Bachelor's Degree Programme

in

Civil Engineering along with Specialization in Construction

Offered by

DEPARTMENT OF CIVIL ENGINEERING

COURSE SYLLABUS

Table 1. Programme Structure of B.E. Civil Engineering along with Specialization in Construction

Semester-Wise Distribution for Construction Engineering Courses

First Year

Spring Semester

Course Code	Course Title	Credit Hrs		
		Th	Pr	Total
CN-101	Engineering Drawing-I	3	1	4
CN-102	*Statics and Dynamics*	*3*	*1*	*4*
EE-102	Electrical Engineering	3	1	4
CY-105	*Applied Chemistry*	*3*	*1*	*4*
MT-111	*Calculus*	*3*	*0*	*3*
HS-105/HS-127	*Pakistan Studies/ Pakistan Studies (for Foreigners)*	*2*	*0*	*2*
	Total	**17**	**4**	**21**

Fall Semester

Course Code	Course Title	Credit Hrs		
		Th	Pr	Total
CN-107	Surveying with Construction Applications	3	1	4
CN-104	Engineering Materials	3	1	4
ME-105	Applied Thermodynamics	3	1	4
PH-121	*Applied Physics*	*3*	*1*	*4*
HS-101	*English*	*3*	*0*	*3*
	Total	**15**	**4**	**19**

Second Year

Spring Semester

Course Code	Course Title	Credit Hrs		
		Th	Pr	Total
CN-216	*Computing Fundamentals for Engineers*	*2*	*2*	*4*
CN-217	Building Construction Technology	3	1	4
CN-218	Drawing for Civil and Construction Engineers	3	1	4
CN-219	Structures-I	3	1	4
HS-205/HS-206	*Islamic Studies/ Ethical Behavior*	*2*	*0*	*2*
	Total	**13**	**5**	**18**

Fall Semester

Course Code	Course Title	Credit Hrs		
		Th	Pr	Total
CN-220	Fluid Mechanics	3	1	4
CN-221	Geotechnical Engineering-I	3	1	4
CN-222	Construction Estimating	3	1	4
MT-330	*Applied Probability and Statistics*	*3*	*0*	*3*
MT-221	*Linear Algebra and Ordinary Differential Equations*	*3*	*0*	*3*
CN-223	*Fundamentals of Applied Economics for Engineers*	*3*	*0*	*3*
	Total	**18**	**3**	**21**

Third Year

Spring Semester

Course Code	Course Title	Credit Hrs		
		Th	Pr	Total
CN-320	Fundamentals of Construction Project Management	3	1	4
CN-321	Structures-II	2	1	3
CN-323	Construction Contracts	3	0	3
CN-324	*Accounting and Financial Management*	*3*	*1*	*4*
AR-310	Architectural Studies for Engineers	3	0	3
HS-304	*Business Communication & Ethics*	*3*	*0*	*3*
	Total	**17**	**3**	**20**

Fall Semester

Course Code	Course Title	Credit Hrs		
		Th	Pr	Total
CN-326	Construction Planning, Scheduling and Control	3	1	4
CN-327	Transportation Engineering	2	1	3
CN-328	Geotechnical Engineering-II	2	1	3
CN-329	Construction Jobsite Management	3	0	3
CN-330	Hydraulic Engineering and Water Resource Management	3	1	4
	Total	**13**	**4**	**17**

Final Year

Spring Semester

Course Code	Course Title	Credit Hrs		
		Th	Pr	Total
CN-416	Legal and Regulatory Environment in the Construction Industry	3	0	3
CN-417	Temporary Structures in Construction	3	1	4
CN-418	Systems in Building Construction	3	1	4
CN-419	*Leadership, Human and Entrepreneurship Skills in Management*	*3*	*0*	*3*
CN-420	Quality and Safety Management in Construction	3	1	4
CN-426	Construction Engineering Project	0	0	0
	Total	**15**	**3**	**18**

Fall Semester

Course Code	Course Title	Credit Hrs		
		Th	Pr	Total
CN-421	Sustainable Technologies and Disaster Management	3	1	4
CN-422	Construction Economic Analysis	3	0	3
CN-423	*Management and Marketing of Construction Services*	*3*	*0*	*3*
CN-424	Heavy Construction Equipment and Operations	3	1	4
CN-425	Environmental Issues in Construction	3	1	4
CN-426	Construction Engineering Project	0	6	6
	Total	**15**	**9**	**24**

		Th	Pr	T	%
Engg		81	29	110	69.62%
Non-Engg		42	6	48	30.38%
	G. Total			158	

Legend: *Italic: Non-Engineering Course*
Regular: Engineering Course

First Year (F.E.)

