBUTION

Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basic Engineering Products, Electrical Circuit Analysis.

COURSE DESCRIPTION AND OBJECTIVES:

This course provides an overview of various types of electric substations and the methods for improvement of power factor. It also provides the knowledge of transmission line parameters, cables and insulators. The objective of this course is to enable the students to understand the economic aspects of power generation, analyse the performance of transmission lines, distribution systems, insulators and cables.

MODULE-1

UNIT-1 **10L+0T+0P=10 Hours**

ECONOMICS OF POWER GENERATION, POWER FACTOR CORRECTION AND TRANSMISSION LINE PARAMETERS:

Economics of Power Generation: Load curve, load duration and integrated load duration curves, load, demand, diversity, capacity, utilization and plant use factors, numerical problems.

Power Factor Correction: Causes of low power factor, methods of improving power factor- static capacitors, synchronous condenser, phase advancers. Most economical power factor for constant KW load and constant KVA type loads.

Transmission Line Parameters: Classification of line conductors, calculation of resistance, skin effect, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, proximity effect, significance of transposition.

UNIT-2 **6L+0T+16P=22 Hours**

SUBSTATIONS AND PERFORMANCE OF TRANSMISSION LINES:

Substations: Classification of substations, selection of site and layout of substation, bus bar arrangements.

- **Performance of Transmission Lines:** Classification of lines - short, medium (nominal T and) and long (equivalent T and), calculation of A, B, C, D constants, ferranti effect, power flow through a transmission line.

PRACTICES:

- Familiarization of the transmission line.
- Verification of Ferranti Effect of the transmission line.
- ABCD parameters of transmission line.
- Finding the efficiency of the transmission lines at different loads.

MODULE-2

UNIT-1 **8L+0T+0P=8 Hours**

SAG AND TENSION CALCULATIONS, OVERHEAD LINE INSULATORS AND CORONA:

SAG and Tension Calculations: Sag and tension calculations with equal and unequal heights of towers, effect of wind and ice on weight of conductors, stringing chart, sag template.

Overhead Line Insulators: Types of insulators, string efficiency and methods for improvement, voltage distribution.

Corona: Introduction, critical disruptive voltage, corona loss, factors affecting corona loss and methods of reducing corona loss, disadvantages of corona, interference between power and Communication lines. Numerical problems.

UNIT-2 **8L+0T+16P=24 Hours**

UNDERGROUND CABLES AND AC DISTRIBUTION:

Underground Cables: Types of cables, construction, calculation of insulation resistance, stress and capacitance, grading of cables, proximity effect.

AC Distribution: Introduction, single phase, 3-phase 3 wire, 3 phase 4 wire system.

PRACTICES

- Determination of the SIL of the transmission line.
- Determination of regulation of the given transmission line.
- To find out the string efficiency across the string of insulators.
- Formation for symmetric π configuration for Verification of AD-BC=1.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Determine the parameters of transmission line.	Apply	1	1, 2, 3, 9, 11
2	Illustrate the role of insulators and calculation of string efficiency.	Apply	2	1, 2, 4, 6, 9, 11
3	Analyse the significance for economic analysis of power generation and power factor.	Analyze	1	1, 2, 9, 11
4	Analyse the selection of underground cables, different distribution system topologies.	Analyze	2	1, 2, 6, 7, 9, 11
5	Evaluate the performance of short, medium and long transmission lines.	Evaluate	1	1, 2, 5, 9, 11

TEXT BOOKS:

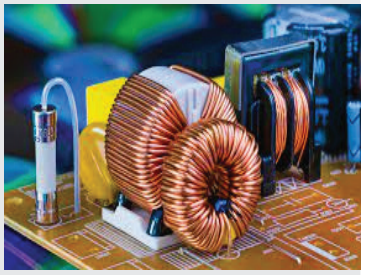
1. C.L. Wadhwa, “Generation, Distribution and Utilization of Electrical Energy”, 8th edition, New Age International, 2022.
2. W.D. Stevenson, “Elements of Power System Analysis,” 4th edition, Mc Graw Hill, 2000.

REFERENCE BOOKS:

1. C.L. Wadhwa, “Electrical Power Systems”, 6th edition, New Age International, 2018.
2. M.V. Deshpande, “Elements of Electrical Power Station Design”, 3rd edition, Wheeler Pub. 2018.

SKILLS:

- ✓ *Design overhead transmission lines by considering different parameters.*
- ✓ *Design and suggest insulators for specific voltage level.*
- ✓ *Design underground cables by considering different parameters.*
- ✓ *Identify reasons for voltage fluctuations at the consumer end.*



Source: https://www.capabilitydevelopment.org/Coursedesc/ioc/D-C-MACHINES-AND-TRANSFORMERS

22EE203 DC MACHINES AND TRANSFORMERS

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basics of Electromagnetics.

COURSE DESCRIPTION AND OBJECTIVES:

- To present a problem oriented introductory knowledge of Electrical Machines.
- To focus on the study of electro mechanical energy conversion & different parts of electrical machine.
- To address the underlying concepts & methods behind Electrical Engineering machines.
- To identify & formulate solutions to problems relevant to Electrical Machines and find the efficiency of machine.
- To Enable the students to understand the characteristics of DC Machines and Transformers and analyse their performance under different testing conditions.

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours**

INTRODUCTION TO DC MACHINES:

Constructional details, Principle of operation, EMF equation, Classification of DC machine based on excitation, Armature reaction and commutation methods, Applications in real time systems.

UNIT-2 **12L+0T+8P=20 Hours**

Performance of DC Machines Torque equation, characteristics and Speed control techniques, Power flow diagram and relations, Losses and efficiency, Parallel operation of DC Generators, Methods of testing on DC Machines.

PRACTICES:

- Determination of critical field resistance and critical speed using magnetization characteristics of DC shunt generator.
- Load test on DC shunt generator.
- Brake test on DC shunt motor.
- Speed control of DC shunt motor.
- Swinburne's test on DC shunt motor.
- Hopkinson's test on DC machines.

MODULE-2

UNIT-1 **12L+0T+8P=20 Hours**

INTRODUCTION TO 1-PHASE & 3-PHASE TRANSFORMERS:

Constructional details-Principle of operation, EMF equation, Equivalent circuits, Voltage regulation, Conditions for minimum and maximum voltage regulation, Applications in real time systems, Different configuration of 3 phase transformers.

UNIT-2 **12L+0T+8P=20 Hours**

TESTING & PARALLEL OPERATION OF TRANSFORMERS:

Losses, Efficiency, Testing of Transformers, Parallel operation of single phase transformer with equal and unequal voltage ratio, Single phase auto transformer, saving of copper, equivalent circuit.

PRACTICES:

- OC and SC test on single phase transformer.
- Sumpner's test on a pair of single phase transformers.
- Parallel operation of two single phase transformers.
- Scott connection of transformers.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the effect of armature reaction and the process of commutation.	Analyze	1	1, 2, 9, 11
2	Analyse parallel operation of single phase Transformers and DC Generators.	Analyze	1, 2	1, 2, 9, 11
3	Select different 3-phase transformers connections in real time transmission system.	Analyze	2	1, 2, 3, 9, 11
4	Evaluate the performance and characteristics of DC motors through experimentation.	Analyze	1	1, 2, 6, 9, 11
5	Describe the construction and working principle of single phase Transformers.	Evaluate	2	1, 2, 9, 11

TEXT BOOKS:

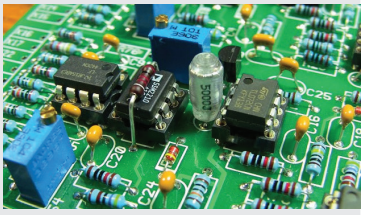
1. P.S. Bimbra, "Electrical Machinery", 7th edition, Khanna Publishers, 2011.
2. I.J. Nagrath and D.P. Kothari, "Electric Machines", 5th edition, Tata Mc-Graw Hill Publishers, 2017.

REFERENCE BOOKS:

1. A.E. Clayton and Hancock, "Performance and Design of D.C Machines", 3rd edition, BPB Publishers, 2004.
2. R. D. Begamudre, "Electromechanical Energy Conversion with Dynamics of Machines", 2nd edition, New Age International (P) Ltd., 2003.

SKILLS:

- ✓ *Analyze the magnetising and load characteristics of DC generators*
- ✓ *Analyze the performance of DC machines by conducting various tests.*
- ✓ *Test the transformer under no load and short circuit conditions and obtain the Equivalent circuit.*



Source: https://www.eletimes.com/the-perennial-role-of-analog-electronics

22EE204 ANALOG ELECTRONICS

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with fundamental concepts of semi-conductor devices and circuits. Along with semi-conductor devices it also deals with the op-amps. The objective of the course is to enable students to understand the working of simple electronic circuits such as clippers, clampers, amplifiers, filters and regulators.

MODULE–1

UNIT-1 **12L+0T+8P=20 Hours**

INTRODUCTION TO SEMICONDUCTOR DEVICES:

Diodes: Current equation of diode and temperature variations, Analysis of half-wave and full-wave rectifiers with capacitor filter, Clippers and clampers.

BJT: Formation of PNP and NPN transistor, Transistor current components, Transistor as an amplifier-CB, CE and CC configurations with performance comparison.

FET: Working principles and characteristics of JFET and MOSFET.

UNIT-2 **12L+0T+8P=20 Hours**

TRANSISTOR BIASING (BJT & FET):

DC load line, AC load line and selection of operating point, Need for biasing, Biasing techniques, Thermal runaway and thermal stability.

PRACTICES:

- Study of clipping operation.
- Study of clamping operation.
- Input and Output Characteristics of BJT.
- Input and Output Characteristics of MOSFET.

MODULE-2

UNIT-1 **6L+0T+4P=10 Hours**

OPERATIONAL AMPLIFIERS:

Ideal op-amp, Non-idealities in an op-amp, Inverting and non-inverting amplifier, differential amplifier.

555 TIMER: Working and pin diagram of 555 timer.

UNIT-2 **18L+0T+12P=30 Hours**

APPLICATIONS OF OP-AMP:

Linear Applications of OP-AMP: V-I converters, Sample & Hold circuits, Instrumentation amplifier, Integrator, Active filter, P, PI and PID controllers using op-amp.

Non Linear Applications: Voltage comparators, Hysteretic comparator, Square-wave and triangular-wave generators; Precision half wave rectifier, Peak detector, Zero crossing Detector, Oscillators (Wein bridge and phase shift), Application of 555 timer.

PRACTICES:

- Design of basic arithmetic circuits such as adder and subtractor.
- Design of Integrator and differentiator.
- Design of oscillator circuits.
- Design of voltage comparators using op-amp.
- Design of active LPF/HPF using op-amp.
- Design of Astable multi vibrator using op-amp.
- Schmitt trigger by using BJT/op-amp/555 Timer.

SKILLS:

- ✓ *Analyze the signal conditioning circuits*
- ✓ *Realization of multi vibrator using 555 times.*
- ✓ *Analyze the oscillator circuits.*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

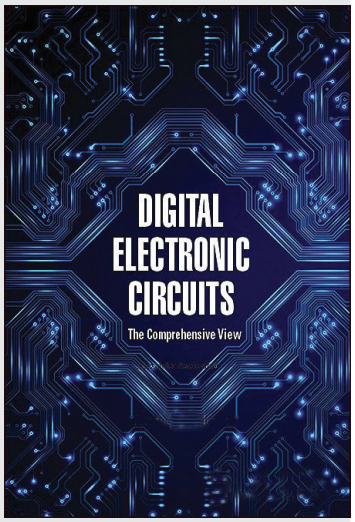
CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify the characteristics of diode, transistors, 555 timer and op-amp.	Apply	2	1, 2, 3, 4, 9, 11
2	Analyse various rectifier and amplifier circuits.	Analyse	1, 2	1, 2, 3, 4, 9, 11
3	Design sinusoidal and non-sinusoidal oscillators.	Evaluate	2	1, 2, 3, 4, 9, 11
4	Apply the knowledge of KVL and KCL to obtain voltage / current waveforms at different points in analog electronic circuits such as diode clippers and clampers.	Apply	1, 2	1, 2, 3, 4, 9, 11
5	Conduct experiment using analog electronic components to function as amplifier, comparator, rectifier, ADC and DAC.	Evaluate	1, 2	1, 2, 3, 4, 9, 11

TEXT BOOKS:

1. Ramakant A. Gayakwad, “Op-Amps and Linear - Integrated Circuits”, 4th edition, PHI, 2000.
2. D. Roy Choudhary and Shail. B.Jain, “Linear Integrated Circuits”, 5th edition, New Age International Publishers, 2018.

REFERENCE BOOKS:

1. R.L. Boylestad and Lovis Nashelsky, “Electronic Devices and Circuits Theory”, 10th edition, Pearson Eduction, 2010.
2. A.S. Sedra and K.C. Smith, “Microelectronic Circuits”, 7th edition, New York, Oxford University Press, 2017.



Source: https://www.worldscientific.com/

22EE205 DIGITAL ELECTRONIC CIRCUITS

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic Athematic.

COURSE DESCRIPTION AND OBJECTIVES:

- This course deals with the fundamentals of number systems, and Boolean expressions that are used to realize combinational and sequential circuits.
- Its objective is to minimize the logical expressions using Boolean postulates, to design various combinational and sequential circuits.
- To provide a sufficient number of applications/case studies to demonstrate the techniques used.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

FUNDAMENTALS OF DIGITAL SYSTEMS:

Concept of Number systems, Binary Arithmetic, One's and two's complements, Canonical and Standard Forms - SOP and POS forms, Basic Logic gates, and universal gates, Simplification of logic functions using Karnaugh maps.

UNIT-2 **8L+8T+0P=16 Hours**

COMBINATIONAL LOGIC DESIGN:

Design using conventional logic gates, Half adder, Full adder, Half subtractor, and Full subtractor, Code converters, Comparators, and Parity generator/detector, Decoders, Encoders, De-multiplexers, and Multiplexers, Design of combination circuits using Decoders and Multiplexers.

PRACTICES:

- 7-Segment LED display.
- Digital Watch Design.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

SEQUENTIAL LOGIC CIRCUITS:

Latches, Flip-Flops and Triggering, Shift registers, Counters - Ripple counters, Mod-n counter and Concept of State diagram and State table.

UNIT-2 **8L+8T+0P=16 Hours**

FINITE STATE MACHINES:

Design of sequential counter, Design of Mealy FSM, Design of Moore FSM.

PRACTICES:

- Sequence Detectors.
- Traffic light control system.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the knowledge of digital logic concepts to optimize digital circuits.	Apply	1	1, 2, 3, 4, 9, 11
2	Analyze sequential digital circuits for given problem statement.	Analyze	2	1, 2, 3, 4, 9, 11
3	Design and practical implementation of Sequential logic circuits.	Create	2	1, 2, 3, 4, 9, 11
4	Design and practical implementation of Combinational logic circuits.	Create	1	1, 2, 3, 4, 9, 11

SKILLS:

- ✓ *Minimize Boolean expression.*
- ✓ *Construct different combinational and sequential circuits.*
- ✓ *Verify the functionality of digital circuits.*
- ✓ *Design combinational and sequential circuits for a given application*
- ✓ *Data acquisition using ADC & DAC*

TEXT BOOKS:

1. Digital Logic and Computer Design, M. Morris Mano, Pearson India, 2017, ISBN: 9789332586048.
2. Digital Electronics, G. K. Kharate, Oxford University Press, 2012, ISBN: 9780198061830.

REFERENCE BOOKS:

1. A Anand Kumar, “Fundamentals of Digital Circuits”, Prentice-Hall of India Pvt.Ltd, 2006, ISBN: 9788120317451.
2. J.F. Walkerly, “Digital Design Principles and Practices”, 5th edition, PHI/Pearson Education, 2018, ISBN: 9780134460093.
3. M. Predko , “Digital Electronics Demystified”, McgrawHill, 2005, ISBN: 9780071471244.

Source: https://www.geeksforgeeks.org/best-way-to-start-with-competitive-programming-geeksforgeeks-cp-live-course/

22TP203 ADVANCED CODING COMPETENCY

Hours Per Week :

L	T	P	C
0	0	2	1

PREREQUISITE KNOWLEDGE: Programming in C, Data Structures.

COURSE DESCRIPTION AND OBJECTIVES:

This course helps to understand the impact of the choice of data structures and design strategies to solve the problem in an efficient manner. This course also provides the understanding of advanced graph applications and also throw light in tractable intractable problems.

MODULE-1

UNIT-1 **0L+0T+8P =8 Hours**

STACKS, QUEUES AND SINGLE LINKED LISTS:

PRACTICES:

Problems On Stacks & Queues

- Check if given stack of integers are consecutive or not (could be ascending or descending).
- Find the maximum sum in a sliding window using queues.
- Given a queue of integers, rearrange the elements by interleaving the first half with the second half.
- Given an integer k and a queue of integers, reverse the order of the first k elements of the queue.
- Given a maze in the form of a rectangular matrix filled with O, X or M where O represents an open cell, X represents a blocked cell and M represents landmines, find the shortest distance of every open cell in the maze from its nearest mine.
- For a given parenthesis expression, check whether it is balanced parenthesis or not.
- Reverse a number using stack.
- You are given a string s consisting of lowercase English letters. A duplicate removal consists of choosing two adjacent and equal letters and removing them. We repeatedly make duplicate removals on s until we no longer can.
- Find first Unique character in a string (Queue).
- Implement Tower of Hanoi problem.

Problems On Linked Lists

- Given a random pointer to a random node in a singly linked list, clone the list.
- Given a list rotate the list to the right by k places.
- Remove duplicates from a sorted list.
- Find fractional node in a singly linked list.
- Sort a linked list using constant space complexity.
- Delete a node in start, middle, end of Singly linked list.
- Add a node in start, middle, end of Singly linked list.
- Find whether given single linked list is circular or not.
- Arrange a singly linked list in Descending order.
- Addition of two numbers using Singly Linked List.

UNIT-2 **0L+0T+8P =8 Hours**

DOUBLY LINKED LISTS, CIRCULAR LINKED LISTS:

PRACTICES:

Problems on Double Linked Lists and Circular Linked Lists

- Implement a clockwise rotation of a doubly linked list by N places.
- Count triplets in a sorted doubly linked list whose product is equal to a given value x.
- Find the product of all prime nodes in a doubly linked list.
- Find the count of common nodes in two doubly linked lists.
- Find pairs with given product in a sorted doubly linked list.
- Delete all the even nodes of a circular singly linked list.
- Count nodes in a circular linked list.
- Delete all prime nodes from a circular singly linked list.
- Exchange first and last nodes in a circular linked list.
- Reverse a doubly circular linked list.
- Linear search using a stack of incomplete sub problems.
- 1 2 3 4 5 6 in stack S is push X is pop, SSSSXXSSSXXX.
- Recursively remove all adjacent duplicates.
- Check if a given singly linked list is a palindrome using stack.
- Convert a multilevel singly linked list to a singly linked list.
- Remove duplicates from an unsorted doubly linked list.
- Sort a doubly linked list using insertion sort.
- Check if a doubly linked list of characters is palindrome or not.
- Swap Kth node from beginning with Kth node from end in a Double Linked List.
- Convert a Binary Tree into Double Linked List.

SKILLS:

- ✓ *Experienced to Store data and various types of data to handle.*
- ✓ *Ordering and sorting of data.*
- ✓ *Indexing and Searching of required data from large data sequences.*
- ✓ *Exposed to various characteristics such as Linear or non-linear, Homogeneous or heterogeneous and Static and Dynamic.*

MODULE-2

UNIT-1 **0L+0T+8P =8 Hours**

TREES:

PRACTICES:

Problems on Trees

- Given a sorted doubly linked list, convert it into a balanced BST.
- Given a singly linked list with data in the ascending order, convert it into a height balanced BST.
- Print the leaf to root path for every leaf node in a binary tree.
- Write a function to implement the reversed level order traversal of a binary tree.
- Truncate a given binary tree to remove nodes that lie on a path having sum less than K.
- Find the vertical sum in a given binary tree.
- Delete minimum & Maximum element from a BST.
- Implement Inorder, preorder and postorder tree traversal techniques.
- Print Kth largest element in a BST.
- Implement Zig-Zag tree traversal.

UNIT-2 **0L+0T+8P =8 Hours**

GRAPHS:

PRACTICES:

Problems on Graphs

- Given a directed acyclic graph, determine whether there is a path that visits every vertex exactly once.
- Reverse a directed graph such that each edge from v to w is replaced by an edge from w to v.
- Find the shortest path in a graph that visits each vertex at least once, starting and ending at the same vertex.
- Find the minimum number of throws required to win a snake and ladder game.
- Implement DFS of a Graph.
- Implement BFS of a Graph.
- Detect whether a cycle is present in an undirected graph.
- Detect cycle in a Directed Graph.
- Find Shortest Distance to goal node from root node in a graph.
- Find no. of nodes in Kth level of a Graph.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply various data structures to solve a different algorithm.	Apply	1,2	1
2	Investigate the various data structures to solve a given problem in an efficient manner.	Analyse	1,2	2
3	Design and implement an appropriate hashing function for an application.	Create	1,2	4

TEXT BOOKS:

1. Reema Thareja, “Data Structures Using C”, 2nd Edition, Oxford University Press, 2014.
2. Seymour Lipschutz, “Data Structures with C”, 1st Edition, McGraw Hill Education, 2017.

