

**UNDERGRADUATE PROGRAMME**

**SYLLABUS CIVIL**

**ENGINEERING**

**SEMESTER SYSTEM**

**BATCH: 2023**

**1<sup>st</sup> Year**

**2<sup>nd</sup> Year**

**3<sup>rd</sup> Year**

**4<sup>th</sup> Year**

## SCHEME OF STUDIES

### First Year (F.E.) Civil Engineering

Batch 2023 FIRST YEAR ----- SEMESTER SYSTEM					
Course Code	Course Title	Crd Hrs			
		Th	Pr	T	
<b>Civil Engineering</b>					
<b>FALL</b>	CE-107	Engineering Drawing-I	1	2	3
	CE-102	Statics and Dynamics	3	1	4
	CE-108	Engineering Materials	2	1	3
	EE-123	Basic Electrical Engineering	2	0	2
	MT-114	Calculus	3	0	3
	ES-106	Pakistan Studies OR	1	0	1
	ES-127	Pakistan Studies (for Foreigners)			
<b>SPRING</b>	CE-109	Engineering Surveying-I	2	1	3
	CE-110	Chemistry for Civil Engineers	1	1	2
	CE-111	Introduction to Computing for Civil Engineers	1	2	3
	ME-110	Basic Mechanical Engineering	2	0	2
	EA-111	Functional English	2	0	2
	MT-221	Linear Algebra & Ordinary Differential Equations	3	0	3

## **SYLLABUS –FE SPRING SEMESTER ENGINEERING**

### **CE-107**

### **ENGINEERING DRAWING-1**

**Introduction:**

Use and care of Drawing Instruments, Standard Drawing Office Practice, Principles of Orthographic Projection related to Simple Solids.

**Descriptive Geometry:**

Lines in Space and in Planes showing their traces and true inclination to planes of projection, Plane curves, Cycloid, Hypocycloid, In-volute, Curves of Interpenetration of Solids, Development of Surfaces, Isometric Views, Shadows.

**Machine Drawing:**

Representation of Riveted Joints, Screwed Fastenings, Keys and Cotters, Preparation of fully Dimensioned Working Drawing of component parts of machines, Practice in reading of drawing and deduction of new views from those given.

**Symbols and Abbreviations:**

Building materials, Electric and Plumbing symbols and Abbreviations.

**CE-102**

**STATICS AND DYNAMICS**

<b>Static of Particles:</b>	Forces in a Plane, Newton's First Law, Free Body Diagram, Forces in Space (Rectangular components), Equilibrium of a Particle in Space.
<b>Kinematics of Particles:</b>	Rectilinear and Curvilinear motion of particles, Components of Velocity and Acceleration, Motion relative to a frame in translation.
<b>Kinetics of Particles:</b>	Newton's Second Law, Dynamic Equilibrium, Rectilinear and Curvilinear motion, Work and Energy, Kinetic energy of a particle, Principle of Work and Energy, Conservation of Energy, Impulse and Momentum, Impulsive Forces and Conservation of Momentum, Impact; Direct and Oblique, Conservation of Angular Momentum.
<b>Rigid Bodies:</b>	Equivalent Systems of Forces, Principle of Transmissibility, Moment of a Force, Couple, Varignon's Theorem, Centre of Gravity of a three dimensional body and Centroid of a Volume, Moments of Inertia, Radius of Gyration, Parallel Axis Theorem.
<b>Equilibrium of Rigid Bodies:</b>	Free-Body Diagram, Equilibrium in two and three Dimensions, Reaction at Supports and Connections, Equilibrium of 2-Force and 3-Force Bodies.
<b>Kinematics of Rigid Bodies:</b>	General Plane Motion, Absolute and Relative Velocity and Acceleration.
<b>Plane Motion of Rigid Bodies:</b>	Forces and Acceleration, Energy and Momentum, Conservation of Linear and Angular Momentum.
<b>Friction:</b>	Basic Principles relating to Friction between Solid bodies, Friction angle and Wedges.
<b>Analysis of Structures:</b>	Internal Forces and Newton's Third Law, Planar and Space Trusses, Methods of Joints and Sections, Forces in Cables, Introduction of Shear force and Bending moment in Simply Supported beams and Cantilever beams.

**CE-108**

**ENGINEERING MATERIALS**

**Materials and their Properties**

Introduction of materials, Construction materials, Physical, mechanical and chemical properties, Electrical and thermal properties.

**Binding Materials:**

Introduction and manufacture of Ordinary Portland Cement, Constituents of cement, Types of cement and their use, Properties and field tests of cement, Special cements, Introduction and preparation of lime, Setting and hardening of lime, Applications of lime, Comparison (cost and characteristics) of lime and cement.

**Fine & Coarse Aggregates and Stones:**

Definition and introduction of aggregates, Mechanical and physical properties of aggregates, Importance and methods of grading of aggregates, Introduction, types, applications, characteristics of good building stones, Artificial stones.

**Cementitious materials:**

Introduction and methods of preparation of paste, Properties and application of paste, Introduction and methods of preparation of mortars, Properties and application of mortars, Introduction about concrete Components and manufacture of concrete, properties of concrete, Types of concrete

**Metals (Steel and Aluminium):**

Introduction to steel, Mechanical and physical properties of steel, Application of steel in civil engineering projects, Introduction to aluminium, Mechanical and physical properties of aluminium, Application of aluminium in civil engineering projects

**Ceramics, Bricks and Blocks:**

History and evolution of ceramics, Manufacture of ceramics, Properties and applications of ceramics in buildings, History and evolution of bricks, Properties and applications of bricks, Dimensions, manufacture and classification of bricks, History and evolution of bricks, Properties and applications of bricks, Dimensions, manufacture and classification of bricks, History and evolution of blocks, Properties and applications of blocks, Dimensions, manufacture and classification of blocks.

**Glass and Wood:**

Constituents of glass and methods of manufacture, Types, use and significance of glass in civil engineering, Advantages and drawbacks of glass, Structure of tree and general characteristics, Types, seasoning and preservation of wood, Lamination of wood

**Pavement Materials:**

Bitumen, Asphalt, Road Metal,

**Miscellaneous Construction Materials:**

Asbestos, Plaster of Paris, Abrasives, Rubber, Cork, Plastics, Paint, Thermometry and acoustics, Bamboo, Natural, artificial and steel fibres, Modern Materials, (Fibre reinforced polymer etc.)

**EE-123****BASIC ELECTRICAL ENGINEERING****Electric and  
Magnetic Circuits:**

Electric Circuits, Kirchoff's Laws, Superposition Theorem, Substitution Theorem  
Thevenin's Theorem Norton's Theorem, Rosen's Theorem of Star/mesh  
Transformation, Proof for DC circuits and their application to Circuit Analysis,  
Magnetic Circuits, Series and Parallel circuits, Principles of calculation of Ampere-  
turns for Magnetic Circuits of Electromagnets, Transformers, Bipolar and Multi-  
polar DC machines, Inductances in Series and Parallel, Hysteresis Loss, Eddy Current  
Loss, Lifting Power of a Magnet.

**AC Single Phase and  
Poly phase Systems:**

Single Phase systems, Series, Parallel and Series Parallel Circuits, J Operator  
Method and Polar Method, Resonance and Measurement of Power and Power Factor,  
Poly-phase Systems, Poly-phase Generation, Star and Delta Connections, Voltage  
and Current relations, Measurement of Power and Power Factor, Balanced and  
Unbalanced Load Analysis.

**DC Machines:**

Construction, Simple Lap and Wave Windings, Equalising Connections and  
Dummy Coils, Elementary concept of Armature Reaction and Commutation, Cross  
and Demagnetising Ampere-turns. DC Generators, Types, EMF Equation, Losses,  
Efficiency Performance Curves, Characteristics, Critical Resistance, Speed and  
Effect of Armature Reaction of OCC, Internal and External Characteristics from  
OCC neglecting and accounting Armature Reaction, Calculation of Series Ampere-  
turns for Level and Over, Compounding, Motors, Principle, Back EMF, Torque,  
Speed and Speed Regulation, Types, Characteristics, Performance Curves. Losses  
and Efficiency, Speed and Torque problems involving Magnetization Curve,  
Charging and Ignition Circuits of Automobiles

**AC Synchronous:**

Construction, Stator Single Layer, Double Layer and Concentric Windings,  
Damping Windings, Coil Span Factor, Distribution Factor, Leakage and Armature  
Reaction, Synchronous Impedance, Alternation, Types, EMF Equation, Speed and  
Frequency, Losses and Efficiency, Alternator on Load, Voltage Regulation by  
Synchronous Impedance Method, Synchronous Motors, Types, Principle of  
Working, Vector Diagram on Load and its analysis for Stator Current, Power Factor,  
Torque and Mechanical Output, Effect of Variation of Excitation, Losses and  
Efficiency.

**Machine AC Induction**

Induction Motors, Construction, Types, Rotating Field Theory, Principle of  
Working.

**Machines:**

Slip and its effect on Motor Current Quantities, Losses, Efficiency and Performance  
Curves, Starting, Full Load and Maximum Torque relations, Torque Slip  
Characteristics.

**Transformers:**

Construction, Principle of Working, EMF Equation, Transformation Ratings, No  
Load Working and Vector Diagram, Magnetizing Current, Vector Diagram on Load,  
Equivalent Circuit, Open Circuit and Short Circuit Test, Losses, Efficiency and  
Performance Curves, All-day-efficiency, Percentage and Per Unit R, X and Z,  
Voltage Regulation and Kapp's Regulation Diagram, Transformer as a Mutually  
Inductive Circuit.

**Converting Machines:**

Rotary Converters, Construction, Principle of Working, Transformer Connections,  
Voltage and Current Ratings of Single and 3 Phase Converters, Mercury Arc  
Rectifiers, Construction, Operation, Transformer Connections, Voltage and Current  
Ratios of Single Phase and 3 Phase Rectifiers

**MT-114****CALCULUS****Set and Functions:**

Define rational, irrational and real numbers; rounding off a numerical value to specified number of decimal places or significant figures; solving quadratic and rational inequalities involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, DeMorgan'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.

**Propositional Logic:**

Definition of Proposition, Statement and Argument, Logical Operators, Simple and Compound proposition, various types of connectives, Truth table, tautology, Contradiction, Contingency & Logical equivalence.

**Boolean Algebra:**

Definition, Boolean function, duality, some basic theorems & their proofs, two valued Boolean algebra, Truth functions, Canonical sum of product form, Digital logic Gates & Switching circuit designs

**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)

**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'Hopital's 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, exact differential and its application in computing errors, extreme values of a function of two variables with and without constraints, Solution of nonlinear 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, Centre of pressure and depth of centre of pressure

**Solid Geometry:**

Coordinate Systems in three dimensions, Direction cosines and ratios, vector equation of a straight line, plane and sphere, Curve tracing of a function of two and three variables, Surfaces of revolutions, transformations (Cartesian to polar & cylindrical)

**ES-106**

**PAKISTAN STUDIES**

**Historical and ideological perspective of Pakistan Movement:**

Two Nation Theory: Claim of Muslims of being a separate nation from Hindus, based upon cultural diversity. Cultural diversity and interests as bases for the demand of Pakistan – Lahore resolution. Creation of Pakistan: Factors leading to the creation of Pakistan. Quaid-e-Azam and the demand of Pakistan.

