# Scheme of Studies of BE Civil (Specialization in Urban) for the Batch 2019 ONLY

## FIRST YEAR

| Fall Semester | | | | | Spring Semester | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Title | Credit Hours | | | Course Code | Course Title | Credit Hours | | |
| | | Th. | Pr. | Total | | | Th. | Pr. | Total |
| UE-118 | Engineering Surveying-I | 3 | 1 | 4 | UE-117 | Engineering Drawing & Drafting-I | 1 | 2 | 3 |
| EE-123 | Basic Electrical Engineering | 2 | 0 | 2 | UE-102 | Statics and Dynamics | 3 | 1 | 4 |
| ME-110 | Basic Mechanical Engineering | 2 | 0 | 2 | UE-104 | Engineering Materials | 3 | 1 | 4 |
| MT-114 | Calculus | 3 | 0 | 3 | HS-205/ HS-209 | Islamic Studies OR Ethical Behaviour (for Non-Muslims) | 2 | 0 | 2 |
| CY-110 | Applied Chemistry for Engineers | 2 | 1 | 3 | HS-111 | Functional English | 2 | 0 | 2 |
| HS-106 / HS-127 | Pakistan Studies/ Pakistan Studies (for Foreigners) | 1 | 0 | 1 | MT-221 | Linear Algebra & Ordinary Diff. Equation | 3 | 0 | 3 |
| | | | | | HSK-1 | Chinese Language | NC | | |
| | Total Credits | 13 | 2 | 15 | | Total Credits | 14 | 4 | 18 |

## SECOND YEAR

| Fall Semester | | | | | Spring Semester | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Title | Credit Hours | | | Course Code | Course Title | Credit Hours | | |
| | | Th. | Pr. | Total | | | Th. | Pr. | Total |
| UE-201/CE-201 | Engineering Surveying - II | 3 | 1 | 4 | UE-253/CE-222 | Engineering Drawing -II | 1 | 2 | 3 |
| UE-251/CE-205 | Mechanics of Solids -I | 3 | 1 | 4 | UE-254/CE-219 | Fluid Mechanics-I | 3 | 1 | 4 |
| UE-252/CE-220 | Geology for Engineers | 2 | 1 | 3 | UE-255/CE-221 | Structural Analysis -I | 3 | 0 | 3 |
| HS-218 | Business Communication | 2 | 1 | 3 | HS-219 | Professional Ethics | 2 | 0 | 2 |
| UE-155/CE-111 | Intro to Computing for Civil Engineering | 1 | 2 | 3 | MT-331 | Probability & Statistics | 3 | 0 | 3 |
| HSK-2 | Chinese Language | NC | | | CF-303 | Applied Economics for Engineers | 3 | 0 | 3 |
| | | | | | | | | | |
| | Total Credits | 11 | 6 | 17 | | Total Credits | 15 | 3 | 18 |

## THIRD YEAR

| Fall Semester | | | | | Spring Semester | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Title | Credit Hours | | | Course Code | Course Title | Credit Hours | | |
| | | Th. | Pr. | Total | | | Th. | Pr. | Total |
| UE-351/CE-320 | Reinforced Concrete Design-I | 3 | 0 | 3 | AR-309 | Architecture and Town Planning | 3 | 0 | 3 |
| UE-352/CE-321 | Construction Engineering | 3 | 0 | 3 | UE-305/CE-305 | Soil Mechanics-I | 3 | 1 | 4 |
| UE-353/CE-323 | Quantity & Cost Estimations | 3 | 0 | 3 | *UE-356* | *Traffic Engineering and Management* | *3* | *0* | *3* |
| ***UE-455*** | ***Municipal Engineering and Urban Management*** | ***2*** | ***0*** | ***2*** | *UE-218* | *Law and Regulatory Control Studies* | *2* | *0* | *2* |
| MT-443 | Numerical Analysis | 3 | 0 | 3 | UE-355/CE-424 | Essential in Construction Project Management | 3 | 0 | 3 |
| ***UE-361*** | ***Planning & Design of Transportation System*** | ***3*** | ***1*** | ***4*** | UE-453/CE-420 | Reinforced Concrete Design- II | 3 | 0 | 3 |
| | Total Credits | 17 | 1 | 18 | | Total Credits | 17 | 1 | 18 |

## FINAL YEAR

| Fall Semester | | | | | Spring Semester | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Course Code | Course Title | Credit Hours | | | Course Code | Course Title | Credit Hours | | |
| | | Th. | Pr. | Total | | | Th. | Pr. | Total |
| UE-403/CE-403 | Soil Mechanics-I | 3 | 1 | 4 | ***UE-360*** | ***Mechanics of Solid-II*** | ***2*** | ***0*** | ***2*** |
| *UE-452* | *Urban Mass Transportation* | *2* | *0* | *2* | *UE-435* | *Financial Resource Management* | *2* | *0* | *2* |
| UE-451/CE-418 | Hydraulic Engineering and Water Resources Engineering-I | 3 | 1 | 4 | ***UE-460*** | ***Geoinformatics*** | ***1*** | ***1*** | ***2*** |
| ***UE-359*** | ***Structural Analysis-II*** | ***2*** | ***0*** | ***2*** | UE-454/CE-421 | Design of Steel Structures | 3 | 0 | 3 |
| EN-301 | Environmental Engineering-I | 2 | 1 | 3 | EN-401 | Environmental Engineering-II | 2 | 1 | 3 |
| UE-415 | Urban Engineering Project | 0 | 3 | 3 | UE-415 | Urban Engineering Project | 0 | 3 | 3 |
| | | | | | | | | | |
| | Total Credits | 12 | 6 | 18 | | Total Credits | 10 | 5 | 15 |
| | Total Fall semesters | | | 68 | | Total Spring semesters | | | 69 |
| Grand Total- 137 | | | | | | | | | |

**Bold fonts, Italics and thick border are courses, that have been introduced in the scheme as per desire of PEC (EAB-100)**

# Syllabus (Batch 2019)

## *Contents of Courses*

## FIRST YEAR (Fall Semester)

### UE-118: ENGINEERING SURVEYING – I

| UE-118 | ENGINEERING SURVEYING – I |
|---|---|
| **Basics of Surveying** | 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. |
| **Measurement of Horizontal Distances** | 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. |
| **Levelling** | 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. |
| **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. |
| **Surveying Instruments** | 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 EDMI Operation, EDM Characteristics, EDM Accuracies, Geometry of EDM, Electro-Optical and Microwave Instruments, Total Stations. |
| **Traverse Surveys** | 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. |

### EE-123: BASIC ELECTRICAL ENGINEERING

| EE-123 | BASIC ELECTRICAL ENGINEERING |
|---|---|
| **Fundamentals of Electric Circuits** | Charge, Current of voltage and power, Voltage and current sources, Ohm's Law. |
| **Voltage and Current Laws** | Nodes, Paths, Loops and branches, Kirchoff's Current law, Kirchoff's Voltage Law, The single loop circuits, The single node Pair Circuits, |

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| | Series and Parallel Connected Independent Sources, Resistors in series and parallel, Voltage and Current Division. |
| **Critical Analysis Techniques** | Multi Nodal, Analysis, The super Nodal, mech 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. |
| **On Line Diagram** | Symbols of different components, understanding of one line diagram from generation to the distribution end. |
| **Basic Electronics** | Operation Application of diode/transistor circuits and systems, fundamental concepts of amplifier and oscillators, Concepts of digital Electronics. |