REFERENCE BOOKS:

1. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures”, illustrated edition, Computer Science Press, 2006.
2. Richard F. Gilberg and Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, 2nd Edition, CENAGE Learning, 2005.
3. R G Dromey and Pearson, “How to solve it by Computer”, 2nd edition, Impression edition, 1998.

22TP204 PROFESSIONAL COMMUNICATION LABORATORY

Hours Per Week :

L	T	P	C
0	0	2	1

Source: https://www.coursera.org/specializations/improve-english

PREREQUISITE KNOWLEDGE: High School-level English.

COURSE DESCRIPTION AND OBJECTIVES:

To improve the overall professional communication skills (LSRW) of students and prepare them for their profession as engineers and managers. To provide them exposure to conventions of corporate communication and training them on how to function in the business world.

MODULE-1

UNIT-1 **0L+0T+8P=8 Hours**

BASICS OF BUSINESS WRITING SKILLS, PRACTICING BUSINESS CORRESPONDENCE AND REPORT WRITING:

Business English Vocabulary: Glossary of most commonly used words (formal and informal usage).

Elements of Technical Writing: Sentence structure, reducing verbosity, arranging ideas logically, building coherence, cohesive devices and transitional words.

Mechanics of Writing: Elementary rules of grammar, choice of diction, elementary principles of composition, matters of form, punctuation, conventions of business communication, language and professional tone, code of conduct (not sending illegal, offensive, disparaging personal remarks or comments) in written business communication.

Business Correspondence: E-mail: nature and scope, e-mail etiquette, clear call for action, common errors in composing e-mails, office communication such as meeting agenda and notice, circular and memo.

Letter-Writing: Formal and informal letters, structure of formal letters, expressions of salutations, different types of letters [such as sales letter, complaint letter, response to the complaint letter (dispute resolution), letter of permission, letter of enquiring, claim letter – letter of apology etc], introductory and concluding paragraphs and clear call for action.

Professional Proposal/Report: Differentiating proposals and reports, Drafting formal business proposals, types of reports such as factual reports, feasibility reports and survey reports, parts of a report (such as title page, declaration, acknowledgements, table of contents, abstract, introduction, findings, conclusion and recommendations).

New Age Corporate Communication Media: Importance of social media communication and Etiquettes, form and structure, sharing texts through Twitter, Whatsapp, instgram etc.

UNIT-2 **0L+0T+8P=8 Hours**

PRACTICING COMMUNICATIVE LANGUAGE IN VARIOUS PROFESSIONAL CONTEXTS:

Speaking: Speaking in business context, assertiveness, politeness, making requests, queries and questions, negotiations, asking for information, offering suggestions, conflict resolution, contacting clients, initiating, addressing delegates (in public), delivering the presentation effectively, telephone etiquettes, delivering seminar/proposal/report effectively, team meeting etiquettes (face to face and conference call), making effective one minute presentations(JAM) and participating in Group Discussions.

PRACTICES:

- Basic grammar practice, framing paragraphs on topics allocated, paraphrasing an article or a video in your own words, finding topic sentences in newspaper articles, finding out new words from a professional viewpoint and understanding the meaning and its usage.

SKILLS:

- ✓ *To enhance listening and spoken abilities of students needed for professional and social success in interpersonal situations, group interactions, and personal and professional presentations.*
- ✓ *Understand and practice specific functions and vocabulary in a business context.*
- ✓ *Produce short business reports, proposals and correspondence.*
- ✓ *Write various business documents through reading techniques.*

- Perusing samples of well-prepared business emails, memo, letter writing and short proposals and reports, students will draft business correspondence writing tasks and different proposals/ reports on topics assigned.
- Watching videos/listening to audios of business presentations, classroom activities of team and individual presentations, using PPTs, mock exercises for BEC speaking, agreeing, disagreeing politely, developing content, extended speaking in Group Discussion(s).

MODULE-2

UNIT-1 **0L+0T+8P=8 Hours**

READING AND COMPREHENDING BUSINESS DOCUMENTS:

Reading: Reading and comprehending business documents, learning business register, regularizing the habit of reading business news, suitable vocabulary, skimming and scanning a text for effective and speedy reading and dealing with ideas from different sectors of corporate world in different business contexts.

UNIT-2 **0L+0T+8P=8 Hours**

IMPARTING AND PRACTICING LISTENING SKILLS:

Listening: Specific information in business context, listening to telephonic conversations / messages and understanding the correct intended meaning, understanding the questions asked in interviews or in professional settings, summarizing speaker's opinion or suggestion, enable active listening.

PRACTICES:

- Hand-outs; matching the statements with texts, finding missing appropriate sentence in the text from multiple choices, using right vocabulary as per the given context and editing a paragraph.
- Working out BEC/TOEFL/IELTS listening exercises with hand-outs; matching the statements with texts, finding missing appropriate sentence in the text from multiple choice- multiple choices, using right vocabulary in context-editing a paragraph, listening to a long conversation such as an interview and answer MCQ s based upon listening.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Possess comprehensive skills in listening and reading business texts in formal context.	Apply	2	7
2	Communicate effectively both in their academic as well as professional environment.	Apply	2 &1	10
3	Clear grasp on the register of business language.	Analyze	1	8
4	Possess the ability to write business reports and proposals clearly and precisely to succeed in their future.	Create	1	12
5	Make effective presentations and participate in formal context.	Create	2	10

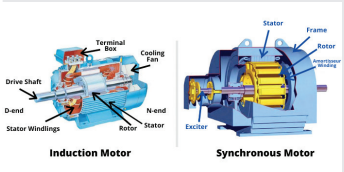
TEXT BOOK:

1. S. Schnurr, "Exploring Professional Communication: Language in Action", London: Routledge, 2013

REFERENCE BOOKS:

1. Brook Hart Guy, "Cambridge English Business Bench Mark: Upper Intermediate", 2nd Edition: CUP, 2014.
2. Cambridge University Publication, "Cambridge: BEC VANTAGE Practice Papers", CUP, 2002.
3. J. Seely, "The Oxford Guide to Effective Writing and Speaking", Oxford University Press, 2005.

22EE207 INDUCTION AND SYNCHRONOUS MACHINES



Source: https://hermitageautomation.com/difference-induction-and-synchronous-motor/

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: DC Machines.

COURSE DESCRIPTION AND OBJECTIVES:

- Provide knowledge on construction, operation, types and applications of Induction and synchronous machines.
- Discuss the complete characteristic features of different Induction and synchronous machine and special machines in their field of applications.
- Study of special machines.

MODULE-1

UNIT-1 **12L+0T+2P=14 Hours**

INTRODUCTION TO INDUCTION MACHINES:

Constructional details, Principle of operation, Starting Methods, Applications in real time systems.

UNIT-2 **12L+0T+14P=26 Hours**

PERFORMANCE OF INDUCTION MACHINES:

Torque-slip characteristics, Power flow diagram and relations, Losses and efficiency, Speed control techniques, Equivalent circuit.

PRACTICES:

- Separation of no-load losses in three phase induction motor.
- Load test on three-phase squirrel cage induction motor.
- Load test on three-phase slip ring induction motor.
- Determination of performance characteristics of single phase induction motor.

MODULE-2

UNIT-1 **12L+0T+2P=14 Hours**

INTRODUCTION TO SYNCHRONOUS MACHINES:

Constructional details, Principle of operation, EMF equation, Prediction of voltage regulation methods, V and inverted V-curves of Synchronous motor, Power output of Synchronous motor & hunting.

UNIT-2 **12L+0T+14P=26 Hours**

PARALLEL OPERATION OF SYNCHRONOUS MACHINES:

Methods of synchronization, Synchronizing power., Effect of change in excitation and prime mover torque, Two reaction theory - direct and quadrature axis synchronous reactance; Slip test.

PRACTICES:

- Regulation of a three phase alternator by synchronous impedance method.
- Regulation of a three phase alternator by M.M.F. method.
- Regulation of three phase alternator by Z.P.F. method.

SKILLS:

- ✓ *Identify suitable starting method for a 3-phase induction motor based on the application.*
- ✓ *Suggest a suitable speed control technique for a 3-phase induction motor based on the application.*
- ✓ *Determine the voltage regulation of alternator at any given load.*
- ✓ *Choose an appropriate special machine for given application.*

- V and Inverted V curves of a three phase synchronous motor.
- Determination of Xd and Xq of a salient pole synchronous machine.
- Load Test on three phase alternator.

COURSE OUTCOMES:

Upon successful completion of this course, students will have to ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyse speed torque characteristics and speed control of induction motors.	Analyze	1	1, 2, 9, 11
2	Analyse parallel operation of alternators.	Analyze	2	1, 2, 9, 11
3	Evaluate the performance of induction motor.	Evaluate	1	1, 2, 9, 11
4	Evaluate performance characteristics of induction machines.	Evaluate	1	1, 2, 9, 11
5	Obtain V and characteristics of synchronous machine.	Evaluate	2	1, 2, 9, 11

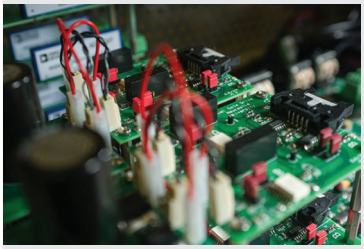
TEXT BOOKS:

1. P.S. Bimbra, “Electrical Machinery”, 7th edition, Khanna Publishers, 2011.
2. I.J. Nagrath and D.P. Kothari, “Electric Machines”, 5th edition, Tata Mc-Graw Hill Publishers, 2017.

REFERENCE BOOKS:

1. Charles I Hubert, “Electric Machines (Theory, operation, applications, adjustment and control)”, 2nd edition, Pearson India, 2009.
2. P.S.Bimbra, “Generalized Theory of Electrical Machines”, 5th edition, Khanna Publications, 2009.

22EE208 POWER ELECTRONIC DEVICES AND CIRCUITS



Source: https://www.ncl.ac.uk/engineering/research/electrical-electronic-engineering/electrical-power/electronics/

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basics of Electrical and Electronics Engineering, Analog Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

Power electronics involves the study of electronic circuits intended to control the flow of electrical energy. It deals with the processing and control of 'raw' electrical power from an electrical source such as an AC mains supply, a battery bank, a photovoltaic array, or a wind turbine into a form quality suitable for a particular electrical load. It is an enabling technology with a very wide range of applications, such as military/avionic products, industrial products, transportation system, telecom products, medical equipments etc.

MODULE–1

UNIT-1 **15L+0T+10P=25 Hours**

POWER SEMI-CONDUCTOR DEVICES AND SINGLE PHASE CONTROLLED CONVERTERS:

Power Semi-Conductor Devices: Introduction, operation and characteristics of power devices (SCR, MOSFET, IGBT and GTO); Snubber Protection, Triggering and commutation of SCR.

Single Phase Controlled Converters: Study of semi and full bridge converters for R and RL loads; Analysis of load voltage - derivations of form factor and ripple factor; Effect of source impedance. Performance parameters.

UNIT-2 **09L+0T+06P=15 Hours**

THREE PHASE:

Study of semi and full bridge converters for R and RL loads, Load voltage and current waveforms. Performance parameters.

PRACTICES:

- Study of characteristics of SCR, MOSFET & IGBT.
- Gate firing circuits for SCR's.
- Forced commutation circuits (Class A, Class B, Class C, Class D & Class E).
- Single phase fully controlled bridge converter with R and RL loads (MATLAB Simulation & Hardware).
- Single phase half controlled converter with R load (MATLAB Simulation & Hardware).

MODULE–2

UNIT-1 **15L+0T+10P=25 Hours**

CHOPPERS AND AC-AC CONVERTERS:

Choppers: Analysis of step-down (Buck Converter) and step-up (Boost Converter), Control strategies-time ratio and current limit control; Analysis of fly-back, forward converters for SMPS.

AC-AC Converters: Single phase AC voltage regulators with R and RL loads, Sequence control of AC voltage regulators; Single phase to single phase cyclo converter - step up and step down with R and RL loads.

SKILLS:

- ✓ *Understand the switching characteristics of various power semi conductor devices.*
- ✓ *Design the commutation circuits for SCRs based on application.*
- ✓ *Design a SCR based controlled converter for given specifications.*
- ✓ *Design a buck converter for given specifications.*
- ✓ *Design a boost converter for given specifications.*
- ✓ *Design a PWM generator for given duty ratio.*

UNIT-2 **09L+0T+06P=15 Hours**

INVERTERS:

Principle of operation of single phase full bridge square wave, Quasi-square wave, PWM inverters and comparison of their performance; Three phase inverters (120 & 180 degree); voltage control of single and three phase inverters.

PRACTICES

- DC-DC non isolated converters (Buck , boost) (MATLAB Simulation & Hardware).
- Single phase cyclo-converter with R and RL loads.
- Single phase series inverter with R and RL loads.
- Single phase parallel inverter with R and RL loads.
- Single phase AC Voltage Controller with R and RL Loads (MATLAB Simulation & Hardware).

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Selection of Power Semiconductor device as per application of converter.	Apply	1	1, 2, 6, 9
2	Compare the operation of two, three and six pulse converters and draw output waveforms with / without source and load inductance.	Analyse	1	1, 2, 9, 12
3	Classify choppers and outline the applications of SMPS.	Analyse	2	1, 2, 3, 9, 12
4	Design and analysis of DC/AC, AC/DC and AC/AC converters through experimentation.	Create	1, 2	1, 2, 9, 12
5	Illustrate the operation of AC voltage controller, cyclo-converter and its application.	Create	2	1, 2, 3, 9, 12

TEXT BOOKS:

1. Dr. P.S. Bimbra, “Power Electronics” 4th edition, Khanna publishers, 2021.
2. M.D. Singh and K.B. Khanchandani, “Power Electronics”, 2nd edition, Tata Mc-Graw Hill, 2017.

REFERENCE BOOKS:

1. Vedam Subrahmanyam, “Power Electronics Devices, Converters, Application”, 1st edition, New Age International, 2015.
2. Ned mohan, Tore M.Undeland and William P. Robbins, “Power Electronics Converters, Applications and Design”, 3rd edition, Wiley, 2022.

22MS201 MANAGEMENT SCIENCE

Source: https://xueqi326.wordpress.com/semester-3/management-science/

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic knowledge of management

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to analyze the importance of management, significance of operation management and carry out production operations through work-study. Students will be able to analyse the markets, customers, competitors, and then plan HR function effectively. These management practices, functional areas of the organisation will helps the students to build up their career in the corporate world.

MODULE-1

UNIT-1 **6L+6T+0P =12 Hours**

INTRODUCTION TO MANAGEMENT:

Concepts of Management and organization- nature, importance and Functions of Management, Systems approach to Management - Taylor's Scientific Management Theory, Fayol's Principles of Management, Mayo's Hawthorne Experiments, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Leadership Styles, Social responsibilities of Management.

UNIT-2 **10L+10T+0P =20 Hours**

OPERATIONS MANAGEMENT:

Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement, Objectives, Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records. Statistical Quality Control: control charts for variables and attributes (simple problems).

PRACTICES:

- Collect some examples with videos for types of production.
- Carry out production operations through work-study.
- Practice problems with Inventory control methods and Quality Control charts.

MODULE-2

UNIT-1 **8L+8T+ 0P =16 Hours**

HUMAN RESOURCES MANAGEMENT:

Concepts of Human Resource Management, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation, and Merit Rating.

UNIT-2 **8L+8T+0P =16 Hours**

MARKETING MANAGEMENT:

Evolution of Marketing, Functions of Marketing Selling Vs Marketing, 4 P's of Marketing – Product Mix - Product Life Cycle – Place Mix – Channels of Distribution – Price Mix – Pricing Methods – Promotion Mix – Tools of Promotions.

SKILLS:

- ✓ *Expert in managerial skills*
- ✓ *Maintain social relations*
- ✓ *Evaluate pricing strategies*

PRACTICES:

- Select any Designation in an organization and try to describe its job description and job specifications
- How do you deal with grievances at your work
- Analyze marketing mix in various situations

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Carry out production operations through work-study	Apply	1, 2	1, 2, 3, 5
2	Analyze the nature and importance of management	Analyze	1	1,2,4,6
3	Significance of Operations Management.	Analyze	1, 2	1,2,5
4	Analyze the markets, customers, and competition	Analyze	2	1,2,4,5,6
5	Plan and control the HR function effectively	Evaluate	1, 2	1,2,3,4,5,6

TEXT BOOKS:

1. Rajan Saxena: Marketing Management, 4th Edition, TMH, 2013.
2. Dilip Kumar Battacharya, Principles of Management, Pearson, 2012.

REFERENCE BOOKS:

1. Philip Kotler, Kevin Lane Keller, Abraham Koshy and Mithleshwar Jha: Marketing Management, 13th Edition, Pearson Education, 2012.
2. Dipak Kumar Bhattacharyya, Production and Operations Management, Universities Press, 2012.
3. Gary Dessler, “Human Resource Management”, 12th Edition, Pearson- 2012.
4. K.Aswathappa, “Human Resource Management”, Text and Cases”, TMH, 2011.
5. Harold Koontz, Heinz Weihrich, A.R. Aryasri, Principles of Management, TMH, 2010.

III

YEAR

B.Tech.

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CONTENTS

I SEM & II SEM

I SEMESTER

22TP301	-	Soft Skills Lab
22EE301	-	Linear Control Systems
22EE302	-	Electrical Measurements & Instrumentation
22EE303	-	Analysis and Operation of Power Systems
	-	Department Elective – 2
	-	Open Elective – 2
22EE306	-	Industry interface course (Modular course)
22EE305	-	Inter-Disciplinary Project – Phase-I
		NCC/ NSS/ SAC/ E-cell/ Student Mentoring/ Social activities/ Publication
		Minor / Honors – 2

II SEMESTER

22TP302	-	Quantitative Aptitude & Logical Reasoning
22EE307	-	Microprocessors & Microcontrollers
22EE308	-	Digital Signal Processing
	-	Department Elective – 3
	-	Department Elective – 4
	-	Open Elective – 3
22EE309	-	Inter-Disciplinary Project – Phase-II
	-	Minor / Honors – 3

22TP301 SOFT SKILLS LABORATORY

Source: https://choosework.ssa.gov/blog/2019-07-23-soft-skills-an-intro-to-effective-communication

Hours Per Week :

L	T	P	C
0	0	2	1

PREREQUISITE KNOWLEDGE: Grasp on their own academic achievements.

COURSE DESCRIPTION AND OBJECTIVES:

To impart employability skills like resume preparation and facing interviews. To enable trainees to develop interpersonal and leadership skills and to train them on work place skills like making presentations, participating in group discussions etc.

MODULE-1

UNIT-1 **0L+0T+8P=8 Hours**

PERSONALITY DEVELOPMENT:

Soft Skills: Need for soft skills, professionalism, employability skills; Communication: Need for effective communication - the process of communication, levels of communication, flow of communication, choice of diction and style with reference to setting (formal, semi-formal or informal); communication networks, barriers to communication, miscommunication, noise and ways to overcome the barriers; Career Planning: Job vs. career, SWOT analysis.

UNIT-2 **0L+0T+8P=8 Hours**

LANGUAGE AND VOCABULARY:

Vocabulary Building: Word etymology, roots, prefixes & suffixes, synonyms & antonyms, collocations, one-word substitutes, analogies, idioms and phrases, contextual guessing of unfamiliar words, task-oriented learning; Reflection of language on Personality, Gender sensitive language in MNCs, Mind your language, Seven essential skills for a team player; attentive listening, intelligent questioning, gently persuading, respecting other's views, assisting others, sharing, participating actively.

PRACTICES:

- Self-Introduction.
- Personal and Academic SWOC.
- Johari Window.
- Giving and taking opinions of Self Vs others and assessing oneself.
- Goal setting.
- Short, Mid and Long Term goals planning the semester.
- Time management: four quadrant system.
- Stephen Covey Time Management Matrix planning a semester.
- Stress-management.
- Questionnaire to assess level of stress.
- 50 words towards resume preparation and interviews.
- Newly coined words.
- Gender sensitive words and Words acceptable in Indian context and objectionable international context.

MODULE-2

UNIT-1 **0L+0T+8P=8 Hours**

LANGUAGE IN ACTION:

Functional English: Situational dialogues, Role plays (including small talk); Group Discussion: Articulation and flow of oral presentation, dynamics of group discussion, intervention, summarizing and conclusion, voice modulation, content generation, Key Word Approach (KWA), Social, Political, Economic, Legal

SKILLS:

- ✓ *Balance social and emotional intelligence quotients though SWOC, JOHARI etc. activities.*
- ✓ *Prepare tailor made resume and face various job interviews with enriched personality traits.*
- ✓ *Career planning with clear personal and professional goals.*
- ✓ *Solve personal and professional life hiccups with confidence and maturity.*

and Technical Approach (SPELT), View Point of Affected Part (VAP), language relevance, fluency and coherence – 11th and 12th weeks; Resume preparation: Structure and presentation, defining career objective, projecting one's strengths and skill-sets, summarizing, formats and styles and covering letter-Statement of Purpose.

