UNDERGRADUATE PROGRGAMME

SYLLABUSES

CIVIL ENGINEERING

SEMESTER SYSTEM

BATCH: 2012-2013

COURSES OF STUDY AND MARKS DISTRIBUTION

First Year (F.E.) Civil Engineering

Spring Semester

S. No.	Course Code	Course Title	Credit Hours		
			Theory	**Practical**	**Total**
1	CE-101	Engineering Drawing-I	2	1	3
2	CE-102	Statics and Dynamics	3	1	4
3	EE-116	Principels of Electrical Engineering	3	1	4
4	CY-105	Applied Chemistry	3	1	4
5	MT-111	Calculus	3	0	3
6	HS-105	Pakistan Studies OR	2	0	2
	HS-127	Pakistan Studies (for Foreigners)			

Fall Semester

S. No.	Course Code	Course Title	Credit Hours		
			Theory	**Practical**	**Total**
1	CE-103	Engineering Surveying-I	3	1	4
2	CE-104	Engineering Materials	3	1	4
3	ME-105	Applied Thermodynamics	3	1	4
4	PH-121	Applied Physics	3	1	4
5	HS-101	English	3	0	3

SYLLABUS – SPRING SEMESTER ENGINEERING

CE-101 **ENGINEERING DRAWING-1**

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

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

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

Symbols and Abbreviations: Building materials, Electric and Plumbing symbols and Abbreviations.

CE-102 **STATICS AND DYNAMICS**

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, 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 and 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.

EE-116 **PRINCIPLES ELECTRICAL ENGINEERING**

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

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

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

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

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

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

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

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

CY-105	**APPLIED CHEMISTRY**
Gases:	Gas Laws, Kinetic gas equation, Vandar Waal's Equation, Critical phenomenon, liquidification of gases, specified 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).
Thermochemistry:	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 fuels.
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, Class Organic engineering materials: Polymers, Rubbers, Plastics and Paints, Semiconductors and Dielectric materials.

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 (Absolute value, greatest integer and combining functions). Graph of some well known functions. Limit of functions and continuous and discontinuous functions with graphical representation.
Propositional Logic:	Definition of Proposition, Statement and Argument, Logical Operators, Simple and Compound proposition, various types of connectives, Truth table, tautology, Contradiction, Contingency & Logical equivalence.
Boolean Algebra:	Definition, Boolean function, duality, some basic theorems & their proofs, two valued Boolean algebra, Truth functions, Canonical sum of product form, Digital logic Gates & Switching circuit designs
Complex Number:	Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and Hyperbolic functions)
Differential Calculus:	Differentiation and Successive differentiation and its application, Leibnitz theorem, Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series, Taylor and Maclaurin series, L' Hopitals 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)

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.
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's Economy, Discussion on Social and Environmental Issues.
Foreign Policy:	Relations of Pakistan with Neighbours, the Muslim World and 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 Levels.

HS-127	**PAKISTAN STUDIES (FOR FOREIGNERS)**
Land of Pakistan:	Land and People, Strategic Importance, Important and Beautiful Sights: Natural Resources (some portion of Economics of Pakistan)
A Brief Historical Background:	A brief historical survey of Muslim Community in the Sub- Continent, British Rule and its Impacts, Indian Reaction, Two-Nation Theory, its Origin and Development, Factors leading towards the Demand of a separate Muslim State, Creation of Pakistan.
Government & Political Development in Pakistan:	Constitution of Pakistan, A brief outline, Governmental Structure, Federal **a**nd Provincial, Local Government Institutions, Political History and its brief account.
Pakistan & the Muslim World:	Relations with Muslim Countries

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

SYLLABUS – FALL SEMESTER ENGINEERING

CE-103 **ENGINEERING SURVEYING – I**

Basics of Surveying: Definition, Evolution of Surveying, Types and Classes of Surveys, Plane Table Survey, 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 / Tacheometers: Introduction, Types of Theodolites, Repeating, Directional and Electronic Theodolites, Temporary adjustments, Measurement of Horizontal and Vertical Angles, Prolonging a Straight Line, Permanent Adjustments, Use of Tachometers in computation of Horizontal and Vertical Distances.

Electronic Distance Measurement: General, Principles of EDMI 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 Methods, Use of computer programs.

CE-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, Quality Control, Additives and Admixtures, Air Entrainment, Lightweight Concrete, Hot and Cold Weather Concrete, Precast 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, Fibre board.

