Scheme of Studies of BE Civil (Specialization in Urban) for the Batch 2025 and onwards

Bachelor of Engineering in Civil (Specialization in Urban)

First Year

Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	T			Th	Pr	T
PH-129	Applied Physics *	3	0	3	MT-221	Linear Algebra & Ordinary Differential Equations	3	0	3
ES-105/ ES-107	Pakistan Studies / Pakistan Studies (for Foreigners) **	2	0	2	EA-104	Functional English **	3	0	3
MT-116	Calculus & Analytical Geometry	3	0	3	ES-108	Ideology and Constitution of Pakistan *	2	0	2
ES-206/ ES-209	Islamic Studies OR Ethical Behaviour (for Non-Muslims)	2	0	2	CF-101	IT Fundamentals and Applications *	2	1	3
UE-171	Engineering Drawing-I	1	2	3	UE-173	Engineering Surveying-I	2	1	3
UE-172	Engineering Mechanics	3	1	4	UE-174	Engineering Materials	2	1	3
CY-100	Essentials of Chemistry	NC	-	NC					
		14	**3**	**17**			**14**	**3**	**17**

Second Year

Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	T			Th	Pr	T
UE-271	Engineering Surveying-II	3	1	4	UE-272	Engineering Drawing-II	1	2	3
UE-251	Mechanics of Solids-I	3	1	4	UE-274	Structural Analysis-I	3	0	3
UE-273	Geology for Engineers **	2	0	2	UE-275	Fluid Mechanics-I	3	1	4
UE-154	Chemistry for Civil Engineers	1	1	2	MT-331	Probability & Statistics	3	0	3
EA-218	Business Communication	2	1	3	UE-366	Highway and Airport Engineering *	2	1	3
XX-###	Social Science Electives *^	2	0	2	CF-201	Civics and Community Engagement *	2	0	2
					CF-200	Community Service	-	-	
		13	**4**	**17**			**14**	**4**	**18**

Bachelor of Engineering in Civil (Specialization in Urban)

Third Year

Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	T			Th	Pr	T
UE-375	Reinforced Concrete Design-I	3	0	3	UE-377	Soil Mechanics-I	3	1	4
UE-373	Introduction to AI/Data Science *	3	0	3	UE-378	Quantity & Cost Estimation	3	0	3
UE-352	Construction Engineering	3	0	3	UE-372	Reinforced Concrete Design-II **	2	0	2
UE-371	Sustainable Construction & Disaster Management *	2	0	2	UE-379	Essentials in Construction Project Management	3	0	3
MT-443	Numerical Analysis	3	0	3	UE-356	Traffic Engineering and Management	3	0	3
UE-374	Entrepreneurship *	2	0	2	UE-460	Geoinformatics	1	1	2
UE-359	Structural Analysis-II	2	0	2	EA/ES-###	Foreign Language-I	NC	-	NC
		18	**0**	**18**			**15**	**2**	**17**

Final Year

Fall Semester					Spring Semester (Proposed)				
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	T			Th	Pr	T
UE-470	Soil Mechanics-II **	2	1	3	UE-473	Design of Steel Structures	2	0	2
UE-435	Financial Resource Management	2	0	2	CF-401	Professional Ethics **	2	0	2
UE-452	Urban Mass Transportation	2	0	2	UE-472	Hydraulic and Water Resources Engineering-I	3	1	4
EN-406	Environmental Engineering	3	1	4	UE-471	Mechanics of Solids-II	2	0	2
AR-359	Architecture and Town Planning	2	0	2	UE-474	Law and Regulatory Control Studies	2	0	2
EA/ES-###	Foreign Language-II	NC	-	NC	CF-402	Occupational Health and Safety *	1	0	1
UE-415	Urban Engineering Design Project	0	3	3	UE-415	Urban Engineering Design Project	0	3	3
		11	**5**	**16**			**12**	**4**	**16**
Total Credit Hours							**111**	**25**	**136**

	Social Sciences Electives (2+0) ^			
	Course Title	**Th**	**Pr**	**T**
CF-202	Applied Economics for Engineers	2	0	2
UE-276	Urban Sociology	2	0	2

* New Course ** Course with Revised Credit Hour ^ List of Social Science Electives

EA/ES-### Foreign Language - I		
EA-220	Chinese Language - I	NC
EA-231	Turkish Language - I	NC
EA-224	German Language - I	NC
EA-226	French Language - I	NC
ES-222	Arabic Language - I	NC
EA-233	Japanese Language - I	NC
EA-235	Russian Language - I	NC

EA/ES-### Foreign Language - II		
EA-221	Chinese Language - I	NC
EA-232	Turkish Language - I	NC
EA-225	German Language - I	NC
EA-227	French Language - I	NC
ES-223	Arabic Language - I	NC
EA-234	Japanese Language - I	NC
EA-236	Russian Language - I	NC

First Year (Fall Semester)

PH-129 Applied Physics

PH-129	Applied Physics

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

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

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

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

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

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

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

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

ES-105 Pakistan Studies

ES-105	Pakistan Studies

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

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

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

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

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

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

ES-127 Pakistan Studies (For Foreigners)

ES-127	Pakistan Studies (For Foreigners)

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

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

Government & Politics in Pakistan: Constitution of Pakistan, A brief outline, Governmental structure, Federal & Provincial, Local Government Institutions, Political History, A brief account.

