DEPARTMENT OF ELECTRICAL ENGINEERING

SYLLABI OF COURSES

FOR

B.E. (ELECTRICAL ENGINEERING)

DEGREE PROGRAMME

(APPLICABLE FROM BATCH 2025 & ONWARDS)

Scheme of studies for BE (Electrical) for Batch 2025 onwards

Electrical Engineering

First Year Fall Semester

Course Code	Course Title	Credit Hrs.		
		Th	Pr	Total
EE-125	Basic Electrical Engineering	3	1	4
EA-128	Functional English	3	0	3
MT-116	Calculus & Analytical Geometry	3	0	3
EF-101	IT Fundamentals & Applications	2	1	3
ES-206 / ES-209	Islamic Studies / Ethical Behavior	2	0	2
ES-105/ ES-127	Pak. Studies/Pak. Studies (For Foreigners)	2	0	2
CY-100	Essentials of Chemistry (For Computer Science Background Students)	NC		
	Total:	**15**	**2**	**17**

First Year Spring Semester

Course Code	Course Title	Credit Hrs.		
		Th	Pr	Total
EE-127	Circuit Analysis	3	1	4
MT-221	Linear Algebra & Ordinary Differential Equations	3	0	3
EE-164	Computer Programming	2	1	3
ES-108	Ideology and Constitution of Pakistan	2	0	2
PH-129	Applied Physics	3	0	3
	Total:	**13**	**2**	**15**

Second Year Fall Semester

Course Code	Course Title	Credit Hrs.		
		Th	Pr	Total
EL-240	Electronic Devices and Circuits	3	1	4
EE-264	Data Structures and Algorithms	2	1	3
MT-226	Multi Variable Calculus	3	0	3
EA-244	Academic Reading and Writing+	3	0	3
EE-111	Engineering Drawing & Workshop Practice	0	2	2
EF-201	Civics and Community Engagement	2	0	2
	Total:	**13**	**4**	**17**

Second Year Spring Semester

Course Code	Course Title	Credit Hrs.		
		Th	Pr	Total
EE-282	Electromagnetic Fields	3	0	3
EE-233	Signals and Systems	3	0	3
CS-220	Digital Logic Design	3	1	4
EF-200	Community Service	NC		
CE-109	Engineering Surveying-I	2	1	3
ME-116	Basic Mechanical Engineering	3	0	3
EE-348	Electrical Machines I	2	0	2
	Total:	**16**	**2**	**18**

Third Year Fall Semester						Third Year Spring Semester				
Course Code	**Course Title**	**Credit Hrs.**				**Course Code**	**Course Title**	**Credit Hrs.**		
		Th	**Pr**	**Total**				**Th**	**Pr**	**Total**
EE-396	Digital Signal Processing	3	1	4		EE-362	Power System Analysis	3	1	4
MT-442	Numerical Methods	3	0	3		EE-355	Embedded Systems	2	1	3
EE-224	Instrumentation and Measurement	2	1	3		EA/ES ###	Foreign Language-I	NC		
MG-485	Entrepreneurship	2	0	2		EE-314	Power Electronics	3	1	4
MT-331	Probability and Statistics	3	0	3		EE-359	Electrical Power Distribution and Utilization	3	1	4
EE-347	Electrical Machines II	2	1	3		EE-265	Artificial Intelligence	2	1	3
	Total:	**15**	**3**	**18**			**Total:**	**13**	**5**	**18**

Final Year Fall Semester						Final Year Spring Semester				
Course Code	**Course Title**	**Credit Hrs.**				**Course Code**	**Course Title**	**Credit Hrs.**		
		Th	Pr	Total				Th	Pr	Total
EE-457	Electrical Power System Protection	3	1	4		MG-482	Organizational Behavior	3	0	3
EE-401	Electrical Engineering Design Project	0	3	3		CS-439	Computer Communication Networks	2	0	2
EE-352	Electrical Power Transmission	3	0	3		EE-401	Electrical Engineering Design Project	0	3	3
EE-375	Feedback Control Systems	3	1	4		EE-414	Power Generation	3	0	3
EA/ES ###	Foreign Language-II	NC				EF-305	Engineering Economics and Management	3	0	3
TC-306	Communication Systems	3	0	3		EF-309	Occupational Safety and Health*	1	0	1
	Total:	**12**	**5**	**17**			**Total:**	**12**	**3**	**15**

DEPARTMENT OF ELECTRICAL ENGINEERING

SYLLABI OF COURSES FOR BE (ELECTRICAL ENGINEERING) APPLICABLE FORM BATCH 2025 & ONWARDS

EE-125 Basic Electrical Engineering

Fundamentals of Electric Circuits - Charge, Current, Voltage and Power, Voltage and Current Sources, Ohm's Law. Equivalent resistance of a circuit.

Voltage and Current Laws - Node, Loop and Branches, Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), single-loop circuits, single Node- Pair Circuit, Series and Parallel Connected Independent Sources.

Circuit Analysis Techniques - Nodal Analysis, Mesh Analysis, Linearity and Superposition, Source Transformations, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer theorem.

Capacitors and Inductors - Capacitor, Inductor, Inductance and Capacitance Combination, voltage current relationship for inductor and capacitor. Energy storage.

Introduction to AC Circuits - Sinusoids and Phasors, Phasor Relationships for Circuit Elements, Impedance and Admittance, Kirchhoff's Laws in the Frequency Domain, Impedance Combinations, Instantaneous and Average Power, Maximum Average Power Transfer, Effective or RMS Value, Apparent Power and Power Factor, Complex Power, Conservation of AC Power.

Sinusoidal Steady-State Analysis - Nodal Analysis, Mesh Analysis, Superposition Theorem, Source Transformation, Thevenin and Norton Equivalent Circuits.

EA-128 FUNCTIONAL ENGLISH

Listening skills and subskills: Effective listening techniques: listening for gist, details, and specific information in a range of situations (AV lectures, interviews, documentaries etc.)

Speaking Skills: Speaking with fluency and accuracy in a variety of situations including conversations, group discussion, academic and social interaction, public speaking, presentation skills, and interviews Pronunciation improvement exercises (through websites, apps, and in class worksheets)

Reading and subskills: Reading strategies: Skimming, scanning, and detailed reading, identifying main ideas, supporting details, and inferences (multiple genres including newspapers, books, stories, documentaries etc). Reading Practice: Reading comprehension tasks. Reading output tasks (notes, summary, discussion, counter argument etc.)

Study skills: Effective note-taking strategies for lectures, meetings, and reading texts. Taking in varied forms paragraph, lists, infographics etc.) Interpreting instructions oral and written. Effective examination taking technique (comprehending instructions, planning, and writing answers ensuring relevance and precise.

Writing skills: Writing process, Pre-writing strategies (Mindmapping, cubing, outlining, clustering etc.) Writing to describe, argue, compare and contrast, persuade through writing prompts. Writing academic and professional genres: emails, letters, short report, resume, cover letter, building profiles on various job portal. Writing accuracy: Identifying and overcoming grammatical problems.

Vocabulary And Grammar Development: Vocabulary Development strategies. Exposure and practice to develop every day and academic vocabulary for formal contexts.

MT-116 CALCULUS AND ANALYTICAL GEOMETRY

Set and Functions: Define rational, irrational and real numbers; rounding off a numerical value to specified value to specified number of decimal places or significant figures; solving quadratic, and rational inequalities in involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, De Morgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions). Graph of some well-known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

Differential Calculus: Differentiation and Successive differentiation and its application: Leibnitz theorem. Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series. Taylor and Maclaurin series, L Hopitals rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, extreme values of a function of two variables with and without constraints. Solution of non-linear equation, using Newton Raphson method.

Integral Calculus: Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence. Beta and Gamma functions and their identities, applications of integration relevant to the field.

Sequence & Series: Sequence, Infinite Series, Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.

Analytical Geometry: Review of vectors, scalars and vector products, Three-dimensional coordinate system and equation of straight line and plane and sphere, curve tracing of a function

Databases: Fundamentals of databases, organization and storage, introduction to Information Systems (IS) and Management Information Systems (MIS), real world IS and MIS applications.