Rubber, Plastics and Bituminous Materials: Composition, Varieties, Properties and Uses of Bitumen, Asphalt Glass, Rubber Laminates, Adhesives, Asbestos, Fibre Glass, Paints and Varnishes

Insulating Materials: Waterproofing and Heat Insulating Materials, Acoustical Materials.

ME-105 **APPLIED THERMODYNAMICS**

Thermodynamic Properties: **W**orking Substance, System, Pure Substance, PVT Surface, Phases, Properties And State, Units, Zeroth Law, Processed 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 Relations: Thermodynamic Equilibrium, Reversibility, Specific Heats and their Relationship, Entropy, Second Law of Thermodynamics, Property relations from Energy Equation, Frictional Energy.

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 Vapour Curves, Phase Diagrams, Rankine Cycle, Components of Steam Power Plant.

Internal Combustion Engines: Otto Cycle, Diesel Cycle, Dual Combustion Cycle, Four-stroke and Two-stroke Engines, and Types of Fuel.

Reciprocating Compressors: Condition for Minimum Work, Isothermal Efficiency, Volumetric Efficiency, Multi-Stage Compression, Energy Balance for a Two-Stage Machine with Intercooler.

Introduction To Heating and Cooling Load and its calculations, Comfort Charts,

Air-Conditioning and Refrigeration: Outline of A.C. Systems, Consideration for Air – Conditioning in Buildings, Natural Ventilation, Insulating 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 on current, Hall effect, Brot-Savart Law, Ampere's Law, Fields of rings and coils, Magnetic dipole, Diamagnetism, Paramagnetism 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

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**

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

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COURSES OF STUDY AND MARKS DISTRIBUTION

Second Year (S.E.) Civil Engineering

Spring Semester

S. No.	Course Code	Course Title	Credit Hours		
			Theory	**Practical**	**Total**
1	CE-201	Engineering Surveying-II	3	1	4
2	CE-206	Geology for Engineers	3	1	4
3	CE-202	Introduction to Computing For Civil Engineers	2	1	3
4	CE-205	Mechanics of Solids-I	3	1	4
5	HS-205	Islamic Studies OR	2	0	2
	HS-209	Ethical Behaviour			

Fall Semester

S. No.	Course Code	Course Title	Credit Hours		
			Theory	**Practical**	**Total**
1	CE-204	Fluid Mechanics-I	3	1	4
2	CE-203	Engineering Drawing-II	2	1	3
3	CE-209	Structural Analysis-I	3	1	4
4	MT-330	Applied Probability & Statistics	3	1	4
5	MT-221	Linear Algebra & Ordinary Differential Equations	3	0	3
6	AR-309	Architecture and Town Planning	3	0	3

SYLLABUS – SPRING SEMESTER ENGINEERING

CE- 201 **ENGINEERING SURVEYING – II**

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

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

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

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

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

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

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

CE-202 **INTRODUCTION TO COMPUTING FOR CIVIL ENGINEERS**

Computer and System: Computer hardware fundamentals, Operating Systems: DOS, WINDOWS.

Fundamentals: Spreadsheets, Flow Chart techniques.

Structured programming Language: Character set, keywords, identifiers, data types and size, variable declaration, expression, labels, statements, formatted input output statements, types of operators, data type operators, data type conversion, mixed mode arithmetic, control structures, Functions, library functions, parameter passing, recursion,

arrays declaration, initialization and usage, multi-dimensional arrays. Files, function for file handling, I/O Operations.

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

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

CE-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.

CE-205 **MECHANICS OF SOLIDS – I**

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

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

Slope and Deflection: Curvature, slope and deflection of beams using integration methods

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

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

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 Prophet hood, Seerat life of the Prophet as embodiment of Islamic-Ideology, Faith in Here-after (AKHRAT), Effects of the beliefs on worldly life
Ibadah:	Concept of Ibadah, Major Ibadah, Salat, Zakat, Hajj and Jehad
Basic Source of Shariah:	The Holy Quran, Its Revelation and Compilation, The Authenticity of the Text, Hadith, Its Need, Authenticity and Importance, Consensus (Ijmaa), Analogy (Qiyas)
Sources of Knowledge:	Islamic Approach to Intuition, Reason and Experience, Revelation (Wahi) as a Source of Knowledge
Moral and Social Philosophy of Islam:	The concept of Good and Evil, Akhlaq-e-Hasna with special reference to Surah Al-Hujrat, Professional Ethics (Kasb-e-Halal)

