

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

(EFFECTIVE FOR THE BATCH 2013-14)



DEPARTMENT OF URBAN AND INFRASTRUCTURE ENGINEERING

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

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COURSES OF STUDY**First Year****Spring Semester**

| Course No. | Course Title | Credit Hours | |
|------------------------|---|---------------------|------------------|
| | | Theory | Practical |
| UE-103 | Engineering Surveying-I | 3 | 1 |
| ME-105 | Applied Thermodynamics | 3 | 1 |
| EE-102 | Electrical Engineering | 3 | 1 |
| MT-111 | Calculus | 3 | 0 |
| CY-105 | Applied Chemistry | 3 | 1 |
| HS-105/ HS-127 | Pakistan Studies OR Pakistan Studies (for Foreigners) | 2 | 0 |

Fall Semester

| Course No. | Course Title | Credit Hours | |
|-------------------|-----------------------|---------------------|------------------|
| | | Theory | Practical |
| UE-107 | Engineering Drawing | 3 | 1 |
| UE-102 | Statics and Dynamics | 3 | 1 |
| UE-104 | Engineering Materials | 3 | 1 |
| PH-121 | Applied Physics | 3 | 1 |
| HS-101 | English | 3 | 0 |

**Second Year
Spring Semester**

| Course No. | Course Title | Credit Hours | |
|----------------|---|--------------|-----------|
| | | Theory | Practical |
| UE-206 | Geology for Engineers | 2 | 1 |
| UE-203 | Computer Tools and Applications | 2 | 1 |
| UE-211 | Engineering Drawing and Drafting | 2 | 1 |
| UE-212 | Mechanics of Solids | 3 | 1 |
| HS-205/ HS-209 | Islamic Studies OR Ethical Behaviour (for Non-Muslims) | 2 | 0 |
| UE-201 | Engineering Surveying-II | 3 | 1 |

Fall Semester

| Course No. | Course Title | Credit Hours | |
|------------|--|--------------|-----------|
| | | Theory | Practical |
| UE-213 | Planning and Design of Transportation Systems | 3 | 1 |
| UE-214 | Fluid Mechanics | 3 | 1 |
| MT-331 | Probability & Statistics | 3 | 0 |
| MT-221 | Linear Algebra & Ordinary Differential Equations | 3 | 0 |
| AR-203 | Urban Sociology | 2 | 1 |

**Third Year
Spring Semester**

| Course No. | Course Title | Credit Hours | |
|------------|---|--------------|-----------|
| | | Theory | Practical |
| UE-307 | Civil Works Quantity & Cost Estimations | 3 | 1 |
| UE-316 | Traffic Engineering and Management | 3 | 1 |
| UE-318 | Principles of Engineering Construction | 3 | 1 |
| UE-319 | Analysis of Structures | 3 | 1 |
| AR-302 | Urban Planning and Management | 2 | 1 |
| HS-304 | Business Communication & Ethics | 3 | 0 |

Fall Semester

| Course No. | Course Title | Credit Hours | |
|------------|---|--------------|-----------|
| | | Theory | Practical |
| UE-305 | Soil Mechanics-I | 3 | 1 |
| UE-317 | Reinforced Concrete Design | 3 | 1 |
| UE-320 | Urban Hydrology and Municipal Engineering | 2 | 1 |
| CF-303 | Applied Economics for Engineers | 3 | 0 |
| EN-301 | Environmental Engineering-I | 2 | 1 |

Final Year
Spring Semester

| Course No. | Course Title | Credit Hours | |
|------------|---|--------------|-----------|
| | | Theory | Practical |
| UE-403 | Soil Mechanics-II | 3 | 1 |
| UE-416 | Mechanics and Design of Steel Structures | 3 | 1 |
| UE-418 | Hydraulic Engineering and Water Resource Management | 2 | 1 |
| UE-417 | Advanced Technologies and Disaster Management | 3 | 1 |
| EN-401 | Environmental Engineering-II | 2 | 1 |
| UE-415 | *Urban Engineering Project | - | - |

Fall Semester

| Course No. | Course Title | Credit Hours | |
|------------|--------------------------------------|--------------|-----------|
| | | Theory | Practical |
| UE-406 | Construction Planning and Management | 3 | 1 |
| UE-412 | Urban Mass Transportation | 3 | 1 |
| UE-414 | Law and Regulatory Control Studies | 3 | 0 |
| CF-401 | Financial Resource Management | 3 | 0 |
| EN-402 | Environmental Impact Assessment | 3 | 0 |
| UE-415 | Urban Engineering Project | 0 | 6 |

*Duration of one academic year: required literature survey and preliminary work will be done during this semester

Contents of Courses
FIRST YEAR

FIRST YEAR - SPRING SEMESTER**UE-103****ENGINEERING SURVEYING – I**

| | |
|---|---|
| Basics of Surveying: | Definition, Evolution of Surveying and geomatics, Types and Classes of Surveys, Surveying Instrumentation, Survey References, Units of Measurement, Location Methods, Accuracy and Precision, Errors and Mistakes, Accuracy Ratio, Stationing, Field notes, Field management. |
| Measurement of Horizontal Distances: | Methods of Linear measurement, Types of Measurement, Chains, 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. |
| Levelling: | Definitions, Theory of Differential Levelling, Effects of Curvature and Refraction, Types of Levels, Automatic Level, Digital Level, Adjustment of Levels, Types of Levelling Staff, Levelling Operations, 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. |
| Angles and Directions: | 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. |
| Theodolites : | Introduction, Types of Theodolites, Repeating, Directional and Electronic 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, Field procedures for Total Stations in Topographic Surveys, Construction layout using Total Stations. |
| Traverse Surveys: | Open and Closed Traverses, 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. |