Pakistan & the Muslim World: Relations with the Muslim countries

Language and Culture: Origins of Urdu Language, Influence of Arabic & Persian on Urdu Language & Literature, A short history of Urdu literature

MT-116 Calculus and Analytic Geometry

MT-116	Calculus and Analytic Geometry

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

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

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

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

Analytical Geometry: Review of vectors, scalars and vector products, Three-dimensional coordinate system and equation of straight line and plane and sphere, curve tracing of a function of two and F/QSP 07/05/01 three variables, surface revolutions, coordinate transformation.

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

ES-206 Islamic Studies

ES-206	Islamic Studies

Fundamentals of Islam: Tauheed, Arguments for the Oneness of God; **Al-Ambiya-22, Al-Baqarah-163-164,** Impact of Tauheed on human life, Place of Man in the Universe: **Al Israa/Bani Israil-70**; Purpose of creation: **Al zariyat-56,** Prophethood, Need for Prophet, Characteristics of Prophet, Finality of Prophethood: **Al-Imran-79, Al-Hashr-7, Al- Maidah-3,** and Faith in Hereafter (Aakhirat), Effects on worldly life: **Al-Hajj-5, Al-Baqarah-48, Hadith**

Ibadah: Concept of Ibadah, Major Ibadah, Salat, Zakat, Hajj and Jihad. **Al-Mu'minun-1-11, Al Anfaal- 60, & Two Ahadiths**

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

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

Seerat of the Holy Prophet(PBUH):

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

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

c) Engagement and communication with collaborators and foes:

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

d) Social values and rights, (peace & harmony, tolerance, solidarity, collaborations, inclusivity & cohesion) **Case Studies from Seerah**: Al –Fudoul Confederacy, Placement of Black stone, charter of Medina, Treaty of Hudaibya)

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

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

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

ES-209 Ethical Behaviour (For Foreigners)

ES-209	Ethical Behaviour (For Foreigners)

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

Basic Moral Concepts: Right and Wrong, Good and Evil

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

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

UE-171 Engineering Drawing - I

UE-171	Engineering Drawing - I

Introduction: Use and care of Drawing Instruments, Standard Drawing Office Practice, Drawing types with respect to technicality and project execution

Conceptual Drawings and Projection system: Conceptual Drawings and Projections: Classification of projects (Perspective and parallel, Oblique, Axonometric projection, Orthographic projections), Sections

Architectural Plan, Elevation and Section: Architectural plan, elevation, section, site plan of a single and double- storey RCC house

Electrical, Plumbing, and HVAC Drawings: Building materials, Electric and Plumbing symbols and Abbreviations, Electrical, plumbing and HVAC of single and double storey RCC house

Computer Aided Drafting: Introduction to AutoCAD, General and basic know how related to computer aided drafting in AutoCAD, Basic draw commands, basic edit commands, Layers etc., AutoCAD applications for Civil engineering drawings.

UE-172 Engineering Mechanics

UE-172	Engineering Mechanics

Basic Properties: Concepts of space, time, mass, velocity, acceleration and force; scalar and vector quantities; Newton's law of motion; law of gravitation

System of Forces: Resultant and resolution of co-planar forces using parallelogram, triangle & polygon law and funicular polygon; Simple cases of resultant and resolution of forces in space; Conditions of equilibrium of co-planar forces, analytical and graphical; Formulations

Equilibrium of Rigid Bodies: Free body concept, conditions of support and attachment to other bodies; support reactions under different types of loading; Degree of restraints and static determinacy; Statically determinate problems specially of civil engineering importance; Equilibrium of two force and three-force bodies; Introduction to internal forces in plane trusses using method of joints and method of sections; Introduction to shear force and bending moment diagrams.

Kinematics: Work, energy and power; Virtual work formulation of equilibrium of co-planar force; Potential energy, energy criterion for equilibrium, Stability of equilibrium; Application to simple cases

Rigid Bodies: Geometrical properties of plane areas; First moment of area, centroid, second moment of area, principle axes; Polar moment of area and radius of gyration

Friction: Coulomb's theory of friction; Problem involving friction on flat and curved surfaces

Application of Principle of Dynamics: Rectilinear and curvilinear motion; Newton's equation of motion, dynamic equilibrium; Introduction to practical use of the above principle and properties.

CY-100 ESSENTIALS OF CHEMISTRY

CY-100	ESSENTIALS OF CHEMISTRY

Stoichiometry:

Significant figures, mole and Avogadro number, empirical and molecular formulas, stoichiometry yield (theoretical and practical)

Atomic Structure and Bonding:

Subatomic particles, Rutherford's and Bohr's atomic models, quantum numbers, electronic configuration, chemical bond, theories of covalent bond, shapes of molecules.

States of Matter:

Kinetic molecular theory, gas laws, liquid properties, types of solids, types of crystals

Acid, Base and Salt:

Theories of acids and bases, buffer solutions

Solutions and Colloids:

Properties and types of solutions, concentration units, colloids, and its classification

Electrical Conductance:

Redox reaction with balancing concept, electrode, electrode potential, and electrochemical series, corrosion

Organic Chemistry:

Organic compounds and their classification, homologous series, functional groups, nomenclature of organic Compounds.

Inorganic Chemistry:

Periodic classification of elements, periodic laws, group trends of various properties of s and p block elements, general characteristics of transition elements, IUPAC nomenclature of complexes.

First Year (Spring Semester)

MT-221 Linear Algebra and Ordinary Differential Equations

MT-221	Linear Algebra and Ordinary Differential Equations

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

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

2nd and Higher Orders Equations: Special types of 2nd 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.