HS-209	**ETHICAL BEHAVIOUR**
Nature, Scope and Methods of Ethics:	Ethics and Religion, Ethical teachings of World Religions
Basic Moral Concepts:	Right and Wrong, Good and Evil
Ethical Systems in Philosophy:	Hedonism, Utilitarianism, Rationalism & Kant, Self Realization Theories, Intuitionism
Islamic Moral Theory:	Ethics of Quran and its Philosophical basis, Ethical precepts from Quran and Hadith and Promotion of Moral Values in Society

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SYLLABUS – FALL SEMESTER ENGINEERING

CE- 204	**FLUID MECHANICS – I**
Basic Concepts and Units Definitions:	Density, specific weight, mass, viscosity, compressibility, surface tension, vapor pressure, Continuum, Lagrange and Eulerian description
Fluid static's:	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:	Types of flow, Streamline and streak lines, Velocity and acceleration in steady & unsteady flow, Equation of continuity, Flow net
Steady Flow:	Energy, Energy Equations, Hydraulic grade line and energy line, Flow in a curved path, Vortex and cavitation
Impulse-Momentum:	Basic principle, Force on pressure conduits, stationary and moving blades, reducers and bends, Torques in rotating machines, Applications
Dimensional Analysis & Similitude:	Definitions, Geometric and other similarities, dimensionless numbers, .
Forces on Immersed bodies:	Introduction to boundary layers, approximate solutions, Lift and drag over a flat plate, Application to simple problems
Fluid Properties Measurements:	Static, velocity and acceleration measurements, Orifices meter, notches & weirs, venture meter

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CE-203	**ENGINEERING DRAWING – II**
General:	Need and requirement of drawings for civil Engineering projects. General nature of drawings, components, symbols and nomenclature needed for specific drawings such as architectural, structural, plumbing, electrical, air-conditioning, roads and earth work etc. Drawings at different stages of projects, Elements of perspective drawing
Civil Engineering Drawing:	General description of drawings related to civil Engineering projects.
Building Drawing:	Elements of architectural planning and design, conceptual, schematic and working drawings and details of residential, commercial, religious, recreational, industrial, clinical, hospital, and educational buildings, Details of doors, windows, staircases etc. Elements of structural drawing and detailing, preparation of foundation plan, structural framing, slab details, staircase details, water tanks, beam and column elevations and sections mostly pertaining to reinforced concrete structures. Details of steel roof truss, connection details and fabrication drawings Plumbing and electrical detailing pertaining to small residential units
Computer Aided Drafting:	General and basic know how related to computer aided drafting, e.g. co-ordinate system, drawings setup procedure, basic draw commands, basic edit commands,

Layers, creating text and defining styles options, block and drawing import/export options, Cross hatching, save and plot (2D) and isometric drawings.

CE - 209 **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.

MT-330 **APPLIED 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.

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, non-singular, symmetric, non-symmetric, upper, lower, diagonal), Rank of a matrix using row operations and special method, Echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, matrix of linear transformations, eigen value and eigen vectors of a matrix, Diagonolization, Applications of linear algebra in relevant engineering problem
1st Order Differential Equations:	Basic concept, Formation of differential equations and solution of differential equations by direct integration and by separating the variables, Homogeneous equations and equations reducible to homogeneous form, Linear differential equations of the order and equations reducible to the linear form. Bernoulli's equations and orthogonal trajectories, Application in relevant Engineering
2nd and Higher Orders Equations:	Special types of 2nd order differential equations with constant coefficients and their solutions, The operator D, Inverse operator 1/D, Solution of differential by operator D methods; Special cases, Cauchy's differential equations, Simultaneous differential equations, simple application of differential equations in relevant Engineering
Partial Differential Equation:	Basic concepts and formation of partial differential equations, Linear homogeneous partial differential equations and relations to ordinary differential equations, Solution of first order linear and special types of second and higher order differential equations, D' Alembert's solution of the wave equation and two dimensional wave equations, Lagrange's solution, Various standard forms.
Fourier Series:	Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients; Expansion of function with arbitrary periods, Odd and even functions and their Fourier series; Half range expansions of Fourier series.

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, 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.