ME-105**APPLIED THERMODYNAMICS**

| | |
|-------------------------------------|--|
| Thermodynamic Properties: | Working substance; System; Pure substance; PVT surface; Phases; Properties and state; Units; Zeroth Law; Processes and cycles; Conservation of mass. |
| Energy and its Conservation: | Relation of mass and energy; Different forms of energy; Internal energy and enthalpy Work; Generalized work equation Flow and non-flow processes; Closed systems; First Law of Thermodynamics; Open systems and steady flow; Energy equation for steady flow; System boundaries; Perpetual motion of the first kind. |

| | |
|--|--|
| Energy and Property | Thermodynamic equilibrium; Reversibility; Specific heats and their relationship; |
| Relations: | Entropy; Second Law of Thermodynamics; Property relations from energy equation; Frictional energy. Phase diagrams; Rankine cycle; Components of steam power plant. |
| Ideal Gas: | Gas laws; Specific heats of an ideal gas; Dalton's Law of Partial Pressure; Thermodynamic processes. |
| Fundamentals of Heat Transfer: | Conduction and Convection; Radiation; Thermal Conductivity; Overall heat transfer coefficients. Practical Equations. |
| Thermodynamic Cycles: | Cycle work; Thermal efficiency Carnot cycle; Reversed and reversible cycles; Most efficient engine. |
| Two-Phase Systems: | Two-phase system of a pure substance; Changes of phase at constant pressure; Steam tables; Superheated steam; Liquid and vapor curves; |
| Internal Combustion Engines: | Otto cycle; Diesel cycle; Dual combustion cycle; Four-stroke and two-stroke engines; Types of fuels. |
| Reciprocating Compressors: | Condition for minimum work; Isothermal efficiency; Volumetric efficiency; Multi-stage compression; Energy balance for a two-stage machine with intercooler. |
| Introduction to Air-Conditioning and Refrigeration: | Heating and cooling load and its calculations; Comfort charts; Outline of A.C. systems; Consideration for air - conditioning in buildings; Natural Ventilations; Insulating materials. |

EE-102**ELECTRICAL ENGINEERING**

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|--|--|
| Electric and Magnetic Circuits: | Electric Circuits, Kirchoff's Laws, Superposition Theorem, Substitution Theorem Thevenin's Theorem Norton's Theorem, Rosen's Theorem of Star/mesh Transformation, Proof for DC circuits and their application to Circuit Analysis, Magnetic Circuits, Series and Parallel circuits, Principles of calculation of Ampere-turns for Magnetic Circuits of Electromagnets, Transformers, Bipolar and Multi-polar DC machines, Inductances in Series and Parallel, Hysteresis Loss, Eddy Current Loss, Lifting Power of a Magnet. |
| AC Single Phase and Poly phase Systems: | Single Phase systems, Series, Parallel and Series Parallel Circuits, J Operator Method and Polar Method, Resonance and Measurement of Power and Power Factor, Poly-phase Systems, Poly-phase Generation, Star and Delta Connections, Voltage and Current relations, Measurement of Power and Power Factor, Balanced and Unbalanced Load Analysis. |
| DC Machines: | Construction, Simple Lap and Wave Windings, Equalizing Connections and Dummy Coils, Elementary concept of Armature Reaction and Commutation, Cross and Demagnetizing Ampere-turns. DC Generators, Types, EMF Equation, Losses, Efficiency Performance Curves, Characteristics, Critical Resistance, Speed and Effect of Armature Reaction of OCC, Internal and External Characteristics from OCC neglecting and accounting Armature Reaction, Calculation of Series Ampere-turns for Level and Over, Compounding, Motors, Principle, Back EMF, Torque, Speed and Speed Regulation, Types, Characteristics, Performance Curves. Losses and Efficiency, Speed and Torque problems involving Magnetization Curve, Charging and Ignition Circuits of |

Automobiles

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

AC Induction Machines: Induction Motors, Construction, Types, Rotating Field Theory, Principle of Working. Slip and its effect on Motor Current Quantities, Losses, Efficiency and Performance Curves, Starting, Full Load and Maximum Torque relations, Torque Slip Characteristics.

Transformers: Construction, Principle of Working, EMF Equation, Transformation Ratings, No Load Working and Vector Diagram, Magnetizing Current, Vector Diagram on Load, Equivalent Circuit, Open Circuit and Short Circuit Test, Losses, Efficiency and Performance Curves, All-day efficiency, Percentage and Per Unit R, X and Z,

Voltage Regulation and Kapp's Regulation Diagram, Transformer as a Mutually Inductive Circuit.

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

MT-111

CALCULUS

Set and Functions: Define rational, irrational and real numbers; rounding off a numerical value to specified number of decimal places or significant figures; solving quadratic and rational inequalities 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.

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

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

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

Differential Calculus: Differentiation and Successive differentiation and its application, Leibnitz theorem, Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series, Taylor and Maclaurin series, L' 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

Integral Calculus: Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence, Beta and Gamma functions and their identities, applications of integration, Centre of pressure and depth of centre of pressure

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

CY-105

APPLIED CHEMISTRY

Gases: Gas Laws, Kinetic gas equation, Vander Waal's Equation, Critical phenomenon, liquidification of gases, specific heat (molar heat capacity).