Data Communication and Computer Networking: Network topologies, types of network of two and three variables, surface revolutions, coordinate transformation.

Complex Number: Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions).

EF-101 IT Fundamentals and Applications

Fundamentals of IT: Introduction to Information and Communication Technologies (ICT), Components and scope of ICT, ICT productivity tools, Emerging technologies and future trends, Ethical Considerations in Use of ICT Platforms and Tools, Applications of ICT in education, healthcare and finance. Digital citizenship.

Data Representation and Number Systems: Binary, octal, decimal, hexadecimal systems, data representation: characters, numbers, multimedia.

Programming Languages: Evolution and structures: syntax, semantics, special purpose vs. general-purpose languages, comparative study of data types, control structures and algorithms, basics of coding, practical problem solving.

ES-206 – ISLAMIC STUDIES

Fundamentals of Islam: Tauheed, Arguments for the Oneness of God; Al-Ambiya-22, Al-Baqarah-163-164, Impact of Tauheed on human life, Place of Man in the Universe: Al Israa/Bani Israil-70; Purpose of creation: Al zariyat-56, Prophethood, Need for Prophet, Characteristics of Prophet, Finality of Prophethood: Al-Imran-79, Al-Hashr-7, Al-Maidah-3, and Faith in Hereafter (Aakhirat), Effects on worldly life: Al-Hajj-5, Al-Baqarah-48, Hadith Ibadah: Concept of Ibadah, Major Ibadah, Salat, Zakat, Hajj and Jihad. Al-Mu'minun-1-11, Al Anfaal- 60, & Two Ahadiths

Basic Sources of Shariah: The Holy Quran, Its revelation and compilation, the authenticity of the Text, Hadith, Its need, Authenticity and Importance, Consensus (Ijmaa), Analogy (Qiyas)

Moral and Social Philosophy of Islam: The concept of Good and Evil; A'l e Imran - 110, Al Nahl-125, Akhlaq-e-Hasna with special reference to Surah Al-Hujrat, verses 10, 11, 12, 13, Professional Ethics (Kasb-e-Halal) Al Taha-81, Al Baqar 188, one hadith.

Seerat of the Holy Prophet(PBUH):

a) Moral and ethical teachings of the Holy Prophet (PBUH) with special reference to Hajjat-ul-Wida, (Fundamentals of Islam, Social aspects, Economics aspects, political aspects

b). Personal Characteristics: perseverance & trust in Allah, honesty & integrity, simplicity & humility, mercy & compassion, clemency & forgiveness, bravery & valor, generosity, patience.

c) Engagement and communication with collaborators and foes:

Cases Study from Seerah: Charter of Madina, Ghazwa e Khandaq, Treaty of Hudaibya , Ghazwa e Khayber, Najran's Delegation, Victory of Makkah.

d) Social values and rights, (peace & harmony, tolerance, solidarity, collaborations, inclusivity & cohesion)

Case Studies from Seerah: Al –Fudoul Confederacy, Placement of Black stone, charter of Medina, Treaty of Hudaibya)

leadership skills (Vision, communication, negotiation, conflict management, decision making, relationship building, Integrity, positivity, compassion, empathy, loyalty, accountability, confidence, delegation, empowerment, problem- solving, foresightedness, openness, gratitude and justice).

Teaching of Holy Quran: Translation and tafseer of Surah-e- Fatiha, and The Selected Section of Sura Al-Furqan verses (63-77), Surah-e-Luqman (verses (12-19)).

Nazraah and Tajveed of: Suratul Fatiha, Ayatal Kursi, and last 10 surahs of the Holy Quran. (Ghunnah, Qalqalah, Al-Madd, Noon Sakinah & Tanween Rules)

ES-209 ETHICAL BEHAVIOR (for Non-Muslims)

Nature, Scope and Methods of Ethics: Ethics and Religion, Ethical teachings of World Religions

Basic Moral Concepts: Right and Wrong, Good and Evil

Ethical Systems in Philosophy: Hedonism, Utilitarianism, Rationalism & Kant, Self-Realization Theories, Intuitionism

Islamic Moral Theory: Ethics of Qur'an and its Philosophical basis, Ethical precepts from Qur'an and Hadith and Promotion of Moral Values in Society.

ES-105 PAKISTAN STUDIES

Historical and Ideological Perspective of Pakistan Movement: Two Nation Theory, Factors leading to the creation of Pakistan, Jinnah and demand for Pakistan.

Land of Pakistan: Geophysical conditions of Pakistan, Geopolitical and strategic importance of Pakistan, Natural resources of Pakistan: mineral, water and power resources.

Constitutional process: Early efforts to make a constitution (1947-1956), Salient features of the Constitution of 1956, 1962, Political and Constitutional crisis of 1971, Salient features of the Constitution of 1973, Constitutional amendments from 1973 to date.

Contemporary issues of Pakistan: A brief Survey of Pakistan's economy, The Current Economic Situation of Pakistan: Problems & Issues and future perspective, Social Issues: Pakistan's society and culture: broad features, Literacy and education in Pakistan: problems and issues, Scientific and technical development in Pakistan, Citizenship: national and international. Environmental Issues: Environmental pollution: causes, hazards and solutions, National policy, International treaties, conventions and protocols.

Pakistan's Foreign Policy: Pakistan's Foreign Policy from 1947 to present, Relations with immediate neighbors, Relations with major powers, Relations with the Muslim world.

Human Rights: Conceptual foundations, Western and Islamic perspective of Human Rights, Human Rights in the Constitution of 1973, Human rights issues in Pakistan.

ES-127 PAKISTAN STUDIES (for foreigners)

Land of Pakistan: Land & People-Strategic importance- Important beautiful sights, Natural resources.

A Brief Historical Background: A brief Historical survey of Muslim community in the sub-continent, British rule & its impacts, Indian reaction, two nation theory, Origin & development, Factors leading towards the demand of a separate Muslim state, Creation of Pakistan.

Government & Politics in Pakistan:

Constitution of Pakistan, A brief outline, Governmental structure, Federal & Provincial,

Local Government Institutions, Political History, A brief account.

Pakistan & the Muslim World:

Relations with the Muslim countries

Language and Culture:

Origins of Urdu Language, Influence of Arabic & Persian on Urdu Language &

CY-100 ESSENTIALS OF CHEMISTRY

Stoichiometry: Significant figures, mole and Avogadro number, empirical and molecular formulas, stoichiometry yield.
Atomic structure and Bonding: Subatomic particles, Rutherford's and Bohr's atomic models, quantum numbers, electronic configuration, chemical bond, theories of covalent bond, shapes of molecules.
States of Matter: Kinetic molecular theory, gas laws, liquid properties types of solids, types of crystals.
Acid, Base and Salt: Theories of acid and bases, buffer solution.
Solutions and Colloids: Properties and types of solutions, concentration units, colloids and its classification.
Electrical Conductance: Redox reaction with balancing concept, electrode, electrode potential and electrochemical series, corrosion.
Organic Chemistry: Organic compounds and their classification, homologous series, functional groups, nomenclature of organic Compounds.
Inorganic Chemistry: Periodic classification of elements, periodic laws, group trends of various properties of s and p block elements, general characteristics of transition elements, IUPAC nomenclature of complexes.

EE-127 CIRCUIT ANALYSIS

Introduction to Circuit Analysis- Definition of circuit, analysis, modeling significance of circuit analysis for engineers

Basic RL and RC Circuits- The Source-Free RL Circuit, Properties of the Exponential Response, the Source-Free RC Circuit, the Unit-Step Function, Driven RL Circuits, Natural and Forced Response, Driven RL Circuits.