COURSES OF STUDY AND MARKS DISTRIBUTION

Third Year (T.E.) Civil Engineering

Spring Semester

S. No.	Course Code	Course Title	Credit Hours		
			Theory	Practical	Total
1	CE-315	Construction Engineering	3	1	4
2	CE-304	Reinforced Concrete Design-I	3	1	4
3	CE-319	Fluid Mechanics-II	3	1	4
4	CE-314	Structural Analysis-II	3	0	3
5	EN-301	Environmental Engineering-I	2	1	3
6	HS-304	Business Communication & Ethics	3	0	3

Fall Semester

S. No.	Course Code	Course Title	Credit Hours		
			Theory	Practical	Total
1	CE-301	Mechanics of Solids-II	3	1	4
2	CE-302	Transportation Engineering-I	3	1	4
3	CE-305	Soil Mechanics-I	3	1	4
4	CE-316	Quantity & Cost Estimations	3	1	4
5	MT-443	Numerical Analysis	3	0	3

SYLLABUS – SPRING SEMESTER ENGINEERING

CE-315 **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 Techniques: Site Selection and Orientation of Buildings, Grading Considerations, Layout techniques with special reference to buildings.

Excavation: Excavation in deferent types of soils, stability of excavation and solution of particular problems arising out of condition of sub-soil at site e.g. de-watering, shoring and bracing, sheet piling etc.

Placement of Concrete: Methods of preparation pouring, placement and curing of concrete in foundations. Construction joints in raft foundations, mass concreting, Plinth joints in raft foundations, mass concreting, Plinth beams and plinth protection, damp proof course.

Construction Methodologies: In-Situ and Pre-Cast Concrete Construction of Buildings, Slab on Grade, Plain Cement Concrete Floors, Planar and Non-Planar Roofing Systems. Doors, Windows, Masonry, Brickwork, Glazing, Cladding, Façade, Curtain Wall, Floor Finishing, Interior and Exterior Building Finishes, and Water Proofing. Protection of adjacent Structures. Mechanized construction. Design and use of formwork for various building units/members. Methods of Concreting Vertical and Horizontal Members, including Mechanized Placement, Ready Mix Concrete etc. Construction Joints, Mass concreting, Plinth Beams and Plinth Protection. Planar and Non-Planar Construction Aspects related to Services.

CE-304 **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 Working stress method, serviceability criteria and checks for deflection,

Method of Analysis:	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.

CE-319 **FLUID MECHANICS – II**

Elementary Hydrodynamics:	Ideal and real fluid, Differential equation of continuity, Rotational and irrotational flow, Stream function and velocity potential function, Brief description of flow fields, Othogonality of stream lines and equipotential lines, Flow net and its limitations, Different methods of drawing flow net.
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, Nukuradse'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.
Steady Flow in Open:	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, venturi flume and critical depth flume.
Unsteady Flow:	Flow through pipes, orifices and over weirs under varying heads, Surges in open channel.
Water Turbines:	Types, reaction and impulse-turbines, Momentum equation applied to turbines, Specify speed, Turbine characteristic.
Centrifugal Pumps:	Types, Stages, Works and efficiencies, Specify speed and characteristic curves.
Reciprocating Pumps:	Types, Maximum suction lift, construction features, specific speed, cavitation and operation.
Hydraulic Scale Models:	Concept of similitude and hydraulic modeling.

CE-314 **STRUCTURAL ANALYSIS-II**

Analysis of Indeterminate Structures Using Force Approach:	Compatibility methods for beams and frames with and without support settlement

Analysis of Indeterminate Structures Using Stiffness Approach:	Moment distribution for beams and frames for prismatic and non-prismatic members with and without side-sway and support settlement, Slope deflection method for beams and frames with and without support settlement.
Matrix Methods:	Introduction to flexibility method, Determination of flexibility matrix for beams, Introduction to stiffness method, development of member and structure stiffness matrices, Bending moment and shear force diagrams, Application of computer programs.
Finite Element Method:	Introduction to finite elements, Stiffness matrices for bar elements, Triangular elements and Rectangular elements, Shape functions and Displacement functions, Transformation matrices, Structure stiffness matrix.

EN-301 **ENVIRONMENTAL ENGINEERING-I**

Communicable Disease Control:	Water borne, foodborne, milkborne and vectorborne diseases, Water supply and sanitation.
Environmental Pollution:	Sources, Pollutants, Effects and remedation 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 sand 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 disinfection 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).

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.

