

**SYLLABUS OF BACHELOR OF ENGINEERING  
PROGRAMME IN URBAN ENGINEERING**

**(EFFECTIVE FOR THE BATCH 2017-onwards)**



**DEPARTMENT OF URBAN AND INFRASTRUCTURE ENGINEERING**

**URBAN ENGINEERING  
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY,  
KARACHI-75270, PAKISTAN**

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## COURSES OF STUDY

### First Year

<b>Fall Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>	
		<b>Theory</b>	<b>Practical</b>
UE-118	Engineering Surveying-I	3	1
EE-123	Basic Electrical Engineering	2	0
ME-110	Basic Mechanical Engineering	2	0
MT-114	Calculus	3	0
CY-110	Applied Chemistry for Engineers	2	1
HS-106 / HS-107	Pakistan Studies/ Pakistan Studies (for Foreigners)	1	0
<b>Spring Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>	
		<b>Theory</b>	<b>Practical</b>
UE-117	Engineering Drawing & Drafting-I	1	2
UE-102	Statics and Dynamics	3	1
UE-104	Engineering Materials	3	1
HS-205/ HS-209	Islamic Studies OR Ethical Behaviour (for Non-Muslims)	2	0
MT-221	Linear Algebra & Ordinary Differential Equations	3	0
HS-111	Functional English	2	0

**Second Year**

<b>Fall Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>	
		<b>Theory</b>	<b>Practical</b>
UE-205	Engineering Drawing & Drafting-II	2	2
UE-212	Mechanics of Solids	3	1
UE-215	Engineering Surveying - II	2	1
HS-304	Business Communication & Ethics	3	0
AR-204	Urban Sociology	2	0
UE-114	Computing Tools and Applications	1	2
<b>Spring Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>	
		<b>Theory</b>	<b>Practical</b>
UE-213	Planning and Design of Transportation Systems	3	1
UE-214	Fluid Mechanics	3	1
MT-229	Probability & Statistics	2	0
UE-218	Law and Regulatory Control Studies	2	0
UE-209	Analysis of Structures	3	0
UE-216	Geology for Engineers	2	1

**Third Year**

<b>Fall Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>	
		<b>Theory</b>	<b>Practical</b>
UE-321	Civil Works Quantity & Cost Estimations	1	2
UE-316	Traffic Engineering and Management	3	1
UE-322	Principles of Engineering Construction	3	0
AR-308	Urban Infrastructure Planning & Management	2	0
MT-443	Numerical Analysis	3	0
UE-304	Reinforced Concrete Design	3	1
<b>Spring Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>	
		<b>Theory</b>	<b>Practical</b>
UE-305	Soil Mechanics-I	3	1
UE-306	Structural Analysis and Design	3	0
UE-323	Urban Hydrology and Municipal Engineering	2	1
CF-313	Applied Economics for Engineers	2	0
EN-301	Environmental Engineering-I	2	1
UE-217	Introduction to Geo-Informatics	1	1

**Final Year**

<b>Fall Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>	
		<b>Theory</b>	<b>Practical</b>
UE-403	Soil Mechanics-II	3	1
UE-413	Mechanics and Design of Steel Structures	3	0
UE-427	Hydraulic Engineering and Water Resources Management	2	1
UE-407	Advanced Technologies and Disaster Management	2	0
EN-401	Environmental Engineering-II	2	1
UE-415	Urban Engineering Project		
<b>Spring Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>	
		<b>Theory</b>	<b>Practical</b>
UE-405	Construction Planning & Management	3	0
UE-402	Urban Mass Transportation	2	0
CF-410	Financial Resource Management	2	0
EN-402	Environmental Impact Assessment	2	0
UE-415	Urban Engineering Project	0	6
XX-XXX	Inter-Disciplinary Electives	2	1
UE-421	Modern Aspects of Construction Project Management		
UE-422	Traffic Impact Assessment		
UE-423	Highway and Airfield Pavement Design		
UE-424	Building Information Modeling		
UE-425	Applications in City and Regional Planning		
UE-426	Geosynthetics and their applications	3	0

**Contents of Courses**  
**FIRST YEAR**



**FIRST YEAR - FALL SEMESTER**

<b><u>UE-118</u></b>	<b><u>ENGINEERING SURVEYING – I</u></b>
<b>Basics of Surveying:</b>	Evolution of Surveying and geomatics, Types, Surveying Instrumentation, Survey References, Location Methods, Accuracy and Precision, Errors and Mistakes, Accuracy Ratio, Stationing, Field notes, Field management.
<b>Measurement of Horizontal Distances:</b>	Methods of Linear measurement, Types of Measurement, Tapes, Standard conditions for use of Steel tapes, Taping Accessories and their use, Systematic Taping Errors and Corrections, Random Taping Errors and Mistakes in Taping, Field notes for Taping, Conventional and Electronic Field books.
<b>Levelling:</b>	Theory of Differential Levelling, Effects of Curvature and Refraction, Types of Levels, Techniques of Levelling, Benchmark Levelling (Vertical Control Survey), Profile and Cross-section Levelling, Reciprocal Levelling, Peg test, Errors in Levelling, Contours and their characteristics, Various methods of Contouring.
<b>Angles and Directions:</b>	Horizontal and Vertical Angles, Meridians, Types of Horizontal angles, Azimuths, Bearing, Relationship between Bearings and Azimuths, Reverse Directions, Azimuth and Bearings computations, Magnetic Declination, Types of Compasses.
<b>Surveying Instruments</b>	Theodolites :Introduction, Types of Theodolites, Temporary adjustments, Measurement of Horizontal and Vertical Angles, Prolonging a Straight Line, Permanent Adjustments. Electronic Distance measurement: General, Principles of EDM Operation, EDM Characteristics, EDM Accuracies, Geometry of EDM, Electro-Optical and Microwave Instruments, Total Stations.
<b>Traverse Surveys:</b>	Latitude and Departures, Computation of Error of Closure, and the accuracy of a Traverse, Traversing with Total Station Instruments, Rules of Adjustment, Effects of Traverse Adjustments on the original data, Computation of Omitted Measurements, Area of Closed Traverse by co-ordinate methods, Use of computer programs.
<b><u>EE-123</u></b>	<b><u>BASIC ELECTRICAL ENGINEERING</u></b>
<b>Fundamentals of Electric Circuits:</b>	Charge, Current of voltage and power, Voltage and current sources, Ohm's Law
<b>Voltage and Current Laws:</b>	Nodes, Paths, Loops and branches, Kirchoff's Current law, Kirchoff's Voltage Law, The single loop circuits, The single node-Pair Circuits, Series and Parallel Connected Independent Sources, Resistors in series and parallel, Voltage and Current Division.
<b>Critical Analysis Techniques:</b>	Multi Nodal, Analysis, The super Nodal, mesh Analysis, The super Mesh, Linearity and Superposition, Source Transformations, Thevinin and Norton Equivalent Circuit, Maximum Power Transfer Delta Wye Conversion. Capacitor, inductor, inductance and capacitance combination, The Source Free RL Circuit, Properties of Exponential Response, The Source Free RC Circuit.
<b>On Line Diagram:</b>	Symbols of different components, understanding of one line diagram from generation to the distribution end.
<b>Basic Electronics:</b>	Operation Application of diode/transistor circuits and systems, fundamental concepts of amplifier and oscillators, Concepts of digital Electronics.