EA-128 FUNCTIONAL ENGLISH

EA 128	FUNCTIONAL ENGLISH

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

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

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

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

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

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

ES-108 Ideology and Constitution of Pakistan

ES-108	Ideology and Constitution of Pakistan

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

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

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

Constitution and State Structure: Federal form of State. Parliamentary form of government. Structure of Government (executive, legislature, and judiciary). Distribution of powers between federal and provincial governments.
Fundamental Rights, Principles of Policy, and Responsibilities: Duty of the citizens of Pakistan (Article 5). Overview of fundamental rights to citizens of Pakistan guaranteed by the Constitution 1973 (Articles 8-28).
Overview of Principles of Policy (Articles 29-40).
Constitutional Amendments: Procedures for amending the Constitution. Notable constitutional amendments and their implications: 8th, 13th, 17th, and 18th

CF-101 IT Fundamentals and Applications

CF-101 IT	Fundamentals and Applications

Fundamentals of IT: Introduction to Information and Communication Technologies (ICT), Components and scope of ICT, ICT productivity tools, Emerging technologies and future trends, Ethical Considerations in Use of ICT
Platforms and Tools, Applications of ICT in education, healthcare and finance. Digital citizenship.
Data Representation and Number Systems: Binary, octal, decimal, hexadecimal systems, data representation: characters, numbers, multimedia.
Databases: Fundamentals of databases: organization and storage, introduction to Information Systems (IS) and Management Information Systems (MIS), real world IS and MIS applications.
Data Communication and Computer Networking: Network topologies, types of network
Programming Languages: Evolution and structures: syntax, semantics, special purpose vs. general-purpose languages, comparative study of data types, control structures and algorithms, basics of coding, practical problem solving.

UE-173 Engineering Surveying - I

UE-173	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. Introduction of Global Positioning System (GPS), Global Navigation Satellite Systems (GNSS), Light Detection and Ranging (LiDAR) and Laser Scanning.
Levelling and Contouring: Methods and types of levels, precise levelling, Methods and applications of contouring.

UE-174 Engineering Materials

UE-174	Engineering Materials

Introduction to Engineering Materials: Classification of materials; Role and selection of materials in civil engineering.
Binding Materials: Manufacturing and constituents of Ordinary Portland Cement (OPC); Types and uses of cement; Properties and field/lab tests (e.g., setting time, fineness); Introduction and uses of lime.
Aggregates: Types and classification of fine and coarse aggregates; Mechanical and physical properties; Importance of grading and grading methods; Lab test introduction i.e., sieve analysis, impact value
Concrete: Basic mix design concept (by volume or ratio); Properties of fresh and hardened concrete; Common tests (slump, compaction factor)
Metals (Steel and Aluminum): Introduction to steel and aluminum; Physical and mechanical properties; Structural applications in civil engineering.
Bricks and Blocks: Manufacturing process; Types and classification; Physical properties and field identification; Applications in construction building.
Glass and Wood: Manufacturing methods; types and properties, Application in construction industry; Types, seasoning and preservation of wood
Bitumen and Asphalt: Types and sources; Properties and typical tests (penetration, ductility); Applications in pavement construction
Introduction to Modern Materials: Fibers; Paints; Plastic; and FRP.

Second Year (Fall Semester)

UE-171 Engineering Surveying – II

UE-171	Engineering Surveying - II

Surveying Drafting and Computations: Introduction to Mapping and Computation, Maps and Plans, Plotting, Profiles, Cross-sections, Importance of Areas and Volumes, Uses of Different Formulae for Calculation of Areas and Volumes, 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, Introduction to Tunnel and Underground surveys.

Hydrographic Surveys: General, Objectives of hydrographic Survey, 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, Orth photos, Photogrammetric Mapping, use of modern instruments and techniques for 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, Use of Grid Coordinates, Computation Technique for Azimuth.

UE-251 Mechanics of Solids - I

UE-251	Mechanics of Solids - I

Different Stress States: Uniaxial state of stresses and strains, Relationships between elastic Constants, Response of materials under uniaxial static loading, Normal and shearing stress and strains, 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.

UE-273 Geology for Civil Engineers

UE-273	Geology for Civil Engineers

Introduction to Engineering Geology*:* Definition, scope, and relevance of geology in civil engineering. Rock cycle and overview of geological processes.

Earth Materials: Minerals and Rocks: Common rock-forming minerals (e.g., quartz, feldspar, mica), rock classification, identification and demonstration (igneous, sedimentary, metamorphic), and engineering properties of rocks.

Geological Structures and Mapping: Folds, faults, joints, unconformities. Use of geological maps and cross sections in engineering. Introduction to stereonets and dip/strike analysis.

Geologic Hazards: Earthquakes (seismic waves, plate tectonics, seismic zoning of Pakistan), landslides (types, causes, mitigation), ground subsidence.

Applied Geology in Civil Engineering: Engineering relevance of geology to dams, tunnels, slopes, roads, and foundations. Rock mass classification (RMR/Q), site investigation basics.

Basic Hydrogeology: Groundwater occurrence, aquifers, springs, water table, wells, permeability and flow in soil/rock.

UE-154 Chemistry for Civil Engineers

UE-154	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

CF-202 Applied Economics for Engineers

CF-202	**Applied Economics for Engineers**

Introduction to Engineering Economics; Principles of Engineering Economics, Difference between Traditional and Engineering Economics, Cost and revenues, Types and behaviour of cost, Profit estimation for engineering projects, Basic accounting concepts for engineers, Interpretation and development of income statement, balance sheet and cash flow statement,

Time value of money; Cost of money, Simple and compound interest, Present and future value, Nominal and effective interest rate, Annuity, Uniform gradient series annual equivalent amount.