## ME-110: BASIC MECHANICAL ENGINEERING

| ME-110 | BASIC MECHANICAL ENGINEERING |
|---|---|
| **Thermodynamics** | 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. |
| **Heat transfer** | Fundamentals of heat transfer, conduction, convection, radiation, thermal, conductivity, overall heat transfer coefficient. |
| **Heating Ventilation and Air Conditioning (HVAC)** | Introduction to HVAC components, heating and cooling load, comfort charts, outline of A/C, systems consideration for air-conditioning in building, natural ventilation, insulating materials. |

## MT-114: CALCULUS

| MT-114 | CALCULUS |
|---|---|
| **Set and Functions** | Define rational, irrational and real numbers; rounding off a numerical value to specified number of decimal places or significant figures; solving quadratic and rational inequalities 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. |
| **Complex Number:** | Argand diagram, De Moivre formula, roots 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' Hospitals' rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, |

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| | exact differential and its application in computing errors, extreme values of a function of two variables with and without constraints, Solution of nonlinear equation using Newton Raphson method. |
| **Integral Calculus:** | Indefinite integrals and their computational techniques, reduction formulae, definite integrals and their convergence, Beta and Gamma functions and their identities, applications of integration, Centre of pressure and depth of centre of pressure. |
| **Sequence & Series** | Sequence, Infinite Series, Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series. |

## CY-110: APPLIED CHEMISTRY FOR ENGINEERS

| CY-110 | APPLIED CHEMISTRY FOR ENGINEERS |
|---|---|
| **Electrochemistry** | Law of Electrolysis, E.M.F. series, Corrosion, Types and theories of corrosion, Factors affecting rate of corrosion, Inhibition and protection, Corrosion of ceramics. |
| **Water and Sewerage** | 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. |
| **Fuels** | Types of fuels, Classification of fossil fuels. |
| **Metals and 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-106/HS-127: PAKISTAN STUDIES/ PAKISTAN STUDIES FOR FOREIGNERS

| HS-106 | PAKISTAN STUDIES |
|---|---|
| **Historical and ideological perspective of Pakistan Movement** | Two Nation Theory: Claim of Muslims of being a separate nation from Hindus, based upon cultural diversity. Cultural diversity and interests as bases for the demand of Pakistan – Lahore resolution. Creation of Pakistan: Factors leading to the creation of Pakistan. Quaid-e-Azam and the demand of Pakistan. |
| **Constitutional Process** | Constitutional and Political developments in Pakistan 1947-1973. Salient features of the Constitutions 1956, 1962 and 1973 and amendments. |
| **Land of Pakistan** | Geo-physical conditions. Geo-political and strategic importance of Pakistan. Natural resource, viz: mineral, water and power. |
| **Contemporary issues in Pakistan** | A brief survey of Pakistan Economy: problems, issues and future prospects. Pakistani Society and Culture-Broad features with emphasis on youth role in the development of Pakistan. Literacy and education in Pakistan: problems and issues. State of Science and Technology in Pakistan: A comparison with other countries with special reference to the Muslim world. Environmental issues in |

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|---|---|
| | 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: |
| **HS-127** | **PAKISTAN STUDIES FOR FOREIGNERS** |
| **Land of Pakistan** | Geo Political & Strategic importance of Pakistan Natural Resources of Pakistan Urban & Environmental issues in Pakistan. |
| **Creation of Pakistan** | Factors leading to the Creation of Pakistan. |
| **Constitution and the Government** | The constitution of 1973 – Salient Features. |
| **Pakistan and the Contemporary World** | Foreign Policy of Pakistan Pakistan's stand point on Human Rights Global economic issues. |

# FIRST YEAR (Spring Semester)

## UE-117: ENGINEERING DRAWING & DRAFTING-I

| UE-117 | ENGINEERING DRAWING & DRAFTING-I |
|---|---|
| **Introduction** | 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. |
| **Projections** | Development of surfaces. Orthographic projection, Isometric and pictorial projections of solid figures, making of free hand sketches from solid objects and from orthographic projections. |
| **Symbols and Abbreviation** | Building materials; Electric and plumbing symbols and Abbreviations. |
| **Software** | Introduction to Engineering Drawing Software (AUTOCAD) and basic its basic tools. |

## UE-102: STATIC & DYNAMICS

| 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 |

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| | 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, Centre 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 2-Force and 3-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

| 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. |

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| **Insulating Materials** | Water proofing and heat insulating materials; Acoustical materials. |

## MT-221: LINEAR ALGEBRA & ORDINARY DIFFENTIAL EQUATIONS

| MT-221 | LINEAR ALGEBRA & ORDINARY DIFFERENTIAL EQUATIONS |
|---|---|
| **Linear Algebra** | Linearity and linear dependence of vectors, basis, dimension of a vector space field, Matrix and type of matrices (singular, nonsingular, 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. |
| **1st Order Differential Equations** | Basic concept, Formation of differential equations and solution of differential equations by direct integration and by separating the variables, Homogeneous equations and equations reducible to homogeneous form, Linear differential equations of the order and equations reducible to the linear form. Bernoulli's equations and orthogonal trajectories, Application in relevant Engineering. |
| **2nd and Higher Orders Equations** | Special types of 2nd order differential equations with constant coefficients and their solutions, The operator D, Inverse operator 1/D, Solution of differential by operator D methods; Special cases, Cauchy's differential equations, Simultaneous differential equations, simple application of differential equations in relevant Engineering. |
| **Partial Differential Equation** | Basic concepts and formation of partial differential equations, Linear homogeneous partial differential equations and relations to ordinary differential equations, Solution of first order linear and special types of second and higher order differential equations, D'Alembert's solution of the wave equation and two dimensional wave equations, Lagrange's solution, Various standard forms. |
| **Fourier Series** | Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients; Expansion of function with arbitrary periods, Odd and even functions and their Fourier series; Half range expansions of Fourier series. |

## HS-111: FUNCTIONAL ENGLISH

| HS-111 | FUNCTIONAL ENGLISH |
|---|---|
| **Speaking and Listening** | Listening actively through the use of skills and sub skills, and in a variety of situations. Speaking: Fluency and confidence building through group discussions, role plays and public speaking. |
| **Vocabulary development** | Tips/ strategies in vocabulary enhancement Practice in vocabulary development. |
| **Reading** | Reading skills, Sub skills Reading strategies Reading practice |

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

## HS-205: ISLAMIC STUDIES

| HS-205 | ISLAMIC STUDIES |
|---|---|
| **Tauheed: Prophet Hood: Here-After:** | Al-Ambiya-22, Al-Baqarah - 163&164, Al-Imran-79, Al –Huda7, Al-Maida0h-3, Al –Baqarah-48, and one Hadith. |
| **Basic Islamic Practices:** | Al-Mu' minun-1-11, and two Ahadith. |
| **Amer-Bil-Ma'Roof WaNahi Anil Munkar** | the concept of Good & Evil,Importance and necessity of Da'wat-eDeen Al- Imran – 110,Method of Da'wat-e-Deen An-Nehl-125, AlImran-104, and two Ahadith. |
| **Unity of the Ummah** | Al-Imran-103, Al-Hujurat-10, Al-Imran-64, Al-An' am –108, and two Ahadith. |
| **Kasb-e-Halal** | Ta ha-81, Al- A'raf-32-33, Al-Baqarah-188, and two Ahadith. |
| **Haquq-ul-Ibad** | 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: AnNisa-58, Access to Justice: An- Nisa-135. |
| **Women's Rights** | An-Nehl-97, Al-Ahzab-35, An-Nisa -07. |
| **Relations with NonMuslims** | Al-Mumtahanah-8-9, Al-Anfa'al-61 and The last Sermon of Hajj of Holy Prophet (PBUH): Relevant extracts. |
| **Seerat (life) of the Holy Prophet (PBUH)** | 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-eNabawi), Hujjat-ul-Wida, The last sermon of Khutbatulwida: Translation and important points. |
| **Islamic Civilization** | 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. |