<b><u>ME-110</u></b>	<b><u>BASIC MECHANICAL ENGINEERING</u></b>
<b>Thermodynamics:</b>	Work, heat, open, closed and steady flow systems, thermodynamics properties and processes, absolute and gauge pressure, pressure temperature and flow measurement Laws of thermodynamics, equation of continuity, two phase systems, ideal gas, conservation of mass and energy, basic heat engine and refrigeration cycles.
<b>Heat transfer:</b>	Fundamentals of heat transfer, conduction, convection, radiation, thermal, conductivity, overall heat transfer coefficient.
<b>Heating Ventilation and Air Conditioning (HVAC):</b>	Introduction to HVAC components, heating and cooling load, comfort charts, outline of A/C, systems consideration for air-conditioning in building, natural ventilation, insulating materials.
<b><u>MT-114</u></b>	<b><u>CALCULUS</u></b>
<b>Set and Functions:</b>	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 in involving modulus with graphical representation; Definition of set, set operations, Venn diagrams, DeMorgan's laws, Cartesian product, Relation, Function and their types some well known functions. Limit of functions and continuous and discontinuous functions with graphical representation.
<b>Complex Number:</b>	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)
<b>Differential Calculus:</b>	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' Hospital'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 non linear equation using Newton Raphson method
<b>Integral Calculus:</b>	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
<b>Sequence &amp; Series:</b>	Sequence, Infinite Series, Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.
<b><u>CY-110</u></b>	<b><u>APPLIED CHEMISTRY FOR ENGINEERS</u></b>
<b>Electrochemistry:</b>	Law of Electrolysis, E.M.F. series, Corrosion, Types and theories of corrosion, Factors affecting rate of corrosion, Inhibition and protection, Corrosion of ceramics.

<b>Water and Sewerage:</b>	Sources of water, Impurities, Hardness, Water softening, Purification of water for portable and industrial purposes, Electro dialysis, Introduction to environmental pollution, Main sources and effects, Sewerage treatment.
<b>Fuels:</b>	Types of fuels, Classification of fossil fuels.
<b>Metals and Alloys:</b>	Properties and general composition of metals and alloys such as Iron, Copper, Aluminum, Chromium, Zinc used in engineering field.
<b>Engineering Materials:</b>	Inorganic Engineering materials, Cement, Glass Organic Engineering Materials: Polymers, Rubbers, Plastics and Paints. Semiconductors and Dielectric materials.
<b><u>HS-106</u></b>	<b><u>PAKISTAN STUDIES</u></b>
<b>Historical and ideological perspective of Pakistan Movement :</b>	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.
<b>Constitutional Process</b>	Constitutional and Political developments in Pakistan 1947-1973. Salient features of the Constitutions 1956, 1962 and 1973 and amendments.
<b>Land of Pakistan</b>	Geo-physical conditions. Geo-political and strategic importance of Pakistan. Natural resource, viz: mineral, water and power.
<b>Contemporary issues in Pakistan</b>	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. Urbanization in Pakistan - problems and issues 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:
<b><u>HS-107</u></b>	<b><u>PAKISTAN STUDIES (FOR FOREIGNERS)</u></b>
<b>Land of Pakistan</b>	Geo Political & Strategic importance of Pakistan Natural Resources of Pakistan Urban & Environmental issues in Pakistan
<b>Creation of Pakistan</b>	Factors leading to the Creation of Pakistan

<b>Constitution and the Government</b>	The constitution of 1973 – Salient Features
<b>Pakistan and the Contemporary World</b>	Foreign Policy of Pakistan Pakistan’s stand point on Human Rights Global economic issues

**FIRST YEAR - SPRING SEMESTER**

<b><u>UE-117</u></b>	<b><u>ENGINEERING DRAWING &amp; DRAFTING-I</u></b>
<b>Introduction</b>	Importance, Significance and Scope of Engineering Drawing, Introduction to Drawing Instruments and their Use. Principle of Dimensioning and Scaling, Lettering and Geometry of various shapes. Brief review of machine drawings.
<b>Projections</b>	Development of surfaces. Orthographic projection, Isometric and pictorial projections of solid figures, making of free hand sketches from solid objects and from orthographic projections.
<b>Symbols and Abbreviation</b>	Building materials; Electric and plumbing symbols and Abbreviations
<b>Software</b>	Introduction to Engineering Drawing Software (AUTOCAD) and basic its basic tools.
<b><u>UE-102</u></b>	<b><u>STATICS AND DYNAMICS</u></b>
<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; Center 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 two-force and three-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; 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.

<b>UE-104</b>	<b><u>ENGINEERING MATERIALS</u></b>
<b>Classification and General Aspects of Construction Materials:</b>	Overview of materials used in construction; General aspects related to weight, Density, Specific gravity, Strength, Hardness, Durability, Workability and cost of materials; Classification of materials; Ceramics, metals and organics.
<b>Concrete Materials:</b>	Introduction to concrete; Manufacturing, types and properties of cement; Types and properties of fine and coarse aggregates; Quality of water; Mixing, transportation & placing of concrete; Mix design;; Additives and admixtures; Air entrainment; Light weight concrete; Hot and cold weather concrete; Pre cast concrete with special reference to cement concrete blocks.
<b>Metals and Alloys:</b>	Composition, manufacturing, properties and uses of ferrous metals and their alloys; pig iron; cast iron; wrought iron and steel; Types of steel; Effects of heat treatment of steel; Steel sections and bars; Corrosion and method of its prevention.
<b>Natural Stones, Bricks and Tiles:</b>	General characteristics, varieties and uses of building stones; Manufacture, varieties properties and uses of bricks and tiles
<b>Timber:</b>	Varieties, properties and uses of timber; Grain and moisture in wood; Methods of sawing; Defects decay and insect attack; Seasoning and its methods; Preservation and its methods; Glued laminated timber; Plywood, hardboard, chipboard, particle board, fiber board
<b>Rubber, Plastics and Bituminous Materials:</b>	Composition, varieties, properties and uses of bitumen, asphalt glass, rubber Laminates Adhesives, Asbestos, Fiber Glass, Paints and varnishes. Geo textile and geo-membranes. Plastics and composites.
<b>Insulating Materials:</b>	Water proofing and heat insulating materials; Acoustical materials.
<b>HS-205</b>	<b><u>ISLAMIC STUDIES</u></b>
<b>Tauheed: Prophet Hood: Here-After:</b>	Al-Ambiya-22, Al-Baqarah - 163&164, Al-Imran-79, Al –Huda-7, Al-Maida0h-3, Al –Baqarah-48, and one Hadith.
<b>Basic Islamic Practices:</b>	Al-Mu’ minun-1-11, and two Ahadith.
<b>Amer-Bil-Ma’Roof Wa-Nahi Anil Munkar:</b>	the concept of Good & Evil,Importance and necessity of Da’wat-e-Deen Al- Imran – 110,Method of Da’wat-e-Deen An-Nehl-125, Al-Imran-104, and two Ahadith.
<b>Unity of the Ummah:</b>	Al-Imran-103, Al-Hujurat-10, Al-Imran-64, Al-An’ am –108, and two Ahadith.
<b>Kasb-e-Halal:</b>	Ta ha-81, Al- A’raf-32-33, Al-Baqarah-188, and two Ahadith.
<b>Haquq-ul-Ibad:</b>	Protection of life Al-Maidah-32, Right to Property Al-Nisa-29, Right to Respect & Dignity Al-Hujurat -11-12, Freedom of Expression: Al-Baqarah-256, Equality: Al-Hujurat-13,Economic Security: Al-Ma’arij-24-25, Employment Opportunity on Merit: An-Nisa-58, Access to Justice: An- Nisa-135.
<b>Women’s Rights:</b>	An-Nehl-97, Al-Ahzab-35, An-Nisa -07.
<b>Relations with Non-Muslims</b>	Al-Mumtahanah-8-9, Al-Anfa’al-61 and The last Sermon of Hajj of Holy Prophet (PBUH): Relevant extracts.