Properties of Solution & Liquids: Surface Tension, Viscosity, Osmosis, Osmotic Pressure, pH-Buffer solution, Spectrophotometer, Basic concepts of Colloidal Chemistry, Classification purification (dialysis).

Thermo chemistry: Chemical thermodynamics, Hess's Law, Heat of reaction, Relation between H and U measurement of heat reaction, Bomb Calorimeter

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

Water & Sewage: Sources of water, impurities, hardness, water softening, purification of water for potable and industrial purposes, electro dialysis, introduction to environmental pollution, main sources and effects, Sewage treatment

Fuels: Types of fuels, classification of fossil fuel.

Metals & Alloys: Properties and general composition of metals and alloys such as Iron, Copper, Aluminum, Chromium, Zinc used in engineering field

Engineering Materials: Inorganic engineering materials: Cement, Glass Organic engineering materials: Polymers, Rubbers, Plastics and Paints, Semiconductors and Dielectric materials.

HS-105

PAKISTAN STUDIES

Historical and Ideological Prospective of Pakistan Movement: Two Nation Theory: Definition and Significance; Factors leading towards the Creation of Pakistan; Quaid-e-Azam and the demand of Pakistan.

Land of Pakistan: Geo-physical Conditions; Geo-political and Strategic importance of Pakistan; Natural resources, minerals, water and power.

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|--|---|
| Constitutional Process: | Early efforts to make a constitution: problems and issues; Constitution of 1956 and 1962 and their abrogation; Constitutional and Political Crisis of 1971; Constitution of 1973; Recent Constitutional Developments. |
| Contemporary Issues in Pakistan: | A brief survey of Pakistan Economy; Discussion on Social and Environmental issues. |
| Foreign Policy: | Relations of Pakistan with neighbors; the Muslim World; Super Powers. |
| Human Rights: | Conceptual foundations of Human Rights; Definition, Significance and Importance; Comparison of Islamic and Western perspectives of Human Rights; An overview of UN systems for protection of Human Rights; Review of Important International treaties and Conventions; Pakistan's response to human rights issue at National and International level. |
| <u>HS-127</u> | <u>PAKISTAN STUDIES (FOR FOREIGNERS)</u> |
| Land of Pakistan: | Land and People; Strategic importance; Important and beautiful sights: Natural resources (some portion of economics of Pakistan) |
| A Brief Historical Background: | A brief historical survey of Muslim community in the sub-continent: British rule and its impacts; Indian reaction; Two nation theory, origin and development; Factors leading towards the demand of a separate Muslim state; Creation of Pakistan. |
| Government & Political Development in Pakistan: | Constitution of Pakistan, a brief outline; Governmental structure, federal and provincial, local government institutions; Political history, a brief account. |
| Pakistan & the Muslim World: | Relations with Muslim countries |
| Language and Culture: | Origin of Urdu Language; Influence of Arabic and Persian on Urdu Language and Literature; A short history of Urdu literature; Dominant cultural features. |

FIRST YEAR - FALL SEMESTER**UE-107****ENGINEERING DRAWING-1****General:**

General description, need and requirement of drawing related to Engineering Project. Use and care of drawing instruments; Standard drawing office practice; Principles of orthographic projection related to simple solids.

Descriptive Geometry:

Lines in space and in planes showing their traces and true inclination to planes of projection; Plane curves; Cycloid; Hypocycloid; Involute; Curves of interpenetration of solids; Development of surfaces; Isometric views; Shadows.

Machine Drawing:

Representation of riveted joints, screwed fastenings, keys and cotters; Preparation of fully dimensioned working drawing of component parts of machines; Practice in reading of drawing and deduction of new views from those given

Symbols and Abbreviation:

Building materials; Electric and plumbing symbols and Abbreviations

UE-102**STATICS AND DYNAMICS****Static of Particles:**

Forces in a plane; Newton's First Law; Free body diagram; Forces in space (rectangular components); Equilibrium of a particle in space

Kinematics of Particles:

Rectilinear and curvilinear motion of particles; Components of velocity and acceleration. Motion relative to a frame in translation

Kinetics of Particles:

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.

Rigid Bodies:

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.

Equilibrium of Rigid Bodies:

Free-body diagram; Equilibrium in two and three dimensions; Reaction at supports and connections; Equilibrium of two-force and three-force bodies.

Kinematics of Rigid Bodies:

General Plane motion; Absolute and relative velocity and acceleration

Plane Motion of Rigid Bodies:

Forces and acceleration; Energy and momentum; Conservation of linear and angular momentum

Friction:

Basic principles relating to friction between solid bodies; Friction angle; Wedges.

Analysis of Structures:

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.

UE-104**ENGINEERING MATERIALS****Classification and General Aspects of Construction Materials:**

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.

Concrete Materials:

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.

Metals and Alloys:

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.

Natural Stones, Bricks and Tiles:

General characteristics, varieties and uses of building stones; Manufacture, varieties properties and uses of bricks and tiles

Timber:

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

Rubber, Plastics and Bituminous Materials:

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.

Insulating Materials:

Water proofing and heat insulating materials; Acoustical materials.