## HS-209: ETHICAL BEHAVIOR

| HS-209 | ETHICAL BEHAVIOR |
|---|---|
| **Introduction to Ethics** | Definition of Ethics, Definition between normative and positive science, Problem of freewill, Method of Ethics, Uses of Ethics. |
| **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. |

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| **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. |

# *Contents of Courses*

# SECOND YEAR (Fall Semester)

## UE-201/CE-201: ENGINEERING SURVEYING – II

| UE-201/CE-201 | ENGINEERING SURVEYING – II |
|---|---|
| **Surveying Drafting and Computations** | General, Maps and Plans, Plotting, Contour Maps, Profiles, Cross-sections, End areas and Volumes, Prismoidal formula, Calculation of volumes, Area computations, Area by graphical analysis, Use of surveying software. |
| **Highway and Railway Curves** | Route surveys, Circular curves, Deflections and Chord calculations, Setting out circular curve by various methods, Compound curves, Reverse, Vertical, Parabolic curves, Computation of the high or low point on a vertical curve, Design considerations, Spiral curves, Spiral curve computations, Approximate solution for spiral problems, Super elevation. |
| **Construction Surveys** | Introduction, Horizontal and Vertical control, Buildings, Rail Road, Pipelines and other construction surveys. |
| **Hydrographic Surveys** | General, Objectives of hydrographic survey and electronic charting, Planning, Survey vessels, Vertical control, Depth and Tidal measurements, Position-fixing techniques, Sounding plan, Horizontal control, Processing and Presentation of data. |
| **Photogrammetry** | Introduction, Aerial photogrammetry and its Applications, Flying heights, Flight planning, Relief displacement, Photograph overlap, Ground control for mapping, Mosaics, Stereoscopic viewing and Parallax, Stereo plotting instruments, Analytical plotters, Orthophotos, Photogrammetric mapping. |
| **Control Surveys** | General, Geodesy Universal Transverse Mercator grid system, Modified Transverse Mercator grid system, State plane coordinate grid system, Lambert projection, Computations for the Lambert projection, Computations for the Transverse Mercator Secant Projection, Use of grid coordinates, Horizontal control techniques, Triangulation, Control survey markers, Direction of a line by observations on Polaris, Time and procedure for Observing Polaris, Computation technique for azimuth determination, Gyro theodolite. |
| **Global Positioning System (GPS)** | Background information, Global positioning, Receivers, Satellites, Errors, GPS surveying techniques and applications, Survey planning, Initial ambiguity resolution, Vertical positioning. |

## UE-251/CE-205: MECHANICS OF SOLIDS-I

| UE-251/CE-205 | MECHANICS OF SOLIDS-I |
|---|---|
| **Different Stress States** | Uniaxial state of stresses and strains, Relationships between elastic Constants, Response of materials under different sets of monotonic loading, Normal and shearing stress and strains, |

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| | Gradually and suddenly applied loads, Distribution of direct stresses on uniform and non-uniform members, Thermal stresses and strains. |
| **Bending Theory** | Theory of simple bending, position of neutral axis, moment of resistance and section modulus, Bending and shearing stress distribution in beams, Relationship between loads, shear force and bending moment, Stresses in composite sections. |
| **Slope and Deflection** | Curvature, slope and deflection of beams using integration methods |
| **Theory of Torsion** | Theory of torsion of solids and hollow circular shafts, shearing stress distribution, angle of twist, strength and stiffness of shaft. |
| **Biaxial state of stress** | Biaxial state of stresses, resolution of stresses, Principal plane, principal stresses and strains, Graphical representation of stress and strains, Mohr's circle of stresses and strains. |

## UE-252/CE-220: GEOLOGY FOR ENGINEERS

| UE-252/CE-220 | GEOLOGY FOR ENGINEERS |
|---|---|
| **General Geology Definition and Scope** | The earth as planet, Process of external origin, weathering, erosion, transportation and deposition, of rock material by geological agents, Processes of internal origin volcanism, earthquakes, intrusion, metamorphism and the rock cycle, diastrophism and isostasy. |
| **Elements of Structural Geology** | Folds and faults, joints, fractures and cleavages, unconformities, primary and secondary structural features of rock, Expression of these features on geological field maps and construction of cross sections and geological mapping. |
| **Elements of Crystallography** | Crystallographic system, Important rock and soil forming minerals, and their identification Igneous Sedimentary and metamorphic rocks, fossils, Basic principles of stratigraphy, Geologic time scale, Brief introduction of local geology from bore logs. |
| **Applied Geology** | Application of geology to planning and design of dams, reservoirs, bridges and tunnels, Application of geology to building materials and soils. |
| **Rock Classification** | Litho logical classification, Classification by field measurements and strength tests by rock testing, Physical and mechanical property of rocks. |
| **Earthquakes** | Theory of plate- tectonics, seismic waves, seismology, prediction of earthquakes and preventive measures against earthquakes, Ground subsidence and landslides. |

## HS-218: BUSSINESS COMMUNICATION

| HS-218 | BUSSINESS COMMUNICATION |
|---|---|
| **Foundations of Business Communication** | Definitions: communication, organization, business; understanding the need and scope of business, professional and organizational communication, Conditions, properties, process, tools, modes, levels, types of communication. Principles of Effective Communication & |

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| | Building goodwill (You-attitude, positive emphasis and unbiased language). Listening, non-verbal communication. Communication dilemmas and problems. Feedback and its types. Audience Analysis. |
| **Oral Communication** | Group Discussions and interpersonal skills, Meetings, Interviews, Making presentations. |
| **Business & Technical Writing** | Types of messages: Formats (Letter and memorandum). Letter and memorandum elements and formats. Three Types of Business Messages (routine, negative and persuasive communications). Organizational Plans: Direct, Indirect & AIDA approach. Writing business messages (e-mails, inquiries, requests, replies, regrets, declining offers, letters, routine messages, etc.). Meetings: notice, \ agenda and minutes.Job applications and resumes. Research / scientific reports (structure, layout, writing process). |

## UE-155/CE-111: INTRO TO COMPUTING FOR CIVIL ENGINEERING

| UE-155/CE-111 | INTRO TO COMPUTING FOR CIVIL ENGINEERING |
|---|---|
| **Computer and System** | Computer hardware fundamentals, Operating Systems: DOS, WINDOWS. |
| **Fundamentals** | Spreadsheets, Flow Chart techniques. |
| **Structured programming Language** | Character set, keywords, identifiers, data types and size, variable declaration, expression, labels, statements, formatted input output statements, types of operators, data type operators, data type conversion, mixed mode arithmetic, control structures, Functions, library functions, parameter passing, recursion, arrays declaration, initialization and usage, multi-dimensional arrays. Files, function for file handling, I/O Operations. Selected topics in Programming, with emphasis on numerical techniques as applied to civil engineering problems. |
| **MATLAB** | Import / export data, Create and manipulate variables, Program and run simple scripts, graphics tools to display data. |