<b>Seerat (life) of the Holy Prophet (PBUH):</b>	Birth, life at Makkah, declaration of prophet hood, preaching & its difficulties, migration to Madina, brotherhood (Mawakhat) & Madina Charter, The Holy Wars of the Prophet (Ghazwat-e-Nabawi), Hujjat-ul-Wida, The last sermon of Khutbatulwida: Translation and important points
<b>Islamic Civilization:</b>	In the sub-continent: pre- Islamic civilizations. The political, social & moral impacts of Islamic civilization. In the world: academic, intellectual, social & cultural impact of Islam on the world.
<b><u>HS-209</u></b>	<b><u>ETHICAL BEHAVIOUR</u></b>
<b>Introduction to Ethics:</b>	Definition of Ethics, Definition between normative and positive science, Problem of freewill, Method of Ethics, Uses of Ethics
<b>Ethical Theories:</b>	History of Ethics: Greek Ethics, Medieval, Modern Ethics, Basic concept of right and wrong: good and evil, Utilitarianism, hedonism, self-realization: egoism, intuitionism, rationalism, Kant's moral philosophy
<b>Ethics &amp; Religion:</b>	The relation of Ethics to religion, Basic ethical principles of major religions: Hinduism, Judaism, Buddhism, Zoroastrianism, Christianity, Islam
<b>Ethics, Society and moral theory:</b>	Society as the background of moral life, Ethical foundation of Rights and Duties, Universalism and Altruism, Applied Ethics, Theories of punishment
<b><u>MT-221</u></b>	<b><u>LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS</u></b>
<b>Linear Algebra:</b>	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, Diagonalization, Applications of linear algebra in relevant engineering problem
<b>1st Order Differential Equations:</b>	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
<b>2nd and Higher Orders Equations:</b>	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

<b>Partial Differential Equation:</b>	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.
<b>Fourier Series:</b>	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
<b>HS-111</b>	<b>FUNCTIONAL ENGLISH</b>
<b>Speaking and Listening</b>	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.
<b>Vocabulary development</b>	Tips / strategies in vocabulary enhancement Practice in vocabulary development
<b>Reading</b>	Reading skills, Sub skills Reading strategies Reading practice through variety of reading texts and comprehension exercises Précis writing
<b>Writing</b>	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.



**Contents of Courses**  
**SECOND YEAR**

**SECOND YEAR - FALL SEMESTER**

<b><u>UE-205</u></b>	<b><u>ENGINEERING DRAWING &amp; DRAFTING-II</u></b>
<b>Introduction:</b>	Need and requirement of drawings for civil and urban 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. Perspective Drawing and its components.
<b>Building Drawing and its components:</b>	Elements of architectural planning and design, various building elements, details of doors, windows, staircases etc. Plumbing and electrical detailing pertaining to small residential units.
<b>Structural Drawing and its detailing:</b>	Preparation of reinforcement plans and details for reinforced concrete structure (elevation and section) i.e. slabs, beams, columns, footings, staircase, water tanks. Details of steel roof truss, connection details and fabrication drawings.
<b>Computer Aided Drafting:</b>	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. Preparation of submission Drawing on AutoCAD.
<b><u>UE-212</u></b>	<b><u>MECHANICS OF SOLIDS</u></b>
<b>Different Stress States:</b>	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 no uniform members; Thermal stresses and strains
<b>Bending Theory:</b>	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 Curvature, slope and deflection of beams using integration methods
<b>Biaxial state of stress</b>	Biaxial state of stresses, stress transformation; Principal plane, principal stresses and strains; Graphical representation of stress and strains, Mohr's circle of stresses and strains
<b>Theory of Torsion</b>	Theory of torsion of solids and hollow circular shafts, shearing stress distribution, angle of twist, strength and stiffness of shaft.
<b>Cylinders:</b>	Analysis of thin and thick walled cylinder.
<b><u>UE-215</u></b>	<b><u>ENGINEERING SURVEYING – II</u></b>
<b>Earthwork volume Computations:</b>	End areas and Volumes, Prismoidal formula, Calculation of volumes, Area computations, Area by graphical analysis, Use of surveying software.

<b>Highway and Railway Curves</b>	Route surveys, Circular curves, Deflections and Chord calculations, Setting out circular curve by various methods, Compound curves, Reverse, Vertical, Parabolic curves.
<b>Hydrographic Surveys:</b>	General, Objectives of hydro graphic 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
<b>Photogrammetry:</b>	Introduction, linkage to conventional surveying, aircraft and Satellite Remote Sensing.
<b>Construction and Control Surveys</b>	General, Datums and Map Projections, Coordinate System, Horizontal and Vertical control. Construction Surveys; Overview of layout techniques for Buildings, Rail Road, Pipelines and Tunnels
<b><u>HS-304</u></b>	<b><u>BUSINESS COMMUNICATION AND ETHICS</u></b>
<b>Communication Skills:</b>	Definitions and Conditions, Modes: verbal, non-verbal, vocal, non vocal, sender, Receiver, en-coding, decoding, noise, context, emotional maturity, relationships, etc, Language, perception, Non-verbal, body language, physical appearance, cultural differences etc, Personal and interpersonal skills/ perceptions, Communication dilemmas and problems, Public Speaking – speaking situation, persuasion, Making presentations, Interviews
<b>Business Writing:</b>	Formal / Business letters, e-mails: a) job applications and resumes /CV, b) enquiries, c) complaints / adjustments, d) orders, e) quotations, f) banking etc. Memos: layout, language, style. Meeting management: notice, agenda, conducting/ participating, writing minutes. Contracts and agreements (basic theoretical knowledge and comprehension), Research / scientific reports: types, structure, layout / presentation, writing process etc, Tenders (basic theoretical knowledge and comprehension)
<b><u>Engineering / Business Ethics:</u></b>	Need and objectives for code of ethics and its importance, Types of ethics, involvement and impact in daily life, Problems / conflicts /dilemmas in application (case studies), Sexual Harassment /discrimination in the workplace: a) why it occurs, b) myths regarding sexual harassment, c) how to deal with it, d) gender equality e) respect etc. Codes of conduct: Code of Pakistan Engineering Council, Code for Gender Justice, Brief study of other codes of conduct.
<b><u>AR-204</u></b>	<b><u>URBAN SOCIOLOGY</u></b>
<b>Concepts and Terminology:</b>	Introduction types and formats of social relationship: Urban communities; space and its types (physical, social and economic); social infrastructure; sociology and development; social and psychological characteristics
<b>Urban Communities:</b>	Types and characteristics; communities in relation to build environment; issues related to urban communities; case studies
<b>Issues in Urban sociology:</b>	Population; urbanization; human values; culture, traditions and norms; distribution and utilization pattern of resources gender and space; social justice
<b><u>UE-114</u></b>	<b><u>COMPUTING TOOLS AND APPLICATIONS</u></b>