**Constitutional Process:**

Constitutional and Political developments in Pakistan 1947-1973. Salient features of the Constitutions 1956, 1962 and 1973 and amendments.

**Land of Pakistan:**

Geo-physical conditions. Geo-political and strategic importance of Pakistan. Natural resource, viz: mineral, water and power.

**Contemporary issues in Pakistan:**

A brief survey of Pakistan Economy: problems, issues and future prospects. Pakistani Society and Culture-Broad features with emphasis on youth role in the development of Pakistan. Literacy and education in Pakistan: problems and issues. State of Science and Technology in Pakistan: A comparison with other countries with special reference to the Muslim world. Environmental issues in Pakistan: government policies and measures and suggestions for improvement. Pakistan's role in the preservation of nature through international conventions / treaties. Human Rights in Pakistan: Pakistan's response to human rights issues at national & international levels. Pakistan's Foreign Policy Urbanization in Pakistan - problems and issues



**ES-127**

**PAKISTAN STUDIES (FOR FOREIGNERS)**

**Land of Pakistan:**

Land and People, Strategic Importance, Important and Beautiful Sights: Natural Resources (some portion of Economics of Pakistan)

**A Brief Historical Background:**

A brief historical survey of Muslim Community in the Sub- Continent, British Rule and its Impacts, Indian Reaction, Two-Nation Theory, its Origin and Development, Factors leading towards the Demand of a separate Muslim State, Creation of Pakistan.

**Government & Political Development in Pakistan: and**

Constitution of Pakistan, A brief outline, Governmental Structure, Federal Provincial, Local Government Institutions, Political History and its brief account.

**Pakistan & the Muslim World:**

Relations with Muslim Countries

**Language and Culture:**

Origin of Urdu Language, Influence of Arabic and Persian on Urdu Language and Literature, A short history of Urdu Literature, Dominant Cultural Features.

## **SYLLABUS – FE SPRING SEMESTER ENGINEERING**

### **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, Tacheometry, Theodolite survey

#### **Modern Methods in Surveying:**

Principles of EDM operation, EDM characteristics, Total stations, field procedures  
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.

**CE-110**

**CHEMISTRY FOR CIVIL ENGINEERS**

**Electrochemistry:**

Laws of Electrolysis, E.M.F. series, corrosion (Theories, inhibition & protection)

**Cement & aggregates:**

Chemical composition, Hydration, Structure of hydrated cement, Influence of the compound composition on properties of cement, Alkali- silica reaction in aggregates, Alkali- carbonate reaction, Tests for aggregate reactivity

**Durability of Concrete:**

Diffusion and absorption, Carbonation, Acid attack on concrete, Sulfate attack on concrete, Effects of sea water on concrete

**Water-related chemistry:**

pH, Chloride, TDS, Hardness

**Soil-related Chemistry:**

Chemical formation of soils, pH, organic content, salt content, Mica content

**CE-111**

**INTRODUCTION TO COMPUTING FOR CIVIL ENGINEERS**

**Computer and System:**

Computer hardware fundamentals, Operating Systems: DOS, WINDOWS.

**Fundamentals:**

Spreadsheets, Flow Chart techniques.

**Structured programming Language:**

Character set, keywords, identifiers, data types and size, variable declaration, expression, labels, statements, formatted input output statements, types of operators, data type operators, data type conversion, mixed mode arithmetic, control structures, Functions, library functions, parameter passing, recursion, arrays declaration, initialization and usage, multi-dimensional arrays. Files, function for file handling, I/O Operations.

Selected topics in Programming, with emphasis on numerical techniques as applied to civil engineering problems

**MATLAB:**

Import / export data, Create and manipulate variables, Program and run simple scripts, graphics tools to display data.

**ME-110**

**BASIC MECHANICAL ENGINEERING**

<b>Thermodynamic Properties:</b>	Working Substance, System, Pure Substance, PVT Surface, Phases, Properties and State, Units, Zeroth Law, Processed and Cycles, Conservation of Mass.
<b>Energy and its Conservation:</b>	Relation of Mass and Energy, Different Forms of Energy, Internal Energy and Enthalpy Work, Generalized Work Equation Flow and Non-Flow Processes, Closed Systems, First Law of Thermodynamics, Open Systems and Steady Flow, Energy Equation for Steady Flow, System Boundaries, Perpetual Motion of the First Kind.
<b>Energy and Property Relations:</b>	Thermodynamic Equilibrium, Reversibility, Specific Heats and their Relationship, Entropy, Second Law of Thermodynamics, Property relations from Energy Equation, Frictional Energy.
<b>Ideal Gas:</b>	Gas Laws, Specific Heats of an Ideal Gas, Dalton's Law of Partial Pressure, Thermodynamic Processes.
<b>Fundamentals of Heat Transfer:</b>	Conduction and Convection, Radiation, Thermal Conductivity, Overall Heat Transfer Coefficients, Practical Equations.
<b>Thermodynamic Cycles:</b>	Cycle Work, Thermal Efficiency Carnot Cycle, Reversed and Reversible Cycles, Most Efficient Engine.
<b>Two-Phase Systems:</b>	Two-Phase System of a Pure Substance, Changes of Phase at Constant Pressure, Steam Tables, Superheated Steam, Liquid and Vapour Curves, Phase Diagrams, Rankine Cycle, Components of Steam Power Plant.
<b>Internal Combustion Engines:</b>	Otto Cycle, Diesel Cycle, Dual Combustion Cycle, Four-stroke and Two-stroke Engines, and Types of Fuel.
<b>Reciprocating Compressors:</b>	Condition for Minimum Work, Isothermal Efficiency, Volumetric Efficiency, Multi-Stage Compression, Energy Balance for a Two-Stage Machine with Intercooler.
<b>Introduction to Air-Conditioning and Refrigeration:</b>	Heating and Cooling Load and its calculations, Comfort Charts, Outline of A.C. Systems, Consideration for Air – Conditioning in Buildings, Natural Ventilation, Insulating Materials.

**EA-111**

**FUNCTIONAL ENGLISH**

**Speaking and Listening:**

Listening actively through the use of skills and sub skills, and in a variety of situations. Speaking: Fluency and confidence building through group discussions, role plays and public speaking.

**Vocabulary development:**

Tips / strategies in vocabulary enhancement, Practice in vocabulary development

**Reading:**

Reading skills, Sub skills, reading strategies, reading practice through variety of reading texts and comprehension exercises, Précis writing

**Writing:**

Note taking: Techniques for taking notes from lectures, from books (integrated with listening & reading). Process of Writing with practice in pre writing strategies, in revising, and in, editing for grammar. Writing well- structured and effective paragraphs, essays and letters (routine communication) using proper writing mechanics. Writing descriptions, narrations, cause and effect, compare and contrast etc.

**MT-221****LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS****Linear Algebra:**

Linearity and linear dependence of vectors, basis, dimension of a vector space, 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, Diagonalization, Applications of linear algebra in relevant engineering problem

**1<sup>st</sup> 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 form, Linear differential equations of the order and equations reducible to the linear form. Bernoulli's equations and orthogonal trajectories, Application in relevant Engineering

**2<sup>nd</sup> and Higher Orders Equations:**

Special types of 2<sup>nd</sup> order differential equations with constant coefficients and their solutions, The operator D, Inverse operator 1/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.

**SCHEME OF STUDIES****Second Year (S.E.) Civil Engineering**

Batch 2023 SECOND YEAR ----- SEMESTER SYSTEM					
Course Code	Course Title	Crd Hrs			
		Th	Pr	T	
<b>Civil Engineering</b>					
<b>FALL</b>	CE-201	Engineering Surveying-II	3	1	4
	CE-205	Mechanics of Solids-I	3	1	4
	CE-220	Geology for Engineers	2	1	3
	ES-205	Islamic Studies OR	2	0	2
	ES-209	Ethical Behavior (for Non-Muslims)			
	EA-218	Business Communication	2	1	3
	AR-309	Architecture and Town Planning	3	0	3
<b>SPRING</b>	CE-222	Engineering Drawing-II	1	2	3
	CE-219	Fluid Mechanics-I	3	1	4
	CE-221	Structural Analysis-I	3	0	3
	EA-219	Professional Ethics	2	0	2
	MT-331	Probability & Statistics	3	0	3
	CF-303	Applied Economics for Engineers	3	0	3
	EA-200	Community Service	NC		



**SYLLABUS – SE FALL SEMESTER ENGINEERING**

**CE-201**

**ENGINEERING SURVEYING – II**

**Surveying Drafting and Computations:**

General, Maps and Plans, Plotting, Contour Maps, Profiles, Cross- sections, End areas and Volumes, Prismoidal formula, Calculation of volumes, Area computations, Area by graphical analysis, Use of surveying software.

**Highway and Railway Curves:**

Route surveys, Circular curves, Deflections and Chord calculations, Setting out circular curve by various methods, Compound curves, Reverse, Vertical, Parabolic curves, Computation of the high or low point on a vertical curve, Design considerations, Spiral curves, Spiral curve computations, Approximate solution for spiral problems, Superelevation.

**Construction Surveys:**

Introduction, Horizontal and Vertical control, Buildings, Rail Road, Pipelines and other construction surveys.

**Hydrographic Surveys:**

General, Objectives of hydrographic survey and electronic charting, Planning, Survey vessels, Vertical control, Depth and Tidal measurements, Position-fixing techniques, Sounding plan, Horizontal control, Processing and Presentation of data.

**Photogrammetry:**

Introduction, Aerial photogrammetry and its Applications, Flying heights, Flight planning, Relief displacement, Photograph overlap, Ground control for mapping, Mosaics, Stereoscopic viewing and Parallax, Stereo plotting instruments, Analytical plotters, Orthophotos, Photogrammetric mapping.

**Control Surveys:**

General, Geodesy Universal Transverse Mercator grid system, Modified Transverse Mercator grid system, State plane coordinate grid system, Lambert projection, Computations for the Lambert projection, Computations for the Transverse Mercator Secant Projection, Use of grid coordinates, Horizontal control techniques, Triangulation, Control survey markers, Direction of a line by observations on Polaris, Time and procedure for Observing Polaris, Computation technique for azimuth determination, Gyro theodolite.

**Global Positioning System (GPS):**

Background information, Global positioning, Receivers, Satellites, Errors, GPS surveying techniques and applications, Survey planning, Initial ambiguity resolution, Vertical positioning.

**CE-205**

**MECHANICS OF SOLIDS – I**

**Different Stress States:**

Uniaxial state of stresses and strains, Relationships between elastic Constants, Response of materials under different sets of monotonic loading, Normal and shearing stress and strains, Gradually and suddenly applied loads, Distribution of direct stresses on uniform and non-uniform members, Thermal stresses and strains

**Bending Theory:**

Theory of simple bending, position of neutral axis, moment of resistance and section modulus, Bending and shearing stress distribution in beams, Relationship between load, shear force and bending moment, Stresses in composite sections.

**Slope and Deflection:**

Curvature, slope and deflection of beams using integration methods

**Theory of Torsion:**

Theory of torsion of solids and hollow circular shafts, shearing stress distribution, angle of twist, strength and stiffness of shaft.

**Biaxial state of stress:**

Biaxial state of stresses, resolution of stresses, Principal plane, principal stresses and strains, Graphical representation of stress and strains, Mohr's circle of stresses and strains.