PH-121**APPLIED PHYSICS****Introduction:**

Scientific notation and significant figures, Types of errors in experimental measurements, Units in different systems, Graphical Techniques (Log, semi-log and other non-linear graphs)

Vectors:

Review of vectors, Vector derivatives, Line and surface integrals, Gradient of a scalar.

Mechanics:

The limits of Mechanics, Coordinate systems, Motion under constant acceleration, Newton laws and their application, Galilean invariance, Uniform circular motion, Frictional forces, Work and Energy, Potential Energy, Energy conservation, Energy and our environment, Angular momentum

Electrostatics and Magnetism:

Coulombs Law, Electrostatic potential energy of discrete charges, Continuous charge distribution, Magnetic fields, Magnetic force concurrent, Hall effect, Brot- Savart Law, Ampere's Law, Fields of rings and coils, Magnetic dipole, Diamagnetism, Para magnetism and Ferromagnetism

Semiconductor Physics:

Energy levels in a semiconductor, Hole concept, Intrinsic and Extrinsic regions, Law of Mass Action, P-N junction, Transistor, Simple circuits

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| Waves and Oscillations: | Free oscillation of systems with one and more degrees of freedom, Solution for Modes, Classical wave equation, Transverse modes for continuous string, Standing waves, Dispersion relation for waves, LC network and coupled pendulums Plasma Oscillations |
| Optics and Lasers: | Harmonic travelling waves in one dimension, Near and far fields, Two-slit interference, Huygens Principle, Single-slit diffraction, Resolving power of optical instruments, Diffraction Grating Lasers, Population inversion, Resonant cavities, Quantum efficiency, He-Ne, Ruby and CO ₂ lasers, Doppler effect and sonic boom |
| Modern Physics: | Inadequacy of classical physics, Plank's explanation of black body radiation, Photoelectric effect, Compton effect, Bohr theory of Hydrogen atom, Atomic spectra, Reduce mass, De-Broglie hypothesis, Braggs Law, Electron microscope, Uncertainty relations, Modern atomic model, Zeeman effect, Atomic nucleus, Mass-energy relation, Binding energy, Nuclear forces and fundamental forces, Exponential decay and half-life, Radioactive equilibrium in a chain, Secular equilibrium, Nuclear stability, Radiation detection instruments, Alpha decay, Beta decay, Gamma decay attenuation, Nuclear radiation hazards and safety, Medical uses of Nuclear Radiation, Fission, Energy release, Nuclear Reactors, Breeder Reactor, Nuclear Fusion. |

HS-101**ENGLISH**

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| Study Skills: | Reading, dictionary, library skills, speed reading, writing outlines, note taking |
| Advanced reading Comprehension: | Using texts dealing with science, literature and human rights |
| Oral Communication: | Confidence building, class discussion, speeches, verbal interaction |
| Précis Writing: | Rules of précis writing, practice précis |
| Controlled and guided writing: | Pre writing (planning, information gathering, preparing to write), writing, search for topic sentences, developing a theme, following up ideas and arguments, outline plans etc. |
| Essay Writing: | a) Types of writing– narrative, descriptive, expository, argumentative etc. b) Using guided writing to organize essays. c) Include human rights as essay topics |
| Writing short reports: | a) Short background of report and its importance, b) memo report, c)brief reports on events seen / experienced like visit to an exhibition etc. |
| Letter writing: | a) format and layout, b) formal letters, c) types of letters – invitations(acceptance and refusals), condolence, thanks, congratulations, to the editor, chairman, class advisor, Dean, Vice Chancellor etc. |
| Applied Grammar: | Morphology, Types of sentences, Sentence analysis, Tenses, Jumbled sentences, Question tags, Homonyms and Homophones, and their use in sentences, Punctuation – sentences and paragraphs, Use of idioms |

Contents of Courses
SECOND YEAR

SECOND YEAR - SPRING SEMESTER**UE-206****GEOLOGY FOR ENGINEERS****General Geology****Definition and Scope:**

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

Elements of Structural Geology:

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

Elements of Crystallography:

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

Applied Geology:

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

Rock Classification:

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

Earthquakes:

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

UE-203**COMPUTING TOOLS AND APPLICATIONS****Elementary Programming:**

Programming Basics Concepts; flow charts, algorithm, variables declarations, Logical expressions, Input and Output Statements, IF Statement, Loops in Programming, Matrix manipulation, Programming exercises based on Engineering applications.

Concept of Geo-Spatial Information System:

Definition, Evolution of GIS, Concept of GIS, Scope of GIS, Components of GIS, Hardware, Software, Data, Policy & Protocol of GIS.

UE-211**ENGINEERING DRAWING AND DRAFTING****Infrastructure Projects Drawing:**

Need and requirement of drawings at different stages of designing and construction. Symbols and nomenclature needed for specific drawings such as architectural, structural, plumbing; electrical, air-conditioning etc Drawings at different stages of projects. Elements of perspective drawing

Building Drawing:

Elements of architectural planning and design, conceptual, schematic and working drawings and details of residential, commercial, religious, recreational, industrial, clinical, hospital, and educational buildings; Details of doors, windows, staircases etc.
Elements of structural drawing and detailing, preparation of foundation plan, structural framing, slab details, staircase details, water tanks, beam and column elevations and sections mostly pertaining to reinforced concrete structures.
Details of steel roof truss, connection details and fabrication drawings; Plumbing and electrical detailing. Working and shop drawings.

Road & Earth Work Drawing: Alignment profiles, cross sections, geometric and intersection drawings.