<b>Elementary Programming :</b>	Programming Basics Concepts; flow charts, algorithm, variables declarations, Logical expressions, Input and Output Statements, IF Statement, Loops in Programming, Matrix manipulation
<b>General Computing Applications:</b>	Spreadsheets, Databases, Generating Queries
<b>Computer Algebra Systems (CAS)</b>	Computer solution of engineering problems involving roots of equations, simultaneous equations, curve fitting, integration, differentiation, and differential equations.

**SECOND YEAR - SPRING SEMESTER**

<b><u>UE-213</u></b>	<b><u>PLANNING &amp; DESIGN OF TRANSPORTATION SYSTEM</u></b>
<b>Transportation Systems and Planning</b>	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 Plan.
<b>Geometric and Pavement design of Highway</b>	Geometric design including cross section element Horizontal alignment Curves; Super elevation and gradient Flexible and rigid pavement design; Highway drainage.
<b>Air Transportation:</b>	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.
<b>Waterway Transportation</b>	Role of water transportation as a supplementary transportation system. Classification of harbours; Ports and harbours of Pakistan; Design principles and requirement of harbours; Effect of wind, waves and tides on design; wharves and jetties; Breakwater and groins Channel regulation and demarcations; Classification of docks and their construction; Transit sheds and warehouses. Emerging trends in Ports/ container terminal.
<b><u>UE-214</u></b>	<b><u>FLUID MECHANICS</u></b>
<b>Basic Concepts and Definitions:</b>	Units, density, specific weight, mass, viscosities, compressibility, surface tension, vapor pressure; Continuum, Lagrange and Eulerian description.
<b>Fluid Statics:</b>	Pascal's Law; Measurement of pressure; Pressure head; Hydrostatics forces on submerged areas (plane and curved); Manometers; Buoyancy of fluids; Simple lift and drag equations and their applications
<b>Fluid Kinematics and Steady Flow:</b>	Types of flow; Streamline and streak lines; Velocity and acceleration in steady & unsteady flow; Equation of continuity, Energy Equations; Hydraulic grade line and energy line; Flow in a curved path;
<b>Impulse momentum:</b>	Basic principle; Force on pressure conduits, stationary and moving blades, reducers and bends; Torques in rotating machines; Applications
<b>Fluid Properties Measurements:</b>	Static, velocity and acceleration measurements; Orifices meter, notches & weirs, venturimeter.
<b>Steady Flow Through Pipes:</b>	General equation for friction; Laminar and turbulent flow in circular pipes, semi-empirical theories of turbulence; Velocity profile in circular pipes, pipe roughness, Nukuradse's experiments, Moody's diagrams; Minor losses; Pipe flow problems
<b>Pipe Networks:</b>	Pipes in parallel, branches; Hardy Cross Method; Water hammer; Water Loss; Head losses and material of pipes.

<b><u>MT-229</u></b>	<b><u>PROBABILITY &amp; STATISTICS</u></b>
<b>Presentation of Data:</b>	Classification, tabulation, classes, graphical representation, histograms, frequency polygons, frequency curves and their types.
<b>Measures of Central Tendency:</b>	Means: Arithmetic Mean (A.M), Geometric Mean (GM), Harmonic Mean (HM), and their properties, Weighted mean, median, quartiles, mode and their relations, Merits and demerits of Averages.
<b>Measures of Dispersion:</b>	Range, moments, skewness, quartile deviation, mean deviation, standard deviation, variance and its coefficients, kurtosis.
<b>Curve Fitting:</b>	Goodness of fit, Fitting a straight line, parabola, and circle.
<b>Simple Regression:</b>	Scatter diagram, linear regression and correlation.
<b>Probability:</b>	Definitions, sample space, events. Laws of probability, conditional probability, Dependent and independent events
<b>Random Variable:</b>	Introduction, distribution function, discrete random variable and its probability distribution, Continuous random variable and its probability density function, Mathematical expectation of a random variable, Moment generating functions.
<b>Probability Distribution:</b>	Binomial, Poisson, uniform, exponential and normal distribution functions and its approximation to Poisson distribution.
<b><u>UE-218</u></b>	<b><u>LAW AND REGULATORY CONTROL STUDIES</u></b>
<b>Law:</b>	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 are
<b>Property rights:</b>	Forms and types, Possession use and disposal. Transaction; ownership; tenancy and traditional forms of property accesses
<b>Building plans:</b>	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
<b>Coordination and Action between Civic Agencies:</b>	Consultation with the neighbors, roads authorities' line departments and allied agencies. Declaration and demolition of dangerous buildings; Litigation involved in building; control.
<b><u>UE-209</u></b>	<b><u>ANALYSIS OF STRUCTURES</u></b>
<b>Introduction :</b>	Introduction of structural forms, two dimensional pin connected & flexural form, three dimensional pin connected and flexural form; Surface structure; Simplification for analysis and design
<b>External Loads:</b>	Estimation of external loads external loads, including Dead, Live, Wind and Earthquake loads, Use of codes in estimating different types of external, Static, Dynamic and Moving loads, Load combinations

<b>Statically determinate Structures:</b>	Determinate structures; Static & kinematics determinacy; Compatibility and boundary conditions; Structural safety-stress and deformation characteristics; Small deflection theory. Fundamentals of energy methods; Deformations in pin connected and frame structures by virtual work, moment area, conjugate beam method.
<b>Statically Indeterminate Structures:</b>	Analysis of indeterminate pin connected and framed structures using consistent deformation method, slope deflection method, moment distribution method.
<b>Matrix Methods:</b>	Matrix method of analysis: Stiffness method.
<b><u>UE-216</u></b>	<b><u>GEOLOGY FOR ENGINEERS</u></b>
<b>Introduction to Geology:</b>	The Earth as planet, Process of external origin; weathering and erosion. Processes of internal origin; volcanism, earthquakes, magmatism, plate tectonic & Isostasy. Geological Time scale.
<b>Elements of Structural Geology:</b>	Folds faults, joints, fractures and cleavages Primary & Secondary structures.,
<b>Introduction to Minerals and Rocks:</b>	Crystallographic system Definition, Physical properties of minerals, , Igneous Sedimentary and metamorphic rocks, fossils, Rock classification, stratigraphy, Rock cycle.
<b>Applied Geology:</b>	Application of geology to planning and design of dams, reservoirs, bridges, tunnels, roads/highways, Rocks as construction materials. Bore logs, geological maps,
<b>Rock Classification:</b>	Classification by field measurements and strength tests by rock testing, Physical and mechanical property of rocks.