SYLLABUS – FALL SEMESTER ENGINEERING

CE-301	**MECHANICS OF SOLIDS-II**
Enhanced Topics Related to Beam Bending and Shear:	Unsymmetrical bending, shear flow, shear center, Analysis of curved beams and beams on elastic foundations.
Theory of Elasticity:	Analysis of stresses and strains due to combined effect of axial, bending and twisting forces/moments, Elementary theory of elasticity, equilibrium and compatibility equations, stress and deformation relationships, Stress transformation, polar co-ordinates, Theories of failure.
Torsion of Thin Tubes and Open Sections:	Torsion of non-circular shafts, membrane analogy, Torsion in thin tubes and open sections.
Cylinders:	Analysis of thin and thick cylinders.
Theory of Plasticity:	Elementary theory of plasticity, plastic hinges, shape factor and failure mechanism.
Energy Methods:	Energy methods-General area of application and its usefulness.
Stability:	Struts and columns, Euler, Rankine and other formulas for buckling load of columns, Stability analysis of columns under eccentric loading.

CE-302	**TRANSPORTATION ENGINEERING-I**
Transportation Planning:	Modes of transport, Development of various modes in Pakistan, Role of highways within a Transport System, Highway classification, Highway planning and economic appraisal, Network planning, origin and destination studies
Highway Engineering:	Geometric design including cross section elements, Highway materials. tests and construction practices, Flexible and rigid pavement design, Highway drainage, Highway maintenance.
Traffic Engineering:	Traffic flow characteristics, Traffic studies, Capacity analysis, Traffic control devices.

CE-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 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 preconsolidation pressure, swelling clays and clay-shale
Soil Compaction:	Requirements, principle and methods including standard and modified AASHTO tests.

CE-316 **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 Worked Examples: Quantity Takeoff and Pricing of Labor, Material and Equipment for; Sitework, Concrete, Masonry, Carpentry, and Finishes Works; Overview and Discussion of Estimating Procedures and Considerations for Concrete Retaining Wall, Piles, Steel Truss, Road, Sewer and Water Mains Pipe Works.

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

Contract & Tender: Preparation of civil engineering contracts and tender documents; Evaluation of proposals and contracts.

Use of Estimating Software / Spreadsheets:

MT-443 **NUMERICAL ANALYSIS**

Error Analysis: Types of errors (relative, absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart. Use any computational tools to analysis the numerical solutions.

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

Solution of Non-linear Equation: Numerical methods for finding the roots of transcendental and polynomial equations (Secant, Newton-Raphson, Chebyshev and Graeffe's root squaring methods), rate of convergence and stability of an iterative method, Fixed point iteration, Bisection Method, Non-linear systems of equations, application to consolidation settlement and seepage analysis.

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

Interpolation & Curve Fitting: Lagrange's, Newton, Hermit, Spline, least squares approximation Linear and non-linear curves)

Numerical Integration & Differentiation: Computation of integrals using simple Trapezoidal rule, Simpon's rule, Composite Simpson's and Trapezoidal rules, computation of solutions of differential equations using (Euler method, Euler modified method, Runge Kutta method of order 4)

COURSES OF STUDY AND MARKS DISTRIBUTION

Final Year (B.E.) Civil Engineering

Spring Semester

S. No.	Course Code	Course Title	Credit Hours		
			Theory	**Practical**	**Total**
1	CE-403	Soil Mechanics-II	3	1	4
2	CE-405	Reinforced Concrete Design-II	3	1	4
3	CE-413	Essentials in Construction Project Management	3	1	4
4	CE-407	Transportation Engineering-II	3	1	4
5	CE-418	Hydraulics and Water Resources Engineering-I	3	1	4
6	CE-409	Civil Engineering Project			

Fall Semester

S. No.	Course Code	Course Title	Credit Hours		
			Theory	**Practical**	**Total**
1	CE-401	Design of Steel Structures	3	1	4
2	CE###	Elective Course			
3	CF-303	Applied Economics for Engineers	3	0	3
4	EN-401	Environmental Engineering-II	2	1	3
5	CE-409	Civil Engineering Project		6	6
Elective Course					
1	CE-402	Structural Design & Drawing	3	1	4
2	CE-410	Masonry Structures	3	1	4
3	CE-428	Hydraulics and Water Resource Engineering-II	3	1	4
4	CE-414	Modern Aspects of Construction Project Management	3	1	4
5	CE-415	Building Information Modeling	2	2	4
6	CE-416	Introduction to Entrepreneurship & Opportunity Assessment	3	1	4
7	CE-419	Applied Hydraulics	3	0	3

SYLLABUS – SPRING SEMESTER ENGINEERING

CE-403 **SOIL MECHANICS-11**

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, 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.

CE-405 **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 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 over view.

Design of Different Types of Foundations: Analysis and design of eccentric, strap, strip footings and pile caps.