UNIT-2 **0L+0T+8P=8 Hours**

PREPARING FOR PRESENTATIONS AND INTERVIEWS:

Facing Interviews: Interview process, understanding employer expectations, pre-interview planning, opening strategies, impressive self-introduction, answering strategies, other critical aspects such as body language, grooming, other types of interviews such as stress-based interviews, tele- interviews, video interviews, frequently asked questions (FAQs) including behavioral and HR questions and the aspect looked at by corporate during interviews; Presentation Skills: Selection of a topic, preparing an abstract, gathering information, organizing the information, drafting the paper, citing reference sources – writing striking introductions, discussing the methodology used, developing the argument, presentation style, language, presenting the paper and spontaneously answering audience questions.

PRACTICES:

- Opening and closing a telephonic conversation.
- Making an appointment.
- Making a query.
- Offering/Passing on information.
- Communicating with superiors.
- Expressing agreement/objection.
- Opening bank account (combination of prepared and impromptu situations given to each student).
- Group Discussions on various topics.
- Preparing SoP and Resume.
- Mock interviews on the FAQs including feedback.
- Oral presentation with the help of technology (Preparing PPT and presenting).

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Have the ability to introspect on individual strengths and weaknesses, and emerge as a balanced personality with improved self-awareness and self-worth .	Apply	1	12
2	Observe gender sensitive language and workplace etiquette in his professional life.	Analyze	1	9
3	Be able to prepare a resume and gain the confidence to face an interview.	Create	1&2	10
4	Possess the interpersonal skills to conduct himself/herself effectively in everyday professional and social contexts.	Apply	2	8
5	Bring professionalism into his/her daily activities.	Create	2	8

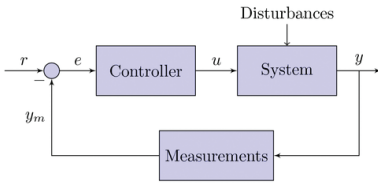
TEXT BOOKS:

1. Adrian Furnham, "Personality and intelligence at work", Psychology Press, 2008.
2. S. P. Dhanvel, "English and Soft skills", Orient Blackswan, 2011.

REFERENCE BOOKS:

1. Edward Holffman, "Ace the corporate personality", McGraw Hill, 2001.
2. John Adair Kegan Page, "Leadership for innovation", Kogan, 2007.
3. Krishna Mohan & NP Singh, "Speaking English effectively", Macmillan, 2008.
4. Rajiv K. Mishra, "Personality Development", Rupa & Co. 2004.

22EE301 LINEAR CONTROL SYSTEMS



Source: https://lab.vanderbilt.edu/taha/teaching/ee-5143-linear-systems-and-controls/

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basic Engineering Mathematics.

COURSE DESCRIPTION AND OBJECTIVES:

This course offers the basic concepts of modeling, analysis and design of linear continuous time systems. The objective of the course is to introduce the modeling of systems from physical laws, feedback characteristics and a few important control system components. In addition, it also provides graphical methods to analyze and assess system stability in time and frequency domains. Further, it introduces the state variable approach and basics of controller's design.

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours.**

INTRODUCTION TO CONTROL SYSTEMS:

Concepts of control systems - Open loop and closed loop control systems and their differences; Different examples of control systems, Classification of control systems; Mathematical Models of Physical Systems; Differential equations, transfer function and block diagram representation of electrical systems; Block diagram algebra, Signal flow graph reduction using Mason's gain formula, Translational and rotational mechanical systems.

UNIT-2 **12L+0T+8P=20 Hours.**

FEED-BACK CHARACTERISTICS & CONTROL COMPONENTS AND TIME RESPONSE ANALYSIS:

Feed-Back Characteristics and Control Components: Feed-Back Characteristics: Effects of feedback - Reduction of parameter variations, Control over system dynamics. Elements of Control Systems: Operation and derivation of transfer function of DC and AC Servo motors, Synchro transmitter and receiver.

Time Response Analysis: Standard test signals, Time response of first order systems, Characteristic equation and transient response of second order systems, Time domain specifications, Steady state response, Steady state errors and error constants.

PRACTICES:

- Characteristics of Magnetic Amplifier.
- Characteristics of Synchros.
- Characteristics Of AC Servo Motor.
- Transfer Function of DC Generator.
- Time Response of Second Order Systems.
- Linear System Analysis (Time Domain Analysis , Error Analysis) Using MATLAB.

MODULE-2

UNIT-1 **12L+0T+8P=20 Hours**

STABILITY AND FREQUENCY RESPONSE ANALYSIS:

Stability: Concept of stability, Routh stability criterion.

Root Locus Technique: Root locus concept, Construction of root loci and analysis.

SKILLS:

- ✓ *Model any physical system (Electrical, Mechanical, Electro-mechanical…).*
- ✓ *Determine overall transfer function of a system using Block Diagram Reduction Technique and SFG method.*
- ✓ *Analyse first and second order systems in time domain.*
- ✓ *Carry out stability analysis of any system in time and frequency domain.*
- ✓ *Design Lag, Lead Compensator using R, L and C for any Linear Time Invariant System.*

Frequency Response Analysis: Introduction, Frequency domain specifications, Bode plots Construction and determination of frequency domain specifications, Phase margin, Gain margin and stability analysis; Introduction to polar plots, Nyquist plots and Nyquist stability criterion.

UNIT-2 **12L+0T+8P=20 Hours**

COMPENSATION TECHNIQUES AND STATE SPACE ANALYSIS:

Compensation Techniques: Design problem, Preliminary design considerations, Realization of basic compensators - lead, lag and lead-lag. PID controllers.

State Space Analysis: Concept of state variables and state model, Derivation of state models from block diagrams and diagonalization, Solving the time invariant state equations, State transition matrix. Concept of controllability and observability.

PRACTICES:

- Stability Analysis (Bode , Root Locus, Nyquist Plot) Linear Time Invariant System using MATLAB.
- State Space Model for Classical Transfer Function Using MATLAB-Verification.
- Design of PID Controller And Simulation Using MATLAB.
- Water level control system using PLC.
- Traffic light control system using PLC.
- Temperature Control System.

COURSE OUTCOMES:

Upon successful completion of this course, students will have to ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Model differential equations for electromechanical systems and describe the effects of feedback on control systems.	Apply	1	1,2,9,11
2	Apply mathematical techniques to perform time response analysis of a control system.	Apply	1	1,2,9,11
3	Analyze linear control systems for absolute stability and relative stability using Root Locus technique and frequency domain analysis.	Analyze	2	1,2,9,11
4	Analysis of control system in state space	Analysis	2	1,2,9,11
5	Design controllers and compensators.	Create	2	1,2,3,4,5,9,11

TEXT BOOKS:

1. Norman. S. Nise, “Control Systems Engineering”, 5th edition, John Wiley and Son’s, 2018.
2. Katsuhiko Ogata, “Modern Control Engineering“, 5th edition, Prentice Hall of India Private Ltd., 2010.

REFERENCE BOOKS :

1. M. Gopal, “Control Systems: Principles and Design”, 3rd edition, Mc Graw, Hill, 2008.
2. Benjamin. C. Kuo, “ Automatic Control System”, Prentice Hall of India Private Ltd., New Delhi, 2009.
3. R.C. Dorf and R.H. Bishop, “Modern Control Systems”, 12th edition, Prentice Hall, 2010.

22EE302 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Source: https://dir.indiamart.com/impcat/electrical-measuring-instruments.html

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basic Electrical and Electronics Engineering, Electric circuits.

COURSE DESCRIPTION AND OBJECTIVES:

This course provides adequate knowledge of various instruments for measuring electrical quantities. The objective of course is to understand basic laws governing the operation and working of instruments and their equivalent circuits used for the measurement of voltage, current, power, energy, frequency and phase angle.

MODULE–1

UNIT-1 **12L+0T+8P=20 Hours**

ELECTRICAL MEASURING INSTRUMENTS:

Analog Ammeters and Voltmeters : PMMC and MI Instruments, Construction, Torque Equation, Range Extension, Effect of temperature, Classification, Errors, Advantages and Disadvantages.

Analog Wattmeter's and Power Factor Meters : Power and Power Factor, Electrodynamometer type wattmeter, power factor meter, Construction, theory, Shape of scale, torque equation, Advantages and disadvantages, active and reactive power measurement in single phase, Measurement in three phase.

Analog Energy Meter : Single phase induction type energy meters, construction, theory, Operation, lag adjustments, Max Demand meters/indicators, Measurement of VAH and VARh.

UNIT-2 **12L+0T+8P=20 Hours**

MEASUREMENT OF CIRCUIT PARAMETERS:

Measurement of Resistance, Inductance and Capacitance : Classification of resistance, Methods of measuring low, Medium and high resistance, Carey Foster's bridge, Kelvin's double bridge, Loss of charge method, DC Crompton's potentiometer, Measurement of inductance - Quality Factor, Maxwell's bridge; Measurement of capacitance and loss angle - Desauty bridge, Wien's bridge.

Instrument Transformers: Need for instrument transformers, CT and PT, Ratio and phase angle errors (Definition and Phasor diagram only).

PRACTICES:

- Calculation of unknown impedance by using Anderson's bridge.
- Calculation of unknown resistance by using Kelvin's double bridge.
- Calculation of unknown capacitance by using Schering Bridge.
- Measurement of choke coil parameters.
- Estimation of ratio error in case of current transformer.
- Estimation of ratio error in case of potential transformer.

SKILLS:

- ✓ *Select appropriate instrument for measuring given quantity.*
- ✓ *Extend the range of ammeter and voltmeter.*
- ✓ *Calculate the energy consumed by domestic load.*
- ✓ *Design Kelvin's double bridge and determine the unknown resistance.*
- ✓ *Design Maxwell Bridge and determine the unknown impedance.*

MODULE –2

UNIT-1 **12L+0T+8P=20 Hours**

TRANSDUCERS:

Measurement of Temperature, RTD, Thermistors, LVDT, Strain Gauge, Piezoelectric Transducers, Digital Shaft Encoders, Tachometer, Hall effect sensors.

UNIT-2 **12L+0T+8P=20 Hours**

ELECTRONIC INSTRUMENTS:

Electronic Display Device, Digital Voltmeters, CRO, measurement of voltage and frequency, Lissajous Patterns, Plotting B-H curve of a magnetic material, Wave Analyzers, Harmonic Distortion Analyzer.

PRACTICES:

- LVDT and the capacitance pickup - Characteristics and Calibration.
- Calibration of LPF wattmeter by Phantom loading test.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply of electronic measuring instruments to various applications	Apply	2	1,2,9,11
2	Compare performance of MC, MI and Dynamometer types of measuring instruments, Energy meters and CRO.	Analyse	1	1,2,9,11
3	Select the circuit parameters using AC and DC bridges.	Apply	1	1,2,9,11
4	Analyze the errors in CTs and PTs.	Analyze	1	1,2,9,11
5	Select transducers for the measurement of temperature, displacement and strain.	Apply	2	1,2,9,11

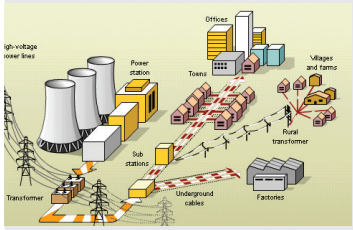
TEXT BOOKS:

1. J. B. Gupta: A course in Electrical and Electronic Measurements and Instrumentation, 13/E, Kataria and Sons 2009.
2. A. K. Sawhney: A course in Electrical Measurements Electronic Measurements Instrumentation, Edition 11, Dhanpat Rai and Sons 2012.

REFERENCE BOOKS:

1. W.D. Coopers and Helfrick, Modern Electronic instrumentation and Measurements Techniques, Prentice Hall of India Pvt. Ltd, 2009.
2. E.W. Gowlding and F.C.Widdis, Electrical Measurements and Measuring Instruments 5/e, Wheeler Publications 2002.

22EE303 ANALYSIS AND OPERATION OF POWER SYSTEMS



Source: https://www.mathworks.com/matlabcentral/fileexchange/59097-power-system-analysis-lab-experiments-using-matlab-manual

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basic Circuit Analysis; Basic of Electrical Machines; Basic of Power Transmission and Distribution.

COURSE DESCRIPTION AND OBJECTIVES:

This course offers comprehensive knowledge on the basics of power system and its operation under steady and transient state. It also deals with the economic distribution of loads in thermal generators. The objective of the course is to model the power system and analyse the power flow, different types of faults, to understand economic dispatch and load frequency control.

MODULE-1

UNIT-1 **14L+0T+0P=14 Hours**

POWER FLOW PROBLEM:

Network Matrices: Formation of system Y-bus by inspection method, Power system Z-bus building up algorithm without mutual coupling (without derivation), simple problems up to four bus systems.

Power Flow Problem-I: Formulation of power flow problem, Types of buses, Classification of variables, Expressions for real and reactive power injections, Formulation of power flow problem, Solution of static power flow equations by Newton Raphson's method, Jacobian elements, Convergence condition, Algorithm and flow chart.

Power Flow Problem-II: Decoupled load flow, Fast decopuled load flow, Assumption, Derivation, algorithm and flow chart, numerical problems up to 3 buses; comparison of all load flow methods.

UNIT-2 **10L+0T+16P=26 Hours**

FAULT ANALYSIS:

Symmetrical Faults: Symmetrical faults, Problem formulation and solving procedure, Selection of circuit breakers.

Unsymmetrical Faults: Introduction to symmetrical components, Unsymmetrical faults analysis and expressions for fault current, Computation of all sequence impedances and sequence networks for alternators, Transformers, Transmission lines and loads.

PRACTICES:

- MATLAB code for formation of bus admittance matrix. (Y bus).
- MATLAB code for formation of Impedance matrices (Z bus).
- MATLAB code for Solution of the nonlinear equation using Newton Raphson method.
- Fast-decoupled method for power flow problem and its derivation from Newton's method, Including Q-limit check, Numerical problems for systems up to 3-buses.

SKILLS:

- ✓ *Formulate basic power flow problem.*
- ✓ *Classify different short circuit faults in power systems.*
- ✓ *Understand the stability problem in power system subjected to disturbances.*
- ✓ *Obtain economic dispatch for given load profile.*
- ✓ *Analyse the problem of load frequency control strategy.*

MODULE-2

UNIT-1 **14L+0T+0P=14 Hours**

POWER SYSTEM STABILITY:

Power System Stability: Introduction to power system stability, Classification of power system stabilities, Steady state and transient stability limits, Power angle curve, Derivation of swing equation, Synchronizing power coefficient, Equal area criterion, Determination of critical clearing angle, Numerical problems, Methods to improve the stability limits.

Optimal Operation in Thermal Power Stations: Cost curve – Incremental fuel and production costs, Optimum generation allocation with and without line losses, Loss coefficients, Numerical problems.

UNIT-2 **10L+0T+16P=26 Hours**

LOAD FREQUENCY CONTROL:

Load Frequency Control-I: Necessity of keeping frequency constant, Definitions of control area, Load frequency control of single area system, Block diagram representation of an isolated power system, Steady state analysis, Dynamic response, Controlled and uncontrolled case, Tie-line bias control, Proportional plus Integral control of single area and its block diagram representation.

Load Frequency Control-II: Load frequency control of 2-area system, Block diagram representation of an isolated power system, Steady state analysis, Dynamic response, Controlled and uncontrolled case, Tie-line bias control, Proportional plus Integral control of single area and its block diagram representation.

PRACTICES:

- Economic Dispatch without considering transmission line loss of a three-bus.
- Generating test system by Lambda Iteration method using MATLAB software.
- Simulation of single area load frequency control with integral controller.
- Simulation of single area load frequency control without integral controller.
- Simulation of Load - Frequency Dynamics of Two-Area control power systems.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Execute the steady state load flow analysis	Apply	1	1,2,3,9,11
2	Apply the symmetrical component theory for fault calculations.	Apply	1	1,2,3,4,9,11
3	Analyse load frequency in single and 2-area systems	Analyze	2	1,2,3,4,9,11
4	Formulate the system matrices by different algorithms.	Evaluate	1	1,2,9,11
5	Judge the optimal scheduling of generators.	Evaluate	2	1,2,3,9,11

TEXT BOOKS:

1. J. Grainger and WD Stevenson Jr, “Power System Analysis”, 1st edition, TMH, 2005.
2. D.P. Kothari and I.J. Nagrath, “Modern Power System Analysis”, 3rd edition, TMH, 2008.

REFERENCE BOOKS:

1. Hadi Saadat, “Power System Analysis”, 1st edition, TMH, 1999.
2. O. I. Elgerd, “Electric Energy Systems Theory an introduction”, 2nd edition,TMH, 2006.
3. P. Kundur, “Power System Stability and Control”, 1st edition, Mc-Graw Hill, 2009

22TP302 QUANTITATIVE APTITUDE AND LOGICAL REASONING

Source: https://images.app.goo.gl/kvtVgA8TkvDCqLhj7

Hours Per Week :

L	T	P	C
1	2	0	2

PREREQUISITE KNOWLEDGE: Basic Logical Thinking and Problem-Solving Ability.

COURSE DESCRIPTION AND OBJECTIVES:

The Students will be introduced to various Arithmetic and Reasoning Problems. The students will have acquaintance with various problems like Time & Work, Time & distance, Percentages, Profit & Loss etc. besides solving puzzles and Critical Reasoning.

MODULE-1

UNIT-1 **4L+8T+0P=12 Hours**

Number system, LCM & HCF of numbers, Percentage, Ratio and proportion, Profit, loss and discount, Average & Mixtures, Simple Interest & Compound interest.

UNIT-2 **4L+8T+0P=12 Hours**

Time and work, Time & distance, Problems on trains, Problems on ages, Permutation & Combinations, Probability.

PRACTICES:

- Each concept would be taught in detail in the class followed by 10 problems solved in the class.
- Students would have to solve 10 additional problems as a homework assignment in each concept.

MODULE-2

UNIT-1 **4L+8T+0P=12 Hours**

Number series, Letter series, Analogy, Odd man out, Coding and decoding, Syllogisms- Statement & Conclusions, Puzzle test.

UNIT-2 **4L+8T+0P=12 Hours**

Blood relations, Direction sense test, Order & Ranking, Seating Arrangements, Calendar & Clocks.

PRACTICES:

- Each concept would be taught in detail in the class followed by 10 problems solved in the class. Students would have to solve 10 additional problems as homework assignments in each concept.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Meet the demands of current job market besides equipping them higher studies like CAT, GMAT etc.	Apply	1	2, 5
2	Solve Arithmetic and Reasoning Problems within shortest possible time without paper work.	Apply	1	2, 5

SKILLS:

- ✓ *Helps in developing and improving problem-solving skills.*
- ✓ *Flexing and honing logical abilities.*
- ✓ *Allow students to develop critical thinking skills.*

3	Exhibit better analytical skills and aptitude skills.	Analyse	2	2, 4
4	Develop interpretational skills.	Evaluation	2	2, 4

TEXT BOOKS:

1. R. S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S. CHAND Publications- Revised Edition, 2017.
2. ARIHANT, "A New Approach to Verbal & Non-Verbal Reasoning", Arihant Publication- Revised Edition, 2021.

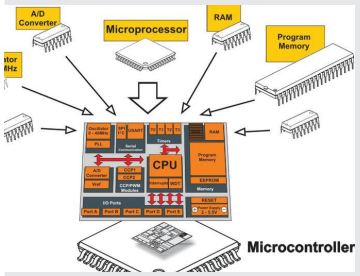
REFERENCE BOOKS:

1. Trishna Knowledge Systems, "Quantitative Aptitude for Competitive Examinations", Pearson Publication, 2013.
2. R. S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", Revised Edition, S. CHAND Publications, 2018.

22EE307 MICROPROCESSORS AND MICROCONTROLLERS

Hours Per Week :

L	T	P	C
3	0	2	4



Source: https://www.electronicsforu.com/resources/difference-between-microprocessor-and-microcontroller

PREREQUISITE KNOWLEDGE: Digital Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the basic architecture, assembly language programming, pin definitions, supporting chips and memory interfacing of microprocessors and microcontrollers. The objective of the course is to understand various addressing modes, different peripheral devices and their interfacing with 8086, 8051 and ARM processor.

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours**

INTRODUCTION TO 8086 MICROPROCESSOR:

Evolution of microprocessors; 8086 microprocessor Architecture, Register model, Memory segmentation, Physical address generation, Addressing modes, Instruction set, Interrupts of 8086. Pin configuration of 8086; 8086 system bus architecture, Physical Memory organization.

UNIT-2 **12L+0T+8P=20 Hours**

INTRODUCTION TO 8051 MICROCONTROLLER:

Comparision of Microprocessors and microcontrollers; 8051 Micro controller Architecture; Signal Description of 8051; Memory organization; Addressing modes of 8051; Instruction set; Assembly language program examples in 8051.

PRACTICES:

- Programs on different Data Transfer Instructions using 8086.
- Arithmetic operations: Addition, Subtraction, Multiplication, Division using 8086.
- Programs to analyze different addressing modes of 8086.
- Program to sort the array of given numbers in ascending order.

MODULE-2

UNIT-1 **12L+0T+8P=20 Hours**

8051 MICROCONTROLLER HARDWARE AND PERIPHERAL INTERFACING:

Parallel Ports in 8051; 8051 Timers; 8051 Serial ports; 8051 Interrupts. Peripheral Interfacing- LCD and Keyboard Interfacing, ADC and Sensor Interfacing, DC Motor and Stepper Motor Interfacing Techniques.