**CE-220**

**GEOLOGY FOR ENGINEERS**

**General Geology  
Definition and Scope:**

The earth as planet, Process of external origin, weathering, erosion, transportation and deposition, of rock material by geological agents, Processes of internal origin volcanism, earthquakes, intrusion, metamorphism and the rock cycle, diastrophism and isostasy.

**Elements of  
Structural Geology:**

Folds and faults, joints, fractures and cleavages, unconformities, primary and secondary structural features of rock, Expression of these features on geological field maps and construction of cross sections and geological mapping.

**Elements of  
Crystallography:**

Crystallographic system, Important rock and soil forming minerals, and their identification Igneous Sedimentary and metamorphic rocks, fossils, Basic principles of stratigraphy, Geologic time scale, Brief introduction of local geology from bore logs.

**Applied Geology:**

Application of geology to planning and design of dams, reservoirs, bridges and tunnels, Application of geology to building materials and soils.

**Rock Classification:**

Litho logical classification, Classification by field measurements and strength tests by rock testing, Physical and mechanical property of rocks.

**Earthquakes:**

Theory of plate- tectonics, seismic waves, seismology, prediction of earthquakes and preventive measures against earthquakes, Ground subsidence and land slides.

**ES-205**

**ISLAMIC STUDIES**

**Fundamentals of Islam:**

Tauheed, Arguments for the Oneness of God, Impact of Tauheed on human life, Place of Man in the Universe, Purpose of creation, Textual study of Surah Al-Rehman and Sura Al-Furqan, Prophet hood, Need for prophet, Characteristics of prophet, Finality of Prophet hood, Seerat life of the Prophet as embodiment of Islamic-Ideology, Faith in Here-after (AKHRAT), Effects of the beliefs on worldly life

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**Ibadah:**

Concept of Ibadah, Major Ibadah, Salat, Zakat, Hajj and Jihad

**Basic Source of Shariah:**

The Holy Quran, Its Revelation and Compilation, The Authenticity of the Text, Hadith, Its Need, Authenticity and Importance, Consensus (Ijmaa), Analogy (Qiyas)

**Sources of Knowledge:**

Islamic Approach to Intuition, Reason and Experience, Revelation (Wahi) as a Source of Knowledge

**Moral and Social  
Philosophy of Islam:**

The concept of Good and Evil, Akhlaq-e-Hasna with special reference to Surah Al-Hujrat, Professional Ethics (Kasb-e-Halal)

**ES-209**

**ETHICAL BEHAVIOUR 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 Quran and its Philosophical basis, Ethical precepts from Quran and  
Hadith and Promotion of Moral Values in Society

**EA-218**

**BUSINESS COMMUNICATION**

**Foundations of Business Communication:**

Definitions: communication, organization, business; understanding the need and scope of business, professional and organizational communication, Conditions, properties, process, tools, modes, levels, types of communication. Principles of Effective Communication & Building goodwill (You-attitude, positive emphasis and unbiased language). Listening, non-verbal communication. Communication dilemmas and problems. Feedback and its types. Audience Analysis

**Oral Communication:**

Group Discussions and interpersonal skills, Meetings, Interviews, Making presentations

**Business & Technical Writing:**

Types of messages: Formats (Letter and memorandum). Letter and memorandum elements and formats. Three Types of Business Messages (routine, negative and persuasive communications). Organizational Plans: Direct, Indirect & AIDA approach. Writing business messages (e-mails, inquiries, requests, replies, regrets, declining offers, letters, routine messages, etc.). Meetings: notice, \ agenda and minutes. Job applications and resumes. Research / scientific reports (structure, layout, writing process)

**AR-309**

**ARCHITECTURE & TOWN PLANNING**

**Architecture**

<b>Historical Development:</b>	Egyptian, Asiatic, Greek, Roman Byzantine and Gothic Architectures, Modern trends with emphasis on Muslim architecture.
<b>Influences:</b>	Geographical, climatic, religious, social, historical.
<b>Principles:</b>	Truth or purpose & beauty.
<b>Qualities:</b>	Strength, vitality, grace, breadth and scale.
<b>Factors:</b>	Proportion, colour and balance.
<b>Use of Materials:</b>	Stone, wood metals, concrete, Composite, ceramics.
<b>General Treatment to Plan of Buildings:</b>	Walls and their construction, Openings and their position, character and, Roofs and their development and employment, Columns and their position, form and decoration, Molding and their form and decoration, Ornament as applied to any buildings.

**Town Planning**

<b>Purpose and Scope:</b>	Definitions of town planning, Trends in Urban growth, Objectives of sound planning, Modern planning in Pakistan and abroad.
<b>Information Required:</b>	Maps, natural resources, economic resources, legal and administrative problems, civic survey.
<b>Urban Ecology:</b>	Need and scope of comprehensive plan, Phases of planning, Principles of planning, Communication (rail road network & airport etc.), port and harbour facilities, street traffic and design.
<b>Urban Zoning and Land Use Control:</b>	Parks and recreation facilities, location of public and semi-public buildings, civic centers, commercial centers, local shopping centers, public schools, Location of industry & residential areas, lay out of street, road crossing & lighting, Community planning, Suburban development, Slum areas and their upgrading.

## SYLLABUS – SE SPRING SEMESTER ENGINEERING

### CE-222

### ENGINEERING DRAWING – II

**General:**

Need and requirement of drawings for civil Engineering projects. General nature of drawings, components, symbols and nomenclature needed for specific drawings such as architectural, structural, plumbing, electrical, air-conditioning, roads and earth work etc. Drawings at different stages of projects, Elements of perspective drawing

**Civil Engineering Drawing:**

General description of drawings related to civil Engineering projects.

**Building Drawing:**

Elements of architectural planning and design, conceptual, schematic and working drawings and details of residential, commercial, religious, recreational, industrial, clinical, hospital, and educational buildings, Details of doors, windows, staircases etc.

Elements of structural drawing and detailing, preparation of foundation plan, structural framing, slab details, staircase details, water tanks, beam and column elevations and sections mostly pertaining to reinforced concrete structures.

Details of steel roof truss, connection details and fabrication drawings

Plumbing and electrical detailing pertaining to small residential units

**Computer Aided Drafting:** General and basic know how related to computer aided drafting, e.g. co-ordinate system, drawings setup procedure, basic draw commands, basic edit commands, Layers, creating text and defining styles options, block and drawing import/export options, Cross hatching, save and plot (2D) and isometric drawings.



**CE- 219**

**FLUID MECHANICS – I**

**Basic Concepts and Definitions:**

Units, Density, specific weight, mass, viscosity etc.

**Fluid statics:**

Pascal's Law, Measurement of pressure, Pressure head, Manometers, Hydrostatic forces on submerged areas (vertical, inclined and curved), Buoyancy of fluids.

**Fluid Kinematics:**

Types of flow, Streamline and streak lines, Velocity and acceleration in steady & unsteady flow, Continuum, Lagrange and Eulerian description, Equation of continuity, mass flow rate, weight flow rate, stream function and velocity potential function and orthogonally, flow net, Rotational and irrotational flow.

**Energy Consideration in Steady Flow:**

Concept of Energy and head, General equations of energy and Bernoulli's assumption for incompressible fluids, Hydraulic grade line and energy line, power consideration, cavitation

**Impulse-Momentum:**

Basic principle, Force on pressure conduits, reducers and bends, jet of water, Structure in open channel.

**Similitude:**

Definitions, Geometric, Kinematic and Dynamic similarities, dimensionless numbers, Buckingham-Pi Theorem.

**Fluid Properties Measurements:**

Fluid properties, Hydrostatic Pressure, velocity measurements, Orifices meter, free and forced vortex, venture meter, notches & weirs,

**CE - 221**

**STRUCTURAL ANALYSIS - I**

**Introduction:**

Introduction of Structural forms, two dimensional pin connected and flexural forms, three dimensional pin connected and flexural forms: Surface structures, Simplification for analysis and design.

**External Loads:**

Techniques of evaluation of estimated external loads, Dead, Live, Wind and Earthquake loads, Use of codes in estimating different types of external, Static, Dynamic and Moving loads, Load combinations.

**Determinacy of Structure:**

Determinate and indeterminate structures, Static and kinematics determinacy, Compatibility and boundary conditions: Structural safety, Stress and deformation characteristics, Small deflection theory.

**Evaluation of Deformation Using Geometric Methods:**

Principal of superposition, Moment area method, Conjugate beams method and Newmark's method

**Evaluation of Deformation Using Energy Principles:**

Unit load method, Principal of real work, Principal of virtual work: Castigliano's theorems

**Arches and Suspension Structures:**

Analysis of arches, Introduction to suspension type structures: Importance of stiffened girders.

**EA-219**

**PROFESSIONAL ETHICS**

**Introduction to Professional & Engineering Ethics:**

Definitions - Ethics, Professional Ethics, Engineering Ethics, Business Ethics; Ethics & Professionalism. Need and scope of Engineering and Professional Ethics through Case Studies. Development of Engineering Ethics & Major issues in Engineering & Professional Ethics

**Moral Reasoning & Ethical Frameworks:**

Ethical Dilemma: Resolving Ethical dilemmas and making Moral Choices. Codes of Ethics (of local and international professional bodies). Moral Theories: Utilitarianism, Rights Ethics and Duty Ethics, Virtue Ethics Self-Realization & Self Interest. Ethical Problem Solving Techniques: Line drawing, flow Charting, Conflict Problems. Case Studies and applications.

**Contemporary Professional Ethics**

Professional Responsibilities. Risk and Safety as an Ethical Concern for Engineers Workplace Responsibilities and Ethics: Teamwork, confidentiality and conflicts of interest, Whistleblowing, Bribe and gift, risk and cost - benefit analyses, gender discrimination and sexual harassment. Environmental Ethics. Computer Ethics & the Internet. Honesty: Truthfulness, trustworthiness, academic and research integrity

**MT-331****PROBABILITY & STATISTICS**

<b>Statistics:</b>	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
<b>Measures of Central Tendency and Dispersion:</b>	Statistics Averages, Median, Mode, Quartiles, Range, Moments, Skewness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems
<b>Curve Fitting:</b>	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.
<b>Simple Regression &amp; Correlation:</b>	Introduction, Scatter diagrams, Correlation & its Coefficient, Regression Lines Rank Correlation & its Coefficient, Probable Error (P.E), Related problems
<b>Sampling and Sampling Distributions:</b>	Introduction, Population, Parameter & Statistic, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-Sampling Errors, Random Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems
<b>Statistical Inference and Testing of Hypothesis:</b>	Introduction, Estimation, Types of estimates, Confidence interval, Tests of Hypothesis, Chi-Square distribution/test, one tails & two tails tests, Application in related problems
<b>Probability:</b>	Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability, Conditional probability, Baye's rule, Related problems in practical significance
<b>Random Variables:</b>	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
<b>Probability Distributions:</b>	Introduction, Discrete probability distributions, Binomial, Poisson. Hyper geometric & Negative binomial distributions, Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance.