Project Evaluation; Evaluating a project, Methods of evaluation of projects, Present worth method, Future worth method, Annual equivalent method, Rate of return method, Cost-benefit estimation, Life cycle cost, Basis of comparisons of alternate projects, Make or buy decisions, Replacement decisions, Sensitivity analysis, breakeven analysis, Scenario analysis

Depreciation and Taxes; Depreciation; Accounting vs Economic, Methods of depreciation, Book and tax depreciation method, Depletion, Gain or loss on the disposal of an asset, Income tax rate for economic analysis

UE-276: URBAN SOCIOLOGY

UE-276	URBAN SOCIOLOGY

Concepts and Terminology: Introduction to Urban Sociology, urban rural differences, Urban suburban & rural communities.

Sociology and Development: Urban communities' types and characteristics, issues related to Urban communities

Issues in Urban sociology: Urbanization; human values & culture, traditions and modernity, effects of technology on humans, postmodern social behaviour of today.

Second Year (Spring semester)

UE-272 Engineering Drawing – II

UE-272	Engineering Drawing - II

Structural Drawings: 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.
Structural Details of Steel Roof Truss: Details of steel roof truss, connection details and fabrication drawings
Drawings and Detailing of Hydraulic and Drainage Structures: Broad prospective about hydraulic and drainage structural details, Layout plan, Sectional details
Drawings and Detailing of Highway and Motor way: Broad prospective about highway and motorway structural details, Layout plan, Sectional details
Introduction to Building Information Modeling (BIM): Different functions of BIM tools, e.g. REVIT etc., 2D and 3D drawings, Architectural drawings in REVIT

UE-274 Structural Analysis – I

UE-274	Structural Analysis - I

Introduction: Introduction of Structural forms, two-dimensional pin connected and flexural forms, three- dimensional pin connected and flexural forms. Idealization 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 and Moving loads and Load combinations.
Determinacy of Structure: Determinate and indeterminate structures, Static and kinematics determinacy, Compatibility and boundary conditions: Structural safety, small deflection theory.
Evaluation of Deformation Using Geometric Methods: Principal of superposition, Moment area method and Conjugate beam method.
Evaluation of Deformation Using Energy Principals: Unit load method, Principal of real work, Principal of virtual work: Castigliano's theorems.
Arches and Suspension Structures: Analysis of Statically Determinate Arches, Introduction to suspension type structures.
Influence Line for Moving Loads: Concept and Evaluation of Influence Lines for Support Reactions, Internal Shear force and Bending Moments in Statically Determinate Beams.
Introduction to modelling & simulation tools: for structural analysis of statically determinate beams and frames.

UE-275 Fluid Mechanics - I

UE-275	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, Hydrostatics 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.
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.
Hydraulic scale models and similitude: Overview of similitude and dimensional analysis, models and prototype, scaling, problems for application. 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.

MT-331 Probability & Statistics

MT-331	Probability & Statistics

Statistics: Introduction, types of data & variables, presentation to data, object, classifications, Tabulation, Frequency distribution, Graphical representation, Simple & Multiple Bar diagrams, Sartorial & Pie-Diagram, Histogram, Frequency Polygon, Frequency Curves & their types.
Measures of Central Tendency and Dispersion: Statistics Averages, Median, Mode, Quartiles, Range, Moments, Skewness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems.
Curve Fitting: Introduction, fitting of a first and second degree curve, fitting of exponential and logarithmic curves, related problems, Principle of least squares, Second order Statistics & Time series not in bit detail.

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

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

Statistical Inference and Testing of Hypothesis: Introduction, Estimation, Types of estimates, Confidence interval, Tests of Hypothesis, Chi-Square distribution/test, one tails & two tails tests, Application in related problems

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

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

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

UE-366: HIGHWAY AND AIRPORT ENGINEERING

UE-366:	HIGHWAY AND AIRPORT ENGINEERING

Transportation Systems & Planning: Role of transportation; Classification of Transportation Systems; Development of various modes in Pakistan; Role of highways within a transport system; Highway classification. Planning needs, goals and Objectives; Types of Plans

Geometric design of Highway: Manual and Computer aided Geometric design of Highways

Highway Pavement Design: Basis of Flexible and rigid pavement design; Manual and Computer aided Pavement design of highways

Highway construction and drainage: Methods of highways construction; Quality Control test and Job mix formula, Urban Highway drainage.

Air Transportation: Component of air transportation; Operations at airports; Airport activity Characteristics of airplanes impacting airport airside operations; Airport site Selection; Airside configuration; Navigation aids; Airport lighting and marking; Terminal buildings; Geometric design of airside; Computer aided Structural design of airfield pavements

CF-201: Civics and Community Engagement

CF-201	Civics and Community Engagement

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

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

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

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

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

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

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

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

CF-200 Community Service

CF-200	Community Service
Orientation to Community Service: [Taught component] Introduction to the concept and practice of community service. Need, objectives and benefits of community service. Foundational theories (educational, undergraduate curriculum, humanities, social science, corporate social responsibility etc.). Tools and skills needed in community service. Contextual examples in community service; case examples. Professional and ethical conduct during community service **Community Service Attachment** Completing 30-35 hours of formal assignment at an organization **Community Service Experience Documentation** Writing a report documenting the experience and submitting it on the prescribed format. **NOTE:** Total contact hour for theory (thought component 8 + documentation activity 6) will be 14 hours.	