# SECOND YEAR (Spring Semester)

## UE-253/CE-222: ENGINEERING DRAWING-II

| UE-253/CE-222 | ENGINEERING DRAWING II |
|---|---|
| **General** | Need and requirement of drawings for civil Engineering projects. General nature of drawings, components, symbols and nomenclature needed for specific drawings such as architectural, structural, plumbing, electrical, air-conditioning, roads and earth work etc. Drawings at different stages of projects, Elements of perspective drawing. |
| **Civil Engineering Drawing** | General description of drawings related to civil Engineering projects. |

| | |
|---|---|
| **Building Drawing** | Elements of architectural planning and design, conceptual, schematic and working drawings and details of residential, commercial, religious, recreational, industrial, clinical, hospital, and educational buildings, Details of doors, windows, staircases etc.<br><br>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.<br><br>Details of steel roof truss, connection details and fabrication drawings.<br><br>Plumbing and electrical detailing pertaining to small residential units. |
| **Computer Aided Drafting** | General and basic know how related to computer aided drafting, e.g. co-ordinate system, drawings setup procedure, basic draw commands, basic edit commands, Layers, creating text and defining styles options, block and drawing import/export options, Cross hatching, save and plot (2D) and isometric drawings. |

## UE-254/CE-219: FLUID MECHANICS-I

| UE-254/CE-219 | FLUID MECHANICS-I |
|---|---|
| **Basic Concepts and Definitions** | Units, Density, specific weight, mass, viscosity etc. |
| **Fluid statics** | Pascal's Law, Measurement of pressure, Pressure head, Manometers, Hydrostatics forces on submerged areas (vertical, inclined and curved), Buoyancy of fluids. |
| **Fluid Kinematics** | Types of flow, Streamline and streak lines, Velocity and acceleration in steady & unsteady flow, Continuum, Lagrange and Eulerian description, Equation of continuity, mass flow rate, weight flow rate, stream function and velocity potential function and othogonality, flow net, Rotational and irrotational flow. |
| **Energy Consideration in Steady Flow** | Concept of Energy and head, General equations of energy and Bernoulli's assumption for incompressible fluids, Hydraulic grade line and energy line, power consideration, cavitation. |
| **Impulse-Momentum** | Basic principle, Force on pressure conduits, reducers and bends, jet of water, Structure in open channel. |
| **Similitude** | Definitions, Geometric, Kinematic and Dynamic similarities, dimensionless numbers, Buckingham-Pi Theorem. |
| **Fluid Properties Measurements** | Fluid properties, Hydrostatic Pressure, velocity measurements, Orifices meter, free and forced vortex, venture meter, notches & weirs. |

## UE-255/CE-221: STRUCTURAL ANALYSIS –I

| UE-255/CE-221 | STRUCTURAL ANALYSIS –I |
|---|---|
| **Introduction** | Introduction of Structural forms, two dimensional pin connected and flexural forms, three dimensional pin connected and flexural forms: Surface structures, Simplification for analysis and design. |
| **External Loads** | Techniques of evaluation of estimated external loads, Dead, Live, Wind and Earthquake loads, Use of codes in estimating different types of external, Static, Dynamic and Moving loads, Load combinations. |
| **Determinacy of Structure** | Determinate and indeterminate structures, Static and kinematics determinacy, Compatibility and boundary conditions: Structural safety, Stress and deformation characteristics, Small deflection theory. |
| **Evaluation of Deformation Using Geometric Methods** | Principal of superposition, Moment area method, Conjugate beams method and Newmark's method. |
| **Evaluation of Deformation Using Energy Principals** | Unit load method, Principal of real work, Principal of virtual work: Castigliano's theorems. |
| **Arches and Suspension Structures** | Analysis of arches, Introduction to suspension type structures: Importance of stiffened girders. |

## HS-219: PROFESSIONAL ETHICS

| HS-219 | PROFESSIONAL ETHICS |
|---|---|
| **Introduction to Professional & Engineering Ethics** | Definitions - Ethics, Professional Ethics, Engineering Ethics, Business Ethics; Ethics & Professionalism. Need and scope of Engineering and Professional Ethics through Case Studies. Development of Engineering Ethics & Major issues in Engineering & Professional Ethics. |
| **Moral Reasoning & Ethical Frameworks** | Ethical Dilemma: Resolving Ethical dilemmas and making Moral Choices. Codes of Ethics (of local and international professional bodies). Moral Theories: Utilitarianism, Rights Ethics and Duty Ethics, Virtue Ethics Self-Realization & Self Interest. Ethical Problem Solving Techniques: Line drawing, flow Charting, Conflict Problems. Case Studies and applications. |
| **Contemporary Professional Ethics** | Professional Responsibilities. Risk and Safety as an Ethical Concern for Engineers Workplace Responsibilities and Ethics: Teamwork, confidentiality and conflicts of interest, Whistleblowing, Bribe and gift, risk and cost - benefit analyses, gender discrimination and sexual harassment. Environmental Ethics. Computer Ethics & the Internet. Honesty: Truthfulness, trustworthiness, academic and research integrity. |

## MT-331: PROBABILITY & STATISTICS

| MT-331 | PROBABILITY & STATISTICS |
|---|---|
| **Statistics** | Introduction, types of data & variables, presentation to data, object, classifications, Tabulation, Frequency distribution, Graphical representation, Simple & Multiple Bar diagrams, Sartorial & Pie-Diagram, Histogram, Frequency Polygon, Frequency Curves & their types. |
| **Measures of Central Tendency and Dispersion** | Statistics Averages, Median, Mode, Quartiles, Range, Moments, Skewness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems. |
| **Curve Fitting** | Introduction, fitting of a first and second degree curve, fitting of exponential and logarithmic curves, related problems, Principle of least squares, Second order Statistics & Time series not in bit detail. |
| **Simple Regression & Correlation** | Introduction, Scatter diagrams, Correlation & its Coefficient, Regression Lines Rank Correlation & its Coefficient, Probable Error (P.E), Related problems. |
| **Sampling and Sampling Distributions** | Introduction, Population, Parameter & Statistic, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-Sampling Errors, Random Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems. |
| **Statistical Inference and Testing of Hypothesis** | Introduction, Estimation, Types of estimates, Confidence interval, Tests of Hypothesis, Chi-Square distribution/test, one tails & two tails tests, Application in related problems. |
| **Probability** | Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability, Conditional probability, Baye's rule, Related problems in practical significance. |
| **Random Variables** | Introduction, Discrete & Continuous random variables, Random Sequences and transformations, Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F) Markove random walks chain/Related problems. |
| **Probability Distributions** | Introduction, Discrete probability distributions, Binomial, Poisson Hyper geometric & Negative binomial distributions, Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance. |