**CE-303**

**APPLIED ECONOMICS FOR ENGINEERS**

<b>Introduction:</b>	Basic Concepts and principles of Economics, Micro-economics theory, the problems of scarcity, Basic concept of Engineering Economy
<b>Economic Environment:</b>	Consumer and Producer goods, Goods and services, Demand and supply concept, Equilibrium, Elasticity of demand, Elasticity of supply, Measures of Economic worth, Price-supply-demand-relationship
<b>Elementary Financial Analysis:</b>	Basic accounting equation, Development and interpretation of financial statements- Income Statement Balance Sheet and Cash flow, Working capital management
<b>Break Even Analysis:</b>	Revenue/cost terminologies, Behavior of Costs, Determination of Costs/Revenues, Numerical and graphical presentations, Practical applications, BEA as a management tool for achieving financial/operational efficiency
<b>Selections Between Alternatives:</b>	Time value of money and financial rate of return, Present value, Future value and Annuities, Cost-benefit analysis, Selection amongst materials, techniques, designs etc. investment philosophy, Investment alternatives having identical lives. Alternatives having different lives, Make or buy decisions and replacement decisions
<b>Value Analysis/ Value Engineering:</b>	Value analysis procedures, Value engineering procedures, Value analysis versus value engineering, Advantages and application in different areas, Value analysis in designing and purchasing
<b>Linear Programming:</b>	Mathematical statement of linear programming problems, Graphic solution Simplex procedure, Duality problem
<b>Depreciation and Taxes:</b>	Depreciation concept. Economic life, Methods of depreciation, Profit and returns on capital, productivity of capital, Gain (loss) on the disposal of an asset, depreciation as a tax shield
<b>Business Organization &amp; Industrial Relationship</b>	a) Type of ownership, single ownership, partnerships, corporation, type of stocks and joint stock companies, Banking and specialized credit institutions b) Labour problems, Labour organizations, Prevention and settlement of disputes
<b>Capital Financing and Allocation:</b>	Capital Budgeting, Allocation of capital among independent projects, financing with debt capital, Financing with equity capital, Trading on equity, Financial leveraging

## SCHEME OF STUDIES

### Third Year (T.E.) Civil Engineering

Batch 2023 THIRD YEAR ----- SEMESTER SYSTEM					
Course Code	Course Title	Crd Hrs			
		Th	Pr	T	
<b>Civil Engineering</b>					
<b>FALL</b>	CE-320	Reinforced Concrete Design-I	3	0	3
	CE-321	Construction Engineering	3	0	3
	CE-302	Transportation Engineering-I	3	1	4
	CE-319	Fluid Mechanics-II	3	1	4
	MT-443	Numerical Analysis	3	0	3
<b>SPRING</b>	CE-323	Quantity & Cost Estimation	3	0	3
	CE-305	Soil Mechanics-I	3	1	4
	CE-314	Structural Analysis-II	3	0	3
	CE-322	Mechanics of Solids-II	3	0	3
	CE-424	Essentials in Construction Project Management	3	0	3
	*EA/ES	Foreign Language			

**SYLLABUS – TE FALL SEMESTER ENGINEERING**

**CE-320**

**REINFORCED CONCRETE DESIGN – I**

**Constituent Materials & Properties:**

Concrete constituent material and its mechanical properties, Properties of hardened cement concrete. Durability aspects and factors contributing towards durability

**Basic Principles of Reinforced Concrete:**

Basic principles of reinforced concrete design and associated assumptions, Behavior of reinforced concrete members in flexure, Design philosophy, design codes, factor of safety and load factors, Prevailing methods of design of reinforced concrete members.

**Working Stress Method of Analysis:**

Working stress method, serviceability criteria and checks for deflection, crack width, and crack spacing, Importance of working stress method related to prestress.

**Ultimate Strength Method:**

Ultimate strength method, analysis of prismatic and non-prismatic sections in flexure, Compatibility based analysis of sections and code requirements for flexure, Analysis of one-way solid and ribbed slabs, two way solid slabs with general discussion on other slab systems, Design for flexure

**Shear in Beams: Bond, Anchorage & Development Length:**

Shear stress in reinforced concrete sections, models and analogies towards solution of diagonal tension problem, Design for diagonal tension Design and detailing for bond, anchorage, development length, laps and splices.

**Columns & Footings:**

Analysis of sections in pure compression, Design of short columns under pure compression and with eccentric loading, Isolated footings, structural design of simple rectangular footing and combined footing.

**CE-321**

**CONSTRUCTION ENGINEERING**

<b>Introduction:</b>	Construction Projects, Project Life Cycle Phases, Key Players, Project Success Parameters, Normal Tracking and Fast Tracking, Project Categories, Building Permits; Codes and Regulations, Construction Standards, Sustainability.
<b>Construction Equipment:</b>	Types of Equipment used specifically in Building Construction, Analysis of Capital; Operating; Investment; Maintenance; Repair Costs, Equipment Productivity and Cost Effectiveness.
<b>Over-view of Constructional Aspects:</b>	An over view of constructional aspects for different types of engineering projects, e.g. building retaining structures, bridges, pavements and special structures, General consideration common to all projects with special reference to building structures.
<b>Layout Techniques:</b>	Site Selection and Orientation of Buildings, Grading Considerations, Layout techniques with special reference to buildings.
<b>Excavation:</b>	Excavation in deferent types of soils, stability of excavation and solution of particular problems arising out of condition of sub-soil at site e.g. de-watering, shoring and bracing, sheet piling etc.
<b>Placement of Concrete:</b>	Methods of preparation pouring, placement and curing of concrete in foundations. Construction joints in raft foundations, mass concreting, Plinth joints in raft foundations, mass concreting, Plinth beams and plinth protection, damp proof course.
<b>Construction Methodologies:</b>	In-Situ and Pre-Cast Concrete Construction of Buildings, Slab on Grade, Plain Cement Concrete Floors, Planar and Non-Planar Roofing Systems. Doors, Windows, Masonry, Brickwork, Glazing, Cladding, Façade, Curtain Wall, Floor Finishing, Interior and Exterior Building Finishes, and Water Proofing. Protection of adjacent Structures. Mechanized construction. Design and use of formwork for various building units/members. Methods of Concreting Vertical and Horizontal Members, including Mechanized Placement, Ready Mix Concrete etc. Construction Joints, Mass concreting, Plinth Beams and Plinth Protection. Planar and Non-Planar Construction Aspects related to Services.



**CE-302**

**TRANSPORTATION ENGINEERING-I**

**Transportation Planning:**

Modes of transport, Development of various modes in Pakistan, Role of highways within a Transport System, Highway classification, Highway planning and economic appraisal, Network planning, origin and destination studies

**Highway Engineering:**

Geometric design including cross section elements, Highway materials. tests and construction practices, Flexible and rigid pavement design, Highway drainage, Highway maintenance.

**Traffic Engineering:**

Traffic flow characteristics, Traffic studies, Capacity analysis, Traffic control devices.

**CE-319**

**FLUID MECHANICS – II**

**Steady Flow through Pressure Conduits:**

General equation for friction, Laminar and turbulent flow, Reynold's Number, Velocity profile in circular pipes, Nikurade's experiment- viscous sub layer; smooth, transition and fully rough pipe concepts and equations & Moody's Diagram, Minor losses, simple pipe-networks-Hardy cross method.

**Steady Flow in Open Channel:**

General equation for friction for open channel, Uniform flow equations(Chezy and Manning), Most Efficient sections, Specific energy, Subcritical, critical and supercritical flow, Froude Number, Non rectangular sections.

**Hydraulic Scale Models:**

Overview of similitude and dimensional analysis, models and prototype, scaling, problems for application.

**Unsteady Flow:**

Discharge with varying heads, Unsteady Flow in incompressible fluids in pipe establishment of steady flow, water hammer and Surge chamber.

**Pumps:**

Types- Centrifugal, Axial flow, reciprocating, rotary, impellers, radial , axial, mixed flow, Specify speed, operating point of pumps, NPSH, pump characteristic curves.

**Turbines/Hydro Power Engineering:**

Types, reaction and impulse-turbines, Momentum equation applied to turbines, Specify speed, Turbine characteristic, Components of Hydro Electric plants.

**MT-443**

**NUMERICAL ANALYSIS**

**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.

**Finite Difference:**

Functions of operators, difference operators and the derivative operators, identities, Linear homogeneous and non-homogeneous difference equations, Numerical Differentiation, Forward Difference Method, Backward Difference Method, Central Difference Method

**Solution of Non-linear Equation**

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. Fixed point iteration, Bisection Method, Non-linear systems of equations, application to consolidation settlement and seepage analysis.

**Solution of Linear Equation:**

Numerical methods for finding the solutions of system of linear equations (Gauss-Elimination, Gauss-Jordan Elimination, Triangularization, Cholesky, Jacobi and Gauss-Seidel), Applications to structural analysis and water distribution network problems.

**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, 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)

## **SYLLABUS – TE SPRING SEMESTER ENGINEERING**

### **CE-323**

### **QUANTITY & COST ESTIMATIONS**

<b>General:</b>	Scope of civil engineering works, General practice in industry or schedule of rates and specifications, Rates analysis, Procedure and Application to Concrete, Description of Schedule of Values, Specifications for various items in construction.
<b>Estimating Basics:</b>	Concept, Need and Significance, Estimate Categories and Project Life Cycle(PLC), Role of Estimates in PLC, Estimate Types, Estimate Accuracy vs. Time, Scheduling the Estimating Process, Estimating Data Needs; Sources; and Data Collection Approaches, Estimating Considerations, Estimating Procedure, Computerized Estimating Overview.
<b>Developing Preliminary Estimates:</b>	Development Process and Illustrative Examples of Conceptual and Assemblies Estimates.
<b>Quantity Takeoff Basics:</b>	Process, Measurement Units, Takeoff Rules, Measurement Accuracy, Organization of Takeoff, Overview of Takeoff by Computer, Review of Estimate Math.
<b>Pricing Basics:</b>	Pricing Parameters, Pricing Sources, Contractor's Risk of Pricing Low or High, Direct and Indirect Cost, Labor Productivity, Overview of the Process and Considerations of Pricing; Labor; Equipment; Materials; Subcontracted Work; and General Conditions.
<b>Definitive Estimates:</b>	Working out quantities, rates and costing analysis of construction works.
<b>Bill Processing:</b>	General principle, Contents and preparation of bills of quantities for a project and maintaining of Measurement Books.
<b>Estimating Worked Examples:</b>	Quantity Takeoff and Pricing of Labor, Material and Equipment for; Sitework, Concrete, Masonry, Carpentry, and Finishes Works; Overview and Discussion of Estimating Procedures and Considerations for Concrete Retaining Wall, Piles, Steel Truss, Road, Sewer and Water Mains Pipe Works.
<b>Further Estimating Concerns:</b>	Estimate Setup, Overhead, Profit, Sources of Estimating Errors, Escalation, Contingency, Life-Cycle Costing.
<b>Contract &amp; Tender:</b>	Preparation of civil engineering contracts and tender documents; Evaluation of proposals and contracts.
<b>Use of Estimating Software / Spreadsheets:</b>	

**CE-305**

**SOIL MECHANICS-I**

<b>Nature of Soils:</b>	Origin, Formation, Soil minerals, Clay mineralogy, Soil structures, Particle shapes and sizes.
<b>Composition and Physical Properties:</b>	Phase diagram, water content, void ratio, porosity, degree of saturation, specific gravity, unit weights, mass-volume relationships, Formation, structural & physical properties of clay minerals.
<b>Index Properties and Classification Tests:</b>	Particle size distribution by sieving and sedimentation, In-Place density test, relative density, Atterberg's limits and their determination, plasticity and liquidity index: Sensitivity and Activity of fine soils
<b>Soil Classification Systems:</b>	Unified soil classification system, M.I.T. system and AASHTO classification systems
<b>Water in Soils:</b>	Free energy (pressure and heads), Capillarity and its effect on soil behavior, Electro-Osmosis, Darcy's law, Seepage forces and their effect on soil stability, Design of filters, Factors effecting permeability, Permeability tests, Laplace's Equation and its solution (Flow Nets), Methods of drainage and dewatering of soils.
<b>Stress Acting in Soils:</b>	Soil mass stresses, effective stress and neutral stress, stress at a point and Mohr's circle, Westergard's and Boussinesq's solutions, Pressure distribution in the soil mass resulting from different vertical surface loadings, Newmark's influence charts.
<b>Shearing Strength of Soils:</b>	Basic principle relating to friction between solid bodies, Coulomb's law, Shear strength parameters, Shearing strength of granular and cohesive soils, Shearing strength tests and their results, effect of strain, rate and drainage conditions on shearing strength.
<b>Compressibility and Consolidation:</b>	Mechanics of consolidation, One - dimensional consolidation equation, coefficient of consolidation, compression index, Consolidation tests and graphical representation of data, Degree of consolidation. Determination of preconsolidation pressure, swelling clays and clay-shale
<b>Soil Compaction:</b>	Requirements, principle and methods including standard and modified AASHTO tests.