UNIT-2 **12L+0T+8P=20 Hours**

ARM ARCHITECTURE:

RISC Vs CISC systems, ARM Philosophy, ARM7TDMI Core Architecture, Functional Diagram, Programmer's Model, ARM State Register Set,THUMB state register set, Current Program Status Register, ARM 7TMI Operating modes, mode bits, Exceptions, Interrupt Vector Table, Interrupt Processing.

SKILLS:

- ✓ *Write assembly language program for 8086 and 8051.*
- ✓ *Debug assembly language programs.*
- ✓ *Make working I/O interfaces.*
- ✓ *Develop application programs for 8 bit and 16 bit processor / controllers.*

PRACTICES:

- Interfacing 7 Segment LED Display to 8051.
- Alphanumeric LCD panel interface to 8051.
- Hex keypad input interface to 8051.
- ADC interface to 8051.
- DAC interface to 8051 for waveform generation.
- Stepper motor control interface to 8051.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Make use of ARM Processor different applications	Apply	2	1,2,9,11
2	Experiment to interface various peripherals to 8051.	Apply	1	1,2,9,11
3	Understand nalyze the architectures of 8086 microprocessors and 8051 micro controllers. Identify various peripheral interfaces to 8051.	Analyze	1	1,2,9,11
4	Create basic assembly language programs for 8086, 8051 and ARM processors.	Analyze	1, 2	1,2,9,11
5	Develop applications based on different processors and controllers.	Create	1, 2	1,2,9,11

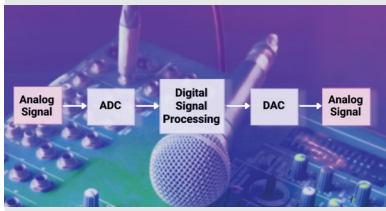
TEXT BOOKS:

1. Douglas V.Hall, “Microprocessors and Interfacing”, 2nd edition, Tata McGraw Hill, 2017.
2. Kenneth J. Ayala, “The 8051 Microcontroller”, 3rd edition, Cengage Learning India Pvt. Ltd, 2009.

REFERENCE BOOKS:

1. Barry B. Brey, “The Intel microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit extensions: architecture, programming, and interfacing”, 8th edition, Pearson Prentice Hall, 2009.
2. Mohamed Rafiquzzaman, “Microprocessors and Microcomputer Based System Design”, 2nd edition, CRC Press, 2007.
3. Steve Furber, “ARM System on Chip Architecture”, 2nd edition, Pearson education, 2000.

22EE308 DIGITAL SIGNAL PROCESSING



Source: https://medium.com/@astontechnologies/digital-signal-processing-71d5206cacfe

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Fourier and Laplace transformation.

COURSE DESCRIPTION AND OBJECTIVES:

To understand the representation of discrete time signals and systems with discrete inputs both in time domain and frequency domain as these constitute basics for DSP. To study both direct and inverse z-transforms, DFT (Discrete Fourier Transforms), FFT (Fast Fourier transforms) and their properties in detail. To design and realize various infinite impulse response (IIR) & finite impulse response (FIR) filters and study their properties. To provide idea about DSP based processing.

MODULE –1

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION TO DISCRETE TIME SIGNALS AND SYSTEMS:

Review of signals and systems, linear shift invariant systems, Stability and causality, Frequency domain representation of discrete time signals and systems. Z-transform and properties, Linear constant coefficient difference equations, Impulse response, Step response.

UNIT-2 **8L+8T+0P=16 Hours**

DFT AND FFT:

Discrete fourier representation of periodic sequences (DTFT), Properties, Frequency response, Discrete Fourier Transform - properties of DFT, Linear convolution of sequences using DFT, Computation of DFT, Fast Fourier Transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT algorithms.

PRACTICES:

- Simulate the system for impulse and step inputs.
- Identify the accelerating methods for processing through DFT & FFT.
- Design FIR/IIR filters for removing unmounted frequencies in the signal.
- Study the relation between Laplace transform and discrete Fourier transform.

MODULE-2

UNIT-1 **10L+10T+0P=20 Hours**

DESIGN AND REALIZATION OF FILTERS:

FIR Filter: FIR system function, Characteristics of FIR digital filters, Frequency response, Design of FIR digital filters using window techniques, Structures of FIR – direct form structure, cascade form structure, linear phase structure.

IIR Filter: IIR system function, Analog filter approximations – Butter worth and Chebyshev; Design of IIR digital filters from analog filters, Analog-to-digital transformations, Structures of IIR - direct form I and II, cascade form, parallel form, signal flow graph and transposed structures; Comparison of IIR and FIR filters.

SKILLS:

- ✓ *Analysis the Discrete systems by using DFT & FFT.*
- ✓ *Analyse the notch filter implementation.*
- ✓ *Analyse the stability of the system.*

UNIT-2 **6L+6T+0P=12 Hours**

DIGITAL SIGNAL PROCESSORS AND APPLICATIONS:

Introduction to DSP processor, Memory architecture, Pipelining, Features of TMS320 family DSP processor, Digital signal processing based speed control of industrial motor drives.

PRACTICES:

- Design FIR, IIR filters for removing unwanted frequencies in the signal.
- Identify the type and order of the filter for a given application.
- Analyse the stability of the designed filter.
- Write a program for PI controller using code composer studio.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply different transformations and operations on signal.	Apply	1	1, 2, 9, 11
2	Apply discrete Fourier transforms and fast Fourier transform for different types of signals, interpret the information obtained and able to reconstruct it as well as to apply Z-transform on a system to get its response.	Apply	1	1, 2, 9, 11
3	Identify the need of digital signal processing in field of electrical engineering and know the features of TMS 320 family digital processor.	Apply	2	1, 2, 3, 9, 11
4	Design FIR filters and its realizations.	Create	2	1, 2, 3, 9, 11
5	Realize IIR filters.	Create	2	1, 2, 3, 9, 11

TEXT BOOKS:

1. John G. Proakis and Dimitris G. Manolakis “Digital Signal Processing: Principles, Algorithms & Applications”, Pearson Education, 2007.
2. A.V. Oppenheim and R.W. Schaffer, “Discrete Time Signal Processing”, 3rd edition, Pearson Education, 2014.

REFERENCE BOOKS:

1. Ramesh Babu, “Digital Signal Processing”, 6th edition, Scitech, 2014.
2. M.H. Hayes, “Digital Signal Processing: Schaum’s outline”, TATA Mc Graw Hill, 2007.
3. A. Nagoor Kani, “Digital Signal Processing”, 2nd edition, TATA Mc Graw Hill, 2017.

DEPT.
ELECTIVES

ELECTRICAL AND ELECTRONICS ENGINEERING

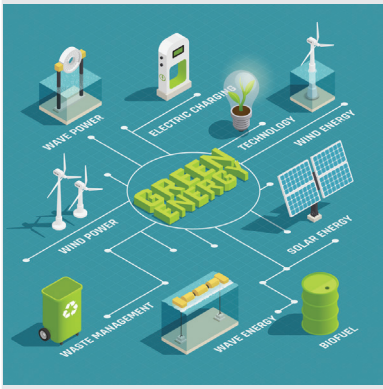
B.Tech.

22EE801	-	Green Energy Technologies
22EE802	-	Electric Vehicles
22EE803	-	High Voltage Engineering
22EE804	-	Switch Mode Power Conversion
22EE805	-	Sensors and Transducers
22EE806	-	Special Electrical Machines
22EE807	-	Optimization Techniques
22EE808	-	Advanced Control Systems
22EE809	-	Advanced Power Electronics
22EE810	-	Power Quality
22EE811	-	Advanced Power System Analysis
22EE812	-	Energy Storage Technologies
22EE813	-	Energy Audit, Conservation and Management
22EE814	-	Smart Grid Technologies
22EE815	-	Energy System Economics
22EE816	-	Flexible AC Transmission Systems
22EE817	-	SCADA Systems and Applications
22EE818	-	Plug-In Electric Vehicles in Smart Grid
22EE819	-	Soft Computing Techniques in Electrical Engineering
22EE820	-	Programmable Logic Controllers
22EE821	-	PV Technologies and Applications
22EE822	-	Utilization of Electrical Energy

COURSE CONTENTS

I SEM & II SEM

22EE801 GREEN ENERGY TECHNOLOGIES



Source: https://www.vectorstock.com/royalty-free-vector/green-energy-technology-isometric-flowchart-vector-17196398

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic Engineering Products.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the types, purpose and operation of renewable energy technologies. The objective of the course is to understand the implementation of energy conversion technologies in the following renewable energy resources, solar, wind biomass and tidal.

MODULE –1

UNIT-1 **8L+8T+0P=16 Hours**

SOLAR ENERGY:

Solar radiation on the earth surface, Sun-Earth angles, Solar thermal power generation technologies.

UNIT-2 **8L+8T+0P=16 Hours**

SOLAR PHOTOVOLTAICS:

Photovoltaic effect, Working of a solar cell, Current equation of a solar cell, Performance characteristics of a PV cell, Parameters of PV Cell, Effect of irradiation and temperature, Solar PV module and array interconnections, Concept of shading on PV module, Ratings of a PV module, Classification of PV systems, Design of PV system.

PRACTICES:

- Determining the best location for Solar PV panels and collectors using solar path finder.
- To study solar pond.
- To study solar distillation.
- To study solar photovoltaic system.

MODULE –2

UNIT-1 **8L+8T+0P=16 Hours**

WIND ENERGY:

Nature of wind, Site selection, Principle of wind energy conversion, Betz limit, Power regulation, Classification of wind mills, aero dynamics, Design of wind turbine for water pumping applications.

UNIT-2 **8L+8T+0P=16 Hours**

BIOMASS AND TIDAL ENERGY:

Biomass: Photosynthesis, Biomass energy conversion technologies, Design of biogas plant.

Tidal Energy: Spring tide, Neap tide, Daily and monthly variation, Tidal range, Modes of tidal power generation, Types of tidal power.

PRACTICES:

- Familiarization with wind energy gadgets.
- Study of wind turbine system for water pumping application.
- To study biogas plants.
- Study of different types of Gasifiers.

SKILLS:

- ✓ *Understand the fundamentals of solar flat plate collectors, concentrating solar collectors and familiar with the solar low, medium and high temperature applications.*
- ✓ *Design of solar panel to obtain required voltage.*
- ✓ *Understand layout and functioning of wind power plants.*
- ✓ *Differentiate between various biomass energy conversion routes.*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Examine various applications of solar collectors.	Analyze	1	1, 2, 3, 7, 9, 11
2	Evaluate efficiency of Solar cell and to understand the functioning of Photon devices.	Evaluate	1	1, 2, 3, 7, 9, 11
3	Examine different components and their functioning in wind power plants.	Analyze	2	1, 2, 3, 7, 9, 11
4	Compare the operation of tidal and OTEC power plants.	Analyze	2	1, 2, 3, 7, 9, 11
5	Develop biomass plant.	Create	2	1, 2, 3, 7, 9, 11

TEXT BOOKS:

1. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, 1st edition, Oxford University Press, 2012.
2. G.S.Sawhney, “Non-Conventional Energy Resources”, 1st edition, PHI Learning, 2012.

REFERENCES BOOKS:

1. S.P. Sukhatme and J.K.Nayak., “Solar Energy”, 3rd edition, Tata Mc-Graw Hill Education Private Limited, 2010.
2. Chetan Singh Solanki, “Solar Photovoltaic: Fundamentals, Technologies and Application”, PHI Learning Pvt., Ltd., 2009.
3. Rajput R.K., “Non-Conventional Energy Sources and Utilization”, revised edition, S. Chand & Co., 2012.
4. G.D. Rai, “Non-Conventional Energy Sources”, 4th edition, Khanna Publishers, 2011.

22EE802 ELECTRIC VEHICLES

Source: https://jmkresearch.com/electric-vehicles-published-reports/

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Power Electronics; Industrial Electric Drives; Electrical Machines-I and Electrical Machines-II.

COURSE DESCRIPTION AND OBJECTIVES:

The objective of this course is to introduce configuration of electrical vehicles and its components, hybrid vehicle configuration by different techniques, sizing of components, design optimization and energy management.

MODULE - 1

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION TO HYBRID ELECTRIC VEHICLES AND CONVENTIONAL VEHICLES:

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, Social and environmental importance of hybrid and electric vehicles, Impact of modern drive-trains on energy supplies.

Conventional Vehicles: Basics of vehicle performance, Vehicle power source characterization, Transmission characteristics, Mathematical models to describe vehicle performance.

UNIT-2 **8L+8T+0P=16 Hours**

HYBRID ELECTRIC DRIVE-TRAINS, ELECTRIC DRIVE-TRAINS AND ELECTRIC PROPULSION UNIT:

Hybrid Electric Drive-Trains: Basic concept of hybrid traction, Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel efficiency analysis.

Electric Drive-Trains: Basic concept of electric traction, Introduction to various electric drive-train topologies, Power flow control in electric drive-train topologies, Fuel efficiency analysis.

Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives.

PRACTICES:

- Developing real-life drive cycles for 2-wheelers, 3-wheelers, cars and buses.
- Extracting features from the drive cycles for sizing motors and converters.
- Control of motors using the drive cycles.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

ENERGY STORAGE AND SIZING THE DRIVE SYSTEM:

Energy Storage: Introduction to energy storage requirements in hybrid and electric vehicles, battery based energy storage and its analysis, Fuel cell based energy storage and its analysis, Hybridization of different energy storage devices.

Sizing the Drive System: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, Sizing the power electronics, Selecting the energy storage technology.

SKILLS:

- ✓ *Selection of E – motors for Electric Vehicles- BLDC/PMSM/ INDUCTION/ SynR MOTORS*
- ✓ *Lithium Batteries and Battery Pack Design for Electric & Hybrid Vehicle Application*
- ✓ *Motor Control Technology for Electric Vehicle applications*
- ✓ *Powertrain Sizing Calculation Procedure and Practice Problems*

UNIT-2 **8L+8T+0P=16 Hours**

COMMUNICATIONS, SUPPORTING SUBSYSTEMS AND ENERGY MANAGEMENT STRATEGIES:

Communications, Supporting Subsystems: In vehicle networks- CAN.

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, Classification of different energy management strategies, Comparison of different energy management strategies.

PRACTICES:

- Study of accessories required for Scooter Hybrid Conversion.
- Lithium Batteries and Battery Pack Design for Electric & Hybrid Vehicle Application.
- Power train Sizing Calculation Procedure and Practice Problems.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources.	Apply	1	1, 2, 3, 4, 7, 9, 11
2	Choose proper energy storage systems for vehicle applications.	Apply	2	1, 3, 7, 9, 11
3	Design and develop basic schemes of electric vehicles and hybrid electric vehicles.	Analyse	1	1, 3, 7, 9, 11
4	Choose proper energy management strategies for vehicle applications.	Analyse	2	1, 3, 9, 11
5	dentify various communication protocols and technologies used in vehicle networks.	Create	2	1, 2, 5, 9, 11

TEXT BOOKS:

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017.

REFERENCE BOOKS:

1. James Larminie and John Lowry, “Electric Vehicle Technology Explained”, Wiley, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.

22EE803 HIGH VOLTAGE ENGINEERING

Source: https://electrical-engineering-portal.com/download-center/books-and-guides/electrical-engineering/high-voltage-practice-theory

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic Electromagnetism and Electro Statics.

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces the basic concepts of high voltage generation, measurements and testing of high voltage equipment's in the system. The objective of the course is to understand failure mechanisms of solids, liquids and gaseous insulation and their usage in high voltage underground cables, overhead transmission lines and transformers.

MODULE - I

UNIT-1 **8L+8T+0P=16 Hours**

ELECTRO STATIC FIELDS, CONTROL AND ESTIMATION:

Electric field intensity, Electric strength, Classification of electric fields, Control of electric field intensity, Basic equations for potential and field intensity in electrostatic fields, Analysis of electric field intensity in homogenous and multi-dielectric electric fields, Numerical methods for estimation of electric field intensity, Applications of insulating materials in transformers, Rotating machines, Circuit breakers, Cable power capacitors and bushings.

UNIT-2 **8L+8T+0P=16 Hours**

BREAKDOWN MECHANISM OF GASEOUS, LIQUID AND SOLID INSULATING MATERIALS:

Mechanism of breakdown in gases, Townsend's first ionization coefficient, Cathode processes, Secondary effects, Townsend's second ionization coefficient, Townsend breakdown mechanism, Streamer or kanal mechanism of spark, Paschen's law, Penning effect, Breakdown in non-uniform fields, Principles of breakdown in solid and liquid dielectrics.

PRACTICES:

- Study filtration and treatment of Transformer Oil.
- Study solid the electrics used in power apparates.
- Determine dielectric strength of Transformer Oil.

MODULE - 2

UNIT-1 **8L+8T+0P=16 Hours**

GENERATION OF IMPULSE VOLTAGES AND CURRENTS:

Rectifier circuits, Cockcroft- Walton voltage multiplier circuit, Electrostatic generator, Generation of high AC voltages by cascaded transformers, Series resonant circuit, Definitions, Generation of high DC impulse generator circuits, Analysis of impulse generator circuit, Multistage impulse generator circuit, Triggering of impulse generator, Impulse current generation.

UNIT-2 **8L+8T+0P=16 Hours**

MEASUREMENT OF HIGH VOLTAGES AND CURRENTS AND HIGH VOLTAGE TESTING OF ELECTRICAL EQUIPMENT:

Measurement of High Voltages and Currents: Sphere gap, Uniform field spark gap, Rod gap, Electrostatic voltmeter, Generating voltmeter, Fortes cue method, Resistive and capacitive voltage dividers, Measurement of high DC, AC and impulse currents.

SKILLS:

- ✓ *Determine break down strength of different insulation mediums.*
- ✓ *Suggest appropriate insulation for a given electrical equipment.*
- ✓ *Design of high voltage DC generator circuit.*
- ✓ *Design of CVT for measuring High voltages.*
- ✓ *Test electrical equipment's at different voltage levels.*

High Voltage Testing of Electrical Equipment: Layout of high voltage laboratory with major testing and measuring equipment's, Determination of their ranges and ratings, Earthing system, Electromagnetic shielding and protective fencing; Testing - overhead line insulators, cables, bushings, Power capacitors, power transformers, circuit breakers; IEC, ANSI, IEEE and Indian standards for testing electrical equipment.

PRACTICES:

- Generation and measurement of direct voltage.
- Electrostatic generator.
- Generation of high AC voltages by cascaded transformers.
- Generation and measurement of AC voltage - sphere gap.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Design the insulation of HV power equipment.	Analyze	1	1,2,9
2	Understand the Breakdown mechanism of Gas, Liquid and solid insulation.	Analyze	2	1,3,7
3	Estimate electric field intensity of different electrode configurations.	Analyze	2	1,2,12
4	Employ Non-destructive test techniques to assess the quality of insulation of high voltage equipment.	Evaluate	2	1,2,9,12

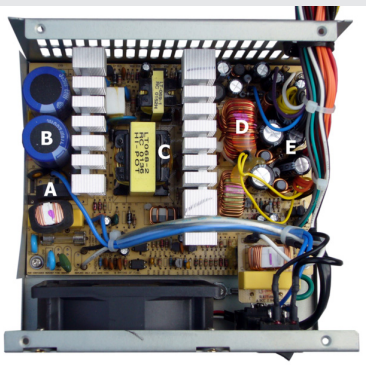
TEXT BOOKS:

1. E. Kuffel, W.S. Zaengl and J. Kuffel, "High Voltage Engineering Fundamentals", Newnes Publishers, 2011.
2. M.S. Naidu and Kamaraju, "High Voltage Engineering", Mc Graw Hill Education (India) Private Limited, 2013.

REFERENCE BOOKS:

1. Ravindra Arora and Wolfgang Mosch, "High Voltage Insulation Engineering", New Age International Publishers, 2016.
2. C.L. Wadhwa, "High voltage Engineering", New Age International Publishers, 2012.

22EE804 SWITCH MODE POWER CONVERSION



Source: https://en.wikipedia.org/wiki/Switched-mode_power_supply

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Power Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces the analysis of various SMPS based converters and their modeling. The objective of course is to understand the concept of SMPS and choose proper SMPS based converters for building drivers.

MODULE–1

UNIT-1 **16L+4T+0P=20 Hours**

SMPS:

Introduction to SMPS, Circuit description of SMPS, Types of SMPS, Different PWM techniques for SMPS.

UNIT-2 **08L+12T+0P=20 Hours**

FLY BACK CONVERTER AND FORWARD CONVERTER:

Fly back converter : Analysis of flyback converter, State space model of flyback converter, Design of control circuit for flyback converter, Applications, Numerical problems.

Forward Converter: Analysis of forward converter, State space model of forward converter, Design of control circuit for forward converter, Applications, Numerical problems.

PRACTICES:

- Study the difference between linear power supplies and switch mode power supplies.
- Study the performances of frequency with modulation and pulse with modulation.
- Derive the minimum inductance required for CCM mode of operation in flyback converter.
- Derive the minimum inductance required for CCM mode of operation in forward converter.

MODULE–2

UNIT-1 **6L+4T+0P=10 Hours**

LUO CONVERTER:

Analysis of luo converter, State space model of luo converter, Design of control circuit for luo converter, Applications, Numerical problems.

UNIT-2 **18L+12T+0P=30 Hours**

HALF BRIDGE AND FULL BRIDGE CONVERTER:

Analysis of half bridge and full bridge converters, State space model of half bridge and full bridge converter, Design of control circuit for half bridge and full bridge converters, Applications.