Third Year (Fall Semester)

UE-375 Reinforced Concrete Design – I

UE-375	Reinforced Concrete Design - I

Constituent Materials & Properties: Overview of the Properties of hardened cement concrete and Steel (e.g. Stress- strain behaviour, modulus of elasticity, etc.)

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 analysis and design of reinforced concrete members, Working Stress Method, Ultimate Strength Method).

Beam Analysis and Design: Flexure analysis and design of beams (singly, doubly, rectangular section, T/L sections, simple span, one end and both end continuous), Shear analysis and design of beams, Design detailing

Serviceability in RC Beams: Working stress method of analysis for serviceability, Check for deflection, crack width and spacing,

Slab Analysis and Design for Gravity Loading: One-way solid and ribbed slabs, Two-way solid slabs using coefficient method, General discussion on other slab systems, Design of staircase, Design detailing

Columns: Analysis of sections in pure compression, Design of short columns under pure compression and with eccentric loading, Design detailing,

Footings: Isolated footings, Structural design of simple rectangular footing. Design detailing

Steel Detailing (Bond, Anchorage & Development Length): Design and detailing for bond, anchorage, development length, laps and splices

UE-352 Construction Engineering

UE-352	Construction Engineering

Introduction: 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.

Construction Equipment: Types of Equipment used specifically in Building Construction, Analysis of Capital, Operating; Investment; Maintenance; Repair Costs, Equipment Productivity and Cost Effectiveness.

Overview: Overview of construction industry, Road works, retaining walls and dams construction, Stability failures and protection, Dewatering, Pile foundation, Earth moving materials and operations, Excavating and lifting equipment's, Loading and hauling equipment's, Construction equipment's economics, Site layout overview and examples, Foundations and its types, Concrete construction, Masonry Construction, Construction joints, Finishing.

Layout Techniques: Site Selection and Orientation of Buildings, Grading Considerations, Layout techniques with special reference to buildings.

Excavation: 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.

Placement of Concrete: 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.

Construction Methodologies: 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.

UE-371: SUSTAINABLE CONSTRUCTION & DISASTERMANAGEMENT

UE-371	SUSTAINABLE CONSTRUCTION & DISASTERMANAGEMENT

Introduction and Overview: The Roots of Sustainable Construction, Sustainable Development and Sustainable Construction, Ethics and Sustainability.

Green Building Assessment: Purpose of Green Building Assessment Systems, International Green Building Assessment Systems, BREEAM, LEED Building Design and Construction Rating System,

Low-Energy Building Strategies: Building Energy Issues, Passive Design Strategy, Building Envelope, Renewable Energy Systems, Smart Buildings and Energy Management Systems

Construction Operations and Commissioning: Site Protection Planning, Managing Indoor Air Quality during

Construction, Construction Materials Management, Construction and Demolition Waste Management

Introduction to Disaster Management: Definitions, Types, hazard vs. disaster, phases (mitigation, preparedness, response, recovery), Disaster Risk Management Framework (DRMF).

Disaster Risk Concepts: Hazard, vulnerability, capacity, risk models; Risk triangle, Damage Probability Matrix (DPM), Risk Mapping.

Earthquake Engineering: Seismic hazard assessment, ground motion parameters, building codes

Emergency Response and Post-Disaster Recovery: Early Warning Systems and Emergency Planning, Sustainable Post-Disaster Reconstruction and its associated cost, resettlement and rehabilitation strategies

MT-443 Numerical Analysis

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, Simpon'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)

UE-374: ENTREPRENEURSHIP

UE-374	ENTREPRENEURSHIP

Introduction: Entrepreneurship definition, Entrepreneurial process, Role of entrepreneurship in economic development, Statistics of Entrepreneurship in Pakistan (startup growth rate, challenges, government initiatives, role of young population, innovation and technological advancement, and impact on Pakistan's economy)

Entrepreneurial Skills: Characteristics and qualities of successful entrepreneurs (including stories of successes and failures); Areas of essential entrepreneurial skills and ability areas such as creative and critical thinking, innovation and risk taking.

Opportunity Recognition and Idea Generation: Opportunity identification (market trends, gaps, and prior experience), evaluation (technical and financial feasibility); exploitation (market entry strategies, growth sustainability); Idea generation techniques for entrepreneurial ventures, market research (SWOT Analysis)

Marketing and Sales: Target market identification and segmentation; Four P's of Marketing (Product, Price, Place, and Promotion; Developing a marketing strategy; Branding; Digital Media Marketing (Social Media Marketing using Facebook, Instagram, LinkedIn, etc.; Search Engine Optimization (SEOs).

Business Plan Development: Writing a comprehensive business plan, Executive summary, market analysis, and financial projections, Operational and management plans.

Financial Literacy: Basic concepts of Income, savings, investments, assets, liabilities, equities, revenue, expenses, cash flows; understanding startup costs, revenue models, and profitability; Budgeting and financial forecasting for tech ventures; banking products (conventional and Islamic modes of financing),

Team Building for Startups: Characteristics of effective teams (Clear Goals & Defined Roles, Conflict

Resolution, Adaptability); Team building and effective leadership (Culture of trust, Empowering & Leading team, Collaboration); Risks of Team Building (Egos and Personality Clashes, Breakups, Difference in Opinion, Unrealistic Expectations)

Regulatory Requirements in Pakistan: Types of enterprises (e.g., sole proprietorship; partnership; private limited companies etc.); Intellectual property rights and protection; Regulatory requirements to register an enterprise in Pakistan.