**CE-314**

**STRUCTURAL ANALYSIS-II**

**Analysis of Indeterminate Structures Using Force Approach:**

Compatibility methods for beams and frames with and without support settlement

**Analysis of Indeterminate Structures Using Stiffness Approach:**

Moment distribution for beams and frames for prismatic and non-prismatic members with and without side-sway and support settlement, Slope deflection method for beams and frames with and without support settlement.

**Matrix Methods:**

Introduction to flexibility method, Determination of flexibility matrix for beams, Introduction to stiffness method, development of member and structure stiffness matrices, Bending moment and shear force diagrams, Application of computer programs.

**Finite Element Method:**

Introduction to finite elements, Stiffness matrices for bar elements, Triangular elements and Rectangular elements, Shape functions and Displacement functions, Transformation matrices, Structure stiffness matrix.

**CE-322**

**MECHANICS OF SOLIDS-II**

**Enhanced Topics Related to Beam Bending and Shear:**

Unsymmetrical bending, shear flow, shear center, Analysis of curved beams and beams on elastic foundations.

**Theory of Elasticity:**

Analysis of stresses and strains due to combined effect of axial, bending and twisting forces/moments, Elementary theory of elasticity, equilibrium and compatibility equations, stress and deformation relationships, Stress transformation, polar co-ordinates, Theories of failure.

**Torsion of Thin Tubes and Open Sections:**

Torsion of non-circular shafts, membrane analogy, Torsion in thin tubes and open sections.

**Cylinders:**

Analysis of thin and thick cylinders.

**Theory of Plasticity:**

Elementary theory of plasticity, plastic hinges, shape factor and failure mechanism.

**Energy Methods:**

Energy Methods-General area of application and its usefulness.

**Stability:**

Struts and columns, Euler, Rankine and other formulas for buckling load of columns, Stability analysis of columns under eccentric loading.

**CE-424**

**ESSENTIALS IN CONSTRUCTION PROJECT MANAGEMENT**

<b>Introduction:</b>	The Construction Industry, Nature and Challenges, Key Industry Support Organizations, Public and Private Works, Past; Present; Opportunities; and Threats with Specific Reference to Pakistani Construction Industry.
<b>Project Management in the Engineering &amp; Construction Industry:</b>	PM knowledge areas; PM Life Cycle processes; Organizational structure of construction project; Responsibilities of client, Key PM Skills; Key Roles and Responsibilities of Client, Consultants - including architects, engineers and allied professionals, constructors, PM and CM; Professional construction management; Project Management issues and need for improved organization and management structures and processes with particular reference to local construction industry.
<b>Project Scoping, Bidding and Preconstruction Planning:</b>	Determining Relative Priorities of Key Project Objectives; Defining Project Scope, Types of tenders / contracts; Pre-Qualification process, Bidding process, Bid Package, Overview of Preconstruction Planning Aspects Including Area and Site Investigation; Preliminary schedules; Value Engineering; Constructability Analysis; Workpackages; Drawings and Specifications review.
<b>Project Planning, and Scheduling by Deterministic Methods:</b>	Planning and Scheduling Overview; Planning and Scheduling Process; Work Breakdown Structure; Planning and Scheduling Activities; Bar/ Gant Charts; ADM & PDM Networks; CPM project scheduling using PDM; Time Constrained Scheduling.
<b>Project Planning, Scheduling by Probabilistic Methods:</b>	Uncertainty Sources; Limitations of Deterministic CPM; PERT scheduling; PERT advantages and limitations; PERT today in construction industry.
<b>Resource and Cost Considerations in Project Planning &amp; Scheduling:</b>	Resource planning and scheduling; Resource Productivity; Resource levelling; Resource curves and profiles; Direct cost versus indirect cost; Contingency and profit; Cost Accrual Patterns; Time cost trade off; Least cost expediting; Project cost accounting; Cash flow and S-Curve;
<b>Project Monitoring and Control:</b>	Project Monitoring System, Project Control Process, Time; Cost; and Work performance Measurement and Evaluation, Percent Complete, Look Ahead Schedules; Earned Value Cost and Schedule Control System
<b>Site Organization:</b>	Site Layout Planning, Contractor's Site (Team) Organization Chart, Mobilization Plan, Overview of Site Management issues. Project Management Career Paths. Use of Computer Software in Planning and Management for Construction Projects.



**SCHEME OF STUDIES****Final Year (B.E.) Civil Engineering**

Batch 2023 FINAL YEAR ----- SEMESTER SYSTEM						
Course Code	Course Title	Crd Hrs				
		Th	Pr	T		
<b>Civil Engineering</b>						
<b>FALL</b>	CE-403	Soil Mechanics-II	3	1	4	
	CE-###	Social Sciences Elective	2	0	2	
	CE-418	Hydraulic and Water Resources Engineering-I	3	1	4	
	CE-420	Reinforced Concrete Design-II	3	0	3	
	EN-301	Environmental Engineering-I	2	1	3	
	CE-409	Civil Engineering Project	0	3	3	
	*EA/ES	Foreign Language-II	NC			
<b>Elective Courses</b>						
<b>SPRING</b>	CE-###	Civil Engineering Elective				
	CE-###	Management Sciences Elective				
	CE-432	Transportation Engineering-II	2	0	2	
	CE-421	Design of Steel Structures	3	0	3	
	EN-401	Environmental Engineering-II	2	1	3	
	CE-409	Civil Engineering Project	0	3	3	
<b>Elective Courses</b>						
	CE-419	Applied Hydraulics	<b>Civil Engineering Elective</b>	3	0	3
	CE-422	Structural Design & Drawing		3	0	3
	CE-423	Masonry Structures		3	0	3
	CE-426	Building Information Modeling		1	2	3
	CE-429	Geosynthetics and their Applications		3	0	3
	CE-431	Geoinformatics Applications		2	1	3
	CE-433	Coastal and Harbour Engineering		3	0	3
	CE-438	Hydraulics and Water Resource Engineering-II		3	0	3
	CN-424	Environmental Issues in Construction		3	0	3
	CN-430	Disaster and Reconstruction Management		3	0	3
	CN-423	Management and marketing of Construction Services	<b>Management Sciences Elective</b>	3	0	3
	CN-432	Leadership and Human Skills in Management		3	0	0
	CE-425	Modern Aspects of Construction Project Management		3	0	3
	CE-434	Procurement Management		3	0	3
	CE-435	Construction Contract Management		3	0	3
	CE-427	Introduction to Entrepreneurship and Opportunity Assessment		<b>Social Sciences Elective</b>	2	0

**SYLLABUS – BE FALL SEMESTER ENGINEERING**

**CE-403**

**SOIL MECHANICS-II**

<b>Sub Soil Investigation:</b>	Purpose, Preliminary and detailed investigation, boring methods, spacing and depth of borings, soil sampling, in situ testing, Standard penetration test, static cone penetration test, Presentation of boring information, Preparation of bore logs
<b>Settlement Analysis:</b>	Settlement by elastic theory, Settlement analysis of a thin stratum of clay from index properties, Thick clay stratum settlement, analysis by strain versus Logarithm of pressure test data, Construction period correction, Secondary consolidation.
<b>Bearing Capacity:</b>	Stability of soil masses, Rankine's, Terzaghi's and Meyerhof's analysis, Ultimate and safe bearing capacities for shallow foundations, Plate bearing test, Deep foundations bearing capacity, Static and dynamic load carrying capacity analysis of pile, Pile load test, Group action in piles, Raft foundation.
<b>Lateral Earth Pressure:</b>	Types of lateral soil pressure, Rankine's and Coulomb's theories of lateral earth pressures, Soil pressure analysis of earth retaining structures (including retaining wall, sheet piles and excavation supports).
<b>Stability of Slopes:</b>	Varieties of failure, Stability analysis of infinite and finite slopes, General method of slices (Swedish Methods), Bishop simplified methods of slices, Friction circle method. Taylor's stability number and stability curves, Effect of pore water and seepage forces on stability
<b>Soil Property Modification:</b>	Mechanical and chemical stabilizations of soil, principles & methods.

**CE-418**

**HYDRAULIC AND WATER RESOURCES ENGINEERING-I**

**Introduction to Water Resources Engineering:**

Hydrogen cycle; Overview, Rain, Surface and sub-surface water hydrology, and water resource estimates

**Open Channels and Sediment Transport:**

Erosion and Sediment yield; Design of open channels - Kennedy's and Lacey's theories

**Surface Water Hydrology:** Rainfall – Local Rainfall, Spatially – Averaged Rainfall, Design Rainfall Interception, Depression storage, Infiltration Rainfall – Runoff Analysis-Runoff Models; Time of Concentration, Peak- Runoff Models.

**Irrigation:**

Irrigation, Indus Basin Irrigation System (Indus water treaty; water apportionment accord etc.), Soil –water-plant relationship, Irrigation methods (Pressurized and non-pressurized).

**Subsurface hydrology/ Drainage:**

Unsaturated and saturated subsurface water and its movement- Darcy's Equation, Water wells and its construction. Waterlogging and Salinity, Surface & subsurface drainage and its methods.

**Dams and Barrages:**

Types, components, and function of barrages and Dams ; Reservoirs

**Introduction to Coastal Engineering:**

Basic terminologies within coastal engineering; Importance of coastal engineering to coastal zone management; Linear wave theory; Wave transformation and attenuation processes; Waves of unusual character.