PRACTICES:

- Study the digital hysteresis current controller.
- Study the voltage mode pulse width controller.
- Derive the transfer function of half bridge inverter using small signal analysis.
- Derive the transfer function of full bridge inverter using small signal analysis.

SKILLS:

- ✓ *Develop SMPS for a particular application.*
- ✓ *Develop mathematical model of flyback, forward luo converter.*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify different SMPS circuits and PWM techniques for SMPS.	Apply	1	1, 2, 9, 11
2	Design and analyse fly back converter.	Analyze	1	1, 2, 9, 11
3	Design and analyse forward converter.	Create	1	1, 2, 3, 9, 11
4	Design and analyse luo converter.	Create	2	1, 2, 3, 9, 11
5	Design and analyse half bridge and full bridge converter.	Create	2	1, 2, 3, 9, 11

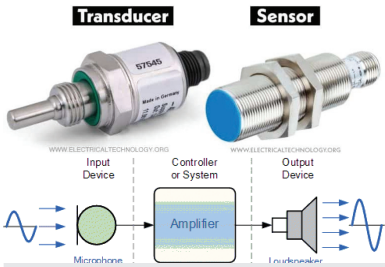
TEXT BOOKS:

1. M.H. Rashid ,"Power Electronics Handbook", Elsevier Publication, 2015.
2. Kjeld Thorborg, "Power Electronics – In Theory and Practice", 1st edition, Overseas Press, 2005.

REFERENCE BOOKS:

1. Ned Mohan, Tore. M.Undeland and William. P. Robbins, "Power Electronics Converters, Applications and Design", 3rd edition, Wiley, 2022.
2. M.H. Rashid, "Power Electronics Circuits, Devices and Applications", 3rd edition, Prentice Hall of India, 2011.

22EE805 SENSORS AND TRANSDUCERS



Source : https://www.electricaltechnology.org/2021/12/difference-between-sensor-transducer.html

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Electrostatics; electromagnetism and Measurement system.

COURSE DESCRIPTION AND OBJECTIVES:

This course make students familiar with the constructions and working principle of different types of sensors and transducers. It also deals with the measuring instruments and the methods of measurement and the use of different transducers.

MODULE–1

UNIT-1 **12L+8T+0P=20 Hours**

FUNDAMENTALS OF SENSORS AND MOTION, PROXIMITY AND RANGING SENSORS:

Fundamentals of Sensors: Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

Motion, Proximity And Ranging Sensors: Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT-2 **12L+8T+0P=20 Hours**

FORCE, MAGNETIC AND HEADING SENSORS:

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto.

PRACTICES:

- Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters.
- Predict correctly the expected performance of various sensors.
- Locate different type of sensors used in real life applications.
- Predict correctly the expected performance of various sensors.

MODULE–2

UNIT- 1 **16L+8T+0P=24 Hours**

RESISTANCE TRANSDUCERS & CAPACITANCE TRANSDUCERS:

Classification of transducers – Selection of transducers - Static characteristics –Dynamic characteristics.

Resistance Transducers - Principle of operation, construction details, characteristics and applications of potentiometer - Strain gauge – types - Resistance temperature detector (RTD)- Thermistor –Hot-wire anemometer.

Inductance and Capacitance Transducers - Induction potentiometer – Variable reluctance transducer – Eddy current transducer –Principle of operation, construction details, characteristics and applications of Linear Variable Differential Transducers.

Capacitive transducer and types - Differential arrangement – Variation of dielectric constant for measurement of liquid level - Dynamic microphone.

SKILLS:

- ✓ *Explain the concept, application and functional elements of sensors and transducers*
- ✓ *Choose proper sensor*
- ✓ *Test measuring systems to evaluate performance*
- ✓ *Design a real-life instrumentation system.*

UNIT-2 **8L+8T+0P=16 Hours**

Modern Transducers - Piezoelectric transducer – Hall Effect transducer – Magneto resistor - Digital displacement transducer– Fiber optic sensor - Introduction to SQUID sensor, Touch screen sensor, Smart Transducer, MEMS and Introduction to linearization of transducer.

PRACTICES:

- Set up testing strategies to evaluate performance characteristics of different types of sensors and transducers.
- Design of a real-life instrumentation system.
- Analyse different types of errors that can occur during the measurement, and the methods.
- Used to correct the measurement errors.
- Compare accuracy and precision with suitable examples.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the various sensors in the Automotive and Mechatronics applications.	Apply	1,2	1,2,9,12
2	Apply the principles of various smart sensors for real time applications.	Apply	2	1,2,3,9,12
3	Expertise in various calibration techniques and signal types for sensors.	Analyze	1,2	1,2,6,9
4	Implement systems with different sensors for real time applications.	Evaluate	2	1,2,9,12

TEXT BOOKS:

1. Ernest O.Doebelin,- Measurement systems, 6th Edition, Tata McGraw Hill Education Private Ltd, New Delhi, 2012.
2. A.K. Sawhney,- A course in Electrical & Electronic Measurement and Instrumentation, DhanpatRai and Company Private Limited, Reprint: 2014.

REFERENCE BOOKS:

1. D. Patranabis, Sensors and Transducers, 2nd Edition, Prentice Hall of India, 2010.
2. John P.Bentley, Principles of Measurement Systems, 4th Edition, Pearson Education, 2004.
3. Neubert H.K.P., Instrument Transducers – An Introduction to their Performance and Design, Oxford University Press, Cambridge, 2003.

22EE806 SPECIAL ELECTRICAL MACHINES

Source: https://padeepz.net/ee6703-special-electrical-machines-question-bank-regulation-2013-anna-university/

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basic of Electromagnetism and DC and AC machines.

COURSE DESCRIPTION AND OBJECTIVES:

To impart knowledge on the following Topics

- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- Construction, principle of operation and performance of permanent magnet synchronous motors.
- Construction, principle of operation and performance of other special Machines.

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours**

STEPPER MOTOR:

Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits – Closed loop control – Concept of lead angle - Applications.

UNIT-2 **12L+0T+8P=20 Hours**

SWITCHED RELUCTANCE MOTORS (SRM):

Constructional features –Principle of operation- Torque prediction–Characteristics Steady state performance prediction – Analytical Method – Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

PRACTICES:

- Select and Evaluate the performance of stepper motor for suitable application.
- Develop the closed loop Control of stepper motor.
- Identify the Switched reluctance motor for suitable application and obtain the performance of motor.
- Obtain the Open Loop Speed control of Switched Reluctance Motor.
- Obtain the Open Loop Speed control of Switched Reluctance Motor.

MODULE-2

UNIT-1 **12L+0T+8P=20 Hours**

PERMANENT MAGNET BRUSHLESS D.C. MOTORS:

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers – Characteristics and Applications.

UNIT-2 **12L+0T+8P=20 Hours**

PERMANENT MAGNET SYNCHRONOUS MOTORS AND OTHER SPECIAL MACHINES:

Constructional features -Principle of operation – EMF and Torque equations - Phasor diagram – performance characteristics and Applications. Constructional features – Principle of operation and Characteristics of Hysteresis motor- Synchronous Reluctance Motor and applications.

SKILLS:

- ✓ *Analyse the characteristics of Stepper motor.*
- ✓ *Identify the Characteristics and applications of Switched Reluctance Motor.*
- ✓ *Describe the Construction, principle of operation and performance of permanent magnet synchronous motors.*
- ✓ *Describe the Construction, principle of operation and performance of other special Machines.*

PRACTICES:

- Obtain the speed control of BLDC motor for suitable application.
- Simulate and analyse the closed loop speed control of BLDC motor.
- Select and Evaluate the performance of PMSM for suitable application.
- Analyse the performance of Hysteresis motor for suitable application.
- Select and Evaluate the performance of Synchronous motor for suitable application.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Describe the operation and control of switched reluctance motors.	Apply	1	1, 2, 9, 11
2	Acquire the knowledge on operation and control of stepper motor.	Analyse	1,2	1, 2, 9, 11
3	Analyse the operation and control of permanent magnet brushless D.C. motors.	Analyse	1	1, 2, 9, 11
4	Describe the operation and control of permanent magnet synchronous motors.	Analyse	2	1, 2, 9, 11
5	Select a special Machine for a particular socital application.	Analyse	2	1, 2, 7, 9, 11

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T. Kenjo and S. Nagamori, Permanent Magnet and Brushless DC Motors, Clarendon Press, London, 1988.

REFERENCE BOOKS:

1. R.Srinivasan, Special Electrical Machines, Lakshmi Publications, 2013.
2. T.J.E.Miller,' Brushless Permanent-Magnet and Reluctance Motor Drives', Oxford University Press, 1989.

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22EE807 OPTIMIZATION TECHNIQUES

Source: https://www.tppl.org.in/2020/fourth-sem/348-optimization-techniques.html

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Basic arithmetic and Algebra, soft computing techniques.

COURSE DESCRIPTION AND OBJECTIVES:

Analyze the advantages and disadvantages associated with the large-scale optimization techniques when applied to problems from Electrical and Computer Engineering applications. Implement selected optimization algorithms commonly used in machine learning and other areas of Electrical and Computer Engineering. Design and implement appropriate optimization approaches for specific Electrical and Computer Engineering applications.

MODULE - 1

UNIT – 1 **12L+8T+0P=20 Hours**

Introduction to Optimization

- Introduction, Historical development.
- Statement of an Optimization Problem.
- Classification of Optimization Problems.
- Optimum design concepts: Definition of Global and Local optima – Optimality criteria Linear programming.
- Review of Linear programming methods for optimum design – Post optimality analysis.

UNIT – 2 **12L+8T+0P=20 Hours**

Non-Linear programming: Unconstrained Optimization

- Gradient-based methods:
  - o Cauchy's steepest descent method.
  - o Newton's method.
  - o Conjugate gradient method.
- Steepest descent method.

  Non-Linear programming: Constrained Optimization
- Direct methods.
- Indirect methods (Penalty function methods).

PRACTICES:

- The rectangle of the largest area that can be enclosed in a fence of the given length.
- The largest volume box with the given surface area.
- Solve Non-linear Programming problems of some kinds.
- Implement the Linear programming techniques using C or any other optimization software.

MODULE – 2

UNIT – 1 **12L+8T+0P=20 Hours**

Modern methods of Optimization-I

- Genetic Algorithms.
- Simulated Annealing.

SKILLS:

- ✓ *Formulate real-life problems with Linear Programming.*
- ✓ *Solve the Linear Programming models using graphical and simplex methods.*
- ✓ *Apply dynamic programming to optimize multi stage decision problems.*
- ✓ *Apply modern optimization methods to optimize multi stage decision problems.*

- Neural-Network-based Optimization.
- Fuzzy optimization techniques.
- Tabu Search.

UNIT – 2 **12L+8T+0P=20 Hours**

Modern methods of Optimization-II

- Particle Swarm Optimization.
- Ant Colony Optimization.
- Meta-heuristics - Nature-inspired Optimization.

PRACTICES:

- Shortest route taken by a salesperson visiting various cities during one tour.
- Optimizing the usage of power in a residential building.
- Implement the different evolutionary algorithms techniques using C or any other optimization software.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply different types of Optimization Techniques in engineering problems and learn the linear programming methods for optimum design.	Apply	1	1, 2, 9, 11
2	Implement constrained Optimization methods.	Apply	1	1, 2, 3, 5, 9, 11
3	Apply Unconstrained Optimization methods.	Apply	1	1, 2, 3, 5
4	Implement modern optimization techniques such as Genetic Algorithms, Ant colony optimization, etc.	Apply	2	1, 2, 5, 9, 11
5	Demonstrate optimization techniques to solve real-time problems.	Analyse	2	1, 2, 3, 9, 11, 12

TEXT BOOKS:

1 Rao S. S. – 'Engineering Optimization, Theory and Practice' – New Age International Publishers – 2012 – 4th Edition.

2 Igor Griva, Stephen G. Nash, Ariela Sofer – 'Linear and Nonlinear Optimization' - Society for Industrial and Applied Mathematics, Philadelphia, March 2009.

REFERENCE BOOKS:

1 K Deb, "Multi Objective Optimization Using Evolutionary Algorithms", John Wiley and Sons, ISBN: 0-471-87339-X, July 2001.

2 Yang, Xin-She, "Optimization techniques and applications with examples", John Wiley & Sons, ISBN 10: 1119490626, 2018.

3 Ke-Lin Du, M. N. S. Swamy, "Search and Optimization by Metaheuristics: Techniques and Algorithms Inspired by Nature", Birkhäuser Basel, ISBN: 3319411926, 2016.

22EE808 ADVANCED CONTROL SYSTEMS

Source: https://www.controleng.com/articles/know-when-to-migrate-a-process-control-system/

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Control Systems.

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces the mathematical modelling, different methods of analysis and design of nonlinear systems. The objective of the course is to understand the concept of state variable analysis, controllability and observability, and applying them for stability analysis techniques.

MODULE–1

UNIT-1 **12L+0T+8P=20 Hours**

STATE SPACE ANALYSIS:

State space representation, Solution of state equation, State transition matrix, Canonical forms – Controllable, Observable and jordan canonical forms.

Tests for controllability and observability for continuous time systems.

UNIT-2 **12L+0T+8P=20 Hours**

MODAL CONTROL:

Effect of state feedback on controllability and observability, Design of state feedback control through pole placement, Full order observer and reduced order observer.

PRACTICES:

- Time response analysis of non linear system using MATLAB.
- State space modeling of DC generator.
- Design of state feedback controller and simulation for a motor using MATLAB.
- Design of state observer and simulation for a motor using MATLAB.

MODULE–2

UNIT- 1 **12L+0T+8P=20 Hours**

DESCRIBING FUNCTION ANALYSIS AND STABILITY ANALYSIS:

Describing Function Analysis: Introduction to nonlinear systems, Types of nonlinearities, Describing functions, Describing function analysis of nonlinear control systems.

Stability Analysis: 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- 2 **12L+0T+8P=20 Hours**

PHASE-PLANE ANALYSIS:

Introduction to phase-plane analysis, Method of isoclines for constructing trajectories, Singular points, Phase-plane analysis of nonlinear control systems.

SKILLS:

- ✓ *Model any nonlinear system (Electrical, Mechanical, Electro-mechanical).*
- ✓ *Analyze non-linear systems using describing function and phase plane technique.*
- ✓ *Analyze stability using lyapunov method.*
- ✓ *Design state feedback controller for the given specifications.*
- ✓ *Design state observer for the given specifications.*

PRACTICES:

- Study of characteristics of non linearities.
- Describing function analysis of non linear system using MATLAB.
- Phase-plane analysis of non linear system using MATLAB.
- Lyapunov stability analysis of non linear system using MATLAB.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Model the given electrical/electro-mechanical systems in state space and find its solution.	Apply	1	1,2,6,9,11
2	Model nonlinear systems, and analyse stability using describing function method.	Apply	1,2	1,2,9,11
3	Analyse the stability of various nonlinear systems using the phase plane trajectory.	Apply	2	1,2,3,9,11
4	Identify the stability of the given linear and nonlinear system using Lyapunov stability theory.	Evaluate	2	1,2,9,11
5	Design pole placement controller and/or observer for the given system to achieve desired specifications.	Create	2	1,2,3,9,11

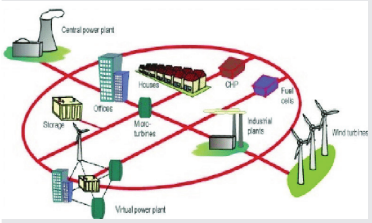
TEXTBOOKS:

1. M. Gopal, " Modern Control System Theory", New Age International Publishers, 5th edition, 2015.
2. Katsuhiko Ogata, " Modern Control Engineering " ,5th edition, Prentice Hall of India Private Ltd., New Delhi, 2010.

REFERENCEBOOKS:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", 2nd edition, New Age International (P) Limited, 2010.
2. Benjamin C Kuo, "Automatic Control system", 1st edition, Prentice Hall of India Private Ltd., New Delhi, 2009.

22EE809 ADVANCED POWER ELECTRONICS



Source: https://www.controleng.com/articles/know-when-to-migrate-a-process-control-system/

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Power Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

The course is aimed to provide exposure of advanced power electronic converters that are utilized by the industries and are not covered in the basic courses on Power Electronics.

MODULE-1

UNIT-1 **6L+4T+0P=10 Hours**

ADVANCED SOLID STATE DEVICES:

MOSFET, IGBT, GTO, IGCT, Power modules, Intelligent power modules, Gating circuits, Thermal design, Protection, Digital signal processors used in their control.

UNIT-2 **18L+12T+0P=30 Hours**

RESONANT CONVERTERS AND MULTI - LEVEL CONVERTERS:

Resonant Converters: Need of resonant converters, Classification, Load resonant converters, Resonant switch converters, Zero-voltage switching DC-DC converters, Zero current switching DC-DC converters, Clamped voltage topologies.

Multi - Level Converters: Need for multi-level converters, Concept of multi-level, Topologies: Diode clamped, Flying capacitor and cascaded H-bridge; Features and relative comparison of these configurations applications, Introduction to carrier based PWM technique for multi-level converters.

PRACTICES:

- Design a 4 quadrant control switch.
- Study the A316J IGBT driver.
- Compares the differences between diode clamped, flying capacitor and cascaded H-bridge multi-level inverter.
- Study the different pulse width modulation.

MODULE - 2

UNIT-1 **9L+6T+0P=15 Hours**

MULTI PULSE CONVERTERS:

Concept of multi-pulse, Configurations for m-pulse (m = 12, 18, 24….) converters, Different phase shifting transformer (Y-1, Y-2, Y-Z1 and Y-Z2) configurations for multi-pulse converters, Applications.

UNIT-2 **15L+10T+0P=25 Hours**

SOLID STATE CONTROLLERS FOR MOTOR DRIVES:

Vector control and direct torque control of induction, Synchronous, Permanent magnet synchronous reluctance motors, Permanent magnet brushless dc (PMLDC) and switched reluctance motors, LCI (load commutated inverter) fed large rating synchronous motor drives, Energy conservation and power quality improvements in these drives.

SKILLS:

- ✓ *Expertise in Matlab/Simulink (or equivalent software) for simulating power electronics systems in various applications.*
- ✓ *Develop a resonant converter.*
- ✓ *Design carrier based PWM technique.*
- ✓ *Know the hardware design of power electronics circuits and systems.*

PRACTICES:

- Study the phase shift transformer required to realize the 12, 18 & 24 pulse converter.
- Study the VSI fed induction motor drive with common voltage mitigation.
- Compare between permanent magnet synchronous motor or brushless DC motor.
- Study the power quality improvement in the case of induction motor drive.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze and simulate resonant converters.	Apply	1	1, 3, 5, 9, 11
2	Evaluate different DC-DC voltage regulators.	Analyze	1	1, 2, 9, 11
3	Evaluate various multi-level inverter configurations.	Analyze	1	1, 2, 3, 9, 11
4	Evaluate Solid State Control devices for various drives and the power quality improvements.	Analyze	2	1, 2, 9, 11
5	Select appropriate phase shifting transformer for a multi-pulse converter.	Evaluate	2	1, 9, 11

TEXT BOOKS:

1. Ned Mohan, Tore M. Undeland and William P. Robbins, “Power Electronics Converters, Applications and Design”, 3rd edition, Wiley, 2022.
2. Muhammad H.Rashid, “Power Electronics - Circuits, Devices and Applications”, Prentice HallofIndia, 3rd edition, 2011.

REFERENCE BOOKS:

1. Bin Wu, “High Power Converters and AC Drives”, John Willey & Sons, Inc., 2017.
2. Muhammad H. Rashid, “Power Electronics Hand book”, 3rd edition, Elsevier, 2015

22EE810 POWER QUALITY

Source: https://www.servomax.in/blog/power-quality-solution-methods/

Hours Per Week :

L	T	P	C
3	2	0	4

PRE-REQUISITE KNOWLEDGE: Power Electronics, Electrical circuit Analysis.

COURSE DESCRIPTION AND OBJECTIVES:

This course is to familiarize students with the reasons of load generated harmonics present in the supply and the methods for their suppression.

MODULE - 1

UNIT-1 **12L+8T+0P=20 Hours**

INTRODUCTION TO POWER QUALITY:

Concept of Power Quality: Frequency variations, voltage variations- sag and swell, waveform distortion –dc offset, harmonics, inter-harmonics, notching and noise.

Fundamentals of Harmonics: Representation of harmonics, waveform, harmonic power, measures of harmonic distortion; Current and voltage limits of harmonic distortions: IEEE, IEC, EN, NORSOK.

UNIT-2 **12L+8T+0P=20 Hours**

CAUSE AND EFFECTS OF HARMONICS:

Causes of Harmonics: 2-pulse, 6-pulse and 12-pulse converter configurations, input current waveforms and their harmonic spectrum; Input supply harmonics of AC regulator, integral cycle control, cyclo converter, transformer, rotating machines, ARC furnace, TV and battery charger.

Effect of Harmonics: Parallel and series resonance, effect of harmonics on static power plant – transmission lines, transformers, capacitor banks, rotating machines, harmonic interference with ripple control systems, power system protection, consumer equipments and communication systems, power measurement.

PRACTICES:

- Study the input current response of 2, 6, 8, 12 pulse converter by using MAT Lab.
- Study the IEEE 519 standards.
- Study the effect of resonance on a radial feeder line.
- Study the switching characteristics of a transformer.