UE-359 Structural Analysis – II

UE-359	**Structural Analysis - II**

Analysis of Indeterminate Structures Using Force Approach: Compatibility methods for beams and frames.

Analysis of Indeterminate Structures using Displacement 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 Stiffness and Flexibility methods, Determination of stiffness matrix for Truss and beam elements, Development of structure stiffness matrix, Shear Force and Bending moment diagrams for statically indeterminate beams and frames, Application of suitable Computer Software for analysis of statically Indeterminate beams and frames.

Introduction to Finite Element Method: Introduction to finite elements, Stiffness matrices for bar elements, Transformation matrices, Structure stiffness matrix**.**

Introduction to modelling & simulation tools: for structural analysis of statically indeterminate beams and frames.

Third Year (Spring Semester)

UE-377 Soil Mechanics – I

UE-377	Soil Mechanics - I

Introduction to Soil Mechanics and Nature of Soils: Origin, formation, types of soil deposits, structure and mineralogy of soils, clay minerals, soil fabric.

Phase Relationships and Physical Properties: Water content, void ratio, porosity, unit weights, air voids, saturation, specific gravity, phase diagram, numerical exercises.

Index Properties and classification systems of Soils: Particle size & shape, sieve & hydrometer analysis, Atterberg limits (LL, PL, SL), plasticity index, liquidity index, activity, sensitivity of clays, consistency charts. Unified Soil Classification System (USCS), AASHTO, Textural classification system, group symbols, descriptive terms.

Permeability and Seepage: Darcy's law, permeability testing (falling/constant head), factors affecting permeability, flow nets, seepage force, capillary rise, quicksand conditions.

In-Situ Stresses in Soils: Total, effective, neutral stress; effects of seepage (upward/downward), Boussinesq's theory, Newmark charts.

Shear Strength of Soils: Mohr-Coulomb theory, direct shear, triaxial, unconfined compression, vane shear tests; role of strain rate, drainage conditions; stress-strain behavior.

Consolidation of Soils: 1D consolidation theory, oedometer test, compression index, coefficient of consolidation, time factor, preconsolidation pressure, secondary compression.

Soil Compaction: Principles, Standard/Modified Proctor tests, moisture-density relationship, field compaction, in-situ density, factors affecting compaction.

UE-378 Quantity and Cost Estimation

UE-378	Quantity and Cost Estimation

General: 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.

Estimating Basics: 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.

Developing Preliminary Estimates: Development Process and Illustrative Examples of Conceptual and Assemblies Estimates.

Quantity Takeoff Basics: Process, Measurement Units, Takeoff Rules, Measurement Accuracy, Organization of Takeoff, Overview of Takeoff by Computer, Review of Estimate Math.

Pricing Basics: 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.

Definitive Estimates: Working out quantities, rates and costing analysis of construction works

Bill Processing: General principle, Contents and preparation of bills of quantities for a project and maintaining of Measurement Books.

Estimating Worked Examples: 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. **Further Estimating Concerns**: Estimate Setup, Overhead, Profit, Sources of Estimating Errors, Escalation, Contingency, Life-Cycle Costing.

Use of Estimating Software/ Spreadsheets

UE-372 REINFORCED CONCRETE DESIGN- II

UE-372	REINFORCED CONCRETE DESIGN- II

Design for Torsion: Analysis and design of reinforced concrete members under combined torsion and shear stress. **Two-way Slab Systems:** Analysis and design of flat plate, and flat slabs, for flexure and shear under gravity loading. **Slender Columns:** Analysis and design of slender columns subjected to combined flexure and axial loading,

Design of Different Types of Foundations: Analysis and design of eccentric and combined footings.

Prestressing Principles & Design Philosophy: Principles of prestressing, properties of high-strength materials used in

prestressing, Behavioral aspects of prestressed beams, post-tensioning and pre-tensioning techniques.
Prestress losses: Prestress losses, immediate and time-dependent losses.

UE-379 Essentials in Construction Project Management

UE-379	Essentials in Construction Project Management

Introduction: 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.

Project Management in the Engineering & Construction Industry: PM knowledge areas: PM Life Cycle processes; Organizational structure of a 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

Project Scoping, Bidding and Preconstruction Planning: 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; Work packages; Drawings and Specifications review.

Project Planning, and Scheduling by Deterministic Planning and Methods: 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.

Project Planning, Scheduling by Probabilistic Methods: Uncertainty Sources; Limitations of Deterministic CPM; PERT scheduling; PERT advantages and limitations; PERT today in construction industry.

Resource and Cost Considerations in Project and Planning & Scheduling: Resource planning and scheduling; Resource Productivity; Resource levelling; Resource curves and profiles; Direct cost versus indirect cost; ; Contingency profit; Cost Accrual Patterns; Time cost trade off; Least cost expediting; Project cost accounting; Cash flow and S-Curve;

Project Monitoring and Control: 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

Site Organization: Contractor's Site (Team) Organization Chart, Overview of Site Management issues. Use of Computer Software in Planning and Management for Construction Projects.

UE-356 : TRAFFIC ENGINEERING & MANAGEMENT

UE-356:	TRAFFIC ENGINEERING & MANAGEMENT

Traffic flow characteristics: Flow characteristics, Interrupted and uninterrupted flows, Traffic bottlenecks Traffic studies; Macroscopic and Microscopic studies, Methods of measuring speed and volume, Relation between speed volume and density. Saturation flow, Traffic delay.