The RLC Circuit- The Source-Free Parallel Circuit, the overdamped Parallel RLC Circuit, Critical Damping, the under damped Parallel RLC Circuit, the Source-Free Series RLC Circuit, the Complete Response of the RLC Circuit, the Lossless LC Circuit

AC Power Analysis - Instantaneous and Average Power, Maximum Average Power Transfer, Effective or RMS Value, Apparent Power and Power Factor, Complex Power, Conservation of AC Power, Power Factor Correction

Three-Phase Circuits - Balanced Three-Phase Voltages, Balanced Wye-Wye Connection, Balanced Wye-Delta Connection, Balanced Delta-Delta Connection, Balanced Delta-Wye Connection, Power in Balanced System, Unbalanced ThreePhase Systems

Magnetically Coupled Circuits - Mutual Inductance, Energy in a Coupled Circuit, Linear Transformers, Ideal Transformers, Ideal Autotransformers, ThreePhase Transformers

Two-Port Network - Impedance Parameters, Admittance Parameters, Hybrid Parameters, Transmission Parameters, Relationship between Parameters, Interconnection of networks

Measurement of Electrical Quantities -Basics of electromechanical instruments, Active and Reactive power measurement, Max. Demand indicator, Induction type KWH meter, p.f meter. Measurement of resistance, measurement of Inductance and capacitance. Measurement of dielectric strength of insulators, high voltage surges. Electronic and digital voltmeters, digital frequency meter, time interval measurement.

MT-221 LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS

Linear Algebra: Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non- singular, symmetric, non- symmetric, upper, lower, diagonal), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, matrix of linear transformations, eigen value and eigen vectors of a matrix, Diagonolization. Applications of linear algebra in relevant engineering problem.

1st Order Differential Equations: Basic concept: Formation of differential equations and solution of differential equations by direct integration and by separating the variables: Homogeneous equations and equations reducible to homogeneous from; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations and orthogonal trajectories: Application in relevant Engineering.

2nd and Higher Orders Equations: Special types of IInd order differential equations with constant coefficients and their solutions: The operator D; Inverse operator I/D; Solution of differential by operator D methods; Special cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering.

Partial Differential Equation: Basic concepts and formation of partial differential equations: Linear homogeneous partial differential equations and relations to ordinary differential equations: Solution of first order linear and special types of second and higher order differential equations; D' Alembert's solution of the wave equation and two dimensional wave equations: Lagrange's solution; Various standard forms.

Fourier Series: Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients: Expansion of function with arbitrary periods. Odd and even functions and their Fourier series; Half range expansions of Fourier series.

EE-164 Computers Programming

Introduction to C/C++: Brief history and development, Typical C/C++ development environment, structure of C/C++ programs, compilation process and debugging.

C/C++ Building Blocks: Data-types, Variables, representation of variables in memory, IEEE 754 Floating Point Standard, Input/output Functions, Operators, Comments.

Structured Programming: Loops (for() loop, while() loop and do-while() loop), Decision making constructs (if() and if()-else statements), nested loops and nested decision making constructs, Applications of Loops and Decision making in algorithms

Arrays and Vectors: Array as linear data structure, Defining and manipulating 1D and 2D arrays, array memory allocation – Static vs. Automatic, C++ Standard Library Class Template Vector.

Functions: C++ Standard Library Header Functions, Function Prototype, Function Definition with multiple arguments, return multiple outputs with Global variables, Storage Classes and Scope rules, Array as argument to Function, Function Over-loading, and Recursion

Pointers: Pointer Overview, Returning data from functions, Pointers and Arrays, Pointers and Strings, Double Indirection, Pointers to Pointers, Pointers to perform disk I/O operation.

Structures: Classical C Structure, Structure of Array, and Union.

ES-108 IDEOLOGY AND CONSTITUTION OF PAKISTAN

Two-Nation Theory: Nation and Nationalism in British India. Inclusive nationalism, Exclusive nationalism, Freedom movement in British India, Two-Nation Theory.

Ideology: definition and its significance: Difference between Philosophy, Ideology, and Theory. Evolution of Islamic ideology in British India. Pakistan movement: role of ideology. Ideological factors that shaped the Constitution(s) of Pakistan (Objectives Resolution 1949).

Introduction to the Constitution of Pakistan: Definition and importance of a constitution. First Constituent Assembly of Pakistan. Main issues that delayed the Constitution-making in Pakistan. Dissolution of the Constituent Assembly. Second Constituent Assembly of Pakistan. Third Constituent Assembly of Pakistan.

Constitution and State Structure: Federal form of State. Parliamentary form of government. Structure of Government (executive, legislature, and judiciary). Distribution of powers between federal and provincial governments.

Fundamental Rights, Principles of Policy, and Responsibilities: Duty of the citizens of Pakistan (Article 5). Overview of fundamental rights to citizens of Pakistan guaranteed by the Constitution 1973 (Articles 8-28). Overview of Principles of Policy (Articles 29-40).

Constitutional Amendments: Procedures for amending the Constitution. Notable constitutional amendments and their implications: 8^{th}, 13^{th}, $17^{th,}$, and $18^{th.}$

PH-129 APPLIED PHYSICS

Vectors & Mechanics: Review of vectors, Newton Laws and their Applications, Frictional Forces and determination of Co-efficient of Friction, Work-Energy Theorem, applications of law of Conservation of Energy, Angular Momentum, Centre of Mass.

Waves and Oscillations: Simple Harmonic Oscillator, Damped Harmonic Oscillation, Forced Oscillation and Resonance, Types of Waves and Superposition Principle.

Optics and Lasers: Huygens Principle, Two-slit interference, Single-Slit Diffraction, Types of Lasers, Applications of Laser.

Modern Physics: Planck's explanations of Black Body Radiation Photoelectric Effect, De-Broglie Hypothesis, Electron Microscope, Atomic structure, X-rays, Radioactive Decay and Radioactive Dating, Radiation Detection Instruments.

Electrostatics and Magnetism: Electric field due to different Charge Distribution, Electrostatic Potential Applications of Gauss's Law, Lorentz Force Ampere's Law, Magnetism, Magnetization, Magnetic Materials.

Electrical Elements and Circuits: Review of electric current, voltage, power, and energy, Ohm's law, inductance, capacitance, Basic Electrical circuits, Electromechanical systems.

Semiconductor Physics and Electronics: Energy levels in a Semiconductor, Hole concept, P-N junction, Diodes, Transistors, Basic Electronic circuits (e.g. rectifier).

Thermodynamics: Review of Laws of Thermodynamics, conduction, convection, and radiation. Thermal conductivity, specific heat, and overall heat transfer coefficients. Heating, Ventilation and Air Conditioning (HVAC)

EL-240 ELECTRONIC DEVICES & CIRCUITS

Semiconductor Basics: Conduction, N and P Types;

Diode: Biasing, V-I Characteristics, Equivalent circuits, Diode as full and half Wave Rectifier, Limiting and Clamping Circuits, Zener and Optical Devices, and their applications;

BJTs: Structure, Operation, Characteristics and Parameters, BJTs as amplifier and switch, Biasing Circuits;

FETs: Basics, Characteristics and Parameters, Biasing, FET as amplifiers;

Power Amplifier: their classes and application

Operational Amplifier: Input modes and parameters, Negative feedback, Bias Current and offset voltage, Open and Closed Loop Response

Basic Op-Amp Applications: Comparators, Summing Amplifiers, Integrators and Differentiators, Instrumentation Amplifiers

EE-264 Data Structures and Algorithms

Algorithm Fundamentals and Complexity Analysis: Algorithm as technology, Design Approach (Design Paradigms), Representation Techniques, Time and Space Complexity, Order of Growth, common Growth Functions, standard notations.

Data Structure Fundamentals: Revision of C/C++ Data-types and Structures, Abstract Data Type (ADT) concept, 1D Array as ADT, ADT for varying-length character Strings, 2D Array as ADT, Structures and Classes as ADT, Pointer Arrays and Records as ADT.

Recursion, Stacks and Queues: Program design with Recursion, Complexity of recurrence problem, Stack ADT, Stack implementation with Arrays, C++ Template as Stack, Stack applications, Recursion with Stacks, Queue as ADT and, Queue implementation.

String Processing: String Operations, Word Processing, Pattern Matching Algorithms.

Numeric and Number Theoretic Algorithms: Calculating Polynomial Equations, Matrix Multiplication, Linear Equations, Trapezoidal Integration, Root Finding of polynomial, Greatest Common Divisor, Primality Testing, Integer Factorization.