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

UE-212**MECHANICS OF SOLIDS**

Different Stress States: Uniaxial state of stresses and strains; Relationships between elastic Constants; Response of materials under different sets of monotonic loading; Normal and shearing stress and strains; Gradually and suddenly applied loads; Distribution of direct stresses on uniform and no 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 Curvature, slope and deflection of beams using integration methods

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

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

Cylinders: Analysis of thin and thick cylinder.

HS-205**ISLAMIC STUDIES**

Fundamentals of Islam: Tauheed; Arguments for the Oneness of God, Impact of Tauheed on human life; Place of Man In the Universe. Purpose of creation; Textual study of Surah Al-Rehman and Sura Al-Furqan. Prophet hood: Need for prophet. Characteristics of prophet; finality of prophethood; Seerat life of the Prophet as embodiment of Islamic-Ideology, Faith in Hereafter (AKHRAT); Effects of the beliefs on worldly life

Ibadah: Concept of Ibadah, Major Ibadat-Salat, Sou Soum Zakat, Hajj and Jihad.

Basic Source of Shariah: The Holy Quran: Its revelation and compilation. The authenticity of the text; Hadith: Its need, authenticity and importance, Consensus(UMA), Analogy (QIYAS)

Sources of Knowledge: Islamic Approach to intuition, Reason and Experience, Revelation (Wahi) as a source of Knowledge.

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

HS-209**ETHICAL BEHAVIOUR**

Introduction to Ethics: Definition of Ethics, Definition between normative and positive science, Problem of freewill, Method of Ethics, Uses of Ethics

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| Ethical Theories: | 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 |
| Ethics & Religion: | The relation of Ethics to religion, Basic ethical principles of major religions: Hinduism, Judaism, Buddhism, Zoroastrianism, Christianity, Islam |
| Ethics, Society and moral theory: | Society as the background of moral life, Ethical foundation of Rights and Duties, Universalism and Altruism, Applied Ethics, Theories of punishment |
| UE- 201 | ENGINEERING SURVEYING – II |
| Surveying Drafting and Computations: | General, Maps and Plans, Plotting, Contour Maps, Profiles, Cross-sections, End areas and Volumes, Prismoidal formula, Calculation of volumes, Area computations, Area by graphical analysis, Use of surveying software. |
| Highway and Railway Curves: | Route surveys, Circular curves, Deflections and Chord calculations, Setting out circular curve by various methods, Compound curves, Reverse, Vertical, Parabolic curves, Computation of the high or low point on a vertical curve, Design considerations, Spiral curves, Spiral curve computations, Approximate solution for spiral problems, Super elevation. |
| Construction Surveys: | Introduction, Horizontal and Vertical control, layout techniques with special reference to Buildings, Rail Road, Pipelines and Tunnels. |
| Hydrographic Surveys: | 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. |
| Photogrammetry: | Introduction, photogrammetry and its Applications, Flying heights, Flight planning, Relief displacement, Photograph overlap, Ground control for mapping, Mosaics, Stereoscopic viewing and Parallax, Stereo plotting instruments, Analytical plotters, Orthophotos, Photogrammetric mapping, Remote Sensing. |
| Control Surveys: | General, Geodesy Universal Transverse Mercator grid system, Modified Transverse Mercator grid system, State plane coordinate grid system, Lambert projection, Computations for the Lambert projection, Computations for the Transverse Mercator Secant Projection, Use of grid coordinates, Horizontal control techniques, Triangulation, Control survey markers, Direction of a line by observations on Polaris, Time and procedure for Observing Polaris, Computation technique for azimuth determination, Gyro theodolite |
| Global Positioning System and Information System: | Background information, Global positioning, Receivers, Satellites, Errors, GPS surveying techniques and applications, Survey planning, Initial ambiguity resolution, Vertical positioning. Geo database, techniques of Data capturing, planning GNSS survey, Questioner Design, and Importing GNSS data in GIS. |

SECOND YEAR - FALL SEMESTER**MT-331****PROBABILITY & STATISTICS**

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| 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. |

MT-221**LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS**

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|------------------------|--|
| 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, ower, 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 |
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| 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 2 nd 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 |
| <u>AR-203</u> | |
| <u>URBAN SOCIOLOGY</u> | |
| Concepts and Terminology: | Urban and rural; family, household and clan; 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 |
| Urban Communities: | Types and characteristics; communities in relation to built environment; issues related to urban communities; case studies |
| Issues in Urban sociology: | Population; urbanization; human values; culture, traditions and norms; distribution and utilization pattern of resources gender and space; social justice |
| <u>UE-213</u> | |
| <u>Planning & Design of Transportation System</u> | |
| Transportation Systems and 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 Plan. |
| Geometric and Pavement design of Highway: | Geometric design including cross section element Horizontal alignment Curves; Super elevation and gradient Flexible and rigid pavement design; Highway drainage. |
| Air Transportation: | 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. |
| Waterway Transportation: | 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. |

UE- 214

FLUID MECHANICS

Basic Concepts and Definitions:

Units, density, specific weight, mass, viscosities, compressibility, surface tension, vapor pressure; Continuum, Lagrange and Eulerian description.

Fluid Statics:

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

Fluid Kinematics and Steady Flow:

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;

Impulse momentum:

Basic principle; Force on pressure conduits, stationary and moving blades, reducers and bends; Torques in rotating machines; Applications

Fluid Properties Measurements:

Static, velocity and acceleration measurements; Orifices meter, notches & weirs, venturimeter.