**Contents of Courses**  
**THIRD YEAR**



**THIRD YEAR - FALL SEMESTER**

<b><u>UE-321</u></b>	<b><u>CIVIL WORKS QUANTITY AND COST ESTIMATIONS</u></b>
<b>General:</b>	Scope of Quantity Surveying; Types of Estimates – Ball parks, thumb rules, square foot, Lump Sum; Rules of Measurements; Procurement Regulations; Concepts of Value Engineering and Life Cycle Costing; Understanding, Specifications, Understanding concepts of Phased Costing
<b>Pre-Award Estimates:</b>	Conceptual Design Estimates; Preparation of BOQ's; Gathering of Cost Data (Market Survey); Rate Analysis; Design Estimates; Tender Stage Estimates. (Procurement Route; Standard Methods of Measurements; Preparing Conditions of Contract; Compilation of Tender Documents, Prequalification of Contractors; Invitation to Tender; Floating of Tenders; Queries and Clarifications; Bids Evaluation; Selection of Contractor; Award of Contract).
<b>Post award estimates Post contract:</b>	Measurement terminology Requests for Information (RFI); Builder's bills of quantities, Measurement, specification and costing of different items of work, Variation Orders/ Change orders, Interim Payment.
<b>Computers in estimating:</b>	Overview; Benefits and Dangers of Computerized Estimating; Spreadsheets; Specialized Estimating Software; Takeoff Software
<b><u>UE-316</u></b>	<b><u>TRAFFIC ENGINEERING AND MANAGEMENT</u></b>
<b>Traffic flow characteristics:</b>	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.
<b>Traffic safety and control:</b>	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.
<b>Capacity analysis:</b>	Analysis of various highway and traffic facilities including multi lane highways and signalized intersection.
<b>Intelligent transport systems:</b>	Introduction to various components of ITS system needs and application. Discussing and debating solution to urban congestions.
<b>Parking design and control:</b>	On street and Off Street Parking, Parking demand and Turnover, Parking Control.
<b><u>UE-322</u></b>	<b><u>PRINCIPLES OF ENGINEERING CONSTRUCTION</u></b>
<b>Overview of the Building Delivery Process:</b>	Project delivery phases, general contractor and project delivery methods, and types of construction projects.
<b>Site Preparation:</b>	Removal of scrubs, trees, surveying and levelling, benchmarking, Layout techniques
<b>Excavation and Heavy Construction:</b>	Soil characteristics, Practices related to Excavating and Lifting, Loading and Hauling, Compacting and Finishing, Paving and Surface Treatments

<b>Substructure Constructional Aspects:</b>	Preparation of ground surface, Ground water and dewatering techniques Supporting structures for excavation, Cofferdams, Piles . Sub structure construction methodologies pertaining to in-situ and precast construction for moderate to high rise buildings General Principles of designing props, bracing and horizontal shuttering platforms, Alignments, plumbs, leveling and cambering, Methods of concreting vertical and horizontal members. Water proofing; Backfilling.
<b>Superstructure Constructional Aspects:</b>	Formwork requirements and design, application and care of formwork for columns, beams and slabs, Constructional methodologies, slab on grade, plain cement concrete floors, Vertical members, Shear walls; Ramps, stairs and Elevator shafts.  Structural Steel , Steel , Field Connections , Safety  Brick Masonry, Concrete Masonry, and Masonry construction practices; jointing of masonry with concrete. Earth quake proof masonry structures
<b>Constructional Aspects related to roofing:</b>	Roofing systems planar and non-planar, Conventional roofs, precast roofs, prefabricated roofs; its construction methodologies, finishes and water proofing.
<b>Non -Structural Elements:</b>	Windows; Types and materials, Definition, Mortar, Bonds and supports for Masonry walls, Ordinary and Special purpose doors, Door materials. Plaster and Gypsum board, Thermal Insulation
<b><u>AR-308</u></b>	<b><u>URBAN INFRASTRUCTURE PLANNING &amp; MANAGEMENT</u></b>
<b>Introduction:</b>	Definition; cities and infrastructure development; types of infrastructure; interface of urban planning and infrastructure examples.
<b>Basic Studies of Urban Planning:</b>	Population/demographic study; Land use study; Study of transport system; Study of Urban landscape and conservation Role of government in provision of community facilities/utilities.
<b>Special Approach to Planning Process:</b>	Urban Design concepts; Theory of good city form; Quantitative methods of urban planning Social welfare planning.
<b>Implementation, Policies, Plans, Programs, Regulation and Renewal:</b>	Definitions of development objectives, policy and planning program; Comprehensive plan and its related documentation process; Programming of community development and capital intensive projects of government; Urban zoning issues; Land subdivisions (both at formal and informal level).
<b>Urban Planning, Management and Maintenance Institutions in Local context:</b>	Organization and structure of Institutions; Internal administration of institutions; People's initiatives and institutions
<b><u>MT-443</u></b>	<b><u>NUMERICAL ANALYSIS</u></b>
<b>Error Analysis:</b>	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.
<b>Finite Difference:</b>	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.

<b>Solution of Non-linear Equation :</b>	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.
<b>Solution of Linear Equation :</b>	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.
<b>Interpolation &amp; Curve Fitting:</b>	Lagrange's, Newton, Hermit, Spline, least squares approximation. (Linear and non-linear curves).
<b>Numerical Integration &amp; Differentiation:</b>	Computation of integrals using simple Trapezoidal rule, 1/3th Simpson's rule, 3/8th Simpson's rule. Composite Simpson's and Trapezoidal rules, computation of solutions of differential equations using ( Euler method, Euler modified method, Runge Kutta method of order 4).
<b>UE-304</b>	<b><u>REINFORCED CONCRETE DESIGN</u></b>
<b>Basic Principles of Reinforced Concrete:</b>	Concrete constituent materials and its mechanical properties; Properties of reinforcing steel, Basic principles of reinforced concrete design and associated assumptions; Design philosophy, Design codes; Factor of safety and load factors.
<b>Working Stress Design:</b>	Overview of Working stress method, Serviceability criteria and checks for deflection, crack width.
<b>Ultimate Strength Method:</b>	Analysis and design of sections in flexure, shear and Compression; One-way solid and two way solid slabs. General discussion on different types of slab, Analysis and design of short columns; Overview of reinforced concrete foundations. Design of isolated and combined footings.
<b>Bond and Detailing requirements:</b>	Bond and anchorage in reinforced concrete members. Detailing requirements, development lengths, laps and splices