Divide and Conquer Approach: Sorting and Searching Algorithms.

Linked Lists: Linked List as Data Structure, List Operations, Implementation using Arrays and Dynamic Variables, Circular and Doubly Linked List, Linked List Implementation in C++, Linked List applications.

Trees: Binary Trees, Representation in memory, Binary Tree Traversals, Lists as Binary Trees, Finding and Deleting element in Tree, Tree Traversal Algorithms, Binary Search Trees, Heaps, Heap-Sort Algorithm.

Graphs: Representation in memory, Graph implementation, elementary Graph Algorithms, Traversal Algorithms, Shortest Path Algorithms.

MT-226 MULTIVARIABLE CALCULUS

Advanced Calculus: Define a stationary point of a function of several variables, define local maximum and saddle point for a function of two variables the stationary points of a several variables, obtain higher partial derivatives of simple functions of two or more variables, iterated integrals, double and triple integrations with applications (area, centoroid, moment of inertia, surface area, and volume, use multiple integrals in solutions of engineering problems.

Vector Calculus: Dot and cross product, Vector differential operator, directional derivative, gradient, divergence, curl of a vector field, and Laplacian operators with applications. (Solenoid, conservative, etc).

Vector Integrations: Evaluate line integrals along simple paths, apply line integrals to calculate work done, apply Green's theorem in the plane to simple examples, evaluate surface integrals over simple surface, use the Jacobean to transform a problem a new coordinate system, apply Gauss' divergence theorem to simple problems, apply Stokes theorem to simple examples.

Curvilinear Coordinates: Unit vectosr in curvilinear system; Transformation of coordinates; Orthogonal coordinate system; Cylindrical coordinate system; Spherical coordinate system; Parabolic cylindrical coordinates; Elliptical cylindrical coordinate system.

EA-244 Academic Reading and Writing

Introduction to Academic Literacy - Academic reading, writing, and expectations. (Academic v/s non-academic texts) -Finding, evaluating, and presenting credible academic sources. -Critical Reading: Identifying main ideas, annotating texts, and analyzing arguments. -Academic Texts: Structure of research proposals, Arguments & Evidence Writing Logical reasoning, integrating evidence, and avoiding fallacies, journal articles, literature review, lab report, policy brief, case study etc. -Academic Writing- Tone, voice, formal vs. informal writing, and structured paragraphs. -Academic Vocabulary Development: Discipline-Specific Academic Vocabulary.

Academic Writing Process: Outlining, organizing, and refining essay plans. -Writing Introductions: Engaging openings, summarizing key points, and implications. -Synthesizing Research: Connecting multiple sources and writing literature and critical reviews. -Drafting & Revising: Overcoming writer's block, refining drafts, and incorporating feedback. -Editing & Proofreading: Improving clarity, grammar, style, and structure. Add attention to technical

formatting (e.g., equations, symbols, figures in STEM fields). -Citation & Referencing: Using APA or IEEE styles and integrating sources.

Interpreting Visuals: Charts, graphs and tables: Drawing logical conclusions from information contained in graphs, diagrams, pie charts and tables with specific reference to the relevant disciplines and their requirements.

EE-111 Engineering Drawing and Workshop Practice

Mechanical Drawing - Pictorial Drawing and their Projections including Isometric view, Oblique view, Orthographic projections and standard practices, Development of Isometric views from orthographic Projects.

Section Views - Intersection at various positions of geometrical bodies, such as pyramids, Cylinders and Cones, section views of transformers and motor.

Civil Drawing - Plan, Elevations (front, left and right) and details of buildings such as Bungalows, Flats, Offices, Workshops, school and market etc., Elements of Perspective drawings.

Electrical Drawing - Understand of basic electrical symbols, Schematic Diagrams of substations, lighting and power distribution boards, home electrical wiring, industrial wiring, electrical drawings of industrial buildings and their specifications. Control drawings and their operation using simple diagrams of automation systems used in substation. Electrical Symbols and One-line diagrams of a typical power system ,11 KV Electric substation building plan including equipment layout, Trenches (for cabling etc.) Manholes, Doors, Windows, Ventilators etc

Workshop safety – Demonstration of safety equipment, Tools and safety gear in accordance with safety regulations, electric shock treatment.

Measurement – Measurement of electrical quantities such as current, voltage, power, inductance, capacitance etc.

Familiarization with Electric Cables and Switching Devices – Familiarization with the type of cables and electric accessories including switches, plugs, circuit breakers, fuses, etc., comprehending their symbols for electrical wiring schematics.

Wiring Circuits and Earthing Concepts – Assembling a parallel electric wiring circuit for a hotel and its testing in accordance with wiring regulations, Demonstration of earthing concepts and installation of an earthing cable.

Introduction to Circuit Designing & PCB Printing – Introduction to circuit designing and simulation using Proteus, Introduction to PCB printing (Fabrication of PCB) and etching in PCB design, demonstration and evaluation of a complete PCB design and fabrication.

EF-201 Civics and Community Engagement

Introduction to Civics and Citizenship: Definition of civics, citizenship and civic engagement, Historical evolution of civics participation, Types of citizenship: active, participatory, digital etc. The relationships between democracy and citizenship

Civics and Citizenship: Concepts of civics, citizenship and civic engagement, Foundation of modern society and citizenship. Types of citizenship: active, participatory, digital etc.

State, Government and Civil Society: Structure and functions of government in Pakistan, The relationships between democracy and civil society, Right to vote and importance of political participation and representation

Rights and Responsibilities: Overview of fundamental rights and liberties of citizens under constitution of Pakistan 1973, Civic responsibilities and duties, Ethical considerations in civic engagement (accountability, non-violence, peaceful dialogue, civility, etc.)

Community Engagement: Concept, nature and characteristics of community, Community development and social cohesion, Approaches to effective community Engagement, case studies of successful community driven initiatives

Advocacy and Activism: Public discourse and public opinion, role of advocacy in addressing social issues, Social action movements

Digital Citizenship and Technology: The use of digital platforms for civic engagement, Cyber ethics and responsible use of social media, Digital divides and disparities (access, usage, socioeconomic, geographic etc.) and their impact on citizenship

Diversity, Inclusion and Social Justice: Understanding diversity in society (ethnic, cultural, economic, political etc.), Youth, women and minorities' engagement in social development, addressing social inequalities and injustice in Pakistan, Promoting inclusive citizenship and equal rights for societal harmony and peaceful co-existence.

EE-282 ELECTROMAGNETIC FIELDS

Vector Analysis: scalars and vectors, vector algebra, the Cartesian coordinate system, vector components and Unit vectors, the vector field, the dot product the cross product, other coordinate systems, circular cylindrical coordinates, the spherical coordinate system, transformations between coordinate systems.

Coulomb's Law and Electric Field Intensity: The experimental law of coulomb, Electric field intensity, field of a point charge, field due to a continuous volume charge distribution, field of line charge, field of sheet charge, streamlines & sketches of fields.

Electric Flux Density Gauss's Law and Divergence: Electric flux density, Gauss's law, application of Gauss's law, some symmetrical charge distributions, differential volume element, divergence, Maxwell's first equation for electrostatics, the divergence theorem.

Energy and Potential: Energy expanded in moving a point charge in an electric field, the line integral, definition of potential difference and potential, the potential field of a point charge, the potential field of a system of charges, conservative property, potential gradient, the dipole, energy density in the electrostatic field.

Conductor Dielectrics and Capacitances: Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, semiconductors, the nature of dielectric materials, capacitance, several capacitance examples, of a two wire lines, current analogies.

The Steady Magnetic Field: Biot Savart's Law, Amperes circuit law, curl, Stoke's theorem, Magnetic flux and magnetic flux density, the scalar and vector magnetic potentials, derivation of steady magnetic field laws.

Magnetic Forces Materials and Inductance: Force on a moving charge, force on a differential current element, force between differential current element, force and torque on a closed circuit, the nature of magnetic materials, Magnetization and permeability, magnetic boundary conditions, the magnetic circuit, potential energy and forces on magnetic materials, inductance and mutual inductance.