MODULE - 2

UNIT-1 **12L+8T+0P=20 Hours**

ELIMINATION OF HARMONICS USING PASSIVE FILTERS:

Elimination / Suppression of Harmonics: High power factor converter, multi-pulse converters using transformer connections (delta, polygon).

Passive Filters: Types of passive filters, single tuned and high pass filters, filter design criteria, double tuned filters, damped filters and their design.

SKILLS:

- ✓ *Able to study the effect of non linear loads on power quality.*
- ✓ *Able to study the effect of ground loop.*
- ✓ *Able to study the effect of harmonics on energy meter reading.*
- ✓ *Able to study the effect of voltage sag on electrical equipment.*

UNIT-2 **12L+8T+0P=20 Hours**

ELIMINATION OF HARMONICS USING ACTIVE FILTERS:

Active Power Filters: Compensation principle, classification of active filters by objective, system configuration, power circuit and control strategy. Single-phase active filter, principle of operation, expression for compensating current, concept of constant capacitor voltage control; Three-phase active filter: Operation, analysis and modelling; Instantaneous reactive power theory.

Unified power quality conditioner, voltage source and current source configurations, principle of operation for sag, swell and flicker control.

PRACTICES:

- Study the performance of 24 pulse converter.
- Study the difference between linear and un-linear load.
- Study the use of PLL circuit in Grid connected converters.
- Derive the compensation currents in case of unbalanced nonlinear load.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the generating source for harmonics.	Analyze	1	1, 2, 9, 11
2	Examine the compensation of load in presence of harmonics and imbalance.	Analyze	2	1, 9, 11
3	Design compensators at distribution level to mitigate power quality issues.	Evaluate	2	1, 3, 9, 11
4	Design the passive filters to supress for harmonics .	Evaluate	2	1, 3, 9, 11

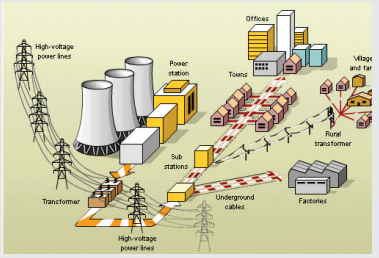
TEXT BOOKS:

1. A. Ghosh and G. Ledwich, “Power quality enhancement using custom power devices”, Kluwer Academic Publication, 2002.
2. Roger C. Dugan et al, “Electrical power systems quality”, Tata McGraw-Hill, 2002.

REFERENCES:

1. Angelo Baggini (Ed), “Handbook of power quality”, John Wiley & Sons, 2008.
2. H. Akagi et al , “Instantaneous power theory and application to power conditioning”, IEEE Press, 2007.

22EE811 ADVANCED POWER SYSTEM ANALYSIS



Source: https://www.mathworks.com/matlabcentral/fileexchange/59097-power-system-analysis-lab-experiments-using-matlab-manual?s_tid=prof_contriblnk

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Power system analysis, Electric circuit analysis.

COURSE DESCRIPTION AND OBJECTIVES:

To perform steady state analysis and fault studies for a power system of any size, explore the estimation of different states of a power system. To impart in depth knowledge on different methods of power flow solutions. To perform optimal power flow solutions, execute short circuit analysis and sensitivity factors for contingency analysis.

MODULE–1

UNIT-1 **12L+0T+8P=20 Hours**

Introduction- Digital computers in power system simulations, System view point, Hierarchy of transmission and distribution system, nature and scope of power system studies.

Transformers - Two winding and auto-transformers, tap changing transformer and loads. Y-bus formation, Bus impedance formulation, algorithms.

UNIT-2 **12L+0T+8P=20 Hours**

Load Flow Studies- Analytical formulation, methods of load flow solutions, Bus mismatch and convergence criteria, Newton Raphson method, concept of decoupled methods.

Fault calculation using Z-bus, unsymmetrical faults, positive, negative and zero sequence impedance matrices, problems

PRACTICES:

- Formation of Bus admittance and bus impedance matrix for tap changing transformers and loads
- Power flow analysis of standard test system for Newton Raphson method using MATLAB.
- Power flow analysis of standard test system for Fast decoupled power flow using MATLAB.
- Short circuit analysis of a synchronous machines without and with load.
- Analysis of unsymmetrical fault using Z bus and sequence impedances.

MODULE–2

UNIT-1 **8L+0T+6P=14 Hours**

Optimal Load Flow Study of Power System- state estimation, method of least squares-test for bad data, power system State Estimation.

UNIT-2 **16L+0T+10P=26 Hours**

Power system control and management – normal operation, abnormal operation, contingency analysis - single outages, multiple outages, DC power flow and sensitivity factors for contingency analysis.

PRACTICES:

- contingency analysis for Single outages.
- contingency analysis for multiple outages.
- Implementation of DC load flow using MATLAB.
- Power system state estimation.
- Optimal power flow solutions for the standard power system network.

SKILLS:

- ✓ *Formulate basic power flow problem.*
- ✓ *Apply different numerical techniques to solve power flow problem.*
- ✓ *Perform contingency analysis in power system.*
- ✓ *Classify different short circuit faults in power systems.*
- ✓ *Understand the stability problem in power system subjected to disturbances.*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	To analyze a Power System Network using graph theory.	Analyze	1	1, 2, 9, 11
2	To interpret the formation of Network matrices.	Analyze	1	1, 2, 9, 11
3	To construct the necessity of load flow studies and various methods of Analysis.	Analyze	2	1, 3, 9, 11
4	To examine short circuit analysis using ZBus.	Evaluate	2	1, 2, 19, 11
5	Perform transient stabilities; determine transient stability using equal area criterion.	Evaluate	2	1, 2, 9, 11

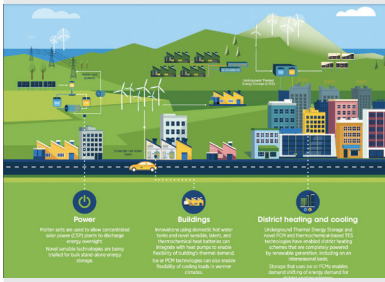
TEXT BOOKS:

1. Electrical Energy Systems Theory -O.I.Elgerd, McGraw Hill Education; 2nd edition (1 July 2017).
2. Computer Methods in Power system Analysis -A.H.El.Abiad, Medtech, 2019.

REFERENCE BOOKS:

1. Computer Techniques in Power System Analysis, 2nd ed – M.A. Pai - Tata Mc Graw Hill Publications, 2014.
2. P. Kundur, “Power System Stability and Control”, 1st edition, Mc-Graw Hill, 2016.

22EE812 ENERGY STORAGE TECHNOLOGIES



Source: https://www.weforum.org/agenda/2021/04/renewable-energy-storage-pumped-batteries-thermal-mechanical/

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Engineering Chemistry.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the concepts of energy storage with major focus on electrochemical storage including ionic batteries, fuel cells and super-capacitors. The course will cover operating principles, physics behind them, characterization methods and advantages of each scheme. The objective of the course is to know the possibilities of energy storage and various technologies involved in it.

MODULE –1

UNIT-1 **8L+8T+0P=16 Hours**

ENERGY STORAGE AND MECHANICAL ENERGY STORAGE SYSTEMS:

Energy Storage: Role of energy storage system, Components of energy storage system, Pros and cons of energy storage systems, Types of energy storage systems.

Mechanical Energy Storage Systems: Pumped Hydro Storage System, Flywheel energy storage system, Compressed air energy storage system.

UNIT-2 **8L+8T+0P=16 Hours**

THERMAL ENERGY STORAGE:

Thermal energy storage systems, Sensible heat storage, Latent heat storage, Working, Thermo-chemical energy storage, Solar pond storage system.

PRACTICES:

- Theoretical investigation of flywheel-based energy storage in off-grid power plants using renewable energy.
- Study of solar pond.
- Familiarization with different Solar Energy thermal storage technologies.

MODULE –2

UNIT-1 **8L+8T+0P=16 Hours**

BATTERY ENERGY STORAGE AND FUEL CELLS:

Battery Energy Storage: Charging and Discharging Mechanisms, Battery Performance characteristics of batteries, Types of batteries, battery terminology, Comparison of batteries.

Fuel Cells: Introduction to fuel cells, components of fuel cells, Types of fuel cells, Performance characteristics of fuel cells, fuel cell stack, fuel cell vehicles.

UNIT-2 **8L+8T+0P=16 Hours**

HYDROGEN STORAGE AND OTHER STORAGE TECHNOLOGIES:

Hydrogen Storage: Hydrogen storage options - Compressed gas, Liquid hydrogen, Hydride, Chemical storage, Comparisons. Safety and management of hydrogen.

SKILLS:

- ✓ *Select appropriate batteries for specific applications.*
- ✓ *Identify appropriate energy storage options.*
- ✓ *Familiar with the solar thermal storage applications.*
- ✓ *Familiar with the performance behavior, operational issues and challenges for all major types of fuel cells.*

Other Storage Technologies: Superconducting magnetic energy storage, Super capacitor energy storage, Comparison of different energy storage technologies.

PRACTICES:

- Charging and discharging characteristics of a battery.
- Study and comparison of various designs of gas flow fields to PEM fuel cells and cell stack performance.
- Study and comparison of various hydrogen storage techniques.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Choose the necessity and usage of different energy storage schemes for different purposes.	Apply	1	1,2,5,7,9,11
2	Analyse the operational mechanisms of each energy storage system.	Analyze	1	1,2,3,7,9,11
3	Apply the concept of solar thermal energy storage for various applications.	Apply	1	1,2,3,5,7,9,11
4	Utilize thermodynamics and electrochemistry principles.	Apply	2	1,2,3,5,7,9,11
5	Characterize and analyze electrochemical energy storage.	Analyze	2	1,2,3,5,7,9,11

TEXT BOOKS:

1. A.G.Ter-Gazarian, “Energy Storage for Power Systems”, Second Edition, The Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), 2011.
2. Archie.W.Culp, “Principles of Energy Conversion”, Mc Graw-Hill Inc., 1991.

REFERENCE BOOKS:

1. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt,” Energy Storage in Power Systems” Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016.
2. A. R. Pendse, “Energy Storage Science and Technology”, SBS Publishers & Distributors Pvt. Ltd., New Delhi, (ISBN – 13:9789380090122), 2011

22EE813 ENERGY AUDIT, CONSERVATION AND MANAGEMENT

Source: https://besten.in/2021/06/energy-conservation-and-energy-audit-in-industries/

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Power Generation Systems, Electrical Machines.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with audit, conservation and management of electrical energy. The objective of the course is to introduce the concepts of energy efficient lighting, space heating and ventilation. The course also deals with methods for improving energy efficiency in different electrical systems.

MODULE–1

UNIT-1 **8L+8T+0P=16 Hours**

BASIC PRINCIPLES OF ENERGY MANAGEMENT:

Energy scenario, Energy Management, Energy Conservation, Energy Audit, Energy Instruments.

UNIT-2 **8L+8T+0P=16 Hours**

CO-GENERATION, TRI-GENERATION AND WASTE HEAT RECOVERY:

Co-generation, Tri-generation and Waste heat recovery Technologies.

PRACTICES:

- Overview of energy scenario and introduction to energy conservation.
- Heat recovery system and its potential opportunities a case study.
- Special features of co-generation plants and their types.

MODULE–2

UNIT-1 **8L+8T+0P=16 Hours**

ENERGY EFFICIENCY IN ELECTRICAL SYSTEMS:

Modification / Replacement of existing systems, Energy efficient motors, Demand side management Techniques.

UNIT-2 **8L+8T+0P=16 Hours**

ENERGY EFFICIENCY IN SPACE HEATING AND VENTILATION:

Water and Space Heating methods, Ventilation, Air-conditioning, Energy conservation methods.

PRACTICES:

- Analysis of electric bill based on tariff of Industrial consumer to reduce energy usage and electric bill.
- Estimate energy saving by improving power factor and load factor a case study.
- Prepare a sample energy audit questionnaire for VFSTR,VU facilities.

SKILLS:

- ✓ *Implement the energy conservation measures for various equipment.*
- ✓ *Analyse different lighting schemes.*
- ✓ *Design a capacitor bank for an energy utility.*
- ✓ *Perform energy audit for an energy utility.*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Examine and determine the performance of various lighting systems.	Apply	1	1, 2, 6, 7, 9, 11
2	Analyse effective energy management policies, methods and planning.	Analyze	1	1, 2, 6, 8, 9, 11
3	Carryout energy audit and economic analysis.	Analyze	1	1, 2, 6, 7, 9, 11
4	Design energy utilization systems for heat recovery.	Create	2	1, 2, 3, 4, 6, 7, 9, 11
5	Design a capacitor bank to address low power factor issues.	Create	2	1, 2, 3, 4, 6, 7, 9, 11

TEXT BOOKS:

1. W. R. Murphy and F. Mc Kay Butterwort, “Energy Management”, 1st edition, Elsevier publications, 2012.
2. Umesh Rathore, “Energy Management”, 2nd edition, S. K. Kataria & Sons, 2014.

REFERENCE BOOKS:

1. Paul O’ Callaghan, “Energy Management”, 1st edition, Mc-Graw Hill Book Company, 1998.
2. V.K Mehta and Rohit Mehta, “Principles of Power Systems”, 1st edition, S. Chand & Company Ltd., 2009.
3. Reay, D.A., “Industrial Energy Conservation”, 1st edition, Pergamon Press, 2003.
4. John. C. Andreas, “Energy Efficient Electric Motors”, 2nd edition, Marcel Inc. Ltd., 1995.

22EE814 SMART GRID TECHNOLOGIES

Source: https://www.digi.com/blog/post/what-is-the-smart-grid-and-how-enabled-by-iot

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Power Electronics; Power System Protection; Analysis and Operation of Power Systems.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the working definitions of smart grid. Distribution generation technologies and voltage control in micro grid system. The objective of the course is to understand the features of smart grid, architecture of smart grid communication technologies for smart grid.

MODULE –1

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION TO SMART GRID:

Working definitions of smart grid and associated concepts – smart grid functions, Traditional power grid and smart grid; New technologies for smart grid, Advantages, Indian smart grid, Key challenges for smart grid.

UNIT-2 **8L+8T+0P=16 Hours**

SMART GRID ARCHITECTURE:

Components and architecture of smart grid design, Review of the proposed architectures for smart grid; Fundamental components of smart grid.

PRACTICES:

- Necessity and evolution of smart grid with policies.
- Review on conventional grid and smart grid.
- Challenges of smart grid.
- proposed architectures for smart grid.
- National and International Initiatives in Smart Grid.

MODULE –2

UNIT-1 **8L+8T+0P=16 Hours**

DISTRIBUTION GENERATION TECHNOLOGIES:

Renewable energy technologies, Micro grids, Storage technologies, Electric vehicles and plug–in hybrids, Environmental impact and climate change, Economic issues.

UNIT-2 **8L+8T+0P=16 Hours**

COMMUNICATION TECHNOLOGIES AND SMART GRID AND SCADA FUNCTIONS:

Communication Technologies and Smart Grid: Communication Technology, Synchro-Phasor Measurement Units (PMUs), Wide Area Measurement Systems (WAMS).

Scada Functions: Introduction to SCADA: Grid operation and control, Difficulties in operating the large power systems manually, Need for SCADA operation, Advantages of SCADA operation; Data acquisition, Monitoring and event processing.

SKILLS:

- ✓ *Acquainted with the concepts of smart grid components.*
- ✓ *Demonstrate the components of Distribution Generation Technologies*
- ✓ *Device the various functions of distribution management system*
- ✓ *Apply the various techniques of communication, computer networking and cyber security for smart metering systems.*
- ✓ *To analyse application of smart grid technology in power system through case studies.*

PRACTICES:

- Wide area measurement techniques.
- Review on Advanced Metering Infrastructure (AMI).
- Importance of electric vehicles and grid integration issues.
- SCADA system hardware architecture.
- SCADA system software architecture.

SKILLS:

- ✓ *A*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply features of Smart Grid in the context of Indian Grid.	Apply	1	1,2,3
2	Implement the architectures for smart grid	Apply	1	3,4
3	Analyse the Distribution Generation Technologies	Analyse	2	1.2.4
4	Analyse the operation of PMUs, PDCs, WAMS	Analyse	2	1,2,3,4
5	Analyse the functionalities of SCADA and	Analyse	2	1,2,4

TEXT BOOKS:

1. Stuart Borlase, “Smart Grids, Infrastructure, Technology and Solutions”, CRC Press, 2013.
2. Ali Keyhani, “Design of Smart Power Grid Renewable Energy Systems”, Wiley IEEE, 1st Edition, 2011.

REFERENCE BOOKS:

1. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong. Wu, Akihiko Yokoyama and Nick Jenkins, “Smart Grid: Technology and Applications”, Wiley, 2012.
2. James Momoh, “Smart Grid: Fundamentals of Design and Analysis”, Wiley, IEEE Press, 2012.
3. A.G. Phadke and J.S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer, 2010.

22EE815 ENERGY SYSTEM ECONOMICS

Source: https://www.ecowatch.com/india-solar-market-2118202661.html

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Principles of Management.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the economic concepts and theories related to the supply and utilization of energy resources and technologies at various levels – economy, firm and individual. The objective of the course is to introduce economic tools, empirical data for economic analysis in the energy system domain to support and influence the decision making in the context of resource planning and energy efficiency to take economically sound decisions.

MODULE –1

UNIT-1 **8L+8T+0P=16 Hours**

ENERGY AND ECONOMICS:

Role and significance of renewable energy sources for sustainable economic development and social transformation, Energy and GDP, GNP and its dynamics, Introduction to economics, Flow in an economy, Law of supply and demand, Concept of engineering economics, Engineering efficiency, Economic efficiency, Scope of energy economics; Element of costs, Marginal cost, Marginal revenue, Sunk cost, Opportunity cost; Break-even analysis and V-ratio.

UNIT-2 **8L+8T+0P=16 Hours**

VALUE ENGINEERING:

Make or buy decision, Interest formula and their applications, Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment present worth factor, Equal payment series capital recovery factor, Uniform gradient series annual equivalent factor, Effective interest rate and examples.

PRACTICES:

- Overview of energy scenario and introduction to energy conservation.
- Energy management concept, principles, benefits and its significant.
- Energy conservation system a case study.

MODULE –2

UNIT-1 **8L+8T+0P=16 Hours**

CASH FLOW:

Methods of comparison of alternatives, Present worth method, Future worth method, Annual equivalent method, Rate of return method and examples; Payback period, NPV, IRR and cost benefit analysis.

UNIT-2 **8L+8T+0P=16 Hours**

REPLACEMENT AND MAINTENANCE ANALYSIS:

Types of maintenance, Types of replacement problem, Determination of economic life of an asset, Replacement of an asset with a new asset, Capital recovery with return and concept of challenger and defender.

SKILLS:

- ✓ *Compare economic and energy parameter of India with other countries.*
- ✓ *Compare various available alternatives.*
- ✓ *Perform replacement and maintenance analysis.*
- ✓ *Perform life cycle analysis of a product.*

DEPRECIATION:

Introduction, Straight line method of depreciation, Declining balance method of depreciation, Sum of the years digits method of depreciation, Sinking fund method of depreciation / Annuity method of depreciation, Service output method of depreciation.

PRACTICES:

- An approach to study energy audit, energy monitoring and targeting.
- Replacement and maintenance analysis in renewable energy system a case study.
- Depreciation in renewable energy system a case study.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Promote different economic principles.	Apply	1	1,2,6,7,8,11
2	Apply various economic policies and application of theories.	Apply	1	1,2,6,7,8,9,11
3	Examine various methods of depreciation.	Analyze	2	1,2,6,7,8,9,11
4	Analyze financial and economic concepts for a given problem.	Analyze	2	1,2,6,7,8,9,11
5	Evaluate different alternatives for better economic efficiency.	Evaluate	2	1,2,6,7,8,9,11

TEXT BOOKS:

1. Panneer Selvam. R, “Engineering Economics”, 1st edition, Prentice Hall of India Ltd, 2001.
2. Subhes C.Bhattacharyya., “Energy Economics”, 1st edition, Springer, 2011.

REFERENCE BOOKS:

1. Chan S.Park, “Contemporary Engineering Economics”, 1st edition, Prentice Hall of India, 2002.
2. U. Aswath Narayana, “Green Energy: Technology, Economics and Policy”, 1st edition, CRC press, 2010.
3. L.J. Truett and D.B. Truett, “ Managerial Economics- Analysis, Problems & Cases”, Wiley India, 8th edition, 2004.
4. Suma Damodaran, “Managerial Economics”, 1st edition, Oxford University Press, 2006.

22EE816 FLEXIBLE AC TRANSMISSION SYSTEMS

Source: https://www.power-technology.com/uncategorized/newsalstom-grid-to-supply-flexible-ac-transmission-systems-to-quwayyah-substation-in-saudi-arabia-281113/

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Electrical circuit Analysis, Power Transmission and Distribution, Power Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the fundamental concepts of FACTS technology which are emerging in the area of power systems. The objective of this course is to understand the role of FACTS technology in delivering quality power at bulk levels.

MODULE - 1

UNIT-1 **8L+8T+0P=16 Hours**

POWER FLOW IN AC SYSTEMS:

Introduction - Power Flow in AC Systems, Loading capability Limits, Dynamic stability considerations, controllable parameters, basic types of FACTS controllers.