Prestressing Principles & Principles of prestressing, properties of high strength materials used in

Design Philosophy:	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.

CE-413 **ESSENTIALS IN CONSTRUCTION PROJECT MANAGEMENT**

Introduction :	The Construction Industry, Nature and Challenges, Key Industry Support Organizations, Public and Private Works, Past; Present; Opportunities; and Threats with Specific Reference to Pakistani Construction Industry.
Project Management in the Engineering & Construction Industry:	PM knowledge areas; PM Life Cycle processes; Organizational structure of a construction project; Responsibilities of client, Key PM Skills; Key Roles and Responsibilities of Client, Consultants - including architects, engineers and allied professionals, constructors, PM and CM; Professional construction management; Project Management issues and need for improved organization and management structures and processes with particular reference to local construction industry.
Project Scoping, Bidding and Preconstruction Planning:	Determining Relative Priorities of Key Project Objectives; Defining Project Scope, Types of tenders / contracts; Pre-Qualification process, Bidding process, Bid Package, Overview of Preconstruction Planning Aspects Including Area and Site Investigation; Preliminary schedules; Value Engineering; Constructability Analysis; Workpackages; 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, Scheduling by Probabilistic Methods:	Uncertainty Sources; Limitations of Deterministic CPM; PERT scheduling; PERT advantages and limitations; PERT today in construction industry.
Resource and Cost Considerations in Project 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.

CE-407 **TRANSPORTATION ENGINEERING-II**

Railway engineering: Types of rail systems, Railway organization in Pakistan, Railway alignment and grades, Cross sectional elements of railway tracks, Pointers and crossings, stations and yards, Railway signalling systems, Laying of tracks and maintenance of railway right-of-way, Creep and anti-creep devices, Various types of railway locomotives, Methods of traction, Track resistances.

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

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

CE-418 **HYDRAULIC AND WATER RESOURCES ENGINEERING-I**

Introduction to Water Resources Engineering: Hydrogen cycle; Overview, Rain, Surface and sub-surface water hydrology, and water resource estimates

Open Channels and Sediment Transport: Erosion and Sediment yield; Design of open channels - Kennedy's and Lacey's theories

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

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

Subsurface hydrology/ Drainage: Unsaturated and saturated subsurface water and its movement- Darcy'sc 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.

SYLLABUS – FALL SEMESTER ENGINEERING

CE-401	**DESIGN OF STEEL STRUCTURES**
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.

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 anlaysis, 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 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

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EN-401 **ENVIRONMENTAL ENGINEERING-II**

Storm Flow & Sewage Flow Estimates:	Rainfall intensity formulae, hydrograph & dry weather flow, sewage quantities, Variations and rates of flows, Velocity gradient & limiting velocities.
Types of Sewerage Systems:	Separate & combined systems, Types shapes, sizes and materials of sewers, Sewer appurtenances, pipe strengths and tests.
Principles of Design:	Construction & maintenance of sewers, Sewer, system analyses, Diameter and gradient, sewer joints, grading, laying, jointing and testing of sewers.
Characteristics of Sewage:	Municipal and industrial wastes, Water pollution, causes and control parameters, Effluent disposal guideline and standards
Sewage Treatment:	Primary, secondary & tertiary treatment, Screening grit chamber, skimming tanks & sedimentation tanks, Activated sludge treatment, trickling filters, oxidation ponds, etc.
Sewage Disposal Method:	Receiving body, assimilation capacity, Stream pollution and self-recovery, sludge handling & disposal, Eff1uent Reuse. Control and management of industrial wastewaters
Building Drainage:	Requirements and arrangement of building drainage, Soil pipes. Anti-siphon pipes and waste water pipes, Sanitary fixtures and traps, House connection and testing of house drainage, Cross connection and back siphon age control.
Solid Waste Disposal:	Types, characteristics, sources and quantities of solid wastes, Collection disposal and recycling.
Laboratory Work:	Related to the above, sampling techniques and examination of wastewater (physical, chemical and microbiological parameters).

CE-402	**STRUCTURAL DESIGN & DRAWING**
Design of Buildings for Wind & Earth Quake:	Analysis and design of reinforced concrete and steel, industrial and commercial type of buildings including affects of wind and earthquake.
Tanks & Reservoirs:	Analysis and design of underground, overhead tanks and reservoirs. Analysis and design of cantilever and counter fort retaining walls
Shell, Plates and Bridges:	Introduction to analysis and design of thin shell, and folded plate structures, steel and RCC bridges.