## CF-303: APPLIED ECONOMICS FOR ENGINEERS

| CF-303 | APPLIED ECONOMICS FOR ENGINEERS |
|---|---|
| **Introduction** | Basic Concepts and principles of Economics, Micro-economics theory, the problems of scarcity, Basic concept of Engineering Economy. |
| **Economic Environment** | Consumer and Producer goods, Goods and services, Demand and supply concept, Equilibrium, Elasticity of demand, Elasticity of |

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

# *Contents of Courses*

# THIRD YEAR (Fall Semester)

## UE-351/CE-320: REINFORCED CONCRETE DESIGN-I

| UE-351/CE-320 | REINFORCED CONCRETE DESIGN-I |
|---|---|
| **Constituent Materials & Properties** | Concrete constituent material and its mechanical properties, Properties of hardened cement concrete. Durability aspects and factors contributing towards durability. |
| **Basic Principles of Reinforced Concrete** | Basic principles of reinforced concrete design and associated assumptions, Behavior of reinforced concrete members in flexure, Design philosophy, design codes, factor of safety and load factors, Prevailing methods of design of reinforced concrete members. |
| **Working Stress Method of Analysis** | Working stress method, serviceability criteria and checks for deflection, crack width, and crack spacing, Importance of working stress method related to pre stress. |
| **Ultimate Strength Method** | Ultimate strength method, analysis of prismatic and non-prismatic sections in flexure, Compatibility based analysis of sections and code requirements for flexure, Analysis of one-way solid and ribbed slabs, two way solid slabs with general discussion on other slab systems, Design for flexure. |
| **Shear in Beams: Bond, Anchorage & Development Length** | Shear stress in reinforced concrete sections, models and analogies towards solution of diagonal tension problem, Design for diagonal tension Design and detailing for bond, anchorage, development length, laps and splices. |
| **Columns & Footings** | Analysis of sections in pure compression, Design of short columns under pure compression and with eccentric loading, Isolated footings, structural design of simple rectangular footing and combined footing. |

## UE-352/CE-321: CONSTRUCTION ENGINEERING

| UE-352/CE-321 | CONSTRUCTION ENGINEERING |
|---|---|
| **Introduction** | Construction Projects, Project Life Cycle Phases, Key Players, Project Success Parameters, Normal Tracking and Fast Tracking, Project Categories, Building Permits; Codes and Regulations, Construction Standards, Sustainability. |
| **Construction Equipment** | Types of Equipment used specifically in Building Construction, Analysis of Capital; Operating; Investment; Maintenance; Repair Costs, Equipment Productivity and Cost Effectiveness. |
| **Over-view of Constructional Aspects** | An over view of constructional aspects for different types of engineering projects, e.g. building retaining structures, bridges, pavements and special structures, General consideration common to all projects with special reference to building Structures. |
| **Layout** | Site Selection and Orientation of Buildings, Grading Considerations, |

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|---|---|
| **Techniques** | Layout techniques with special reference to buildings. |
| **Excavation** | Excavation in deferent types of soils, stability of excavation and solution of particular problems arising out of condition of sub-soil at site e.g. de-watering, shoring and bracing, sheet piling etc. |
| **Placement of Concrete** | Methods of preparation pouring, placement and curing of concrete in foundations. Construction joints in raft foundations, mass concreting, Plinth joints in raft foundations, mass concreting, Plinth beams and plinth protection, damp proof course. |
| **Construction Methodologies** | In-Situ and Pre-Cast Concrete Construction of Buildings, Slab on Grade, Plain Cement Concrete Floors, Planar and Non-Planar Roofing Systems. Doors, Windows, Masonry, Brickwork, Glazing, Cladding, Façade, Curtain Wall, Floor Finishing, Interior and Exterior Building Finishes, and Water Proofing. Protection of adjacent Structures. Mechanized construction. Design and use of formwork for various building units/members. Methods of Concreting Vertical and Horizontal Members, including Mechanized Placement, Ready Mix Concrete etc. Construction Joints, Mass concreting, Plinth Beams and Plinth Protection. Planar and Non-Planar Construction Aspects related to Services. |

## UE-353/CE-323: QUANTITY & COST ESTIMATIONS

| UE-353/CE-323 | QUANTITY & COST ESTIMATIONS |
|---|---|
| **General** | Scope of civil engineering works, General practice in industry or schedule of rates and specifications, Rates analysis, Procedure and Application to Concrete, Description of Schedule of Values, Specifications for various items in construction. |
| **Estimating Basics** | Concept, Need and Significance, Estimate Categories and Project Life Cycle (PLC), Role of Estimates in PLC, Estimate Types, Estimate Accuracy vs. Time, Scheduling the Estimating Process, Estimating Data Needs; Sources; and Data Collection Approaches, Estimating Considerations, Estimating Procedure, Computerized Estimating Overview. |
| **Developing Preliminary Estimates** | Development Process and Illustrative Examples of Conceptual and Assemblies Estimates. |
| **Quantity Takeoff Basics** | Process, Measurement Units, Takeoff Rules, Measurement Accuracy, Organization of Takeoff, Overview of Takeoff by Computer, Review of Estimate Math. |
| **Pricing Basics** | Pricing Parameters, Pricing Sources, Contractor's Risk of Pricing Low or High, Direct and Indirect Cost, Labor Productivity, Overview of the Process and Considerations of Pricing; Labor; Equipment; Materials; Subcontracted Work; and General Conditions. |
| **Definitive Estimates** | Working out quantities, rates and costing analysis of construction works. |
| **Bill Processing** | General principle, Contents and preparation of bills of quantities for a project and maintaining of Measurement Books. |
| **Estimating** | Quantity Takeoff and Pricing of Labor, Material and Equipment |

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| **Worked Examples** | for; Site work, Concrete, Masonry, Carpentry, and Finishes Works; Overview and Discussion of Estimating Procedures and Considerations for Concrete Retaining Wall, Piles, Steel Truss, Road, Sewer and Water Mains Pipe Works. |
| **Further Estimating Concerns** | Estimate Setup, Overhead, Profit, Sources of Estimating Errors, Escalation, Contingency, Life-Cycle Costing. |
| **Contract & Tender** | Preparation of civil engineering contracts and tender documents; Evaluation of proposals and contracts. |
| **Use of Estimating Software / Spreadsheets** | |

**UE-455: MUNICIPAL ENGINEERING AND URBAN MANAGEMENT**

| | Cr. Hrs. | Contact Hrs. | Exam Marks |
|---|---|---|---|
| Th. | 2 | 2 | 100 |
| Pr | - | - | - |

General
Organization of local government; Role of planners; Municipal Engineer co-ordination with different civic agencies.
Sustainable Infrastructure Development
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)
Disaster Management
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
Infrastructure Analysis and Management
Infrastructure study design; cohort studies; cross-sectional studies etc. Infrastructure inventory surveys.