UNIT-2 **8L+8T+0P=16 Hours**

VOLTAGE SOURCE CONVERTERS:

Single phase and 3-phase full wave bridge converters, transformer connections for 12, 24, 48 pulse operation, 3 level voltage source converters, PWM converters.

PRACTICES:

- Study the different types of FACTS controllers used in the present Grid.
- Implement 120^{o} and 180^{o} mode of operation for voltage source converter.
- Study the phase shift transformers used in 12, 24 & 48 pulse converter.
- Study the voltage at different on radial feeder line with the surge impedance loading.

MODULE - 2

UNIT-1 **8L+8T+0P=16 Hours**

STATIC SHUNT COMPENSATION:

Objectives of shunt compensation, Voltage in stability and its prevention, power oscillations and damping, controllable VAR generation, variable impedance type VAR generators.

UNIT-2 **8L+8T+0P=16 Hours**

SVC AND STATCOM:

Dynamic performance, transient stability enhancement with SVC and STATCOM- operating principle – V-I characteristics. Series Compensation & UPFC: Series capacitive compensation, transient stability improvement, Thyristor controlled series capacitor (TCSC), thyristor control power angle regulator (TCPAR), Unified power flow controller.

PRACTICES:

- Study the shunt compensation under unbalanced load.
- Study the differences between SVC and STATCOM.
- List the merits of unified power flow controller.
- Study the point of connection required to connect the STATCOM in case of radial feeder line.

SKILLS:

- ✓ *Analyze the performance of given transmission system with and without FACTS technology.*
- ✓ *Review the static devices for series and shunt control.*
- ✓ *Select suitable FACTS device for specific power quantity/ quality.*
- ✓ *Identify suitable location of FACTS controller for given transmission system.*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Categorize the importance of FACTS devices.	Analyze	1	1, 2, 9, 11
2	Analyze different FACTS devices in Transmission system.	Analyze	1, 2	1, 2, 9, 11
3	Bring out the advantages of FACTS technology.	Evaluate	1, 2	1, 2, 9, 11
4	Design of FACTS controllers for different Power system applications.	Create	2	1, 2, 3, 9, 11

TEXT BOOKS:

1. N.G. Hingorani and L.Guygi, “Understanding FACTS Devices”, IEEE Press Publications, Standard Publishers, Delhi 2001.
2. Mohan Mathur, R., Rajiv. K. Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc., 2018.

REFERENCE BOOKS:

1. E. Achaet. Al. John Wiley, “FACTS: Modelling and Simulation in power Networks”, London, UK, 2004.
2. P. Kundur, “Power System Stability and Control”, McGrawHill, 1994.

22EE817 SCADA SYSTEMS AND APPLICATIONS

Source : https://instrumentationtools.com/applications-of-scada/

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Power system analysis.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the architecture of SCADA system and its components. It describes the basic tasks of SCADA as well as their typical applications like Transmission and Distribution sector operations.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION TO SCADA :

Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in utility automation, Industries.

UNIT-2 **8L+8T+0P=16 Hours**

SCADA SYSTEM COMPONENTS:

Schemes- Remote terminal unit (RTU), Intelligent electronic devices (IED), Programmable logic controller (PLC), Communication network, SCADA server, SCADA/ HMI Systems.

PRACTICES:

- Analysis about evolution of SCADA.
- Operation of Programmable logic controller (PLC).
- Demonstration about the SCADA server.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

SCADA ARCHITECTURE AND SCADA COMMUNICATION:

SCADA Architecture: Various SCADA architectures, Advantages and disadvantages of each system, Single unified standard architecture - IEC 61850.

SCADA Communication: Various industrial communication technologies, Wired and wireless methods and fiber optics.

UNIT-2 **8L+8T+0P=16 Hours**

SCADA APPLICATIONS:

Utility applications, Transmission and distribution sector, Operations, Monitoring, Analysis and improvement; Industries - oil, gas and water; Case studies, Implementation, Simulation exercises.

PRACTICES:

- Simulation exercises on SCADA system.
- SCADA on transmission and distribution sector.
- Demonstration about the various SCADA architectures.

SKILLS:

- ✓ *Formulate logical programming for SCADA system.*
- ✓ *Operate RTU, IED, PLC and SCADA system.*
- ✓ *Develop SCADA Communication system.*
- ✓ *Design SCADA system for industrial applications*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Understand SCADA architecture and SCADA system components.	Apply	1	1, 2, 5, 9, 11
2	Analyze the operation of RTU, IED, PLC, and SCADA/HMI Systems.	Analyze	1	1, 2, 5, 9, 11
3	Evaluate the basic tasks of Supervisory Control Systems SCADA) as well as their typical applications.	Analyze	1	1, 2, 3, 5, 9, 11
4	Apply SCADA systems in transmission and distribution sectors and industries.	Evaluate	2	1, 2, 5, 9, 11
5	Analyze the SCADA communication system, various industrial communication technologies and open standard communication protocols.	Create	2	1, 2, 5, 9, 10, 11

TEXT BOOKS:

1. Stuart A. Boyer, “SCADA-Supervisory Control and Data Acquisition”, Instrument Society of America Publications, 2004.
2. Gordon Clarke and Deon Reynders, “Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems”, Newnes Publications, Oxford, 2004.

REFERENCE BOOKS:

1. William T. Shaw, “Cybersecurity for SCADA Systems”, PennWell Books, 2006.
2. David Bailey and Edwin Wright, “Practical SCADA for Industry”, Newnes Publisher, 2003.

22EE818 PLUG-IN ELECTRIC VEHICLES IN SMART GRID

Source: https://www.torquenews.com/4723/difference-between-hybrid-ev-extended-range-ev-and-fully-electric-ev

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Power Systems; Power Electronics; Grid Integration and Smart Grid.

COURSE DESCRIPTION AND OBJECTIVES:

The objective of this course is to introduce impact of charging on electric vehicles, EV demands and impacts, control strategies for EV's to support frequency and voltage and modeling for smart grid and electric vehicles.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

VEHICLE ELECTRIFICATION & IMPACT OF CHARGING STRATEGIES:

Introduction, Impact of charging strategies, EV charging options and infrastructure, energy, economic and environmental considerations, Impact of EV charging on power grid, effect of EV charging on generation and load profile, Smart charging technologies, Impact on investment.

UNIT-2 **8L+8T+0P=16 Hours**

INFLUENCE OF EVS ON POWER SYSTEM:

Introduction, identification of EV demand, EV penetration level for different scenarios, classification based on penetration level, EV impacts on system demand: dumb charging, multiple tariff charging, smart charging, case studies.

PRACTICES:

- Developing control strategies for vehicle electrification.
- Evocation of EV charging methods by using case studies.
- Implementing methods for identification of EV demand.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

FREQUENCY CONTROL RESERVES & VOLTAGE SUPPORT FROM EVS:

Introduction, power system ancillary services, electric vehicles to support wind power integration, electric vehicle as frequency control reserves and tertiary reserves, voltage support and electric vehicle integration, properties of frequency regulation reserves, control strategies for EVs to support frequency regulation.

UNIT-2 **8L+8T+0P=16 Hours**

ICT SOLUTIONS TO SUPPORT EV DEPLOYMENT :

Introduction, Architecture and model for smart grid & EV, ICT players in smart grid, smart metering, information & communication models, functional and logical models, technology and solution for smart grid: interoperability, communication technologies.

PRACTICES:

- Study of methods required for voltage support and electric vehicle integration.
- Analyze different Information and Communication technologies(ICT) to support EV deployment.
- Development of different smart metering methods.

SKILLS:

✓ *F*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the ICT solutions to support EV deployment.	Apply	2	1, 2, 5, 6, 7, 9, 11
2	Describe about vehicle electrification and impact of charging strategies.	Analyze	1	1, 2, 3, 4, 6, 7, 9, 11
3	Describe the influence of EVs on power system.	Analyze	1	1, 3, 6, 7
4	Describe the frequency control and voltage reserve from EVs.	Analyze	2	1, 3, 6, 7, 9, 11

TEXT BOOKS:

1. SumedhaRajakaruna, FarhadShahnia and Arindam Ghosh, “Plug In Electric Vehicles in Smart Grids-Integration Techniques”, Springer Science + Business Media Singapore Pte Ltd., 2015.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017.

REFERENCE BOOKS:

1. Canbing Li, Yijia Cao, YonghongKuang and Bin Zhou, “Influences of Electric Vehicles on Power System and Key Technologies of Vehicle-to-Grid”, Springer-Verlag Berlin Heidelberg, 2016.
2. Qiuwei Wu, “GRID INTEGRATION OF ELECTRIC VEHICLES IN OPEN ELECTRICITY MARKETS”, John Wiley & Sons, Ltd, 2013.

22EE819 SOFT COMPUTING TECHNIQUES IN ELECTRICAL ENGINEERING

https://www.elprocus.com/soft-computing/

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Engineering Mathematics and any programming language.

COURSE DESCRIPTION AND OBJECTIVES:

- Soft computing refers to principle components like fuzzy logic, neural networks and genetic algorithm, which have their roots in Artificial Intelligence.
- Identifying and describing the soft computing techniques and their roles in building intelligent machines.
- Recognize the feasibility of applying a soft computing methodology for a electrical engineering problem.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION TO SOFT COMPUTING:

Concept of computing systems. “Soft” computing versus “Hard” computing. Characteristics of Soft computing. Some applications of Soft computing techniques.

UNIT-2 **8L+8T+0P=16 Hours**

ARTIFICIAL NEURAL NETWORKS:

Biological neurons and its working. Simulation of biological neurons to problem solving. Different ANNs architectures. Training techniques for ANNs. Applications of ANNs to solve some real life problems.

PRACTICES:

- Design of Neural network controller for DC motor.
- Design of Neural network controller for Power System Problem.

MODULE–2

UNIT-1 **8L+8T+0P=16 Hours**

FUZZY LOGIC:

Introduction to Fuzzy logic. Fuzzy sets and membership functions. Operations on Fuzzy sets. Fuzzy relations, rules, propositions, implications and inferences. Defuzzification techniques. Fuzzy logic controller design. Some applications of Fuzzy logic.

UNIT-2 **8L+8T+0P=16 Hours**

GENETIC ALGORITHMS:

Concept of “Genetics” and “Evolution” and its application to probabilistic search techniques. Basic GA framework and different GA architectures. GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.

PRACTICES:

- Design of Fuzzy Logic controller for DC motor.
- Design of Fuzzy Logic controller for Magnetic suspension system.
- Optimizing PID controller parameters using GA.

SKILLS:

- ✓ *Electrical engineering problem solving using back propagation algorithm.*
- ✓ *Application of fuzzy logic to handle uncertainty and solve engineering problems*
- ✓ *Application of GA to optimization problems*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Solve problems of electrical engineering using back propagation algorithm.	Apply	1	1, 2, 3, 5, 9, 11
2	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.	Apply	2	1, 2, 3, 5, 9, 11
3	Apply genetic algorithms to combinatorial optimization problems.	Apply	2	1, 2, 3, 5, 9, 11
4	Choose existing software tools to solve real problems using a soft computing approach.	Create	1, 2	1, 2, 3, 5, 6, 9, 11

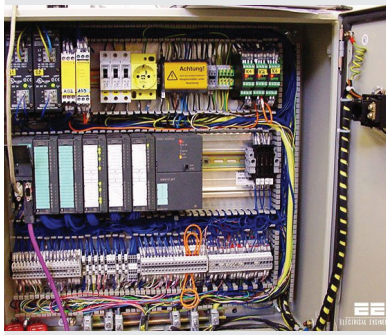
TEXT BOOKS:

1. Neural Networks, Fuzzy Logis and Genetic Algorithms : Synthesis, and Applications, S. Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007.
2. Soft Computing, D. K. Pratihar, Narosa, 2008.

REFERENCE BOOKS:

1. Fuzzy Logic: A Pratical approach, F. Martin, , Mc neill, and Ellen Thro, AP Professional, 2000.
2. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
3. Foundations of Neural Networks, Fuzzy Systems, and Knowldge Engineering, Nikola K. Kasabov, MIT Press, 1998.
4. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
5. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.

22EE820 PROGRAMMABLE LOGIC CONTROLLERS



Source: https://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/plc-handbook

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Any introductory programming course

COURSE DESCRIPTION AND OBJECTIVES:

This course covers basic to intermediate theory & applications of programmable logic controllers. PLCs are used in many industrial and commercial processes. It is expected that some industries require skilled people to install, troubleshoot, program & modify PLCs and PLC-controlled systems. The intent of this course is to have students develop the basic-level skills required by industry.

MODULE - 1

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION TO PLCS

- Introduction to Controllers.
- Internal Architecture of PLC.
- PLC Hardware.
- Principles of Operation, Modifying the Operation.
- PLCs versus Computers, PLC Size and Application.

UNIT-2 **8L+8T+0P=16 Hours**

BASICS OF PLC PROGRAMMING

- Processor Memory Organization, Program Scan, PLC Programming Languages.
- Instructions
  - Relay-Type Instructions.
  - Instruction Addressing.
  - Branch Instructions.
  - Internal Relay Instructions.
  - Programming Examine If Closed and Examine If Open Instructions.
- Entering the Ladder Diagram.
- Modes of Operation.

PRACTICES:

- Identify the main parts of a PLC and describe their function.
- Describe the basic circuitry and applications for I/O modules and interpret I/O and CPU specifications.
- Define the decimal, binary, octal, and hexadecimal, numbering systems and explain BCD, Gray, and ASCII Codes and be able to convert from one numbering or coding system to another.

SKILLS:

- ✓ *Write ladder program for the given expression and also draw ladder logic*
- ✓ *Apply combinations of counter and timers to control systems.*
- ✓ *Compare sequential and combination control processes*
- ✓ *select a PLC for a typical application.*

MODULE - 2

UNIT-1 **8L+8T+0P=16 Hours**

LADDER AND FUNCTIONAL BLOCK PROGRAMMING

- Ladder Diagrams.
- Logic Functions.
- Latching.
- Multiple outputs.
- Functional blocks.
- Writing a Ladder Logic Program Directly from a Narrative Description.

UNIT-2 **8L+8T+0P=16 Hours**

PROCESS CONTROL, NETWORK SYSTEMS, AND SCADA

- Types of Processes.
- Structure of Control Systems.
- On/Off Control, PID Control, Motion Control.
- Data Communications.
- Supervisory Control and Data Acquisition (SCADA).

PRACTICES:

- Construct circuits from Boolean expressions and derive Boolean equations for given logic circuits
- Convert relay ladder schematics to ladder logic programs and program instructions that perform logical operations.
- Analyze and interpret typical PLC timer ladder logic programs.
- Apply Analog PLC functions to given process control applications.
- Develop SCADA system for given applications.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Demonstrate knowledge of programmable logic controllers and process control systems.	Apply	1	1, 2, 3, 9, 11
2	Design PLC program using ladder logic.	Apply	1	1, 4, 5, 9, 11
3	Install and troubleshoot the program.	Apply	2	1, 2, 3, 4, 9, 11
4	Design PLC based system for process control.	Analyse	2	1, 2, 3, 9, 11
5	Integrate PLCs into electro-mechanical systems.	Analyse	2	1, 2, 3, 4, 5, 9, 11

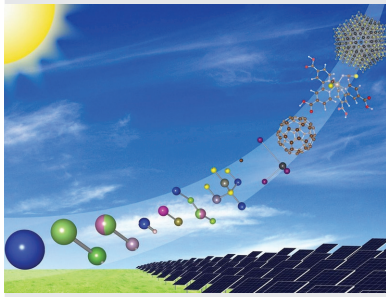
TEXT BOOKS:

1 Frank D. Petruzella – 'Programmable Logic Controllers' – McGraw-Hill Education – 2016 – ISBN 13: 9780073373843, 2016.
2 Max Rabiee – 'Programmable Logic Controllers: Hardware and Programming' - Goodheart-Wilcox Publisher, 4th edition, ISBN 13: 9781631269349, 2017.

REFERENCE BOOKS:

1 William Bolton, "Programmable Logic Controllers", Newnes, 6th edition, ISBN 13: 9780128029299, 2015.
2 Luiz Affonso Guedes, "Programmable Logic Controller", InTech, ISBN 13: 9789537619633, 2010.
3 Gary Dunning, "Introduction to Programmable Logic Controllers: Techniques and Algorithms Inspired by Nature", Delmar, ISBN 13: 9780766817685, 2008.

22EE821 PV TECHNOLOGIES AND APPLICATIONS



Source : https://news.mit.edu/2015/promise-challenges-solar-photovoltaics-0326

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Physics and Basics of Electrical & Electronics Engineering.

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed at familiarizing the students with the fundamentals, characteristics, parameters and manufacturing of solar PV cells, series and parallel connection of solar cells, I-V characteristics of a PV module. In this subject students will learn the sun tracking mechanisms, emerging solar cell technologies, battery energy storage systems, design and PV system applications.

MODULE–1

UNIT-1 **12L+8T+0P=20 Hours**

SOLAR CELLS AND PV MODULES:

Photovoltaic effect - Principle of direct solar energy conversion into electricity in a solar cell, Types of solar cells - Monocrystalline, polycrystalline and amorphous silicon cells, Single diode model of solar cell, current equation, I-V characteristics of a PV cell, Parameters of a solar cell, series and shunt resistances, cell efficiency, cell & module efficiencies, fill factor, Series and parallel connection of solar cells, effect of irradiation and temperature, shading and hot spots.

UNIT-2 **4L+8T+0P=12 Hours**

COMPONENTS OF PV SYSTEMS AND BATTERY ENERGY STORAGE:

Components of PV Systems: Classification of PV systems, small system for consumer applications, Hybrid solar PV system, PV system components – charge controller, solar inverter, net metering system.

Battery Energy Storage: Fundamental concept of batteries - Measuring of battery performance, Charging and discharging of a battery, Storage density, Energy density and safety issues; Types of batteries – Lead Acid, Nickel, Cadmium and Lithium ion batteries.

PRACTICES:

- Demonstrate the I-V and P-V characteristics of PV module with varying radiation and temperature level.
- Demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules.
- Demonstrate the effect of shading on module output power.
- Demonstrate the working of diode as bypass diode and blocking diode in a PV module.
- Obtain the charging and discharging characteristics of a battery.

MODULE–2

UNIT-1 **12L+10T+0P=22 Hours**

MAXIMUM POWER POINT TRACKING AND DESIGN OF PV SYSTEM:

Maximum Power Point Tracking: Sun tracking – single and dual axis tracking, P-V curves, maximum voltage and current in pv cell, concept of MPPT technique and introduction to algorithms.

Design of PV System: Design of PV system for street lighting, water pumping and residential applications.

SKILLS:

- ✓ *Distinguish between series and parallel combination of PV modules.*
- ✓ *Analyze the effect of shading on module output power.*
- ✓ *Design a solar PV system for a particular application.*
- ✓ *Justify the need of various solar cell technologies.*

UNIT-2 **4L+6T+0P=10 Hours**

PV SYSTEM APPLICATIONS AND EMERGING SOLAR CELL TECHNOLOGIES:

PV System Applications: Building-integrated photovoltaic units, solar lamps, solar street lights, solar water pumps, solar cars, aircraft, space solar power satellites.

Emerging Solar Cell Technologies: Organic solar cells, Dye-synthesized solar cells, GaAs solar cells, Thermo Photovoltaics, Concentrated Photovoltaics.

PRACTICES:

- Workout power flow calculations of standalone PV system of DC load with and without battery.
- Workout power flow calculations of standalone PV system of AC load with and without battery.
- Workout power flow calculations of standalone PV system of DC and AC load with and without battery.
- Review the different emerging solar cell technologies.
- Review the various applications of PV system.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the effect of various parameters on the performance of a solar module.	Analyze	1,2	1, 2, 3, 4, 5, 6, 7, 9, 11
2	Classify the Solar PV systems based on requirements.	Analyze	1,2	1, 2, 4, 6, 7, 9, 11
3	Review the various applications of PV system.	Evaluate	2	1, 2, 4, 5, 6, 7, 9, 11
4	Design a Solar PV system.	Create	2	1, 2, 3, 4, 5, 6, 7. 9. 11, 12

TEXT BOOKS:

1. Chetan Singh Solanki., Solar Photovoltaic: “Fundamentals, Technologies and Application”, PHI Learning Pvt., Ltd., 2009.
2. Jha .A.R, “Solar Cell Technology and Applications”, CRC Press, 2010.

REFERENCES:

1. Chetan Singh Solanki., “Solar Photovoltaic Technology and Systems: A Manual for Technicians” PHI Learning Pvt., Ltd., 2013.
2. Sukhatme .S.P, Nayak .J.K, “Solar Energy”, Tata McGraw Hill Education Private Limited, New Delhi, 2010.
3. John R. Balfour, Michael L. Shaw, Sharlave Jarosek., “Introduction to Photovoltaics”, Jones & Bartlett Publishers, Burlington, 2011.

22EE822 UTILIZATION OF ELECTRICAL ENERGY

Source : https://www.ulektznews.com/2021/05/21/course-in-utilization-of-electrical-energy/

Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic Engineering Products.