Time Varying fields and Maxwell's Equations: Faraday's Law, displacement current, Maxwell's equation in point form, Equation in integral form, the related potentials

EE-233 Signals and Systems

LTI Systems: Continuous time LTI Systems, modeling of different physical systems (Electrical, Mechanical and coupled systems), state-space representation of LTI systems, Type of inputs, Zero-input response, Convolution Integral, transient and forced/steady-state response, complete response of LTI systems using classical solution of differential equations, second order systems and their responses (underdamped, overdamped, critically damped)

Fourier Series: Fourier Series Representation of continuous time periodic signals, properties of continuous time Fourier series, exponential form of Fourier series (analysis and synthesis equations)

Fourier Transform: Fourier Transform Representation of continuous time

aperiodic signals, properties of continuous time Fourier transform,

Laplace Transform: Definition, derivation of Laplace transforms of simple functions, inverse transformation techniques Properties, application of Laplace for solution of differential equations of physical systems, analysis of LTI systems using Laplace transform

Magnitude-Phase: representation (for Frequency response) of LTI systems, transfer functions, Bode-plots, frequency responses of first and second order transfer functions. Design of passive and active 1st and 2nd order analog filters.

CS-220 DIGITAL LOGIC DESIGN

Introduction to Digital Design: Basic Logic Gates, Logic Families; Boolean Algebra; Gate-Level Minimization of Boolean Functions using Karnaugh Map; NAND and NOR Implementation, Duality, Active Low Logic; Combinational Logic Circuit Design: Adders, Decoders, Encoders, Multiplexers, DeMultiplexers, Magnitude Comparators and Binary Code Converters; Storage Devices and Sequential Logic: Latches and Flip Flops, Shift Registers, Asynchronous Counters, Mealy and Moore Machines, Synthesis of Sequential Logic Circuits, Synchronous Counters, State Minimization techniques (pair chart) for completely specified sequential circuits; Memories and Programmable Logic Devices: Read Only Memory, Programmable Array Logic and Programmable Logic Array.

EF-200 COMMUNITY SERVICE

Orientation to Community Service: Taught component

Introduction to the concept and practice of community service. Need, objectives and benefits of community service.

Foundational theories (educational, undergraduate curriculum, humanities, social science, corporate social

responsibility etc.). Tools and skills needed in community service. Contextual examples in community service; case

examples. Professional and ethical conduct during community service

Community Service Attachment

Completing 30-35 hours of formal assignment at an organization

Community Service Experience Documentation

Writing a report documenting the experience and submitting it on the prescribed format.

CE-109 ENGINEERING SURVEYING-I

Introduction: Introduction to land surveying, Definitions of basic surveying terms branches and their application, Instruments used

Survey Techniques Distance measurement techniques, Compass survey, Traversing and triangulation, Plane table surveying, Computation of areas and volumes by various methods, Tachometry, Theodolite survey

Modern Methods in Surveying: Principles of EDM operation, EDM characteristics, Total stations, field procedures in Surveying: for total stations in topographic surveys, Construction layouts using total station

Levelling and Contouring: Methods and types of levels, precise levelling, Methods and applications of contouring.

ME 116 BASIC MECHANICAL ENGINEERING

Engineering Mechanics: Statics: Fundamental concepts, Definitions and Units, Newton's First Law, Forces, Moments and couples, Laws of Equilibrium, Free Body Diagrams, Structures, Frames and Mechanics,

Dynamics: Fundamentals of Dynamics, Rigid Body Dynamics, Newton's Second Law, Analysis of Motion in Two & Three Dimensional Spaces, Rectilinear & Curvilinear Motions, Work & Energy, Conservation of Energy.

Thermodynamics: Work, heat, open, closed and steady flow systems, thermodynamics properties and processes, absolute & gauge pressure, pressure temperature and flow measurement, laws of thermodynamics, equation of continuity, two phase systems, ideal gas, conservation of mass & energy, basic heat engine & refrigeration cycles.

Heat Transfer: Fundamentals of heat transfer, conduction, convection, radiation, thermal conductivity, overall heat transfer coefficient

Heating, Ventilation and Air Conditioning (HVAC): Introduction to HVAC components, heating and cooling load, comfort charts, outline of A/C. systems, consideration for air-conditioning in building, natural ventilations, insulating materials.

EE-348 Electrical Machines-I

Fundamentals of Electrical Machinery: A linear machine, Left hand rule, right hand rule, a simple single loop AC and DC. Magnetic flux, flux density, magneto motive force, permeability,

hysteresis, Faraday's law, Lenz's law, induced force on wire, induction of voltage on a conductor.

DC Generators: Construction and working, types, emf equation, losses, efficiency, armature reaction, performance characteristics and their curves.

DC Motors: Types, Back EMF, torque, speed and speed regulation, performance characteristics and their curves, losses and efficiency.

Transformers: Types of transformer, single phase and three phase transformer, construction, principle of working, emf equation, Transformation ratios, no load working and vector diagram, magnetizing current, vector diagram on load, Equivalent circuit, Poly phase transformers, star delta and zig-zag connections for parallel operation, sharing of load, tertiary windings, harmonics and transients in transformers, on load tap changing transformers, auto transformers, vector groups, distribution and power transformer.

EE-396 Digital Signal Processing

Overview of Discrete-time Signals and Systems: Concept of Frequency in Discrete time signals, Relationship with Frequency in Analog domain,

Analog to Digital Conversion: Sampling, Aliasing, Quantization, resolution, Errors and Mitigation, data rates.

Discrete Time Tools: Convolution, Correlation, Properties of Discrete time Signals and Systems.

Linear Constant Coefficient Difference Equations: Modelling discrete systems using difference equations, solution of difference equations. System Realization using Block Diagrams DF-I and DF-II

Discrete Fourier Transform: Frequency Domain Sampling, DFT Properties, Inverse DFT, Windowing and DFT Leakage, Direct Computation of DFT; Linear Transformation

Fast Fourier Transform: Divide and Conquer, Radix algorithms; Inverse FFT, Applications of FFT

Discrete time systems implementation: Overview of z-transform, Analysis of discrete system, Structures of Discrete time systems, Fixed and Floating number types, Quantization effects. Pole Zero maps, Bode Plots

Design of Digital Filters: General Considerations, FIR and IIR Filters, Techniques of FIR and IIR filter Design.

Multi-rate Signal Processing: Down sampling and Up sampling, Decimation, and Interpolation

MT-442 Numerical Methods

Error Analysis Types of errors (relative, Absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart. Use any Computational tools to Analysis the Numerical Solutions.

Linear Operators: Functions of operators, difference operators and the derivative operators, identities.

Difference Equations: Linear homogeneous and non-homogeneous difference equations.

Solution of Non-linear Equations: Numerical methods for finding the roots of transcendental and polynomial equations (Secant, Newton – Raphson Chebyshev and Graeffe's root squaring methods), rate of convergence and stability of an iterative method.

Solution of Linear Equations: Numerical methods for finding the solutions of system of linear equations (Gauss-Elimination, Gauss-Jordan Elimination, triangularization, Cholesky, Jacobi and Gauss – Seidel).

Interpolation &- Curve Fitting: Lagrange's, Newton, Hermit, Spline, least squares approximation. (Linear and non-linear curves).

Numerical Integration & Differentiation: Computation of integrals using simple Trapezoidal rule, 1/3th Simpson's rule, 3/8th Simpson's rule, Composite Simpson's and Trapezoidal rules, computation of solutions of differential equations using (Euler method, Euler modified method, Runge Kutta method of order 4). Numerical Solutions of Partial differential Equations, Optimization problem (Simplex Method). Steepest Ascent and Steepest Descent Methods.

EE-224 Instrumentation and Measurement

Introduction and performance characteristics: Definitions and classification of sensors and actuators; general requirements for interfacing; I/O characteristics & transfer function; impedance & impedance matching; range, span, input and output full scale, resolution, and dynamic range; accuracy, errors, and repeatability; sensitivity and sensitivity analysis; hysteresis, nonlinearity, and saturation; frequency response, response time, and bandwidth; calibration; excitation; Deadband; reliability.