Traffic safety and control: Traffic Lighting; Traffic signals, Signs and markings, Safety and Accident studies, One way and tidal flow systems. Traffic calming, bus priorities, pedestrian facilities and Travel demand management, Road safety audit.

Capacity analysis: Analysis of various highway and traffic facilities including multi-lane highways and signalized intersection.

Intelligent transport systems: Introduction to various components of ITS system needs and application. Discussing and debating solution to urban congestions.

Parking design and control: On street and Off Street Parking, Parking demand and Turnover, Parking Control.

UE-460: GEOINFORMATICS

UE-460	GEOINFORMATICS

Introduction to Geoinformatics: Resources of information, Photogrammetric surveying, Satellite system, Aerial and Satellite photogrammetry.

Geograhic Information System (GIS): Fundamental of GIS, Spatial Data types and acquiring consideration. Data models and structures. Coordinate System, Datum and map projection and transformation. Attribute-based operation, Introduction to Spatial Analysis.

Remote Sensing (RS) : Basic concepts. Physical basis of Remote Sensing, Earth Resources Satellites/Platforms, Sensors, Tpes of Resolutions, Georeferencing, Image Processing Techniques. Classification.

Global Positioning System (GPS): Navigation Satellites, Positioning Systems (GLONASS, GPS & Galileo), Fundamentals and Elements of GPS, System Operation & Characteristics, Errors and Atmospheric effects. Differential GPS (DGPS).

Field and Laboratory Work: Training on GPS instrument-based surveys, Integration GPS data in GIS. Exercise on Image processing software and recent GIS software. Demonstration on RS/GIS applications in engineering disciplines.

Final Year (Fall Semester)

UE-470 Soil Mechanics – II

UE-470	Soil Mechanics - II

Subsoil Investigation: Purpose and planning of site exploration, soil sampling (disturbed/undisturbed), boring methods (auger, rotary), in-situ tests (introduction to SPT, CPT), borehole log preparation.

Bearing Capacity of Shallow Foundations: Basic definitions (gross, net, ultimate, safe bearing capacities), failure modes, Terzaghi's and Meyerhof's bearing capacity equations, water table effects, design of isolated and strip foundations. Brief discussion of *Plate load test and field estimation*.

Lateral Earth Pressure: At-rest, active, and passive pressures, Rankine and Coulomb's theories (dry conditions), simple earth pressure diagrams.

Settlement Analysis: Immediate and consolidation settlements, concept of total and differential settlement, allowable limits, overview of primary and secondary consolidation, graphical interpretation (e–log p), use of compression index (Cc).

Slope Stability Analysis: Infinite slope stability, Swedish circle method, Bishop's simplified method (only concept and equation introduction), Taylor's stability number.

Soil Property Modification: Objectives and need for improvement, mechanical compaction, lime/cement stabilization, basic idea of stone columns and geosynthetics.

UE-435: FINANCIAL RESOURCE MANAGEMENT

UE-435	FINANCIAL RESOURCE MANAGEMENT

Resource Management: Meaning; Nature; Aims; Characteristics; Elements; Functions and Objectives of management

Capital financing and Allocation: Difference between sources of capital; Equity and borrowed capital; Financing with debt capital- cost of debt capital; Financing with bonds-cost of equity capital; Financing through retained profit; Leasing as a source of capital; Capital Allocation; An overview of a typical corporate capital budgeting Process

Banking and specialized Credit Institution: Functions of Bank and Credit Institution; Documentation related to International and Domestic Banks, Financial and funding Institutions.

Business and Consumer Loans: Open-End Credit and charge cards; Installments loans; Early payoffs of loans; Personal property loans; Real estate loans.

Taxation: Basics of taxation; Tax formulas and computation; Tax laws for capital gains

Price Changes and Exchange Rate: Terminology and basic concepts; Differential price inflation or deflation; Application strategy; Foreign Exchange rates and purchasing power.

Home ownership and Mortgage financing (Owning v/s Renting): Mortgage financing for home ownership; Mortgage the investment market in the investment market; Comparing mortgages and different interest rates; Effects of different interest rates; Effects of different mortgages lives

Investment Property: Land inventory; Features of investment real estate; Investment return; Determination of project feasibility

UE-452: URBAN MASS TRANSPORTATION

UE-452:	URBAN MASS TRANSPORTATION

Urban Mass Transit: Need, Types of Mass transit, Mass Transit Planning, Mass Transit Design and operation, Mass Transit Issues, Transportation Demand forecast, System Evaluation.

Rail transit: Rail systems; Railway organization; Railway alignment and grades; Cross sectional elements of railway tracks; Pointers and crossings, stations and yards; Railway signal 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; Subways, LRT and MRT.

Design and Feasibility of Public Transport Projects: O-D surveys for public transport users, Analysis of trip patterns using desire lines; Service scheduling and design of new bus services.

EN-406 Environmental Engineering

EN-406	Environmental Engineering

Introduction: Components of environment, Ecosystem, Human population and urbanization, Water supply and sanitary engineering, Global environmental issues

Environmental Chemistry and Biology: Chemical processes for environmental engineering, Kinetics, Oxygen demand: biochemical, chemical, and theoretical, Microbial degradation

Environmental Pollution: Sources and effects of air and water contaminants, municipal and industrial waste, noise pollution

Environmental Quality Standards: Purpose of standards, Types and components of standards, Legal frameworks (local and international)

Environmental Measurements: Calculate chemical concentration, Measuring GHG emissions, pollution load and toxicity

Pollution Control Measures: Application of fundamental control principles to issues in Water and Wastewater quality, Air quality, Noise and vibration, Solid and hazardous waste management

Water Demand & Supply: Population Forecast, Water Uses & Consumption, Types and Variations in Demand, Maximum Demand & Fire Demand, Urban & Rural Water Supply

Introduction to Environmental Impact Assessment: Environmental Impact Assessment Requirement, Implication and Significance

AR-309: ARCHITECTURE AND TOWN PLANNING

AR-309	ARCHITECTURE AND TOWN PLANNING

Architecture

Historical Development: Egyptian, Asiatic, Greek, Roman Byzantine and Gothic Architectures, Modern trends with emphasis on Muslim architecture.