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces the fundamentals of electrical drives, illumination, electric heating, welding and traction systems. The objective of the course is to provide an opportunity to study varieties of electric drives and their application to electrical traction systems. It also deals with types of lamps, lightning schemes, light control methods, electrical welding techniques and heating methods employed in industry.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

UTILIZATION AND CONTROL OF ELECTRIC DRIVES:

Introduction, Factors governing selection of electric motors, Type of electric drives - Starting and running characteristics, Speed control and temperature rise; Choice of motor rating, Control devices for industrial motors, Motors for particular services, Load equalization.

UNIT-2 **8L+8T+0P=16 Hours**

ELECTRIC HEATING AND ELECTRIC WELDING:

Introduction, Methods of heat transfer, Classification of electric heating methods - Resistance heating, Induction heating and dielectric heating; Electric welding - Resistance and arc welding; Electric welding equipment, Comparison between A.C. and D.C. welding.

PRACTICES:

- Power supply arrangements.
- Selection of motors for domestic appliances.
- Demonstration about the welding equipment.

MODULE-2

UNIT-1 **6L+6T+0P=12 Hours**

ILLUMINATION ENGINEERING:

Introduction, Terms used in illumination, Laws of illumination, Polar curves, Integrating sphere, Sources of light - Tungsten filament lamps and fluorescent lamps; Basic principles of light control, Types of lighting schemes, Flood lighting.

UNIT-2 **10L+10T+0P=20 Hours**

TRACTION SYSTEMS AND TRAIN MOVEMENT AND ENERGY CONSUMPTION:

Traction Systems: Introduction, Different systems of traction, Systems of electric traction, Systems of track electrification. General features of traction motor, Methods of electric braking.

Train Movement and Energy Consumption: Mechanics of train movement, Typical speed- time curves for different services - Trapezoidal and quadrilateral speed-time curves; Calculations of tractive effort, Power, Specific energy consumption for given run.

SKILLS:

- ✓ *Design simple cooling system for motor, for any given application.*
- ✓ *Design heating element for given application.*
- ✓ *Design lighting scheme for given working area.*
- ✓ *Analyze existing traction systems in nearby railway station.*

PRACTICES:

- Awareness about time switches, street lighting, flood lighting.
- Electrical block diagram of an electric locomotive with description of various equipment and accessories used.
- Types of motors used for electric traction.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Make use of operating principles and characteristics of drives with respect to speed and loading condition.	Apply	1	1,2,9,11
2	Choose different types of heating and welding techniques.	Apply	1	1,2,9,11
3	Examine basic principles of illumination and its measurement.	Analyze	2	1,3,7,9,11
4	Make use of basic principle of electric traction including speed–time curves of different traction services.	Apply	2	1,2,6,9,11
5	Analyze various traction system for braking, acceleration and other related parameters, including demand and side management.	Analyze	2	1,2,9,11

TEXT BOOKS:

1. E. Openshaw Taylor, “Utilisation of Electric Energy”, 1st edition., Orient Longman, 2006.
2. Partab, “Art & Science of Utilization of electrical Energy”, 3rd edition, Dhanpat Rai & Sons, 2006.

REFERENCE BOOKS:

1. N.V. Suryanarayana, “Utilization of Electrical Power including Electric drives and Electric traction”, 1st edition, New Age International (P) Limited Publishers, 1994.
2. C.L. Wadhwa, “Generation, Distribution and Utilization of electrical Energy”, 3rd edition, New Age International (P) Limited Publishers, 2010.

HONOURS (ELECTRIC VEHICLES)

B.Tech.

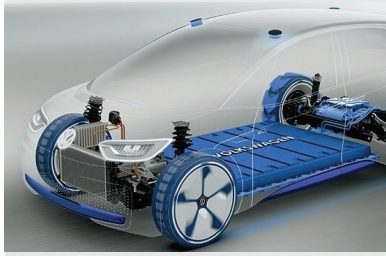
ELECTRICAL AND ELECTRONICS ENGINEERING

22EE951	-	Electric Vehicles Technology
22EE952	-	Energy Storage and Management System
22EE953	-	EV Charging Infrastructure and BMS
22EE954	-	Modelling and Simulation of Electric Vehicles
22EE955	-	Intelligent Transport Systems

COURSE CONTENTS

I SEM & II SEM

22EE951 ELECTRIC VEHICLES TECHNOLOGY



Source: https://www.omazaki.co.id/en/types-of-electric-cars-and-working-principles/

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Basic Electrical & Electronics Engineering; Electrical Machines; Power Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

To make students understand the need and importance of Electric, Hybrid Electric Vehicles and Fuel cell vehicle. To differentiate and analyze the various energy storage devices and battery charging and management systems. To impart knowledge about architecture and performance of Electric and Hybrid Vehicles. To classify the different drives and controls used in electric vehicles.

MODULE-1

UNIT-1 **12L+08T+0P=20 Hours**

OVERVIEW OF EVS AND CHALLENGES:

Components of EVs - architecture of EVs - EV market and promotion-infrastructure needs - EV makers - Comparison in reference of: Energy source, Pollution, Energy diversification, Efficiency, Capital & operating cost, Performance.

UNIT-2 **12L+08T+0P=20 Hours**

Classification of EVS Reference of - Propulsion devices, Energy sources, Energy carriers, Pure Electric Vehicles (PEV) - Hybrid Electric Vehicles (HEV) and Plug-in Hybrid Electric Vehicles (PHEV) - Configurations: BEV, FCEV.

PRACTICES:

- Developing real-life drive cycles for 2-wheelers, 3-wheelers, cars and buses.
- Extracting features from the drive cycles for sizing motors and converters.
- Control of motors using the drive cycles.

MODULE-2

UNIT-1 **12L+08T+0P=20 Hours**

EV ENERGY SOURCE TECHNOLOGIES:

Energy sources used in EVs & HEVs - Medium of power transfer (conductive and wireless) - wireless power transfer - Battery Management System (BMS).

UNIT-2 **12L+08T+0P=20 Hours**

EV COMMUNICATION:

V2V, V2G and its applications in power system - power saving & coordinated charging - layout of power converters for V2G operation - EV configurations: converted & purpose built EVs - components of EV system.

PRACTICES:

- Study of accessories required for Scooter Hybrid Conversion.
- Lithium Batteries and Battery Pack Design for Electric & Hybrid Vehicle Application.
- Power train Sizing Calculation Procedure and Practice Problems.

SKILLS:

- ✓ *Selection of E – motors for Electric Vehicles- BLDC/PMSM/ INDUCTION/ SynR MOTORS*
- ✓ *Lithium Batteries and Battery Pack Design for Electric & Hybrid Vehicle Application*
- ✓ *Motor Control Technology for Electric Vehicle applications*
- ✓ *Powertrain Sizing Calculation Procedure and Practice Problems*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Describe the operation and overview of Electric vehicle	Apply	1	1, 2, 3, 4, 7, 9, 11
2	Illustrate the classification of EVs	Analyse	1	1, 2, 3, 4, 5, 6, 7, 9, 11
3	Analyze different EVs Communications.	Analyse	2	1, 5, 7, 9, 11
4	Make use of energy storage technologies in EVs.	Create	2	1, 5, 7, 9, 11

TEXT BOOKS:

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017.

REFERENCE BOOKS:

1. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, MehrdadEhsaniYiminGao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018.

22EE952 ENERGY STORAGE AND MANAGEMENT SYSTEM

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Basic Electrical and Electronics Engineering; Electrical Machines; Power Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

Course objective is to learn some of the principal advantages of lithium-ion cells versus standard electrochemical battery cells, what their primary components are, and how they work.

MODULE-1

UNIT-1 **12L+8T+0P=20 Hours**

ENERGY STORAGE SYSTEM BATTERIES:

Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zine Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System; Comparison of different Energy Storage System.

UNIT-2 **12L+8T+0P=20 Hours**

BATTERY CHARACTERISTICS & PARAMETERS:

Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries; Electrical parameters Heat generation- Battery design- Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries- Meeting battery performance criteria- setting new targets for battery performance.

PRACTICES:

- Study and understand types and rating of Battery.
- Study of Charging and discharging characteristics.
- Comparative Study of Lead acid and Li-ion battery.

MODULE-2

UNIT-1: **12L+8T+0P=20 Hours**

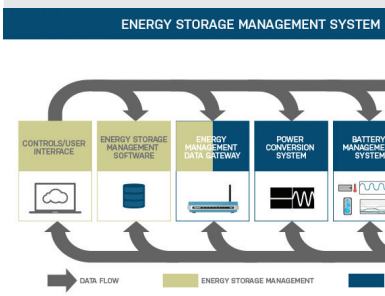
BATTERY MODELLING:

General approach to modelling batteries, simulation model of a rechargeable Li-ion battery, simulation model of a rechargeable NiCd battery, Parameterization of the NiCd battery model, Simulation examples.

UNIT-2 **12L+8T+0P=20 Hours**

BATTERY PACK &BATTERY MANAGEMENT SYSTEM:

Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system, Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests.



Source : https://cleantechnica.com/2015/04/09/us-energy-storage-management-systems-grow-tenfold-2019-gtm/

SKILLS:

- ✓ *Form factors, Chemistry of Lithium ion Battery, Assembly of Lithium ion battery.*
- ✓ *Lithium ion Battery Cell Modelling. Open circuit voltage.*
- ✓ *various techniques to implement Battery thermal management system*

PRACTICES:

- Study of Cell balancing algorithm for Lithium-ion Battery.
- Study and understand Control parameters of battery.
- Compute battery-pack of given energy and power.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of battery management system and design the battery pack.	Apply	2	1, 5, 7, 9, 11
2	Discuss about the different types of energy storage system.	Analyze	1	1, 2, 3, 4, 7, 9, 11
3	Describe about the battery characteristic & parameters	Analyze	1	1, 2, 3, 4, 5, 6, 9, 11
4	Model different types of batteries	Create	2	1, 5, 7, 9, 11

TEXT BOOKS:

1. G. Pistoia, J.P. Wiaux, S.P. Wolsky, “Used Battery Collection and Recycling”, Elsevier, 2001. (ISBN: 0-444-50562-8)”.
2. Guangjin Zhao, “Reuse and Recycling of Lithium-Ion Power Batteries”, John Wiley & Sons. 2017. (ISBN: 978-1-1193-2185-9).

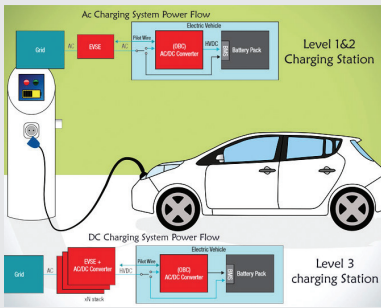
REFERENCE BOOKS:

4. Ibrahim Dinçer, Halil S. Hamut and Nader Javani, “Thermal Management of Electric Vehicle Battery Systems”, JohnWiley& Sons Ltd., 2016.
8. Arno Kwade, Jan Diekmann, “Recycling of Lithium-Ion Batteries: The LithoRec Way”, Springer, 2018. (ISBN: 978-3-319-70571-2).

22EE953 EV CHARGING INFRASTRUCTURE AND BMS

Hours Per Week :

L	T	P	C
3	2	0	4



Source : https://circuitdigest.com/article/electric-vehicle-on-board-chargers-and-charging-stations

PREREQUISITE KNOWLEDGE: Basic Electrical and Electronics Engineering; Electrical Machines; Power Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

Course objective is to learn various charging techniques and charges are available to charge the battery of EVs and learn about BMS requirements, and the requirements for sensing and high-voltage control in detail.

MODULE-1

UNIT-1 **12L+8T+0P=20 Hours**

CHARGING METHODS:

Electric Vehicle Technology and Charging Equipment's - Basic charging Block Diagram of Charger - Difference between Slow charger and fast charger - Slow charger design rating - Fast charger design rating.

UNIT-2 **12L+8T+0P=20 Hours**

TYPES OF CHARGERS:

AC charging and DC charging - On board and off board charger specification - Type of Mode of charger Mode 2, Mode 3 and Mode 4 - EVSE associated charging time calculation - Selection and sizing of fast and slow charger (AC & DC) - AC Pile Charger, DC Pile Charger.

PRACTICES:

- Slow charger design rating.
- Fast charger design rating.
- EVSE associated charge times calculation.

MODULE-2

UNIT-1 **12L+8T+0P=20 Hours**

EVSE COMMUNICATION:

Power Module selection and technical specification - Selection of EVSE Communication Protocol (PLC / Ethernet / Modbus/ CAN Module) - Communication gateway - Specification of open charge point protocol (OCCP 1.6/2.0) - Bharat DC001 & AC001 Charger specification - Communication Interface between charger and CMS (Central Management System) - Payment apps.

UNIT-2 **12L+8T+0P=20 Hours**

CHARGING COMMUNICATION:

Selection of AC charger type-1 , type -2 and type -3 - Communication between AC charger and EV - Selection of DC charger connector GB/T, CHAdeMO, CCS-1 and CSS-2 - Communication methodology of DC fast chargers.

SKILLS:

- ✓ *Battery management System Design strategies. All the component design for battery management system.*
- ✓ *BMS IC Selection techniques.*

PRACTICES:

- Preparation of EV Charger Single Line Diagram.
- Selection of relay and calculation.
- Preparation of EV Charger Electric.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Discuss about the different types of charging methods.	Apply	1	1, 2, 9, 11
2	Apply the concepts of battery management system and design the battery pack.	Apply	2	1, 5, 7, 9, 11
3	Describe about the types of chargers.	Analyze	1	1, 2, 3, 6, 9, 11
4	Model different EV service equipments.	Create	2	1, 2, 3, 7, 9, 11

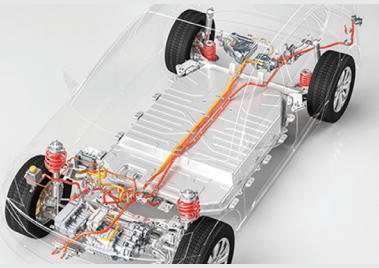
TEXT BOOKS:

1. “Vehicle Inspection Handbook”, American Association of Motor Vehicle Administrators.
2. MehrdadEhsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles_ Fundamentals, Theory, and Design, Second Edition”, CRC Press, 2010.

REFERENCE BOOK:

1. Amir Khajepour, Saber Fallah and AvestaGoodarzi, “Electric and Hybrid Vehicles Technologies, Modeling and Control: A Mechatronic Approach”, John Wiley & Sons Ltd, 2014.

22EE954 MODELLING AND SIMULATION OF ELECTRIC VEHICLES



Source : https://www.plm.automation.siemens.com/global/en/industries/automotive-transportation/battery-modeling-simulation.html

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Basic Electrical and Electronics Engineering; Electrical Machines; Power Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

Course objective is to model and simulate the electric and hybrid vehicles under different operational conditions.

MODULE-1

UNIT-1 **12L+8T+0P=20 Hours**

MODELLING IN PERFORMANCE PARAMETER:

Modelling Vehicle Acceleration - Acceleration performance parameters, modelling the acceleration of an electric scooter, modelling the acceleration of a small car.

UNIT-2 **12L+8T+0P=20 Hours**

MODELLING OF BATTERY ELECTRIC VEHICLES:

Electric Vehicle Modelling - Tractive Effort, Rolling resistance force, Aerodynamic drag, Hill climbing force, Acceleration force, Total tractive effort, Modelling Electric Vehicle Range - Driving cycles, Range modelling of battery electric vehicles, Constant velocity range modelling, Range modelling of fuel cell vehicles, Range modelling of hybrid electric vehicles.

PRACTICES:

- Develop a simulation model for Electric Vehicle to analyze the effect of changing of parameters on vehicle range and performance.
- Develop a simulation model for different driving cycles and analyze these driving cycles.
- Develop a simulation model to analyze the effect of Rolling Resistance on vehicle range and performance.
- Develop a simulation model to analyze the effect of vehicle mass on vehicle range and performance.

MODULE-2

UNIT-1 **12L+8T+0P=20 Hours**

DRIVETRAIN CHARACTERISTICS:

Modelling and Characteristics of EV/HEV Powertrains Components- ICE Performance Characteristics, Electric Motor Performance Characteristics - Battery Performance Characteristics-Transmission and Drivetrain Characteristics-Regenerative Braking Characteristics-Driving Cycles Modelling and Analysis of Electric and Hybrid Electric Vehicles Propulsion and Braking - Longitudinal Dynamics Equation of Motion - Vehicle Propulsion Modelling and Analysis - Vehicle Braking Modelling and Analysis.

UNIT-2 **12L+8T+0P=20 Hours**

ENERGY MANAGEMENT:

Handling Analysis of Electric and Hybrid Electric Vehicles - Simplified Handling Models Energy/Power Allocation and Management - Power/Energy Management Controllers – Rule Based Control Strategies - Optimization-Based Control Strategies.

SKILLS:

- ✓ *Simulation model for different driving cycles and analyze these driving cycles.*
- ✓ *Control strategy for Parallel HEV for developed simulation model and analyze it.*
- ✓ *Simulation model to analyze Electric Motor Performance Characteristics.*

PRACTICES:

- Develop a simulation model to analyze Electric Motor Performance Characteristics.
- Develop a simulation model to analyze Electric Motor Regenerative Braking Characteristics for different Driving Cycles.
- Develop a Control strategy for Parallel HEV for developed simulation model and analyze it.
- Develop a Control strategy for Series HEV for developed simulation model of Parallel HEV and analyze it.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Modeling of vehicle performance parameters.	Apply	1	1, 2, 3, 4, 5, 7
2	Apply the concepts of energy management system.	Apply	2	1, 5, 7, 9, 11
3	Model battery electric vehicles.	Apply	1	1, 2, 3, 4, 5, 6
4	Describe the drivetrain characteristics.	Analise	2	1, 5, 7, 9, 11

TEXT BOOKS:

1. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd, 2003.
2. Amir Khajepour, Saber Fallah and AvestaGoodarzi, “Electric and Hybrid VehiclesTechnologies, Modelling and Control: A Mechatronic Approach”, John Wiley & Sons Ltd, 2014.

REFERENCE BOOKS:

1. Antoni Szumanowski, “Hybrid Electric Power Train Engineering and Technology: Modelling, Control, and Simulation”, IGI Global, 2013.
2. MehrdadEhsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles_ Fundamentals, Theory, and Design, Second Edition”, CRC Press, 2010.

22EE955 INTELLIGENT TRANSPORT SYSTEMS

Source : https://www.shutterstock.com/image-photo/transportation-technology-concept-intelligent-transport-systems-1660696489

Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: AI techniques, Data Structures, Communication systems.

COURSE DESCRIPTION AND OBJECTIVES:

Course objective is to develop a digital map, Positioning module, direction module, wireless communication module and autonomous navigation system for electric vehicles.

MODULE-1

UNIT-1 **12L+8T+0P=20 Hours**

DIGITAL MAP DATABASE MODULE:

Introduction to Modern Vehicle Location and Navigation - Basic Representations - Reference Coordinate Systems - Standards - Proprietary Digital Map Databases - Digital Map Compilation.

Positioning Module - Introduction-Dead Reckoning-Global Positioning System - Sensor fusion - Conventional map matching - Fuzzy logic Based Map matching - Other Map matching algorithms - Map aided Sensor calibration.

UNIT-2 **12L+8T+0P=20 Hours**

DIRECTION MODULE:

Shortest Path - Heuristic Search - Bidirectional Search - Hierarchical search - other algorithms - Guidance while En Route - Guidance while off Route - Guidance with dynamic information.

PRACTICES:

- Develop the digital map database module for 4 wheeler.
- Develop the positioning module for 4 wheeler.
- Develop direction module for 4 wheeler.

MODULE-2

UNIT-1 **12L+8T+0P=20 Hours**

WIRELESS COMMUNICATION MODULE:

Introduction - Communication Subsystem Attributes - Existing Communication Technologies - Communication Subsystem Integration.

UNIT-2 **12L+8T+0P=20 Hours**

AUTONOMOUS LOCATION AND NAVIGATION:

Introduction – Vehicle Location: Standalone Technologies - Radio Technologies - Satellite Technologies - Vehicle Navigation: Coping with complex requirements - Dual use navigation and entertainment components - Centralized location and Navigation Introduction - Automatic Vehicle Location: Centralized and Distributed Approach- Dynamic Navigation: Centralized and Distributed.

SKILLS:

- ✓ *To develop the digital map database module.*
- ✓ *To develop the positioning module.*
- ✓ *To develop direction module.*
- ✓ *To develop wireless communication module.*
- ✓ *To develop autonomous location and navigation.*

PRACTICES:

- Develop autonomous location and navigation.
- To develop a digital map module for a 4 wheeler.
- Develop a proto type autonomous EV.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify digital map database module.	Apply	1	1, 2, 7, 9, 11
2	Make use of the positioning module.	Apply	1	1, 2, 6, 7, 9, 11
3	Examine the direction module.	Analyze	1	1, 5, 7, 9, 11
4	Categorize the wireless communication modules.	Analyze	2	1, 5, 7, 9, 11
5	Develop autonomous location and navigation.	Create	2	1, 2, 3, 4, 7, 9, 11

TEXT BOOKS:

1. "Intelligent Vehicle Technologies Theory and Applications"– L Vlacic, M Parent, F Harashima-Butterworth Heinemann, 2018.
2. "Vehicle location and Navigation Systems" – Yilin Zhao – Artech House Inc., 2017.

REFERENCE BOOKS:

1. Sussman Joseph, "Perspectives on Intelligent Transportation Systems (ITS)", New York, NY: Springer, 2010.
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