**Recommended book(s) for the approved course**
(Author's name, "*Title*", edition, publisher, publication year).

**Text book(s)**

1. Barth Detlef, The Disaster Risk Management Handbook- A learning experience of DRM Model Mansehra, PDMA KP, 2013
2. Ivor H. Seeley, Municipal Engineering Practice, Palgrave, 2014
3. Nitesh Kumar, Textbook of Disaster Management, 1st edition, Satish Serial Publishing House, 2013

## MT-443: NUMERICAL ANALYSIS

| MT-443 | NUMERICAL ANALYSIS |
|---|---|
| **Error Analysis** | Types of errors (relative, Absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart. Use any computational tools to analysis the numerical solutions. |
| **Finite Difference** | Functions of operators, difference operators and the derivative operators, identities. Linear homogeneous and non-homogeneous difference equations. Numerical Differentiation, Forward Difference Method, Backward Difference Method, Central Difference Method. |

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| **Solution of Non-linear Equation** | Numerical methods for finding the roots of transcendental and polynomial equations (Secant, Newton – Raphson Chebyshev and Graeffe's root squaring methods), rate of convergence and stability of an iterative method. Fixed point Iteration, Bisection Method, Nonlinear systems of equations, application to consolidation, settlement and seepage analysis. |
| **Solution of Linear Equation** | Numerical methods for finding the solutions of system of linear equations (Gauss- Elimination, Gauss-Jordan Elimination, Triangularization, Cholesky, Jacobi and Gauss – Seidel). Applications to structural analysis and water distribution network problems. |
| **Interpolation & Curve Fitting** | Lagrange's, Newton, Hermit, Spline, least squares approximation. (Linear and non-linear curves). |
| **Numerical Integration & Differentiation** | Computation of integrals using simple Trapezoidal rule, 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). |

**UE-361: PLANNING & DESIGN OF TRANSPORTATION SYSTEM**

| | Cr. Hrs. | Contact Hrs. | Exam Marks |
|---|---|---|---|
| Th. | 3 | 3 | 100 |
| Pr | 1 | 3 | 50 |

**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 termina.

**Recommended book(s) for the approved course**

(Author's name, "*Title*", edition, publisher, publication year).

**Text book:**


1. Fred L. Mannering, Principles of Highway Engineering and Traffic, Seventh Edition ), Scott S. Washburn and Publisher Wiley,2020
2. Jason C. Yu, Transportation Engineering Introduction to Planning, Design and Operations, Elsevier Science Ltd. (June 1982).
3. Horonjeff, R. Planning and Design of Airports, McGraw-Hill Professional; 5th Edition,2010.
4. Gregory P. Tsinker, Port Engineering Planning Construction Maintenance and Security, John Wiley, 2004.

# THIRD YEAR (Spring Semester)

## AR-309: ARCHITECTURE & TOWN PLANNING

| AR-309 | ARCHITECTURE & TOWN PLANNING |
|---|---|
| | **Architecture** |
| **Historical Development** | Egyptian, Asiatic, Greek, Roman Byzantine and Gothic Architectures, Modern trends with emphasis on Muslim architecture. |
| **Influences** | Geographical, climatic, religious, social, historical. |
| **Principles** | Truth or purpose & beauty. |
| **Qualities** | Strength, vitality, grace, breadth and scale. |
| **Factors** | Proportion, colour and balance. |
| **Use of Materials** | Stone, wood metals, concrete, Composite, ceramics. |
| **General Treatment to Plan of Buildings** | Walls and their construction, Openings and their position, character and shape, Roofs and their development and employment, Columns and their position, form and decoration, Molding and their form and decoration, Ornament as applied to any buildings. |
| | **Town Planning** |
| **Purpose and Scope** | Definitions of town planning, Trends in Urban growth, Objectives of sound planning, Modern planning in Pakistan and abroad. |
| **Information Required** | Maps, natural resources, economic resources, legal and administrative problems, civic survey. |
| **Urban Ecology** | Need and scope of comprehensive plan, Phases of planning, Principles of planning, Communication (rail road network & airport etc.), port and harbour facilities, street traffic and design. |
| **Urban Zoning and Land Use Control** | Parks and recreation facilities, location of public and semi-public buildings, civic centers, commercial centers, local shopping centers, public schools, Location of industry & residential areas, Lay out of street, road crossing & lighting, Community planning, Suburban development, Slum areas and their upgrading. |

## UE-305/CE-305: SOIL MECHANICS-I

| UE-305/CE-305 | SOIL MECHANICS-I |
|---|---|
| **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 |

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|---|---|
| | Activity of fine soils. |
| **Soil Classification Systems** | Unified soil classification system, M.I.T. system and AASHTO classification 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 reconsolidation pressure, swelling clays and clay-shale. |
| **Soil Compaction** | Requirements, principle and methods including standard and modified AASHTO tests. |

## UE-356: TRAFFIC ENGINEERING AND MANAGEMENT

| UE-356 | TRAFFIC ENGINEERING AND MANAGEMENT |
|---|---|
| **Traffic flow characteristics**: | Flow characteristics, Interrupted and uninterrupted flows, Traffic bottlenecks Traffic studies; Macroscopic and Microscopic studies, Methods of measuring speed and volume, Relation between speed volume and density. Saturation flow, Traffic delay. |
| **Traffic safety and control** | Traffic Lighting; Traffic signals, Signs and markings, Safety and Accident studies, One way and tidal flow systems. Traffic calming, bus priorities, pedestrian facilities and Travel demand management, Road safety audit. |
| **Capacity analysis** | Analysis of various highway and traffic facilities including multi-lane highways and signalized intersection. |
| **Intelligent transport systems** | Introduction to various components of ITS system needs and application. Discussing and debating solution to urban congestions. |
| **Parking design and control** | On street and Off Street Parking, Parking demand and Turnover,<br>Parking Control. |

## UE-218: LAW & REGULATORY CONTROL STUDIES

| UE-218 | LAW & REGULATORY CONTROL STUDIES |
|---|---|
| **Law** | Definitions of government and law; legal relations; subjects and objects of legal relations; physical and jurisdictional individuals; Local Government Legislation / Act and Licenses requirement and regulation professional ethics. Importance of regulating built environment in urban areas. |
| **Property rights** | Forms and types, Possession use and disposal. Transaction; ownership; tenancy and traditional forms of property accesses. |
| **Building plans** | Submission of Building applications and drawings including all the procedural requirements enforced by the authority: Site visits, serving of notices; Fines and compounding of violation. Analysis of building proposals: conformity with the development plans, removal of encroachment, land use zoning planning criteria building bylaws, design guidelines, building line / parking requirements, chamfer requirements, construction over cultivators etc. |
| **Coordination and Action between Civic Agencies** | Consultation with the neighbors, roads authorities' line departments and allied agencies. Declaration and demolition of dangerous buildings; Litigation involved in building; control. |

## UE-453/CE-420: REINFORCED CONCRETE DESIGN- II

| UE-453/CE-420 | REINFORCED CONCRETE DESIGN- II |
|---|---|
| **Design for Torsion** | Torsion in reinforced concrete members. Analysis and design of reinforced concrete members under combined torsion and shear stress. |
| **Flat Slab, Flat Plate & Waffle Slab** | Analysis and design of flat plate, flat slabs and waffle slabs, for flexure<br>and shear under gravity loading. |
| **Slender Columns** | Analysis and design of slender columns subjected to combined flexure and axial loading, Guidelines for design of shear walls-an overview. |
| **Design of Different Types of Foundations** | Analysis and design of eccentric, strap, strip footings and pile caps. |
| **Prestressing Principles & Design Philosophy** | Principles of prestressing, properties of high strength materials used in prestressing, Importance of high strength concrete and steel used in prestressing, Behavioral aspects of prestressed beams and comparison with reinforced concrete beams, comparison with reinforced concrete beams, post tensioning and pre- tensioning techniques, comparison and hard-ware requirements. |
| **Prestress Losses** | Prestress losses, immediate and time dependent losses, lump sum and detailed estimation of prestress loss. |
| **Analysis and Design** | Simply supported prestressed beams for flexure and shear. |