**THIRD YEAR - SPRING SEMESTER**

<b><u>UE-305</u></b>	<b><u>SOIL MECHANICS-I</u></b>
<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 pre consolidation pressure, swelling clays and clay-shale
<b>Soil Compaction:</b>	Requirements, principle and methods including standard and modified AASHTO tests.
<b><u>UE-306</u></b>	<b><u>STRUCTURAL ANALYSIS AND DESIGN</u></b>
<b>Structural elements of Super Structure:</b>	Analysis and design of slender RCC columns subjected to combined flexure and axial loading, Deep Beams.
<b>Structural Elements of Sub-Structure:</b>	Analysis and design of combined footing, strap footings. Overview for analysis and design of strip foundation, raft foundation and pile foundation
<b>Buildings subjected to Wind &amp; Earthquake Loads:</b>	Analysis of reinforced concrete and steel, industrial and commercial type of buildings including effects of wind and earthquake. Overview for analysis and design of shear walls

<b>Pre-stressed Concrete:</b>	Principles of pre-stressing, Pre and Post-tensioning, Pre-stress losses, Analysis and design of simply supported pre-stressed beams in flexure and shear, Application in bridges and flyovers
<b>Retaining Structures :</b>	Analysis and design of underground, overhead tanks and reservoirs. Analysis and design of basement walls cantilever and counter fort retaining walls.
<b><u>UE-323</u></b>	<b><u>URBAN HYDROLOGY AND MUNICIPAL ENGINEERING</u></b>
<b>Urban Hydrology</b>	Hydrological cycle; hydrologic unit, Surface water and groundwater hydrology. Precipitation, infiltration, Evaporation, transpiration, outflows. Storage, Rainfall-runoff data analysis
<b>Urban Drainage Works</b>	Stream flow. Run-off-hydrograph, Unit hydrograph, Peak runoff, Rational method, NRCS-TR-55 method. Open channel /Drainage design and disposal
<b>Municipal Engineering</b>	Legal framework (acts/ordinance). Organization of local government; Role of planners; Municipal Engineer co-ordination with different civic agencies
<b>Land development Process:</b>	Regional context; Preparation and contents of neighborhood plan; Subdivision of land i.e. principles, street and block patterns; Development of maps and plans; Zoning restrictions; Local approval process; Financial feasibility
<b>Provision of Government Services:</b>	Street Layout - Global street design (NACTO). Services to support modern transportation and transit systems; Parking facilities, Street lighting
<b>Katchi Abadi:</b>	Katchi Abadi development; Squatters settlement; Improvement land use control and provision of infra structure utilities (water supply, septic tank, etc.)
<b><u>CF-313</u></b>	<b><u>APPLIED ECONOMICS FOR ENGINEERS</u></b>
<b>Introduction:</b>	Basic Concepts including; Scarcity, Micro, Macro and Engineering Economy defined
<b>The Economic Environment:</b>	Demand Analysis, Elasticity of Demand, Types of Goods, Price-Supply-Demand Relationship.
<b>Cost Analysis:</b>	Important cost concepts, Marginal Cost, Opportunity Costs, Fixed and Variable Costs, Breakeven Analysis, Make and Buy Decisions, Value Analysis, Basic concept of Balance Sheet and Income Statements, Concepts and methods of Depreciation
<b>Time Value of Money:</b>	Simple Interest, Compounding and Discounting of single payments and annuities, Sinking Fund
<b>Capital Budgeting Techniques:</b>	Types of Investments, Non-Discounting and Discounting Techniques including ARR, PM, NPR, PI and IRR, Selection among projects having different lives.
<b>Linear Programming:</b>	Mathematical statement of linear programming problems; Graphic solution Simplex procedure; Duality problem
<b>Organization Structure:</b>	Types of ownership, Sole Proprietorship, Partnership and its types, Joint Stock Companies, Labor problems; Labor organizations prevention and settlement of disputes
<b><u>EN-301</u></b>	<b><u>ENVIRONMENTAL ENGINEERING-1</u></b>

<b>Communicable Disease Control:</b>	Water borne, food borne, milk borne and vector borne diseases; Water supply and Sanitation.
<b>Environmental Pollution:</b>	Sources; Pollutants; Effects and remediation of air, water, land, noise and radiation pollution; Toxic/hazardous wastes.
<b>Water Demand &amp; Supply:</b>	Population forecast; Water uses & consumption; Types and variations in demand; Maximum demand & fire demand; Urban & rural water supply; Appropriate technology.
<b>Water Quality:</b>	Water impurities & their health significance; Water quality standards,(U.S. & WHO, etc.); Water quality monitoring; Sanitary survey.
<b>Water Treatment:</b>	Treatment of surface & ground waters, screening, sedimentation, coagulation, coagulants & dosages; Filtration, design aspects of slow and rapid sand filters; Filtration rates, operation head loss, backwash and filter efficiency; Pressure filters; Fluoridation, hardness removal; Iron & Manganese removal; Water softening methods; Water disinfections and chemicals; Use of chlorine, quantity, dosage & efficiency; Emergency treatment methods.
<b>Building Water Supply:</b>	Layout of water supply arrangement; Fixtures and their installation; Tapping of water mains.
<b>Laboratory Works:</b>	Related to the above, sampling techniques and examination of water (physical, chemical and microbiological parameters).
<b><u>UE-217</u></b>	<b><u>INTRODUCTION TO GEO-INFORMATICS</u></b>
<b>Geographic Information System (GIS)</b>	Fundamentals of GIS, Spatial Data types and acquiring consideration. Data models and structures. Attribute-based operation, Introduction to Spatial Analysis. Ethical and legal issues of spatial data mapping
<b>Remote Sensing (RS):</b>	Basic Concepts and principles, Satellite System, Aerial and Satellite photogrammetry, Sensors, Types of Resolutions, Geo-referencing, Image Processing Techniques. Classification.
<b>Global Positioning System (GPS):</b>	Navigational Satellites, Positioning Systems (GLONASS, GPS & Galileo), Fundamentals and Elements of GPS, System Operation & Characteristics, Errors and Atmospheric effects. Differential GPS (DGPS)
<b>Field and Laboratory Work:</b>	Training on GPS instruments based surveys, Integration of GPS data in GIS. Exercises on Image processing software and recent GIS software. Demonstration on RS/GIS applications in engineering disciplines

**Contents of Courses**  
**FINAL YEAR**

**FINAL YEAR -FALL SEMESTER**

<b><u>UE-403</u></b>	<b><u>SOIL MECHANICS-II</u></b>
<b>Sub Soil Investigation:</b>	Purpose, Preliminary and detailed investigation; Boring methods, spacing and depth of borings, soil sampling; In situ testing's; 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>Introduction to Soil Dynamics:</b>	Dynamic loading conditions; Fundamental definitions; Vibration theories of Single Degree-of-Freedom System; Natural frequency of soil-foundation system; Evaluation of various parameters (damping, mass& spring constant) for dynamic analysis; Analysis of machine foundation(vertical mode of vibration only).
<b>Soil Property Modification:</b>	Mechanical and chemical stabilizations of soil, principles & methods.
<b><u>UE-413</u></b>	<b><u>MECHANICS AND DESIGN OF STEEL STRUCTURES</u></b>
<b>Theory of Elasticity</b>	Elementary theory of elasticity, Theories of failure for isotropic materials.
<b>Theory of Plasticity:</b>	Elementary theory of plasticity, plastic hinges, shape factor and failure mechanism.
<b>Introduction to Steel Structures:</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 Bolted and welded tension members of steel.
<b>Flexural Members:</b>	Analysis and design of laterally supported and unsupported steel beams for flexure and shear, Deflection, Design of steel beams for heavy concentrated loads, Bearing plates, Design of purlins