Mechanical & Temperature sensors and thermal actuators: thermo-resistive sensors; thermoelectric sensors; p–n junction temperature sensors; thermomechanical sensors and actuators; heating actuators and their types; resistance-alloy heating elements; immersion-type heating element; ceramic-type heating element; induction-type heating; Force sensors; accelerometers; pressure sensors; velocity sensing.

Electric, magnetic & optical sensors and actuators: photoelectric sensor; CCD sensors and detectors; thermal-based optical sensors; capacitive sensors and actuators; inductive sensors; Hall effect sensors; magnetometers; magnetic actuators; voltage and current sensors.

Interfacing methods and circuits: Op Amps, inverting/ noninverting, voltage follower, instrumentation amplifier, charge amplifier, integrator, differentiator, current amplifier, comparator; linear power amplifiers, Programmable Gain Amplifier, PWM & PWM amplifiers; ADC, DAC and types (Flash, Delta-Sigma and Successive Approximation); bridge circuits; four-wire, two-wire and digital data transmission protocols and buses; linear power supplies, switching power supplies, current sources, voltage references, oscillators; noise and interference.

Communication Protocols: I^2C and one-wire protocols and their usage and detailed specifications; brief discussion of SPI, CAN Bus and GPIB protocols.

Interfacing to microprocessors: architecture, addressing, execution, speed and power, instruction set and programming, I/O, clock & timers, registers & memory, peripherals and functionalities; general requirements for interfacing sensors and actuators; Errors; Virtual Instrumentation on Microprocessors.

MG-485 Entrepreneurship

Introduction to Entrepreneurship; The concept of entrepreneurship, entrepreneurial mindset, social entrepreneurship, essential entrepreneurial skills.

Initiating entrepreneurial ventures; innovation and creativity, assessment of entrepreneurial opportunities, pathways to entrepreneurial venture, sources of capital,

Developing the entrepreneurial plan; legal challenges, marketing challenges, financial planning, export orientation, developing an effective business plan.

Growth strategies; strategic entrepreneurial growth through scaling, valuation of entrepreneurial ventures, harvesting the entrepreneurial venture

MT-331 PROBABILITY & STATISTICS

Statistics: Introduction, Types of data & variables, presentation to data, object, classifications, Tabulation, Frequency distribution, Graphical representation, Simple & Multiple Bar diagrams, Sartorial & Pie-Diagram, Histogram, Frequency Polygon, Frequency Curves & their types.

Measures of Central Tendency and Dispersion: Statistics Averages, Median Mode, Quartiles, Range, Moments, Skew ness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems.

Curve Fitting: Introduction, fitting of a first and second degree curve, fitting of exponential and logarithmic curves, related problems. Principle of least squares, Second order Statistics & Time series not in bit detail.

Simple Regression & Correlation: Introduction, Scatter diagrams, Correlation & its Coefficient, Regression lines, Rank Correlation & its Coefficient, Probable Error (P.E), Related problems.

Sampling and Sampling Distributions : Introduction, Population, Parameter & Statistic, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-Sampling Errors, Random Sampling, Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems.

Statistical Inference And Testing Of Hypothesis Introduction, Estimation, Types of Estimates, Confidence interval, Tests of Hypothesis, ChiSquare distribution/test, one tails & two tails tests. Application in related problems.

Probability: Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability. Conditional probability, Baye's nile. Related problems in practical significance.

Random Variables: Introduction, Discrete & Continuous random variables, Random Sequences and transformations. Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F.), Markove random walks chain/ Related problems.

Probability Distributions: Introduction, Discrete probability distributions, Binomial Poisson, Hyper geometric & Negative binomial distributions. Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance.

EE-347 Electrical Machines II

Synchronous Generators: Construction and working, speed control, Internal Generated Voltage, Equivalent Circuit, Phasor Diagram, Power and Torque relationship, Modes of an alternator operation (Standalone and Parallel), voltage regulation of alternators.

Synchronous Motors: Overexcited and under-excited motors, power factor and power factor control, starting of synchronous motors, torque speed, V-curves circle diagram.

Single Phase Induction Motor: Single phase induction motors, construction and working, rotating field theory, slip and its effect on motor current quantities. Losses, efficiency and performance curves. Starting, full load and maximum torque relations, torque slip characteristics.

Three Phase Induction Motor: Equivalent circuit of induction motor, cage rotor, double cage and high torque motor, magnetizing current of an induction motor, noise of induction motor, crawling and cogging, speed and power factor control of induction motors by injecting EMF in the circuit, phase advancers and phase compensated induction motor, induction generators and regulators, testing of induction motor, efficiency and losses, circle diagram, starter calculations

EE-362 Power System Analysis

Introduction to Power System Analysis: Definition of power system, components of power system, Per Units System, Three phase transformer connections and phase shift, per unit equivalent circuits of balanced three phase two winding transformers, three winding transformers, Autotransformers.

The Admittance Model and Network Calculations : Branch and Node admittances; Mutually coupled Branches in Y-bus; Equivalent Admittance Network; Modification of Y-bus; Impedance matrix and Y-bus; the method of successive elimination; Node Elimination (Kron Reduction); Triangular Factorization.

Power Flow Analysis: Solution of non-linear algebraic equations e.g. Gauss Seidal Method, Newton Raphson Method, Power Flow Solution using different techniques.Power Flow Problem, Power Flow Solutions using Gauss Seidal and Newton Raphson.

Symmetrical Faults: Series RL circuits transients, three phase short circuit- Unloaded Synchronous Machine, Power System three phase short circuits, Bus Impedance Matrix.

Symmetrical Components and Unbalanced Fault calculations: Definition of symmetrical components, Sequence impedance of (1) loads (2) transmission lines (3) transformer, sequence networks of a loaded generator, Unbalanced fault calculations (1) Single line to ground fault (2) double line fault (3) double line to ground fault.

Unsymmetrical Components: System Representation, Single line to ground fault, Line to line fault, double line to ground fault, Sequence bus impedance matrix.

Power System Stability: stability problem, steady state and transient stability, rotor dynamics and swing equation, the power angle equation, equal area criterion of stability, solution of swing equation by graphical method.

EE-355 Embedded System

Introduction to Microcontrollers: Microcontroller and microprocessor architectures; Harvard and Von Neumann architectures; data representation.

The ARM Instruction Set Architecture (ISA): ARM assembly instruction sets; ARM Cortex-M organization; ARM C to ARM assembly translation.

Assembly Programming for the ARM Cortex-M: Program status register; shift and rotate; addition, subtraction, multiplication and division; bit-wise operations; sign and zero extension; data movement between registers; big- and little-endian data storage; memory addressing; branch instructions; loops.

Structured Programming for the ARM Cortex-M in C and Assembly: Basic control structures; register re-use; examples like factorial computation, counting ones in a word, counting digits in an integer, maximum of an array.

Procedural Programming for the ARM Cortex-M in C and Assembly: Subroutines; stack implementation via STM and via LDM; preserving run-time environment via stack; passing arguments to subroutine, examples of problems solved with subroutines;

Mixing C and Assembly for the ARM Cortex-M: Data types and access; data alignment and data structure padding; special variables (static and volatile); inline assembly; calling assembly subroutines from a C program; calling C functions from assembly programs.

Interrupt and Interrupt Handling for the ARM Cortex-M: Introduction to interrupts; Interrupt Service Routine (ISR); interrupt vector table; Nested Vector Interrupt Controller (NVIC); system timer; external and software interrupts.

Instruction Encoding and Decoding: Trade-off between code density and performance; encoding 16-bit and 32-bit instructions; calculating target memory address; instruction decoding examples.

ARM Cortex-M Peripherals: General Purpose Input/Output (GPIO); general-purpose timers and their applications; Direct Memory Access (DMA) controller; Analogue-to-Digital Converter (ADC); ADC architecture, modes and channels; Serial Communication Protocols (Universal Asynchronous Receiver Transmitter (UART), Inter-Integrated Circuit (IIC) communication bus; Serial Peripheral Interface (SPI) communication bus.