## UE-355/CE-424: ESSENTIAL IN CONSTRUCTION PROJECT MANAGEMENT

| UE-355/CE-424 | ESSENTIAL IN CONSTRUCTION PROJECT MANAGEMENT |
|---|---|
| **Introduction** | The Construction Industry, Nature and Challenges, Key Industry Support Organizations, Public and Private Works, Past; Present; Opportunities; and Threats with Specific Reference to Pakistani Construction Industry. |
| **Project Management in the Engineering & Construction Industry** | PM knowledge areas; PM Life Cycle processes; Organizational structure of a construction project; Responsibilities of client, Key PM Skills; Key Roles and Responsibilities of Client, Consultants - including architects, engineers and allied professionals, constructors, PM and CM; Professional construction management; Project Management issues and need for improved organization and management structures and processes with particular reference to local construction industry. |
| **Project Scoping, Bidding and Preconstruction Planning** | Determining Relative Priorities of Key Project Objectives; Defining Project Scope, Types of tenders / contracts; Pre-Qualification process, Bidding process, Bid Package, Overview of Preconstruction Planning Aspects Including Area and Site Investigation; Preliminary schedules; Value Engineering; Constructability Analysis; Work packages; Drawings and Specifications review. |
| **Project Planning, and Scheduling by Deterministic Methods** | Planning and Scheduling Overview; Planning and Scheduling Process; Work Breakdown Structure; Planning and Scheduling Activities; Bar/ Gant Charts; ADM & PDM Networks; CPM project scheduling using PDM; Time Constrained Scheduling. |
| **Project Planning, by Probabilistic Methods** | Uncertainty Sources; Limitations of Deterministic CPM; PERT scheduling; PERT advantages and limitations; PERT today in construction industry. |
| **Resource and Cost Considerations in Project Planning & Scheduling** | Resource planning and scheduling; Resource Productivity; Resource levelling; Resource curves and profiles; Direct cost versus indirect cost; ; Contingency and profit; Cost Accrual Patterns; Time cost trade off; Least cost expediting; Project cost accounting; Cash flow and S-Curve; |
| **Project Monitoring and Control** | Project Monitoring System, Project Control Process, Time; Cost; and Work performance Measurement and Evaluation, Percent Complete, Look Ahead Schedules; Earned Value Cost and Schedule Control System. |
| **Site Organization** | Site Layout Planning, Contractor's Site (Team) Organization Chart, Mobilization Plan, Overview of Site Management issues. Project Management Career Paths. Use of Computer Software in Planning and Management for Construction Projects. |

# *Contents of Courses*

# FINAL YEAR (Fall Semester)

## UE-403/CE-403: SOIL MECHANICS-II

| UE-403/CE-403 | SOIL MECHANICS-II |
|---|---|
| **Sub Soil Investigation** | Purpose, Preliminary and detailed investigation, Boring methods, spacing and depth of borings, soil sampling, In situ testings, 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, Terzahgi'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, and 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. |
| **Soil Property Modification** | Mechanical and chemical stabilizations of soil, principles & methods. |

## UE-452: URBAN MASS TRANSPORTATION

| UE-452 | URBAN MASS TRANSPORTATION |
|---|---|
| **Urban Mass Transit** | Need, Types of Mass transit, Mass Transit Planning, Mass Transit Design and operation, Mass Transit Issues, Transportation Demand Forecast, and System Evaluation. |
| **Rail transit** | Rail systems; Railway organization; Railway alignment and grades; Cross sectional elements of railway tracks; Pointers and crossings, stations and yards; Railway signal systems; Laying of tracks and maintenance of railway right-of-way; Creep and anti-creep devices; Various types of railway locomotives; Methods of traction; Track resistances; Subways, LRT and MRT. |
| **Design and Feasibility of Public Transport Projects** | O-D surveys for public transport users, Analysis of trip patterns using desire lines; Service scheduling and design of new bus services. |

## UE-451/CE-418: HYDRAULIC ENGINEERING AND WATER RESOURCES ENGINEERING-I

| UE-451/CE-418 | HYDRAULIC ENGINEERING AND WATER RESOURCES ENGINEERING-I |
|---|---|
| **Introduction to Water Resources Engineering** | Hydrogen cycle; Overview, Rain, Surface and sub-surface water hydrology, and water resource estimates. |
| **Open Channels and Sediment Transport** | Erosion and Sediment yield; Design of open channels - Kennedy's and Lacey's theories. |
| **Surface Water Hydrology** | Rainfall – Local Rainfall, Spatially – Averaged Rainfall, Design Rainfall Interception, Depression storage, Infiltration Rainfall – Runoff Analysis-Runoff Models; Time of Concentration, Peak- Runoff Models. |
| **Irrigation** | Irrigation, Indus Basin Irrigation System (Indus water treaty; water apportionment accord etc.), Soil –water-plant relationship, Irrigation methods (Pressurized and non-pressurized). |
| **Subsurface hydrology/ Drainage** | Unsaturated and saturated subsurface water and its movement-Darcy's Equation, Water wells and its construction. Waterlogging and Salinity, Surface &subsurface drainage and its methods. |
| **Dams and Barrages** | Types, components, and function of barrages and Dams; Reservoirs. |
| **Introduction to Coastal Engineering** | Basic terminologies within coastal engineering; Importance of coastal engineering to coastal zone management; Linear wave theory; Wave transformation and attenuation processes; Waves of unusual character. |

## UE-359: STRUCTURAL ANALYSIS-II

| UE-359 | STRUCTURAL ANALYSIS-II |
|---|---|
| **Analysis of Indeterminate Structures Using Force Approach** | Compatibility methods for beams and frames with and without support settlement. |
| **Analysis of Indeterminate Structures Using Stiffness Approach** | Moment distribution for beams and frames for prismatic and non-prismatic members with and without side-sway and support settlement, Slope deflection method for beams and frames with and without support settlement. |
| **Matrix Methods** | Introduction to flexibility method, Determination of flexibility matrix for beams, Introduction to stiffness method, development of member and structure stiffness matrices, Bending moment and shear force diagrams, Application of computer programs. |

## EN-301: ENVIRONMENTAL ENGINEERING-I

| EN-301 | ENVIRONMENTAL ENGINEERING-I |
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| **Communicable Disease Control** | Water borne, foodborne and vector borne diseases, Water supply and sanitation. |

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| **Environmental Pollution** | Sources, Pollutants, Effects and remediation of air, water, land and noise pollution, Toxic/hazardous wastes. |
| **Water Demand & Supply** | Population forecast, Water uses & consumption, Types and variations in demand, Maximum & firefighting related demand, Urban & rural water supply, Appropriate technology. |
| **Water Quality** | Water impurities & their health significance, Water quality standards, (U.S. & WHO & Local etc.), Water quality monitoring, Sanitary survey. |
| **Water Treatment** | Treatment of surface & ground waters, screening, sedimentation, coagulation. Filtration, design aspects of slow and rapid sand filters, Filtration rates, operation head loss, backwash and filter efficiency, Pressure filters, hardness removal, Water softening methods, Water disinfection, Emergency treatment methods. |
| **Building Water Supply** | Layout of water supply arrangement, Fixtures and their installation, Tapping of water mains. |
| **Energy Conservation** | Introduction to concepts of energy conservation, energy management in industry and construction activities and green buildings. |
| **Laboratory Works** | Related to the above, sampling techniques and examination of water (physical, chemical and microbiological parameters). |