CE-410	**MASONRY STRUCTURES**
Loadbearing masonry Buildings:	Advantages and development of loadbearing masonry, basic design considerations, Structural safety; limit state design, foundations, unreinforced, reinforced and prestressed masonry, design methods,load combinations
Bricks,blocks and mortars:	Bricks and blocks, mortar, lime, sand, water ,plasticized Portland cement mortar, use of pigments, frost inhibitors, proportioning and strength, choice of unit and mortar, wall ties, concrete infill and grout; reinforcing and prestressing steel.
Masonry Properties:	Compressive strength, strength of masonry in combined compression and share, tensile strength of masonry, stress-strain properties of masonry, modulus of elasticity, effects of workmanship on masonry strength, thermal effects, creep , shrinkage.
Design for vertical and Lateral loading:	Wall and column behaviour under axial load, Wall and column behaviour under eccentric load, slenderness ration, calculation of eccentricity, vertical load resistance, modification factors, distribution and analysis for lateral forces.
Cavity Walls:	One wythe loaded axially, effects of ties, two wythe loaded axially
Reinforced masonry:	Flexural strength, shear strength of reinforced masonry, deflection of reinforced masonry beams, reinforced masonry columns
Prestressed masonry:	Methods of prestressing, basic theory, general flexural theory, shear stress, deflections, loss of prestress
Construction Aspects:	Placement of steel reinforcement, grouting, control of cracking and movement joints, quality assurance, flashing for masonry construction
Anchorage to Masonry:	Type of anchor bolts, placement and embedment of anchor bolts in masonry grout, nominal strength of anchor bolts, nominal axial strength of anchor bolts loaded in tension and in combined, tension and shear, nominal shear strength of headed and bent-bar anchor bolts in shear; headed and bent-bar anchor bolts in combined axial tension and shear, structural walls and their anchorage requirements.

CE-414 **MODERN ASPECTS OF CONSTRUCTION PROJECT MANAGEMENT**

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

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

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

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

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

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

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

CE-415 **BUILDING INFORMATION MODELLING**

BIM Fundamentals: BIM Overview; BIM vs. Traditional CAD; Common BIM Terminology; Value of BIM; BIM as a Communication and Collaboration Tool; BIM Benefits; Typical BIM Process; BIM Implementation Needs and Challenges.

BIM Technology: Phased Structure of a BIM project; Classes of BIM Tools; Common BIM Applications; Planning and Organizing the Use of BIM Tools; Embedding BIM Tools into Processes; Identifying and Selecting BIM Tools.

Application of BIM Technology on a Real Time Project of Challenging Scope: Developing an Architectural Model; Walls; Slabs; Roofs; Ceilings; Floor Coverings and Wall Coverings; Doors and Windows; Speciality Items, Developing a Structural Model; Foundations; Columns; Beams/ Slabs; Roof Systems; Trusses, Developing an MEP Model; HVAC only, Developing a Site Plan, Developing Project Schedule (4D), Develop understanding of how BIM models are integrated with schedules, Developing Templates for Estimating (5D), Performing Energy Analysis, Develop understanding of how BIM models are applicable to the Energy Analysis, Construction Management and Facilities Management; Develop understanding of how BIM models are applicable to the Construction Management and Facilities Management processes, Performing Walkthroughs/ Flythroughs/ Animation, Presentation Issues/ Rendering, Following software may be used; Revit Architecture, Revit Structure, Revit MEP, Tekla, Constructor, Estimator, Control, Navisworks, EcoTect, etc.

Discussion on BIM Benefits usingReal Time Project: Stakeholder and Site Coordination, Sustainable Design and Construction, Construction Detailing, Pre-Construction Tasks such as Analyzing Constructability, Cost Estimation, Scheduling, Clash Detection, Materials and Methods, Site Safety Improvement, Quality Assurance, Documentation of the Construction Process, Integration of Design and Construction Models, Facilities Management, Improved Trade Coordination, More Accurate Quantity Surveying, Change Management, Risk Analysis, Energy Analysis, etc.

Further Aspects: Process Change from BIM Use, BIM as an Underlying Enabler of Effective Team Communication.