<b>Compression Members:</b>	Analysis and design of axially loaded steel columns, Euler buckling load of columns. Eccentrically loaded steel columns. Columns in braced and unbraced frames
<b>Connections:</b>	Design of bolted and welded simple connections.
<b><u>UE-427</u></b>	<b><u>HYDRAULIC ENGINEERING AND WATER RESOURCE MANAGEMENT</u></b>
<b>Open Channels Hydraulics:</b>	Review of basic equation of steady flow in open channel/Steady uniform flow empirical equations (Chezy and Manning), Specific energy and super-, sub-, and critical depths. Design of alluvial channel (Kennedy and Lacey's Theory) and outlets.
<b>Hydrodynamics:</b>	Ideal and real fluids, rotational and irrotational flow fields, Orthogonality of stream lines and equipotential lines, flow net concepts. Hydraulic Machinery and their characteristics: Pumps and turbines.
<b>Surface Water:</b>	Hydraulic structure-Dams and Barrages, diversions / intake works.
<b>Groundwater:</b>	Ground water hydraulics, wells types and construction, well yield. Control of groundwater contamination, monitoring devices for GW levels and data evaluation. Subsurface (tile) drainage
<b>Water Resources Systems:</b>	Water Resources planning and development Saline water use and wastewater reuse, recycle and disposal. Water management for domestic, industrial and recreational use through available water resources and development of new water resources, water conservation, sustainability.
<b>Landscape Irrigation:</b>	Water-Soil-plant relationship, Water requirement for landscaping. Pressurized and non-pressurized irrigation methods, irrigation scheduling
<b><u>UE-407</u></b>	<b><u>ADVANCED TECHNOLOGIES AND DISASTER MANAGEMENT</u></b>
<b>Advanced Technologies:</b>	Green building Concepts, Sustainable Infrastructure Development such as LEED Systems, Renewable Energy technologies (e.g. wind/solar/Thermal), and construction technologies such as (Trenchless technology).
<b>Facility Management and advanced materials for Strengthening of Infrastructures</b>	Latest development in materials e.g.(cement and aggregate replacement materials) and their contribution in repair of infrastructures, Non -Destructive Testing techniques, Maintenance of different infrastructure facilities. Rehabilitation and repair strategies for reinforced concrete and other infrastructures.
<b>Disaster Management:</b>	Predictions and preparedness strategies for natural disasters such as Earthquakes, Tsunami and Floods. Emergency management; Follow-on Disasters; Recovery plans; Strategies for protection; Loss estimation; Risk and Vulnerability Analysis; Disaster Mitigation.
<b><u>EN-401</u></b>	<b><u>ENVIRONMENTAL ENGINEERING-II</u></b>
<b>Storm Flow &amp; Sewage Flow Estimates:</b>	Rainfall intensity formulas, hydrograph & dry weather flow, sewage quantities; Variations and rates of flows; Velocity gradient & limiting velocities.
<b>Types of Sewerage Systems:</b>	Separate & combined systems; Types shapes, sizes and materials of sewers; Sewer appurtenances, pipe strengths and tests.

<b>Principles of Design:</b>	Construction & maintenance of sewers; Sewer, system analyses; Diameter and gradient, sewer joints, grading, laying, Jointing and testing of sewers.
<b>Characteristics of Sewage:</b>	Municipal and industrial wastes; Water pollution, causes and control parameters; Effluent disposal guideline and standards
<b>Sewage Treatment:</b>	Primary, secondary & tertiary treatment; Screening grit chamber, skimming tanks & sedimentation tanks; Activated sludge treatment, trickling filters, oxidation ponds, etc.
<b>Sewage Disposal Method:</b>	Receiving body, assimilation capacity; Stream pollution and self-recovery, sludge handling & disposal; Effluent Reuse. Control and management of industrial wastewaters
<b>Building Drainage:</b>	Requirements and arrangement of building drainage; Soil pipes, antisiphon pipes and waste water pipes; Sanitary fixtures and traps; House connection and testing of house drainage; Cross connection and back syphonage control.
<b>Solid Waste Disposal:</b>	Types, characteristics, sources and quantities of solid wastes; Collection disposal and recycling.
<b>Laboratory Work:</b>	Related to the above, sampling techniques and examination of wastewater (Physical, chemical and microbiological parameters).
<b><u>UE-415</u></b>	<b><u>URBAN ENGINEERING PROJECT</u></b>

**FINAL YEAR - SPRING SEMESTER**

<b><u>UE-405</u></b>	<b><u>CONSTRUCTION PLANNING &amp; MANAGEMENT</u></b>
<b>Introduction to Construction Management:</b>	Nature of construction industry, Types of construction projects, Functions of owner, architect, engineer, contractor, and construction manager, Types of tenders/contracts; Project Management structures, Scope statement, Establishing project priorities, Work Break Down Structures, Responsibility Matrices
<b>Estimations of Costs, Resources and Time:</b>	Factors influencing the quality of estimates, Estimating guidelines, Macro and Micro estimates.
<b>Project Planning, Scheduling and Control by Deterministic Models:</b>	CPM by arrow notation and precedence notation with computations by event and activity, Times total floats, free floats and independent floats; Time scaled network. Linear Scheduling method
<b>Project Planning, Scheduling and Control by Probabilistic Models:</b>	PERT Program evaluation and review technique; Statistical tools as mean, variance, S.D., probability distribution, Beta Curve, Central Limit Theorem, Computer program(s) for construction management.
<b>Cost Considerations in Project Scheduling:</b>	Direct cost, indirect cost, variation of activity, direct costs with time, time cost trade off; Resource levelling, least cost expediting, S-Curve
<b><u>UE-402</u></b>	<b><u>URBAN MASS TRANSPORTATION</u></b>
<b>Urban Mass Transit:</b>	Need, Types of Mass transit, Mass Transit Planning, Mass Transit Design and operation, Mass Transit Issues, Transportation Demand forecast, System Evaluation
<b>Rail transit:</b>	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
<b>Design and Feasibility of Public Transport Projects:</b>	O-D surveys for public transport users, Requirements and methods, Analysis of trip patterns using desire lines; Determining financial feasibility of the new bus service; Operating conditions for an urban mass transit project, Service scheduling and design of new bus services, Factors involved, Methodology
<b><u>CF-410</u></b>	<b><u>FINANCIAL RESOURCE MANAGEMENT</u></b>
<b>Resource Management:</b>	Meaning; Nature; Aims; Characteristics; Elements; Functions and Objectives of management
<b>Capital financing and Allocation:</b>	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.
<b>Banking and specialized Credit Institution:</b>	Functions of Bank and Credit Institution; Documentation related to International and Domestic Banks, Financial and funding Institutions
<b>Business and Consumer Loans:</b>	Open-End Credit and charge cards; Installments loans; Early payoffs of loans; Personal property loans; Real estate loans