# FINAL YEAR (Spring Semester)

## UE-360: MECHANICS OF SOLIDS-II

| UE-360 | MECHANICS OF SOLIDS-II |
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| **Enhanced Topics Related to Beam Bending and Shear** | Unsymmetrical bending, shear flow, shear center, Analysis of curved beams and beams on elastic foundations. |
| **Theory of Elasticity** | Analysis of stresses and strains due to combined effect of axial, bending and twisting forces/moments, Elementary theory of elasticity, equilibrium and compatibility equations, stress and deformation relationships, Stress transformation, polar co-ordinates, Theories of failure. |
| **Torsion of Thin Tubes and Open Sections** | Torsion of non-circular shafts, membrane analogy, Torsion in thin tubes and open sections. |
| **Theory of Plasticity** | Elementary theory of plasticity, plastic hinges, shape factor and failure mechanism. |
| **Stability** | Struts and columns, Euler, Rankine and other formulas for buckling load of columns, Stability analysis of columns under eccentric loading. |

| UE-460: GEOINFORMATICS | | | |
|---|---|---|---|
| | Cr. Hrs. | Contact Hrs. | Exam Marks |
| Th. | 1 | 1 | 100 |
| Pr | 1 | 3 | 50 |

**Introduction to Geo informatics Resources of information:** Photogrammetric surveying, Satellite System, Aerial and Satellite photogrammetry. **Geographic Information System (GIS):** Fundamentals of GIS, Spatial Data types and acquiring consideration. Data models and structures. Coordinate System, Datum and map projection and their transformation. Attribute-based operation, Introduction to Spatial Analysis. **Remote Sensing (RS):** Basic Concepts. Physicals basis of Remote Sensing, Earth Resources Satellites/ Platforms, Sensors, Types of Resolutions, Georeferencing, Image Processing Techniques. Classification. **Global Positioning System (GPS):** Navigational Satellites, Positioning Systems (GLONASS, GPS & Galileo), Fundamentals and Elements of GPS, System Operation & Characteristics, Errors and Atmospheric effects. Differential GPS (DGPS). **Field and Laboratory Work:** Training on GPS instruments-based surveys, Integration GPS data in GIS. Exercises on Image processing software and recent GIS software. Demonstration on RS/GIS applications in engineering disciplines

**Recommended book(s) for the approved course**
(Author's name, "*Title*", edition, publisher, publication year).

**Text book:**


1. Michael Kennedy, The Global Positioning System and Arc GIS System, 3rd Edition, Taylor & Frances, New York, , 2017
2. Thomas, M. Lillesand & Ralph W. Kiefer, Remote Sensing and Image Interpretation, 7th edition, John Wiley & Sons, Inc. 2015,
3. Clarke, K. Getting Started with Geographic Information System, Prentices Hall, New York 3rd Edition, 2010, ISBN-1879102897
4. Chang, K. T., Introduction to Geographic Information Systems, 9th Ed. McGraw-Hill Higher Education, 2019


## UE-435: FINANCIAL RESOURCE MANAGEMENT

| UE-435 | FINANCIAL RESOURCE MANAGEMENT |
|---|---|
| **Resource Management** | Meaning; Nature; Aims; Characteristics; Elements; Functions and Objectives of management. |
| **Capital financing and Allocation** | Difference between sources of capital; Equity and borrowed capital; Financing with debt capital- cost of debt capital; Financing with bonds-cost of equity capital; Financing through retained profit; Leasing as a source of capital; Capital Allocation; An overview of a typical corporate capital budgeting Process. |
| **Banking and specialized Credit Institution** | Functions of Bank and Credit Institution; Documentation related to International and Domestic Banks, Financial and funding Institutions. |
| **Business and Consumer Loans** | Open-End Credit and charge cards; Installments loans; Early payoffs of loans; Personal property loans; Real estate loans. |
| **Taxation** | Basics of taxation; Tax formulas and computation; Tax laws for capital gains. |
| **Price Changes and Exchange Rate** | Terminology and basic concepts; Differential price inflation or deflation; Application strategy; Foreign Exchange rates and purchasing power. |
| **Home ownership and Mortgage financing (Owning v/s Renting)** | Mortgage financing for home ownership; Mortgage the investment market in the investment market; Comparing mortgages and different interest rates; Effects of different interest rates; Effects of different mortgages lives. |
| **Investment Property** | Land inventory; Features of investment real estate; Investment return; Determination of project feasibility. |

## UE-454/CE-421: DESIGN OF STEEL STRUCTURES

| UE-454/CE-421 | DESIGN OF STEEL STRUCTURES |
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| **Introduction** | Steel properties, design load and load factors, Types and shapes of structural steel members, Specifications and design codes, Safety factors. |
| **Tension Members** | Design of threaded, riveted and welded tension members. |
| **Flexural Members** | Design of laterally supported and unsupported beams, Deflection, Design of beams for heavy concentrated loads, Bearing plates, Design of purlins, Design of beams with unsymmetrical cross-section and unsymmetrical bending, Design of builtup beams, gentry girder and plate girder. |
| **Compression Members** | Design & analysis of axially loaded columns, Design of laced columns, Analysis and design of eccentrically loaded columns, Length effects and evaluation of effective length factor for columns in braced and unbraced frames. |
| **Connections** | Types of high strength bolts and rivets, Friction & bearing type connections, Fasteners subjected to eccentric loads, Design of seated beam connection, Continuous beam-to-beam and beam to-column connection. |
| **Framing System & Design** | Design of industrial frame works, crane and gantry girder-setting of geometry, different load conditions and lateral bracing, Design of frames using plastic analysis. |
| **New Design Codes** | Introduction of LRFD. |

## EN-401: ENVIRONMENTAL ENGINEERING- II

| EN-401 | ENVIRONMENTAL ENGINEERING- II |
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| **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** | Separate & combined systems; Types shapes, sizes and materials of sewers; Sewer appurtenances, pipe strengths and tests. |
| **Principles of Design** | Construction & maintenance of sewers; Sewer, system analyses; Diameter and gradient, sewer joints, grading, laying, Jointing and testing of sewers. |
| **Characteristics of Sewage** | Municipal and industrial wastes; Water pollution, causes and control parameters; Effluent disposal guideline and standards. |
| **Sewage Treatment** | Primary, secondary & tertiary treatment; Screening grit chamber, skimming tanks & sedimentation tanks; Activated sludge treatment, trickling filters, oxidation ponds, etc. |
| **Sewage Disposal Method** | Receiving body, assimilation capacity; Stream pollution and self-recovery, sludge handling & disposal; Effluent Reuse. Control and management of industrial wastewaters. |
| **Building Drainage** | Requirements and arrangement of building drainage; Soil pipes, antisyphon pipes and waste water pipes; Sanitary fixtures and traps; House connection and testing of house drainage; Cross connection and back syphonage control. |
| **Solid Waste Disposal** | Types, characteristics, sources and quantities of solid wastes; |

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| | Collection disposal and recycling. |
| **Laboratory Work** | Related to the above, sampling techniques and examination of wastewater (Physical, chemical and microbiological parameters). |