EE 314 POWER ELECTRONICS

Introduction: SSDs in power electronics, power diodes, power transistors, Power MOSFETS, Thyristors, Triacs, Diac. Characteristics of GTO, RCT, etc. Series and parallel operation of SCR, LASCR. Thyristor turn on, integral cycle control and phase angle control, elementary and advanced firing schemes, sequence and close loop control

Uncontrolled and Controlled Rectifiers: Single phase, three phase, semi converter, full converter, dual converter, analysis and performance, parameters as harmonic factor, utilization factor, power factor, distortion factor, etc. rectifiers with purely resistive, highly inductive and RL loads. Application of Uncontrolled and Controlled rectifiers in electrical drives and power system.

DC Chopper: Principle, Step-up and Step-down operation, Buck regulator, Boost regulator, Buck-boost regulator, Cuk regulator, Choppers using thyristors. Application of DC Choppers in electrical drives and power system.

Protection Analysis: Over voltage, over current, di/dt & dv/dt protection, heat sinks.

Inverters: Principles, half bridge, full bridge inverters, constant phase width modulation, variable PW modulation, sinusoidal PW modulation, modified SPWM. Application of inverters in electrical drives and power system.

Electronic Power Supplies: Design and analysis of regulated power supplies, switch mode power supplies, Uninterrupted power supplies. Application of Electronic Power supplies in electrical drives and power system.

EE-359 Electrical Power Distribution & Utilization

Introduction to Distribution System: Distribution System Arrangement from Sub-transmission to Consumer Services, Types of Distribution system, DC& AC Distribution systems, Distribution transformer; earthingresistance and earthing practices, Power Factor &its improvement techniques.

Distribution Substation: Single Line
Diagram, selection of site for a substation, Bus bar Schemes, Substation Equipment, Fuses, Relays, Contactors, Circuit Breakers, Isolators, Surge Arresters, Measuring Instruments: CTs & PTs and CCVTs.

Load Characteristics: Types of Load, Estimation of Load, Loadcurves, Maximum Demand, Demand Interval, Diversity Factor, Demand Factor, Utilization Factor, Load Management, Private Power Policy, Energy Tariff.

Power Cables: Cable Construction, Types of Cables, Insulating materials, Conducting materials, Capacitance of a Cable, Dielectric Power Loss, Thermal Characteristics of Cables, Cable Installation, Cable Selection Criteria, Calculation of Current Rating of Cables, Voltage drop calculation, Cable Fault Localization.

Illumination: Basic Definitions related to illuminations, Laws of Illumination, Polar Curve of Lamps, Factors involve in designing of lighting Scheme, Lighting standards, Different types of Lamps – construction and working.

Electric Heating, Welding and Traction: Advantages of Electric Heating, Resistance, Induction & Dielectric Heating, Microwave & Infrared Heating, Resistance Welding & its Type. Different types of traction, advantages and disadvantages.

EE-265 Artificial Intelligence

Introduction: The idea of machine learning, Importance and relevance to electrical engineering, type of machine learning, important tools (e.g., Python, Scikit learn etc.)

Linear Regression: Simple linear regression, cost function, normal equation, gradient descent (batch, stochastic, mini-batch), learning rate, multinomial regression, regularization (lasso, ridge)

Logistic Regression: Introduction to classification problems, sigmoid function, logit function, log loss cost function, multinomial logistic regression, softmax function.

Support Vector Machines (SVM): Preprocessing data with min-max scaling, standardization, idea of support vectors, linear SVM classification, soft margin classification, hard margin classification, ridge loss, SVM for nonlinear decision boundaries, kernel trick, polynomial kernel, radial basis function, Support Vector Classification

Decision Trees: Introduction to non-parametric methods, decision trees structure for classification, gini impurity, entropy impurity, regularization hyperparameters, regression using decision trees

Unsupervised Learning: Clustering, K-means algorithm, PCA

Neural Networks: idea of neuron, perceptron, multi-layer perceptron (MLP), backpropagation, regression MLP, classification MLP, implementation with Keras,

Deep Learning (DL): Activation functions, vanishing and exploding gradients, optimization function (momentum, adam, RMSProp, etc), regularization, Vision application with DL

Fuzzy Logic (FL): Introduction and FL theory, Fuzzy sets and membership functions, linguistic variables and fuzzy rules, engineering application of fuzzy logic.

Ethics in AI: Fairness, Bias, and Discrimination; Privacy and Surveillance; Accountability and Transparency; Automation and Impact on Employment; Autonomous Systems and Safety; Deepfakes, Misinformation, and Manipulation; Governance, Regulation, and Policy; Environmental Impact of AI.

EE-457 Electrical Power System Protection

Circuit Breakers and Switchgears: Introduction, Principle of circuit interruption, Short circuit studies in a power system, Faults at Generator Terminals, Faults in the system, Circuit breaker-Types and characteristics, Type of switchgear, Interrupting capacity of a circuit breakers and switchgears, Ratings of circuit breakers, Circuit Breaker operating mechanism, HVDC circuit breaking, Current Limiting Reactors; Use and location, Short circuit currents and size of reactor.

Modern Circuit Breakers: Construction and testing, Modern trend in HV circuit breakers, Vacuum Circuit breakers, SF6 Power Circuit breakers, Transients in power system, Switching Transients, Testing of circuit breaker, Test techniques for high rating circuit breaker, Selection of circuit breaker.

Protective Relays - Need for protective relaying in power systems, Basic requirements of protective relaying, Principles and characteristics of protective relaying, Theory and classification of relays, Theory of application of relays, Instrument Transformers, Types of relays, Auto reclosing, Under frequency/over frequency relays, Microprocessor based relays, Numerical relays, Protection Coordination.

Protection of Generators - Allocation of protective devices for stator, rotor, and prime mover of a generator, Faults in Generator windings, Generator Protection

Protection of Transformers - Busbars and Motors: Transformer Protection, Short circuit protection of Transformers by percentage differential relays, Differential Protection of a three winding transformer, Generator transformer Unit Protection, Gas accumulator and pressure relays, Protection of Motors, Protection of induction motors by static relays.

Protection of Transmission Lines - Busbar protection, Distance protection, Zones of protection.

EE-352 ELECTRICAL POWER TRANSMISSION

Power Systems Overview: Per Unit system, Phasor notation, complex power, power triangle, direction of power flow, current and power in balanced three- phase circuits, Power system infrastructure, transmission and sub-transmission system, AC/DC system, standard voltages for transmission and sub transmission.

Impedance of Transmission Lines: Conductor types, Resistance, Skin effect, Line inductance based on flux considerations. Inductance of single phase 2- wire line, inductance of composite conductor line, use of tables. Inductance of 3-ph line with equilateral and unsymetricalspacings, transposition, inductance of Bundled conductors. Capacitance of two-wire and 3-phase line, effect of earth on capacitance; capacitance of bundled conductors, parallel circuit lines.

Current and Voltage Relationship on a Transmission Line: Representation of lines in terms of ABCD parameters for short, medium and long transmission lines, voltage and current waves,

SIL loading, power flow through the line, power transmission capability, voltage regulation, series and shunt compensation for long transmission line.

Mechanical Design of Overhead Lines: Line supports, sag and tension calculations, total length of conductor, supports at different levels, mechanical degree of safety, effect of wind pressure & ice loading, conductor vibration & use of dampers.

Insulators: Insulator material, types of insulators, voltage distribution over insulator string, string efficiency, methods of improving the string efficiency, testing of insulators.

Corona: The phenomenon of corona, disruptive critical voltage and visual critical voltage, conditions effecting corona loss, power loss due to corona, radio interference due to corona.

EE 375 FEEDBACK CONTROL SYSTEMS

Introduction: Introduction to control systems, examples and classifications, Feedback and its characteristics. Nature and representation of control system problem, block diagram fundamentals and terminology for a feedback control system. Response of second order systems with time-domain specifications. Closed Loop Transfer functions of physical systems.

Block Diagram Algebra: Canonical and unity feedback forms of control system block system block diagram, block diagram reduction techniques and theorems, signal flow graph algebra, block diagram reduction using signal flow graphs.