Influences: Geographical, climatic, religious, social, historical.

Principles: Truth or purpose & beauty.

Qualities: Strength, vitality, grace, breadth and scale.

Factors: Proportion, colour and balance.

Use of Materials: Stone, wood metals, concrete, Composite, ceramics.

General Treatment to Plan of Buildings: Walls and their construction, Openings and their position, character and shape, 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

Purpose and Scope: Definitions of town planning, Trends in Urban growth, Objectives of sound planning, Modern planning in Pakistan and abroad.

Information Required: Maps, natural resources, economic resources, legal and administrative problems, civic survey.

Urban Ecology: 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.

Urban Zoning and Land Use Control: 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.

Final Year (Spring Semester)

UE-473: DESIGN OF STEEL STRUCTURES

UE-473:	DESIGN OF STEEL STRUCTURES

Introduction: Design philosophies, Specifications and design codes, and Types of structural steel shapes.

Tension Members: Analysis and design of bolted tension members.

Flexural Members: Analysis and design of laterally supported and unsupported beams with compact sections for flexure and shear, bending strength, and deflection in beams.

Compression Members: Analysis and design of axially loaded columns, Length effects and evaluation of effective length factor for columns in braced and unbraced frames.

Connections: Analysis and design of simple bolted and welded connections.

Plate Girder: Analysis and Design of Plate Girder.

CF-401 Professional Ethics

CF-401	**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, Flowcharting, Conflict Resolution. 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

UE-472 Hydraulics and Water Resources Engineering - I

UE-472	**Hydraulics and Water Resources Engineering - I**

Introduction to Water Resources Engineering: Hydrological 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, Evapotranspiration, 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.

Water Quality and Lake Dynamics: Water quality background, Important Concepts, Best Management Practices, Biological Impaired Water.

UE-471: MECHANICS OF SOLID- II

UE-471	MECHANICS OF SOLID- II

Enhanced Topics Related to Beam Bending and Shear: Unsymmetrical bending, shear flow, shear center, Analysis of curved beams.

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, Torsion in thin tubes and open sections. Torsion in thin and thick wall cylinders.

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

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

UE-474: LAW & REGULATORY CONTROL STUDIES

UE-474	LAW & REGULATORY CONTROL STUDIES

Law: Definitions of government and law; legal relations; subjects and objects of legal relations; physical and jurisdictional individuals; Local Government Legislation / Act and Licenses requirement and regulation professional ethics. Importance of regulating built environment in urban areas.

Property rights: Forms and types, Possession use and disposal. Transaction; ownership; tenancy and traditional forms of property accesses.

Building plans: Submission of Building applications and drawings including all the procedural requirements enforced by the authority: Site visits, serving of notices; Fines and compounding of violation. Analysis of building proposals: conformity with the development plans, removal of encroachment, land use zoning planning criteria building bylaws, design guidelines, building line / parking requirements, chamfer requirements, construction over cultivators etc.

Coordination and Action between Civic Agencies: Consultation with the neighbors, roads authorities' line departments and allied agencies. Declaration and demolition of dangerous buildings; Litigation involved in building; control.

CF-402 Occupational Safety and Health

CF-402	**Occupational Safety and Health**

Health and Safely Foundations: Nature and scope of health and safety, Reasons/benefits and barriers for good practices of health and safety, Legal framework and OHS Management System

Fostering a Safety Culture: Four principles or safely- RAMP (Recognize, Assess, Minimize, Prepare), Re-thinking safety-learning from incidents, Safety ethics and rules, Roles and responsibilities towards safety, Building positive attitude towards safety, Safety cultures in academic institutions.

Recognizing and Communicating Hazards: Hazards and Risk, Types of hazards: Physical (mechanical and non-mechanical), Chemical (Toxic and biological agents), electrical, fire, construction, heat and temperature, noise and vibration, falling and Lifting etc., Learning the language of safety: Signs. symbols and labels, Finding Hazard Information, Material safety data sheets, Safety data sheets and the GHS (Globally Harmonized Systems)

Accidents & Their Effect on Industry: Costs of accidents, Time lost, Work injuries. parts of the body injured on the job, Chemical burn injuries, Construction injuries, Fire injuries.

Assessing and Minimizing the Risks from Hazards: Risk Concept and Terminology, Risk assessment procedure, Risk Metrics, Risk Estimation and Acceptability Criteria, Principles of risk prevention, selection and implementation of appropriate Risk controls, Hierarchy of controls

Preparing for Emergency Response Procedures: Fire, Chemical Spill, first Aid, Safety Drills/Trainings: Firefighting, Evacuation in case of emergency

Stress and Safety at work Environment: Workplace stress and sources, Human reaction to workplace stress, Measurement of workplace stress, Shift work, stress and safety, improving safety by reducing stress, Stress in safety managers, Stress and workers compensation

Incident Investigation: Importance of investigation, Recording and reporting, Techniques of investigation, Monitoring, Review, Auditing Health and Safety