**CE-420**

**REINFORCED CONCRETE DESIGN-II**

<b>Design for Torsion:</b>	Torsion in reinforced concrete members. Analysis and design of reinforced concrete members under combined torsion and shear stress.
<b>Flat Slab, Flat Plate &amp; Waffle Slab:</b>	Analysis and design of flat plate, flat slabs and waffle slabs, for flexure and shear under gravity loading.
<b>Slender Columns:</b>	Analysis and design of slender columns subjected to combined flexure and axial loading, Guidelines for design of shear walls-an over view.
<b>Design of Different Types of Foundations:</b>	Analysis and design of eccentric, strap, strip footings and pile caps.
<b>Prestressing Principles &amp; Design Philosophy:</b>	Principles of prestressing, properties of high strength materials used in prestressing, Importance of high strength concrete and steel used in prestressing, Behavioral aspects of prestressed beams and comparison with reinforced concrete beams, comparison with reinforced concrete beams, post tensioning and pre-tensioning techniques, comparison and hard-ware requirements.
<b>Prestress Losses:</b>	Prestress losses, immediate and time dependent losses, lump sum and detailed estimation of prestress loss.
<b>Analysis and Design:</b>	Simply supported prestressed beams for flexure and shear.

**EN-301**

**ENVIRONMENTAL ENGINEERING-I**

**Communicable Disease Control:**

Water borne, foodborne and vectorborne diseases, Water supply and sanitation.

**Environmental Pollution:**

Sources, Pollutants, Effects and remediation of air, water, land and noise pollution, Toxic/hazardous wastes

**Water Demand & Supply:** Population forecast, Water uses & consumption, Types and variations In demand, Maximum & fire fighting related demand, Urban & rural water supply, Appropriate technology.

**Water Quality:**

Water impurities & their health significance, Water quality standards, (U.S. & WHO & Local etc.), Water quality monitoring, Sanitary survey.

**Water Treatment:**

Treatment of surface & ground waters, screening, sedimentation, coagulation. Filtration, design aspects of slow and rapid sand filters, Filtration rates, operation head loss, backwash and filter efficiency, Pressure filters, hardness removal, Water softening methods, Water disinfection, Emergency treatment methods.

**Building Water Supply:**

Layout of water supply arrangement, Fixtures and their installation, Tapping of water mains.

**Energy Conservation:**

Introduction to concepts of energy conservation, energy management in industry and construction activities and green buildings.

**Laboratory Works:**

Related to the above, sampling techniques and examination of water (physical, chemical and microbiological parameters).

**CE-409**

**CIVIL ENGINEERING PROJECT**

**SYLLABUS – BE SPRING SEMESTER ENGINEERING**

**CE-432**

**TRANSPORTATION ENGINEERING-II**

**Railway engineering:**

Types of rail systems, Railway organization in Pakistan, Railway alignment and grades, Cross sectional elements of railway tracks, Pointers and crossings, stations and yards, Railway signalling systems, Laying of tracks and maintenance of

railway right-of-way, Creep and anti-creep devices, Various types of railway locomotives, Methods of traction, Track resistances.

**Coastal Engineering:**

Classification of harbours, Ports and harbours of Pakistan, Design principles and requirements of harbours, Effect of wind, waves and tides on design, Wharves and jetties, Breakwaters and groynes, Channel regulation and demarkation, Classification of docks and their construction, Transit sheds and warehouses.

**Airport Engineering:**

Component of air transportation, Airport activity, Aircraft characteristics affecting airport airside, Airport site Selection, Airside configuration, Navigation aids, Airport lighting and marking, Distribution concepts of terminal buildings, Geometric design of airside, Structural design of airfield pavements.

**Ports and Harbours:**

Classification of harbours, Ports and harbours of Pakistan, Wharves and jetties, Breakwaters and groynes

**CE-421**

**DESIGN OF STEEL STRUCTURES**

<b>Introduction:</b>	Steel properties, design load and load factors, Types and shapes of structural steel members, Specifications and design codes, Safety factors.
<b>Tension Members:</b>	Design of threaded, riveted and welded tension members.
<b>Flexural Members:</b>	Design of laterally supported and unsupported beams, Deflection, Design of beams for heavy concentrated loads, Bearing plates, Design of purlins, Design of beams with unsymmetrical cross-section and unsymmetrical bending, Design of builtup beams, gentry girder and plate girder.
<b>Compression Members:</b>	Design & analysis of axially loaded columns, Design of laced columns, Analysis and design of eccentrically loaded columns, Length effects and evaluation of effective length factor for columns in braced and unbraced frames.
<b>Connections:</b>	Types of high strength bolts and rivets, Friction & bearing type connections, Fasteners subjected to eccentric loads, Design of seated beam connection, Continuous beam-to-beam and beam to-column connection.
<b>Framing System &amp; Design:</b>	Design of industrial frame works, crane and gantry girder-setting of geometry, different load conditions and lateral bracing, Design of frames using plastic analysis.
<b>New Design Codes:</b>	Introduction of LRFD.



**EN-401**

**ENVIRONMENTAL ENGINEERING-II**

**Storm Flow & Sewage  
Flow Estimates:**

Rainfall intensity formulae, hydrograph & dry weather flow, sewage quantities, Variations and rates of flows, Velocity gradient & limiting velocities.

**Types of Sewerage Systems:** Separate & combined systems, Types shapes, sizes and materials of sewers, Sewer appurtenances, pipe strengths and tests.

**Principles of Design:** Construction & maintenance of sewers, Sewer, system analyses, Diameter and gradient, sewer joints, grading, laying, jointing and testing of sewers.

**Characteristics of Sewage:** Municipal and industrial wastes, Water pollution, causes and control parameters, Effluent disposal guideline and standards

**Sewage Treatment:** Primary, secondary & tertiary treatment, Screening grit chamber, skimming tanks & sedimentation tanks, activated sludge treatment, trickling filters, oxidation ponds, etc.

**Sewage Disposal Method:** Receiving body, assimilation capacity, Stream pollution and self-recovery, sludge handling & disposal, Effluent Reuse. Control and management of industrial wastewaters

**Building Drainage:** Requirements and arrangement of building drainage, Soil pipes. antisyphon pipes and waste water pipes, Sanitary fixtures and traps, House connection and testing of house drainage, Cross connection and back siphon age control.

**Solid Waste Disposal:** Types, characteristics, sources and quantities of solid wastes, Collection disposal and recycling.

**Laboratory Work:** Related to the above, sampling techniques and examination of wastewater (physical, chemical and microbiological parameters).

## **Civil Engineering Electives**

### **CE-419**

#### **Steady Flow through Pressure Conduits:**

#### **Steady Flow in Open channel:**

#### **Design of Conveyance Infrastructure:**

#### **Forces on Immersed bodies:**

#### **Hydrodynamics:**

#### **Finite Control Volume Analysis:**

#### **Unsteady Flow:**

#### **Impulse-Momentum:**

### **APPLIED HYDRAULICS**

Overview, Empirical equation for pipe flow-Hazen William etc., Branching Pipes Three reservoir problem, Pipes in series and parallel, Pipe Networks-Hardy Cross Method, manual and computer based problem solution.

Equation of gradually Varied Flow, Water Surface Profiles and Classification System, Hydraulic jump, phenomena, application and location.

Canal, outlets, regulating structures, Flumes, Chutes, Siphons, Culverts, Energy Dissipation structures, Canal lining.

Simple Lift and drag equations and their applications, Introduction to boundary layers, approximate solutions, Lift and drag over a flat plate, Application to simple problems.

Flow net and its limitations, Different methods of drawing flow net, Viscous Flow, Stress-Deformation Relationships, The Navier-Stokes Equations.

Surges in pipes and open channel.

Stationary and moving blades, reducers and bends, Torques in rotating machines, Applications.

**CE-422**

**STRUCTURAL DESIGN & DRAWING**

**Design of Buildings for  
Wind & Earth Quake:**

Analysis and design of reinforced concrete and steel, industrial and commercial type of buildings including effects of wind and earthquake.

**Tanks & Reservoirs:**

Analysis and design of underground, overhead tanks and reservoirs. Analysis and design of cantilever and counter fort retaining walls

**Shell, Plates and Bridges:**

Introduction to analysis and design of thin shell, and folded plate structures, steel and RCC bridges.

**CE-423**

**MASONRY STRUCTURES**

**Loadbearing masonry Buildings:**

Advantages and development of loadbearing masonry, basic design considerations, Structural safety; limit state design, foundations, unreinforced, reinforced and prestressed masonry, design methods, load combinations

**Bricks, blocks and mortars:**

Bricks and blocks, mortar, lime, sand, water, plasticized Portland cement mortar, use of pigments, frost inhibitors, proportioning and strength, choice of unit and mortar, wall ties, concrete infill and grout; reinforcing and prestressing steel.

**Masonry Properties:**

Compressive strength, strength of masonry in combined compression and shear, tensile strength of masonry, stress-strain properties of masonry, modulus of elasticity, effects of workmanship on masonry strength, thermal effects, creep, shrinkage.

**Design for vertical and Lateral loading:**

Wall and column behaviour under axial load, Wall and column behaviour under eccentric load, slenderness ratio, calculation of eccentricity, vertical load resistance, modification factors, distribution and analysis for lateral forces.

**Cavity Walls:**

One wythe loaded axially, effects of ties, two wythe loaded axially

**Reinforced masonry:**

Flexural strength, shear strength of reinforced masonry, deflection of reinforced masonry beams, reinforced masonry columns

**Prestressed masonry:**

Methods of prestressing, basic theory, general flexural theory, shear stress, deflections, loss of prestress

**Construction Aspects:**

Placement of steel reinforcement, grouting, control of cracking and movement joints, quality assurance, flashing for masonry construction

**Anchorage to Masonry:**

Type of anchor bolts, placement and embedment of anchor bolts in masonry grout, nominal strength of anchor bolts, nominal axial strength of anchor bolts loaded in tension and in combined, tension and shear, nominal shear strength of headed and bent-bar anchor bolts in shear; headed and bent-bar anchor bolts in combined axial tension and shear, structural walls and their anchorage requirements.

**CE-426**

**BUILDING INFORMATION MODELLING**

<b>BIM Fundamentals:</b>	BIM Overview; BIM vs. Traditional CAD; Common BIM Terminology; Value of BIM; BIM as a Communication and Collaboration Tool; BIM Benefits; Typical BIM Process; BIM Implementation Needs and Challenges.
<b>BIM Technology:</b>	Phased Structure of a BIM project; Classes of BIM Tools; Common BIM Applications; Planning and Organizing the Use of BIM Tools; Embedding BIM Tools into Processes; Identifying and Selecting BIM Tools.
<b>Application of BIM Technology on a Real Time Project of Challenging Scope:</b>	Developing an Architectural Model; Walls; Slabs; Roofs; Ceilings; Floor Coverings and Wall Coverings; Doors and Windows; Speciality Items, Developing a Structural Model; Foundations; Columns; Beams/ Slabs; Roof Systems; Trusses, Developing an MEP Model; HVAC only, Developing a SitePlan, Developing Project Schedule (4D), Develop understanding of how BIMmodels are integrated with schedules, Developing Templates for Estimating (5D),Performing Energy Analysis, Develop understanding of how BIM models areapplicable to the Energy Analysis, Construction Management and FacilitiesManagement; Develop understanding of how BIM models are applicable to theConstruction Management and Facilities Management processes, Performing Walkthroughs/ Flythroughs/ Animation, Presentation Issues/ Rendering, Followingsoftware may be used; Revit Architecture, Revit Structure, Revit MEP, Tekla,Constructor, Estimator, Control, Navisworks, EcoTect, etc.
<b>Discussion on BIM Benefits using Real Time Project:</b>	Stakeholder and Site Coordination, Sustainable Design and Construction, Construction Detailing, Pre-Construction Tasks such as AnalyzingConstructability, Cost Estimation, Scheduling, Clash Detection, Materials and Methods, Site Safety Improvement, Quality Assurance, Documentation of the Construction Process, Integration of Design and Construction Models, Facilities Management, Improved Trade Coordination, More Accurate Quantity Surveying, Change Management, Risk Analysis, Energy Analysis, etc.
<b>Further Aspects:</b>	Process Change from BIM Use, BIM as an Underlying Enabler of Effective Team Communication.