Steady Flow Through Pipes:

General equation for friction; Laminar and turbulent flow in circular pipes, semi-empirical theories of turbulence; Velocity profile in circular pipes, pipe roughness, Nikuradse's experiments, Moody's diagrams; Minor losses; Pipe flow problems

Pipe Networks:

Pipes in parallel, branches; Hardy Cross Method; Water hammer; Water Loss; Head losses and material of pipes.

Contents of Courses
THIRD YEAR

THIRD YEAR - SPRING SEMESTER

UE-307

CIVIL WORKS QUANTITY AND COST ESTIMATIONS

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|----------------------------------|--|
| General: | Scope of civil engineering works; General practice in government departments for schedule of rates and specifications; Rates analysis; Specifications for various items in construction. |
| Estimation & Costing: | Working out quantities, rates and costing analysis of construction materials; Valuation, Depreciation and sinking fund |
| Bill Processing: | General principle; Contents and preparation of bills of quantities for a project and maintaining of Measurement Books. |
| Worked Examples: | Measurement, specification and costing of: excavation and back filling, mass concrete retaining wall, beams, concrete piles, steel or wood truss or steel framed gantry, estate road, sewer and water main pipe works. |
| Contract & Tender: | Preparation of civil engineering contracts and tender documents |
| Civil Work Account: | General principles of account of work; Responsibilities of engineer, contractor & owner. |

UE-316

TRAFFIC ENGINEERING AND MANAGEMENT

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| 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-318

PRINCIPLES OF ENGINEERING CONSTRUCTION

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| Over-view of Constructional Aspects: | An over view of constructional aspects and principles for different types of engineering projects, e.g. building retaining structures, bridges, pavements and special structures; General consideration common to all projects with special reference to building structures |
| Layout Techniques: | Layout techniques with special reference to buildings |
| Excavation: | Excavation in deferent types of soils, and solution of particular problems arising out of condition of sub – soil at site e.g. de-watering, shoring and bracing, sheet piling etc. |

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| 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. |
| Substructure Constructional Aspects: | Sub structure construction methodologies pertaining to insitu and precast construction for moderate to high rise buildings; Mechanized construction techniques e.g. lift slabs etc; Form work for general institute construction and a comparison with precast construction; General Principles of designing props, bracing and horizontal shuttering platforms. Alignments, plumbs, leveling and cambering; Methods of concreting vertical and horizontal members, including mechanized placement, ready mix concrete etc. |
| Earth Work Road Constructions & Flooring Systems: | Materials; Construction machineries; Technologies involved during execution of Marine structures long-term and short-term maintenance of said works Constructional methodologies, slab on grade, plain cement concrete floors, floor finishing; Roofing systems planar and non-planar, its construction methodologies, finishes and water proofing |
| Non Structural Elements: | Non structural elements, specially masonry and brickwork with sufficient details related to constructional aspects; Doors, windows alignment, plumb and fixation; Construction aspects related to services. |

UE-319**ANALYSIS OF STRUCTURE**

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| Introduction: | Introduction of structural forms, two dimensional pin connected & flexural form, three dimensional pin connected and flexural form; Surface structure; Simplification for analysis and design |
| External Load: | Techniques of evaluation of estimated external loads, Dead, live , Wind and Earthquake loads, Use of Codes in estimating different types of external Static, Dynamic and Moving Loads, Load combinations. |
| Statically determinate Structures: | Determinate structures: Static and kinematics determinacy; Compatibility and boundary conditions; Structural safety-stress and deformation characteristics Small deflection theory. Virtual work and virtual displacement; Fundamental of energy method; Principle of superposition; Maxwell's & Betty Law. Deformation in pin connected and frame structures by virtual work, moment area, elastic load, conjugate beam method, energy method. |
| Statically Indeterminate Structures: | Analysis of indeterminate pin connected and framed structures using consistent deformation method, slope deflection method, moment distribution method. |
| Matrix Methods: | Matrix method of analysis: Flexibility method; Stiffness method. |

AR-302**URBAN PLANNING AND MANAGEMENT**

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| Urban Planning and Management Context: | Local planning process since British period and after Independence of Pakistan); Current planning process in Pakistan with special focus on Karachi; Inter-governmental relationships in local planning its complexity and unresolved issues. |
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Basic Studies of Urban Planning: 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.

Special Approach to Planning Process: Urban Design concepts; Theory of good city form; Quantitative methods of urban planning Social welfare planning.

Implementation, Policies, Plans, Programs, Regulation and Renewal: 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).

Urban Planning, Management and Maintenance Institutions in Local context: Organization and structure of Institutions; Internal administration of institutions; People's initiatives and institutions

HS-304

BUSINESS COMMUNICATION AND ETHICS

Communication Skills: 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

Business Writing: 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)

Engineering / Business Ethics: 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.