CE-416 **INTRODUCTION TO ENTREPRENEURSHIP AND OPPORTUNITY ASSESSMENT**

Introduction to Entrepreneurial Process: Definition and Philosophy; Need and Significance of Innovation and Entrepreneurship; Role within the Economy; Social Implications; Entrepreneurs as Role Models; Past and Future of Entrepreneurship; Overview of the Entrepreneurial Management Process; Idea Generation; Opportunity Evaluation;

Making a Strategy; Gathering Resources; Launching the Business; Growing the Business; Harvesting Returns, Entrepreneurship in different contexts; Social (donating profits, "doing good", non-profit); Organizational (start-ups, corporate, public sector); Individual (career management).

Introduction to Innovation: What is Innovation?, Innovations in Organizations, Decision Making and Strategy, Sources of Innovation, Fostering Innovation and Entrepreneurship.

Entrepreneurial Traits: Entrepreneurial Mind-Set; Entrepreneurial Strategy; Personal Potential for Entrepreneurship; Career Paths for Entrepreneurs.

From Idea to Market – An Overview: Research and Invention, Innovation, Introduction to Technology Transfer; Background; Technology Transfer Cycle; Pitfalls in Commercialization, Invention Evaluation and Assessment; Review of Inventions – Novelty and Utility; Understanding your Invention, Intellectual Property Basics – Patent; Copyright; Trademark, Assessing Licensing/ New Business Opportunities, Technology Development, Technology Marketing; Product and Market Assessment; Marketing Strategy; Targeting Companies, Technology Licensing; Valuation; Licensing Agreements; Negotiation; Technology Assessment Report.

Entrepreneurial Assessment: Identifying the Purpose of the Proposed Business; Developing and Communicating the Business Idea; Identifying and Analyzing the Potential Business Market; Delineating a Product or Service; Evaluation of Expected and Requisite Revenue Generation.

Legal Considerations and Liabilities: Intellectual Property; Legal Issues in Establishing an Organization; Patents; Trademarks; Licensing; Product Safety and Liability; Insurance and Contracts.

CE-428 **HYDRAULICS AND WATER RESOURCE ENGINEERING II**

Hydrology: Weather Systems, Precipitation Analysis, Intensity-Duration-Frequency curve, Stream flow, Unit and Synthetic Hydrograph Analysis

Sediment Engineering: Weathering, Erosion and Sediment Processes, Factors Affecting Erosion, Sediment Yield e.g., RUSLE, Sediment Transport processes, Erosion and Pollution, Vegetate Waterways

Irrigation & Drainage: Crop Water Requirement/Soil-Water-Plant Relationship; Irrigation Strategies, Irrigation System Designs Subsurface Drainage Design; Occurrence of Groundwater, Well Hydraulics (Theim and Theis Equations)

Hydrological Analyses: Probability concept, Annual Maxima, Flow Duration Curve, Risk and Reliability

Hydrologic Simulation Models: Introduction and steps to Watershed Modelling, Application of Hydrologic Models

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

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

Tides and Water level:	Predict tidal variations and appreciate the impact of tides in the coastal environment; tidal power
Coastal Processes:	Surf zone processes: cross shore and longshore currents; sediment transport; beach response and profiles; shoreline erosion/ Bluff erosion
Introduction to Coastal Management:	Coastal management strategies, Management of coastal lands and water: ground water, waste water and other forms of pollution; Principles of coastal defence and techniques: artificial headlands, breakwater and rip-rap, groynes, beach nourishment, sea walls, managed retreat; wave-coastal structure interaction

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CE-419 **APPLIED HYDRAULICS**

Steady Flow through Pressure Conduits:	Overview, Empirical equation for pipe flow-Hazen William etc., Branching Pipes Three reservoir problem, Pipes in series and parallel, Pipe Networks-Hardy Cross Method, manual and computer based problem solution.
Steady Flow in Open channel:	Equation of gradually Varied Flow, Water Surface Profiles and Classification System, Hydraulic jump, phenomena, application and location.
Design of Conveyance Infrastructure:	Canal, outlets, regulating structures, Flumes, Chutes, Siphons, Culverts, Energy Dissipation structures, Canal lining.
Forces on Immersed bodies:	Simple Lift and drag equations and their applications, Introduction to boundary layers, approximate solutions, Lift and drag over a flat plate, Application to simple problems.
Hydrodynamics:	Flow net and its limitations, Different methods of drawing flow net, Viscous Flow, Stress-Deformation Relationships, The Naiver-Stokes Equations.
Finite Control Volume Analysis:	
Unsteady Flow:	Surges in pipes and open channel.
Impulse-Momentum:	Stationary and moving blades, reducers and bends, Torques in rotating machines, Applications.

CE-409 **CIVIL ENGINEERING PROJECT**