**CE-429**

**Geosynthetics and their Applications**

**Fundamentals of Geosynthetics**

Introduction, definitions and classification, historical development, Raw materials and manufacturing processes, Properties and test methods and application areas

**Geosynthetics functions and Mechanisms**

Separation, filtration, reinforcement, drainage, containment, combined Functions.

**Soil-Geosynthetic**

Introduction, Granular soil behavior, Soil- geosynthetic interaction mechanisms, Soil- geosynthetic interface resistance, Factors influencing soil- geosynthetic interaction, Laboratory tests for quantification of soil- geosynthetic interface resistance.

**Engineering applications techniques**

Filters and drains, soil subgrades, landfills, retaining walls, embankments, canals and reservoirs, pavements, slope stabilization, erosion control.

**CE-431**

**Geo-Informatics Applications**

<b>Map Projections:</b>	Concepts of Projections and Transformations, Coordinate Systems, Field Coordinates and Global Coordinate Syncing. Locating Datum, Introduction of Global Horizontal Control Systems.
<b>Vertical Control:</b>	Understanding Vertical Controls, World Geodimetric System of Vertical Control, Earth's Gravitational Model, Establishing Local Vertical Control, Synchronization of Local and Global Vertical Control Points.
<b>GIS:</b>	Fundamentals of GIS Data Handling, Standards of Data Files, Introduction to spatial analysis. Hands-on with software
<b>Data Files:</b>	Standard Database Formats, Understanding GIS data. Vector and Raster Formats, Spatial Statistics.
<b>Instrumentations:</b>	Navigational Satellites, Positioning Systems (GLONASS, GPS & Galileo), Fundamentals and Elements of GPS, System Operation & Characteristics, Errors and Atmospheric effects. Differential GPS (DGPS).
<b>Remote Sensing:</b>	Physicals basis of Remote Sensing, Satellite System, Aerial and Satellite photogrammetry, Sensors, Types of Resolutions, Geo-referencing, Image Processing Techniques, Classification. Acquisition of Global Datasets, Understanding Digital Elevation Model, Digital Surface Model, and Limitations of Satellite acquired data. Other Spatial Data Acquisition Technologies: Use of Drone Technology in Geoinformatics, Data Transformation, Application.
<b>Practical Work:</b>	GNSS and Surveying. Image processing software and GIS based exercises. Applied exercises of GIS and RS in Civil Engineering.
<b>Legal implication Pakistan:</b>	Ethical and National responsibilities during the development & sharing of spatial database, of GIS in Mapping & Surveying Act 2014

**CE-433**

**COASTAL AND HARBOUR ENGINEERING**

**Wave Statistics:**

Short and long-term wave statistics; irregular waves; Rayleigh distribution, Wave generation – wind; Simple wave hindcasting models.

**Tides and Water level:**

Physics of Tides, prediction of tidal variations and appreciate the impact of tides in the coastal environment; tidal power;

**Coastal Processes:**

Surf zone processes: cross shore and longshore currents; sediment transport; beach response and profiles; shoreline erosion/ Bluff erosion.

**Introduction to Coastal Management: Coastal management strategies,**

Management of coastal lands and water: ground water, waste water and other forms of pollution; Principles of coastal defence and techniques: artificial headlands, breakwater and rip-rap, groynes, beach nourishment, sea walls, managed retreat; wave-coastal structure interaction.

**Harbour Engineering:**

Design principles and requirements of harbours, effects of waves and tides on design, Wharves and jetties, Channel regulation and demarcation, Classification of docks and their construction, Transit Sheds and warehouses.



**CE-438**

**HYDRAULICS AND WATER RESOURCE ENGINEERING II**

<b>Hydrology:</b>	Weather Systems, Precipitation Analysis, Intensity-Duration-Frequency curve, Stream flow, Unit and Synthetic Hydrograph Analysis
<b>Sediment Engineering:</b>	Weathering, Erosion and Sediment Processes, Factors Affecting Erosion, Sediment Yield e.g., RUSLE, Sediment Transport processes, Erosion and Pollution, Vegetate Waterways
<b>Irrigation &amp; Drainage:</b>	Crop Water Requirement/Soil-Water-Plant Relationship; Irrigation Strategies, Irrigation System Designs Subsurface Drainage Design; Occurrence of Groundwater, Well Hydraulics (Theim and Theis Equations)
<b>Hydrological Analyses:</b>	Probability concept, Annual Maxima, Flow Duration Curve, Risk and Reliability
<b>Hydrologic Simulation Models:</b>	Introduction and steps to Watershed Modelling, Application of Hydrologic Models
<b>Water Quality and Lake Dynamics:</b>	Water quality background, Important Concepts, Best Management Practices, Biological Impaired Water.

**CN-424**

**ENVIRONMENTAL ISSUES IN CONSTRUCTION**

<b>Environment:</b>	Definition, Climatic factors, soil-air-water relationship.
<b>Environmental Pollution:</b>	Sources, Pollutants, Effects and remediation of air, water, land, noise and radiation pollution, Toxic/hazardous wastes, Wastes related to construction activities.
<b>Environmental Impact Assessment:</b>	Requirement, Implication and significance, International; Federal and Provincial EPA Standards, Bye-laws and legislation, EIA of big and small projects as per National and International guidelines.
<b>Water Demand &amp; Supply:</b>	Population forecast, Water uses & consumption, Types & variations in demand, Maximum demand & fire demand, Urban & rural water supply, Technology.
<b>Water Quality and Treatment:</b>	Water impurities & their health significance, Water quality standards, (U.S. & WHO, Pakistan etc.), Water quality monitoring, Various methods of treatment of surface & ground waters including screening, sedimentation, coagulation, filtration, disinfection and water softening methods, Emergency treatment methods.
<b>Sewage and Sewerage Systems:</b>	Wastewater types, Separate and combined sewer systems, Types, sizes and materials of sewers, Sewer appurtenances, pipe strength and tests.
<b>Building Water Supply and Drainage:</b>	Layout of water supply arrangement, Fixtures and their installation, Tapping Of water mains, Requirements and arrangement of building drainage, Soil pipes, Antisyphon pipes and waste water pipes, Sanitary fixtures and traps.
<b>Construction Waste Disposal:</b>	Types, characteristics and sources of construction wastes, Collection disposal and recycling.
<b>Energy Conservation:</b>	Effective utilization and management of energy services in construction activities, Green building concepts.

**CN-430**

**DISASTER AND RECONSTRUCTION MANAGEMENT**

**Foundations of Sustainability:** Defining Sustainable Construction, Whole Systems Thinking, Collaboration as Sustainability in Action, Key Features of Sustainable Construction, The Green Construction Movement, Emerging Directions.

**Material Technologies:** Recycling of Conventional Construction Materials, Overview of Emerging Construction Materials and Products with Specific Reference to their Effectiveness towards Sustainable Construction.

**Construction Technologies:** Overview of Latest Developments in Construction Technology, such as Trenching e.g. Trench-less Technology; Specialized Formworks; Technologies for Building Deep Waterproof Basements; Mechanized Construction Methods & Equipment, Slip Forms, Effectiveness of Technologies towards Sustainable Construction.

**Disaster Management:** Monitoring of Infrastructure facilities; strategies for protection against possible damages; maintenance for different infrastructure facilities. Rehabilitation and repair strategies for reinforced concrete, repair and rehabilitation of pipe networks; sewers; roads and drainage facilities, Predictions and preparedness strategies for natural disasters such as Earthquakes etc; Emergency management; Awareness Programs; Follow-on Disasters; Recovery plans; Strategies for protection; Loss estimation; Risk and Vulnerability Analysis; Disaster Mitigation.

## Management Sciences Electives

**CN-423**

### MANAGEMENT AND MARKETING OF CONSTRUCTION SERVICES

<b>Introduction:</b>	Nature of Construction Business, Primary Causes of Business Failure, Business Strategies to Minimize Failure Risk, Leadership Challenges, Introduction to Organizational Behavior.
<b>Company Organization:</b>	Alternative Forms of Business Organization: Proprietorships; General and Limited Partnerships; Corporations; Limited Liability Companies; Joint Ventures.
<b>Strategic Planning and Management:</b>	Introduction, <i>Planning Process</i> : Mission Statement; Vision; Strategic Assessment; Strategic Objectives; Company Strategies and Short-Term Goals; Action Plans; Performance Measurement, Situation Analysis, Strategy Formulation, Strategy Implementation, Strategy Evaluation, Organization Strategy and Project Selection, Project Portfolio Management, Project Screening Matrix.
<b>Organizational Structures and Culture:</b>	Functional Structure, Dedicated Project Teams, Matrix Structure, Network Organization, Advantages and Disadvantages, Choosing the Right Structure, Organizational Culture, Culture Diagnosis, Dimensions, Sustaining Mechanism.
<b>Human Resources Management:</b>	Job Design and Analysis, HR Planning, Recruiting Employees, Selecting Employees, Performance Management, Employee Retention, Safety and Wellness.
<b>Business Development:</b>	Marketing Construction Services, Marketing Process, <i>Market Analysis</i> : Demand Assessment; Customer Satisfaction Assessment; Competition Assessment, Marketing Strategies, Marketing Tools, Marketing Plan, Acquisition of Work.
<b>Financing a Company's Financial Needs:</b>	Sources of capital; Equity and borrowed capital; Financing with debt capital; Financing with bonds; Financing through retained profit; Financial and Funding Institutions; <i>Loans</i> : Long-Term, Short-Term, Amortization Schedule, Early Payoffs and Closing Costs; Lines of Credit; Leasing; Trade Financing; Credit Cards; Equity Financing; Financial Documents.
<b>Managing Inter-Organizational Relations:</b>	Sustaining Collaborative Relationships, The Art of Negotiating, Managing Customer Relations.
<b>Problem Solving and Decision Making:</b>	Problem Solving, The Decision-Making Process, Objective Versus Subjective Decision Making, Scientific Decision-Making Tools, Employee Involvement, Role of Information, Using MIS, Creativity in Decision Making.
<b>Knowledge and Information Management in Construction:</b>	Overview of the Nature and Dimensions of Knowledge Management, Construction as Knowledge Based Industry, Knowledge Management Process, Overview on Application of Knowledge Management to Construction Business

**CN-432**

**LEADERSHIP, HUMAN AND ENTREPREUNERSHIP SKILLS IN MANAGEMENT**

**Leadership**

Definition, Influence, Social Network Building, Leadership and Ethics, Building Trust, Qualities of an Effective Leader, Leadership Skills: Inherited or Learned? Motivation and Inspiration, Leadership Styles, Building and Maintaining a Following, Leadership vs. Management, Leadership and Change.

**Team Building and Teamwork:** Team Building Approaches, Situational Factors, Building High Performance Project Teams, Character Traits and Teamwork, Handling Conflict, Inhibitors of Teamwork, Rewarding Team Performance, Multicultural Teams, Team Pitfalls.