THIRD YEAR - FALL SEMESTER**UE-305****SOIL MECHANICS-I**

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| Nature of Soils: | Origin; Formation; Soil minerals; Clay mineralogy; Soil structures; Particle shapes and sizes. |
| Composition and Physical Properties: | Phase diagram, water content, void ratio, porosity, degree of saturation, specific gravity, unit weights, mass-volume relationships; Formation, structural & physical properties of clay minerals. |
| Index Properties and Classification Tests: | 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 |
| Soil Classification: | Unified soil classification system, M.I.T. system and AASHTO classification |
| Systems: | systems |
| Water in Soils: | 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. |
| Stress Acting in Soils: | 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. |
| Shearing Strength of Soils: | 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. |
| Compressibility and Consolidation: | 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 |
| Soil Compaction: | Requirements, principle and methods including standard and modified AASHTO tests. |

UE-317**REINFORCED CONCRETE DESIGN**

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| Basic Principles of Reinforced Concrete: | Concrete constituent material and its mechanical properties; assumptions; Behavior of reinforced concrete members in flexure; shear and compression; Design philosophy, Design codes; Factor of safety and load factors |
| Working Stress Design: | Working stress method and its importance; Serviceability criteria and checks for deflection, crack width. |

Ultimate Strength Method: Ultimate strength method; Analysis and design of sections in flexure, shear and Compression; One-way solid and two way slab design; General discussion on different types of slab systems and identification of available methods; Short and long columns, classification and general procedure of designing such columns; Design of isolated footings; Discussion of different types of footings and identification of design procedure for such footings.

Pre stressing Principles & Design Philosophies: Principles of pre stressing; Behavioural aspects of Pre stressed beams; Post and pre-tensioning techniques; Pre-stress losses; Analysis and Design of simply supported pre stressed beam in flexure and shear

UE-320**URBAN HYDROLOGY AND MUNICIPAL ENGINEERING**

General: Organization of local government; Role of planners; Municipal Engineer co-ordination with different civic agencies.

Land development Process: 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

Provision of Government Services: Street layout and design; Transit services; Parking facilities, Street lighting;

Katchi Abadi: Katchi Abadi development; Squatters settlement; Improvement land use control and provision of infra structure utilities

Urban Hydrology: Precipitation; Surface and Ground water Reservoirs; Dams; Lakes; Water conveyance by canals. Evaporation and transpiration.

Urban Storm Water Drainage: Stream flow and run-off-hydrograph, unit hydrograph, synthetic hydrographs and matrix method of unit hydrographs

CF-303**APPLIED ECONOMICS FOR ENGINEERS**

Introduction: Basic Concepts; Engineering Economy defined; Measures of financial effectiveness - Non - monetary values

The Economic Environment: Consumer and Producer goods; Measures of economic worth; Price-Supply-Demand Relationship

Selections Between Alternatives: Present Economy, Selections among materials, techniques designs etc; A basic investment philosophy; Alternatives having identical lives; Alternatives having different lives.

Value Analysis: Important cost concepts; Cost-benefit analysis feasibility studies; Value analysis in designing and purchasing.

Linear Programming: Mathematical statement of linear programming problems; Graphic solution Simplex procedure; Duality problem

Depreciation and Valuation: Types of Depreciation; Economic life; Profit and interest; Returns to capital, productivity of capital Discrete and continues compounding; Discounting; sinking fund problems.

Capital Financing and Stock Budgeting: Types of ownership: Types of stock; Partnership and joint companies; Banking and specialized credit institutions.

Theory of Production: Factors of production; Laws of Returns; Break-even charts and relationships

Industrial Relationship: Labor problems; Labor organizations prevention and settlement of disputes.

EN-301

ENVIRONMENTAL ENGINEERING-1

Communicable Disease Control: Water borne, food borne, milk borne and vector borne diseases; Water supply and Sanitation.

Environmental Pollution: Sources; Pollutants; Effects and remediation of air, water, land, noise and radiation pollution; Toxic/hazardous wastes.

Water Demand & Supply: Population forecast; Water uses & consumption; Types and variations in demand; Maximum demand & fire demand; Urban & rural water supply; Appropriate technology.

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

Water Treatment: 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.

Building Water Supply: Layout of water supply arrangement; Fixtures and their installation; Tapping of water mains.

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

Contents of Courses
FINAL YEAR

FINAL YEAR -SPRING SEMESTER

UE-415

URBAN ENGINEERING PROJECT

UE-403

SOIL MECHANICS-II

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| Sub Soil Investigation: | 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 |
| Settlement Analysis: | 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. |
| Bearing Capacity: | 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. |
| Lateral Earth Pressure: | 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). |
| Stability of Slopes: | 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 |
| Introduction to Soil Dynamics: | 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). |
| Soil Property Modification: | Mechanical and chemical stabilizations of soil, principles & methods. |

UE-416

MECHANICS AND DESIGN OF STEEL STRUCTURES

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| Theory of Elasticity: | Elementary theory of elasticity, Theories of failure for isotropic materials. |
| Theory of Plasticity: | Elementary theory of plasticity, plastic hinges, shape factor and failure mechanism. |
| Introduction to Steel Structures: | Steel properties, design load and load factors, Types and shapes of structural steel members, Specifications and design codes, Safety factors. |
| Tension Members: | Design of Bolted and welded tension members of steel. |
| Flexural Members: | Design of laterally supported and unsupported steel beams, Deflection, Design of steel beams for heavy concentrated loads, Bearing plates, Design of purlins , Analysis and Design of steel beams with unsymmetrical cross-section and unsymmetrical bending, Shear Centre, Shear Flow, Analysis of curved beam, |

Design of built-up beams, gentry girder and plate girder.