<b>Taxation:</b>	Basics of taxation; Tax formulas and computation; Tax laws for capital gains
<b>Price Changes and Exchange Rate:</b>	Terminology and basic concepts; Differential price inflation or deflation; Application strategy; Foreign Exchange rates and purchasing power
<b>Home ownership and Mortgage financing (Owning v/s Renting):</b>	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.
<b>Investment Property:</b>	Land inventory; Features of investment real estate; Investment return; Determination of project feasibility.
<b><u>EN-402</u></b>	<b><u>ENVIRONMENTAL IMPACT ASSESSMENT</u></b>
<b>Introduction:</b>	Environmental Impact Assessment requirement, its implication and significance International, Federal and Provincial, Environmental Protection Agency Standards. Environmental assessment bye-laws and legislation. EIA analysis of big and small projects as per National and International guidelines
<b>Pollutants and their Impacts:</b>	Air, Water, Land and Noise pollution assessment; Impact of pollutants on Atmosphere, on land, on water and on marine life; controlling agencies monitoring EIA
<b>Evaluation Method:</b>	Performa and conclusion keeping in consideration of socioeconomic and Environmental effect on natural areas such as human, Animal and Plant life
<b><u>UE-415</u></b>	<b><u>URBAN ENGINEERING PROJECT</u></b>
<b><u>XX-XX</u></b>	<b><u>INTER-DISCIPLINARY ELECTIVES</u></b>
<b><u>UE-421</u></b>	<b><u>MODERN ASPECTS OF CONSTRUCTION PROJECT MANAGEMENT</u></b>
<b>Organizing for Construction Project Management:</b>	Trends in Modern Management, Strategic Planning and Project Programming, Organization of Project Participants, Stake holders in a Project – Client, Consultant, Contractor, Interpersonal Behavior in Project Organizations, Perceptions of individual stake holders.
<b>Project delivery Methods:</b>	Traditional and alternative delivery methods, organization of stakeholders, parties contracts. Relational and Lean Project delivery systems. FIDIC, JCT, RICS etc
<b>Construction Contracts:</b>	Definition of contract, major requirement of contracts, Contracts by delivery methods, Contracts by Payment Schemes. Types of Contracts – LumpSum, Unit Rate, Cost Plus, Turn Key, EMC,
<b>Resource Management and Planning:</b>	Kinds of Resource Constraint, Resource-constrained scheduling. Resource Allocation Methods. Histograms
<b>Quality Management:</b>	Quality Planning, Perform Quality Assurance, Perform Quality Control. Tools for QAQC Management

<b>Risk Management:</b>	Risk Management Planning, Risk Identification, Qualitative Risk Analysis, Quantitative Risk Analysis, Risk Response Planning, Risk Register, Risk Monitoring and Control. Effects of Project Risks on Organization
<b><u>UE-422</u></b>	<b><u>TRAFFIC IMPACT ASSESSMENT</u></b>
<b>Fundamentals of Traffic Impact Assessment:</b>	The Traffic Impact Assessment Report: Familiarization with the Components
<b>Traffic Impact and Transport Planning:</b>	Trip Generation and Distribution, Mode Split and Route Assignment
<b>Traffic impact and Traffic Engineering Analysis:</b>	Determination of Level of Service (LOS)
<b>Transport and Traffic Survey for Traffic Impact Assessment:</b>	Methods of collecting, processing, analyzing and managing various, transport and traffic data necessary for a TIA study
<b>Transport Systems Management (TSM) and Travel Demand Management (TDM):</b>	Concepts, models, and practice.
<b><u>UE-423</u></b>	<b><u>HIGHWAY AND AIRFIELD PAVEMENT DESIGN</u></b>
<b>Basic Concepts:</b>	Principles relative to the design, construction and rehabilitation of highway and airfield pavement systems.
<b>Elastic Slab Theory</b>	Introduction to multi-layered elastic and slab theories, properties of pavement materials and methods of characterization, stochastic treatment of design variables.
<b>Advanced Topics in Pavement Design</b>	Review of existing rigid and flexible design methods as well as major fundamentals relative to the rehabilitation of existing pavement system. Familiarization to relevant software.
<b><u>UE-424</u></b>	<b><u>BUILDING INFORMATION MODELING</u></b>
<b>Introduction to BIM fundamentals</b>	BIM in global scenario, Software in BIM, Integration of Software, Market Need for BIM, BIM Local Scenario
<b>Modeling Building Elements:</b>	Modeling exterior and interior walls, creating floors and roofs, Adding doors, windows, footings, columns, and beams.
<b>Building Envelope</b>	Modeling wall types and design features, working with doors, windows, and wall openings, creating roofs with different shapes and slopes.

<b>Curtain Systems:</b>	Designing curtain grid patterns, adjusting grids and mullions, creating and using curtain panels types.
<b>Interiors and Circulation:</b>	Creating stairs and ramps, customizing stair shapes, modeling elevators. Sheets and construction documents Families creation Model Sharing: internal and external sharing Site Design and analysis Conceptual Massing Productivity, Interoperability Visualization and Rendering Constructability: Project phase and Design Options Integrated practice
<b>Energy Analysis Concepts :</b>	Energy Analysis by Mass and Building Element Mode, Green Building Studio (GBS), Day Light Analysis. Etc.
<b><u>UE-425</u></b>	<b><u>APPLICATIONS IN CITY AND REGIONAL PLANNING</u></b>
<b>City and regional planning concepts and terminologies:</b>	Phases of planning. Principles of planning, standard formats of urban planning process; procedures and outputs
<b>Urban Zoning and land use applications:</b>	Parks and recreation facilities, location of public and semi-public infrastructure, Land Use Control: 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.
<b>Applications in Urban Infrastructure:</b>	Street design, road network, metropolitan railways, & airport planning, port and harbour facilities, spatial analysis, sectoral analysis, case examples from cities in Pakistan.
<b><u>UE-426</u></b>	<b><u>GEOSYNTHETICS AND THEIR APPLICATIONS</u></b>
<b>Fundamentals of Geosynthetics:</b>	Introduction, Definitions and classification, Historical development, Basic functions and selection, Raw materials and manufacturing processes, Properties, test methods and Application areas
<b>Geosynthetics functions and Mechanisms</b>	Separation, filtration, reinforcement, drainage, containment, combined functions
<b>Soil–Geosynthetics interaction</b>	Introduction, Granular soil behavior, Soil–geosynthetics interaction mechanisms, Soil–geosynthetics interface resistance, Factors influencing soil–geosynthetics interaction, Laboratory tests for quantification of soil–geosynthetics interface resistance
<b>Engineering applications and installation techniques</b>	Filters and drains, soil subgrades, landfills, retaining walls, embankments, canals and reservoirs, pavements, slope stabilization, erosion control.