**Effective Communication:** Inhibitors, Establishing a Conducive Communication Climate, Improving Communication, Improving Interpersonal Skills, Personality and Communication.

**Education and Training:** Training Needs Assessment, Effective Training Provision, Evaluating Training, Managers as Trainers and Trainees, Workforce Literacy, Improving Learning, Inhibitors, Performance Appraisal.

**CE-425**

**MODERN ASPECTS OF CONSTRUCTION PROJECT MANAGEMENT**

**The Art of Project Management:**

Key Project Management Competencies and Skills - Leadership; Developing People; Communication; Interpersonal; Stress Handling; Problem-Solving; Time Management; Delegation; Motivation; Change Management; Conflict Management; Management by Wandering Around; Ethics; Improving Personal Productivity; etc., Developing the Skills Needed to be an Effective Project Manager.

**Project Procurement Management:**

Project Delivery System – DBB; DB; BOT; CM@Risk; Recent Trends, Project contracts/ Payment; Schemes – Lump Sum; Unit Price; Cost Plus; GMP; Recent Trends, Considerations for Selection of Right Delivery System and Contract Type, Contract Award Mechanisms and Associated Issues – Bidding; Negotiated Awards, Recent Advancements in Procurement Systems, Overview of PPRA Bidding Rules, Lowest Cost Bidding, Multi-Parameter Bidding.

**Overview of Regulatory Environment:**

Local Industry Organizations Regulating Construction Business, Overview of Engineering and Professional Registration; Contractor Licensing; Insurance and Bonding, Coordination between Civic Agencies, Consultation with Authorities; Line Departments and Allied Agencies, Approvals, Authorities Having Jurisdiction, Completion Certificate.

**Jobsite Management:**

Site organization; Staffing; Subcontracting; Construction Ethics; Job Commencement; Construction Operations; Procurement; Jobsite Management; Documentation and Record Keeping on Jobsite; Submittals; Samples; Shop Drawings; Jobsite Layout and Control;

**Construction Quality Management:**

Concepts, Principles, Views, Relationship with Value and Organizational Excellence, Quality and Global Competitiveness, Quality Management, Four Stages of Quality Management, Inspection, Quality Control, Quality Established by the Contract, Quality Control in Subcontract Work, Quality Assurance, Overview of ISO, Total Quality Management, From QA to TQM, Cost of Quality, TQM Implementation in Construction Industry, Establishing and Maintaining a Total Quality Culture, ISO 9000 and TQM, Overview of Quality Tools; Pareto Charts, Cause-and-Effect Diagrams, Check Sheets, Histograms, Scatter Diagrams, Run Charts and Control Charts, Stratification.

**Construction Health, Safety and Environment:**

Need for Safe Practices; Humanitarian Concerns; Economic Costs and Benefits; Legal and Regulatory Considerations, Roles of Construction Personnel in Safety, Overview of Accident Causation Theories, Safety Record Keeping, Safety Management System, Safety Program; Policies and Rules; PPE; Hazard Analysis; HSE Communications; Accident Investigation and Reporting; Training; Safety Committees; Recording Injuries and Illnesses; Emergency Response, Overview of OSHA and OHSAS Safety Regulations, Incident and Injury Free Environment (IIF); Concept; Employee and Management Participation in Promoting Safety; Incentives; Teamwork Approach in Promoting Safety; Establishing a Safety-First Corporate Culture; IF Pathway; IIF Techniques, Total Safety and Its Components, Continuous Safety Improvement.

**Project Closeout:**

Construction Closeout and Turnover Process, Punch Lists, Participant Roles in Closeout, Substantial Completion, Implementing the Closeout, Paperwork Requirement, Creating the Final report, Logging Lessons Learned, Project Performance Evaluation and Reviews, System Testing and Documentation, Operating and Maintenance Manuals and Inspection, Facility Startup and Evaluation, Financial Resolution of the Project, Miscellaneous, Certifications and Releases, As-Built Drawings, Project Feedback, Post-Construction Services.

**CE-434**

**PROCUREMENT MANAGEMENT**

**Key Concepts:**

Overview of Procurement and its Management; Relationship with Organizational Success and Supply Chain Management; Procurement Governance Framework; Key Procurement Skills; Procurement Cycle; Critical Success Factors and Key Considerations

**Public Procurement**

Goals; Categories; Importance; Key Principles; Participants, Stakeholders and Beneficiaries; Comparison with Private Sector Procurement; Procurement Regulatory Framework and Reforms: PPRA and SPPRA; An Overview of SPPRA, SPPRA Act and Rules.

**Procurement Planning:**

Standard as per PMI PMBOK; Key Significance; Key Challenges/ Issues; Key Considerations; Key Components of the Procurement Plan; Procurement Plan Standards and Best Practices; Related SPPRA Rules; Specifications/ Requirements Planning and Market Research; Cost Estimations and Budgeting; Cases.

**Procurement Methods:**

Procurement Methods for Goods, Works, Consulting and Non-Consulting Services; Selection of Appropriate Method; Cases.

**Preparation of Bidding Documents and NIT:**

Preparation of SBDs for Works; Preparation of RFP for Intellectual Services; RFQs; NIT and the Advertisement Process; Related SPPRA Rules; Cases

**Conducting, Administering and Closing Procurements**

Standard as per PMI PMBOK; Pre-Bid Meetings; Prequalification and Post Qualification; Bid Submission and Opening; Bid Evaluation (Technical and Financial); Life Cycle Cost and Value Aspects; Risk Management in Procurement; Dealing with Misrepresentations; Contract Award; Post Award; Overview of Contract Management; Overview on the Redressal of Grievances and Dispute Settlement Process; Blacklisting; Procurement Closeout; Related SPPRA Clauses; Cases

**Recent Advancements in Procurement Management:**

Overview of Best Practices such as Lean, Sustainable and other Recent/ Advanced Procurement Strategies

**CE-435****CONSTRUCTION CONTRACTS MANAGEMENT**

<b>Introduction to Contracts:</b>	General Description, Construction Contracts, Elements, Form, Intent, Privity, Format and Major Components, Key Drafting Considerations.
<b>Contract Award Mechanisms:</b>	Open vs. Sealed Bids, Bids vs. Negotiated Best Value Awards, General Considerations in Bids for Public Projects, Overview of PPRA Bidding Rules, Responsible and Responsive Bidder, Lowest Cost Bidding, Multi-Parameter Bidding, General Considerations in Bids for Private Projects, Bid Bonds, Bidding Advantages and Disadvantages, Bid Issues.
<b>The Bidding Process:</b>	Bid Advertisement, Prequalification, Bid Decision, Bidding Period, Bid Package, Accuracy of Bidding Information, Instructions to Bidders, Addenda, Alternates, Modification and Withdrawal of Bids, Award, Mistakes in Bids, Bid Qualification.
<b>Subcontractors &amp; Subcontracts:</b>	GC-Sub and Owner-Sub Relationships, Subcontractor Bidding and Selection Process, Bid Shopping, Advantages and Disadvantages of Subcontracting, Insurance and Bonding Requirements, Subcontract Agreement and Terms, <i>Subcontract Management</i> : Contract Provisions; Flow-Down Clauses; Back charges; Changes; Extra Work; Delays; Safety and Waste Management, Supplier Contracts.
<b>Contract Conditions:</b>	General and Supplementary Conditions of Contract, Overview and Discussion on Use of Standard Contracts in Construction – PEC, AIA, FIDIC, etc.
<b>Contract Specifications:</b>	Role; Relationship with Drawings; Organization; Types; CSI Divisions; Basic Writing Principles; Division 01 – General Requirements, Sample Specifications from other CSI Divisions, Specifications Resources, Writing Procedures.
<b>Contract Interpretations and Modifications:</b>	Interpreting Contract Documents, Common Rules of Contract Interpretation, Contract Modifications, Substitutions, Feedback.
<b>Overcoming Politics, Negativity, and Conflict in the Workplace:</b>	Power and Politics, Organizational Structure and Internal Politics, Impact of Internal Politics on Project Quality, Controlling Internal Politics, Overcoming Negativity in Organizations, Managing Conflict.
<b>Motivating Others:</b>	Using Positive Reinforcement to Motivate Others, Using Recognition to Motivate Others, Motivation Theories, Techniques for Self-Motivation.
<b>Helping Others Develop and Grow:</b>	Being a Nurturing; Positive Person, Mentoring Coworkers, Characteristics and Types of Mentoring, Specific Mentoring Behaviors, Coaching Skills and Techniques, Helping Difficult People, Types of Difficult People, Tactics for Dealing with Difficult People.
<b>Stress Management and Personal Productivity:</b>	Understanding and Managing Stress, Improving Personal Productivity.
<b>Introduction to Entrepreneurship Skills:</b>	Entrepreneurial Mind-Set, Corporate Entrepreneurship, Entrepreneurial Strategy, Creativity and the Business Idea, Identifying and Analyzing Opportunities, Intellectual Property and Other Legal Issues for the Entrepreneur, Knowing the Competition, Construction Business Plan, Organizational Plan, Understanding Investment Risk, Financial Plan, Strategies for Growth and Managing the Implication of Growth.



## Social Sciences Electives

**CE-427**

### **INTRODUCTION TO ENTREPRENEURSHIP AND OPPORTUNITY ASSESSMENT**

<b>Introduction to</b>	Definition and Philosophy; Need and Significance of Innovation and
<b>Entrepreneurial Process:</b>	Entrepreneurship; Role within the Economy; Social Implications; Entrepreneurs as Role Models; Past and Future of Entrepreneurship; Overview of the Entrepreneurial Management Process; Idea Generation; Opportunity Evaluation; Making a Strategy; Gathering Resources; Launching the Business; Growing the Business; Harvesting Returns, Entrepreneurship in different contexts; Social (donating profits, “doing good”, non-profit); Organizational (start-ups, corporate, public sector); Individual (career management).
<b>Introduction to Innovation:</b>	What is Innovation?, Innovations in Organizations, Decision Making and Strategy, Sources of Innovation, Fostering Innovation and Entrepreneurship.
<b>Entrepreneurial Traits:</b>	Entrepreneurial Mind-Set; Entrepreneurial Strategy; Personal Potential for Entrepreneurship; Career Paths for Entrepreneurs.
<b>From Idea to Market – An Overview:</b>	Research and Invention, Innovation, Introduction to Technology Transfer; Background; Technology Transfer Cycle; Pitfalls in Commercialization, Invention Evaluation and Assessment; Review of Inventions – Novelty and Utility; Understanding your Invention, Intellectual Property Basics – Patent; Copyright; Trademark, Assessing Licensing/ New Business Opportunities, Technology Development, Technology Marketing; Product and Market Assessment; Marketing Strategy; Targeting Companies, Technology Licensing; Valuation; Licensing Agreements; Negotiation; Technology Assessment Report.
<b>Entrepreneurial Assessment:</b>	Identifying the Purpose of the Proposed Business; Developing and Communicating the Business Idea; Identifying and Analyzing the Potential Business Market; Delineating a Product or Service; Evaluation of Expected and Requisite Revenue Generation.
<b>Legal Considerations and Liabilities:</b>	Intellectual Property; Legal Issues in Establishing an Organization; Patents; Trademarks; Licensing; Product Safety and Liability; Insurance and Contract