Compression Members: Design & analysis of axially loaded steel columns, Design of laced columns, Analysis and design of eccentrically loaded steel columns, Length effects and evaluation of effective length factor for steel columns in braced and unbraced frames. Struts and columns; Euler, Rankine and other formulas for buckling load of columns; Stability analysis of columns under eccentric loading.

Connections: Design of riveted bolted and welded connections.

UE-418

HYDRAULIC ENGINEERING AND WATER RESOURCE MANAGEMENT

Elementary Hydrodynamics: Ideal and real fluid, Differential equation of continuity, Rotational and of flow fields, Orthogonality of stream lines and equipotential lines, Flow net and its limitations, Different methods of drawing flow net.

Steady Flow in Open channels: Uniform flow equations (Chezy and Manning), Specific energy and critical depth, Dynamic equation of gradually varied depth, surface profiles and back water curves, Hump and constrictions, Hydraulic jump, Broad crested weirs, venture flume and critical depth flume.

Centrifugal Pumps: Types, Stages, Works and efficiencies, Specify speed and characteristic curves.

Surface Water: Design of open lined and unlined channels, Sustainable tapping; Resources; Principles of planning and development. Land drainage for reducing water table; Types of Surface drainage.

Water Transmission System: Water Resources planning and development for future demand including storage reservoirs Saline water use and wastewater technique, Development of Ground water storage by constructing check dams and delay action dams; Developing the Water streams, rivers for permanent recharging basins and use the facility for recreational Waterways and open space for Land use.

Ground Water: Control of ground water contamination and monitoring devices. Water management for Domestic, Industrial and recreational use through available water resources and development of new water resources Ground water hydraulics, wells, yields, tube wells.

Irrigation: Water soil co relationship, Irrigation Method and technique for conserving the water losses; Design of alluvial canal and outlet; Water requirement for the garden lawn etc., Lift irrigation

UE- 417

ADVANCED TECHNOLOGIES AND DISASTER MANAGEMENT

Material Technologies: Recycling of conventional constructional materials, cement replacement materials, new reinforced concrete e.g. Ferro cement, Fiber -reinforced concrete; fibers, synthetic and glass fibers etc; Aggregate replacement.

Constructional Technologies: Latest development in trenching and excavation e.g. trench less technology; specialized formworks; technologies for building deep waterproof basements; mechanized construction methods and equipments.

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

EN-401**ENVIRONMENTAL ENGINEERING-II**

Storm Flow & Sewage Flow Estimates: Rainfall intensity formulas, hydrograph & dry weather flow, sewage quantities; Variations and rates of flows; Velocity gradient & limiting velocities.

**Types of Sewerage Systems:
Principles of Design:** Separate & combined systems; Types shapes, sizes and materials of sewers; Sewer appurtenances, pipe strengths and tests. Construction & maintenance of sewers; Sewer, system analyses; Diameter and gradient, sewer joints, grading, laying, Jointing and testing of sewers.

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

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

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

Building Drainage: Requirements and arrangement of building drainage; Soil pipes, antisiphon pipes and waste water pipes; Sanitary fixtures and traps; House connection and testing of house drainage; Cross connection and back syphonage control.

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

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

FINAL YEAR - FALL SEMESTER**UE-415****URBAN ENGINEERING PROJECT****UE-406****CONSTRUCTION PLANNING & MANAGEMENT**

Introduction to Construction Management: 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.

Estimations of Costs, Resources of Time Project Planning, Scheduling and Control by Deterministic Models: Factor influencing the quality of estimates, Estimating guidelines, Macro and Micro estimates. CPM by arrow notation and precedence notation with computations by event and activity, Times total floats, free floats and independent floats; Time scaled network

Project Planning, Scheduling and Control by Probabilistic Models: PERT Program evaluation and review technique; Statistical tools as mean, variance, S.D., probability distribution, Beta Curve, Central Limit Theorem, Computer Program(s) construction management.

Cost Considerations in Project Scheduling: Direct cost, indirect cost, variation of activity, direct costs with time, time cost trade off; Resource leveling , least cost expediting, S-Curve

Introduction to Financial Accounting: The balance sheet, book keeping system, ledger, cashbook, etc

UE-412**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

Environmental Issues: Effects on Environment, Air Pollution, Noise Pollution, Visual Intrusion and Degrading the Aesthetics, Community Impact, Road side amenities, Landscaping, Roadside Arboriculture

UE-414**LAW AND 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

Property rights: Forms and types, Possession use and disposal

Building plans: Submission of Building applications and drawings: Procedural checks: ownership verification; planning application forms; Drawing fees, No objection certificates, Advertisement; etc. Site visits, serving of notices; Fines and compounding of violation. Analysis of building proposals: conformity with the development

plans, 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; Decision about approval of planning proposal; completion certificate. Demarcation and removal of encroachments; Declaration and demolition of dangerous buildings; Litigation involved in building; control; Commercialization policy and its effectiveness.

CF-401

FINANCIAL RESOURCE MANAGEMENT

Engineering & 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.

Communicating Economy Study Results:

Top managers; Roles and responsibilities; Management perspectives; Communication strategies.

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

EN-402

ENVIRONMENTAL IMPACT ASSESSMENT

Introduction:

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

Pollutants and their Impacts:

Air, Water, Land and Noise pollution assessment; Impact of pollutants on Atmosphere, on land, on water and on marine life; controlling agencies monitoring EIA

Evaluation Method: Performa and conclusion keeping in consideration of socioeconomic and Environmental effect on natural areas such as human, Animal and Plant life