Control System Stability: Stability of control systems, Routh Hurwitz Criteria for Stability, Conditional Stability, and Classification of feedback systems by type, analysis of system types, Steady State error efficiency, coefficients, and constant

Root Locus: Introduction, rules for construction of root locus, qualitative analysis of root locus, analysis of performance characteristic of systems in time domain, dominant pole zero approximations, System design via root locus compensation, PID controller.

Control System Design: Introduction and review of control system design for closed loop systems via gain and phase margin adjustment in Bode/Nyquist/Polar plots.

Introduction to Digital Control: Computer control systems, Single-loop digital control system, Digital control vs Analog Control systems, Relation between S and z-domain and responses.

TC-306 Communication Systems

Introduction: Introduction to Communication, elements of Communication system, Fundamental Limitations, Hartley Shannon law Needs and benefits of Modulation, electromagnetic spectrum, multiplexing and multiple access, Phasors and Line Spectra

Analog Communication: Baseband and carrier communication, Linear CW (AM, SSB, DSB, VSB) Modulation and demodulation techniques, modulator and demodulator Circuits, AM and

SSB Transmitters and Receivers, SSB Filters, Transmission Bandwidth for AM, Angle/ Exponential CW (FM, PM) Modulation and demodulation techniques, modulator and demodulator Circuits, FM/ PM Transmitter, FM Generation Methods, Transmission Bandwidth for FM/PM , Carson's rule, PLL Systems, Preemphasis and De-emphasis circuits, Narrowband and wideband FM, Demodulation of FM/PM and Receivers

Noise: Mathematical representation, Signal to Noise Ratio, Noise in AM, FM, and PM systems

Digital Communication systems: Digital transmitters and receivers,

Pulse Modulation, Pulse Amplitude Modulation, Pulse Position and Pulse width Modulation, BER, Introduction to information theory, Digital CW modulation, Coherent and nonCoherent systems, Digital modulation error-control coding.

MG-482 Organizational Behavior

Introduction to Organizational Behavior: Foundations of OB: Management functions, roles, and skills Effective versus successful managerial activities Replacing intuition with systematic study Exploring OB challenges and opportunities facing globalization: Improving quality and productivity Improving people skills Managing work force diversity Responding to globalization Empowering people Stimulating innovation and change Coping with temporariness Handling declining employee loyalty Improving ethical behavior

Foundations of Individual Behaviour: Individuals & Organizations: Biographical traits and ability Personality Perceptions and individual decision making: Understanding perception and its significance, factors influencing perception Linking perception and individual decision making Optimizing decision making model Alternative decision making models Issues in decision making Values, attitudes and job satisfaction: Importance, sources, types of values Sources and types of attitude Attitude and consistency Measuring job satisfaction Determinants of job satisfaction Effect of job satisfaction on employee performance Ways employees can express dissatisfaction Motivation - basic concepts and applications

Foundations of Group Behaviour: Group in OB: Defining and classifying groups Stages of group development, work group behavior Dynamics of groups Understanding work teams: Team versus group; types of teams, creating high performance teams Turning individuals into team players Communication: communicating at interpersonal and organizational level Leadership:

basic approaches and contemporary issues Conflict & negotiation: defining conflict; transition in conflict thought Conflict process Negotiation - strategies, process and issues

Foundations of Organizational Structure: Organizational structure and design Work design Work stress Organizational culture: definition Culture's functions, employees and organizational culture Organization change and development: forces for change Managing planned change, resistance to change Approaches to managing organizational change

CS-439 Computer Communication Networks

Introduction to Computer Networks: OSI reference model, the TCP/IP reference model; Packet Switching and Architectures; Circuit Switching and Architectures;
Data Link Layer and issues; Error Correction and Congestion Control in Networks;
Network Layer and Issues (Protocols and Services); IPv4 and IPv6, IP addressing and subnetting; Network Routing; Wireless Network;
Transport Layer and Issues, Transmission Control Protocol, User Datagram Protocol

EE-414 Power Generation

Principles of Energy Conversion and Integration of energy sources– Introduction, types of conventional and non-conventional energy sources, efficiency and cost comparison, site selection, thermodynamic cycles, integration of different energy sources.

Conventional Energy Sources: Thermal Power Plants: Working of power plant, plant layout, types of boiler, types of steam and gas turbines and other station auxiliaries.

Hydroelectric Power Plants: Working, plant layouts, types of hydro-electric turbine and other station auxiliaries.

Nuclear Power Plants: Working, plant layout, fission and fusion reaction, critical mass chain reaction, moderators, reactor control and cooling, classification of reactors, radiation damages and shielding.

Non-Conventional Energy Sources: Solar Photovoltaic: PV system, types of solar cells, charge controllers, shading effect and its protection, power and efficiency calculations.

Wind Energy: Types of wind turbine, kinetic energy conversion, wind turbine generators, power and energy equations, wind speed characteristics of a site, air density, aerodynamics of wind turbine.

Bio Mass: Components and layout, agricultural residues, environmental benefits and impacts.

Fuel Cells: Thermodynamic principles of fuel cells, efficiency of fuel cell and limiting factors, design of fuel cells, fuel cells in electric vehicles.

EF-305 ENGINEERING ECONOMICS & MANAGEMENT

Introduction: Basic Concepts and principles of Economics, Micro- and Macro-economic theory, the problem of scarcity. Basic concepts of Engineering Economy, Financial effectiveness and non-monetary factors

Economic Environment: Consumers and producer goods, Goods and services, Demand & Supply concept. Market Equilibrium, Elasticity of demand, Elasticity of Supply, Measures of Economics worth, Price-supply-demand-relationship, Revenue, Cost and profit function.

Elementary Financial Analysis: Basic accounting equation. Development and interpretation of financial statements-Income Statement, Balance Sheet and Cash Flow, Working capital management, Financial Ratio Analysis .

Time Value of Money and Financial Returns: Concepts of simple, compound and effective interest rates, Less often than compounding period and more once a year; Present Value, Future Value and Annuities concepts, Uniform gradient and geometric sequence of cash flow.

Depreciation and Taxes: Depreciation concept, Economic life, Methods of depreciation, Gain (loss) on the disposal of an asset, Depreciation as a tax shield.

Basic cost concepts and Break Even Analysis: Types of costs and cost curves; Determination of Cost/Revenues. Numerical and graphical presentations. Practical applications, BEA as a management tools for achieving financial/operational efficiency

Linear Programming: Mathematical statement of linear programming problems, Graphical solutions, Simplex method, Duality Problems. Business Organizations and financial Institutions: Type of ownership, single ownership, partnerships, corporation, type of stocks and joint stock companies, Banking and specialized credit institutions.

Project Management: Integration of Organization Strategy with Projects, Defining the project, developing a network plan, managing risk, reducing project time, project
selection and comparing alternatives techniques scheduling resources:

Introduction to Projection Management and Production Concepts: Basic production function, stages of production, returns to scales, Production lead time, Production rate, capacity, operations, planning and control, order processing, Scheduling, Material requisitions planning, line of balance

EF-309 Occupational Safety and Health

Introduction to Occupational Safety and Health, Historic development in the subject, Safety Legislations, Safety and Ethics;

Hazards – Mechanical and Machine, Falling, lifting and Vision related hazards, Temperature and Pressure, Electrical, Fire, Radiation, Chemical and Material, Noise and Vibration, Computers and Automation related Hazards, Industrial Hygiene and Confined Spaces; Case Studies

Hazard Analysis, Concepts of Risks, Incidents and Accidents, Accident Prevention and Control, Personal Protective Equipment, Management Responsibilities, Accident Causation, Reporting and Investigation; Case Studies

Developing and maintaining Safety Culture, OSH and Environment Codes, Standards and Regulations, ISO Standards 14001 and 45001/BS OHSAS 18001

EE-401 Electrical Engineering Design Project

The final year students will be required to consult the Chairman of Electrical Engineering Department regarding the offering of various projects in the department. The student or group of students will be assigned the project by teaching by teacher concerned and will carry out the assignment as required a directed by the teacher. At the end of the academic session, they will submit the written report on work of their project to the Chairman, preferably in the typed form. The students will be required to appear before a panel of examiners for oral examination.