Spring Semester

CN-101 **ENGINEERING DRAWING-I**

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.

CN-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-102 **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, Equalizing Connections and Dummy Coils, Elementary concept of Armature Reaction and Commutation, Cross and Demagnetizing Ampere-turns. DC Generators, Types, EMF Equation, Losses, Efficiency Performance Curves, Characteristics, Critical Resistance, Speed and Effect of Armature Reaction of OCC, Internal and External Characteristics from OCC neglecting and accounting Armature Reaction, Calculation of Series Ampere-turns for Level and Over, Compounding, Motors, Principle, Back EMF, Torque, Speed and Speed Regulation, Types, Characteristics, Performance Curves. Losses and Efficiency, Speed and Torque problems involving Magnetization Curve, Charging and Ignition Circuits of Automobiles
AC Synchronous:	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).

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

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

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

Fuels: Types of fuels, classification of fossil 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, De Morgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions). Graph of some well known functions. Limit of functions and continuous and discontinuous functions with graphical representation.

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 and 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.

First Year (F.E.)

Fall Semester

CN-107	**SURVEYING WITH CONSTRUCTION APPLICATIONS**
Basics of Surveying:	Definition of Surveying, Types and Classes, Instrumentation, Units of Measurement, Location Methods, Accuracy and Precision, Errors and Mistakes, Stationing, Field notes, Field management, Calculation of volumes and areas.
Levelling:	Definition, Concept of Differential Levelling, Effects of Curvature and Refraction, Types of Levels, Adjustment of Levels, Levelling Types, Tools, Operations and Techniques, Errors, Contours – Description, Characteristics and Plotting.
Measurement of Horizontal Distances - Conventional and Electronic:	Conventional methods of Linear measurement, Types of Measurement, Use of Steel Tapes and Taping Errors, Principles of EDMI Operation, EDM Characteristics, Accuracies and Geometry, Types of EDMIs.
Introduction to Theodolite And Total Station:	Types of Theodolites, Adjustments, Measurement of Horizontal and Vertical Angles, Use of Tachometers for Distance Measurement, Total Station Capabilities, Field Techniques and Procedures in Topographic Surveys, Construction Layout and Traversing using Total Station.
Traverse Surveys and Computations:	Traverses and Types, Latitude and Departure, Error of Closure, Accuracy, Rules of Adjustment, Computation of Omitted Measurements, Area of Closed Traverse, Horizontal and Vertical Angles and types, Meridians, Azimuths, Bearings, Reverse Direction Azimuth and Bearing computations, Magnetic Declination.
Highway Curves:	Route surveys, Circular curves, Deflections and Chord calculations, Setting out circular curve, Compound curves, Reverse, Vertical, Parabolic curves, Computation of the high or low point on a vertical curve, Design considerations, Spiral curves, Approximate solution for spiral problems, Super-elevation.
Construction Surveys:	Overview of Surveying Applications in Construction, including Highway, Pipelines, Tunnels, Building Construction, and Bridges/ Culverts.
Introduction to Geomatics:	Definition, Branches, Aerial Photography, Airborne and Satellite Imagery, Remote Sensing Satellites, Geographic Information System, GPS satellite system, Working, Structure and Accuracy of GPS system, GPS Signals, Sources of errors.

CN-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: Working 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 Air-Conditioning and Refrigeration:	Heating and Cooling Load and its calculations, Comfort Charts, Outline of A.C. Systems, Consideration for Air – Conditioning in Buildings, Natural 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 traveling 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

Second Year (S.E.)

Spring Semester

CN-216	**COMPUTING FUNDAMENTALS FOR ENGINEERS**
Introductory Concepts	Computer Classification, Computer Characteristics, Modes of Operation.
Operating System Concepts	Basic Operating System Concepts; With GUI; Without GUI; UNIX; DOS; Windows.
Spreadsheet Calculations	Use of MS Excel as a Construction Engineering & Management Problem-Solving Tool
Database Concepts	Basic Database Concepts; Distributed Computing; Client-Server Computing
Management Information Systems	MIS Concepts; MIS Application for Engineers
System Analysis and Design	Basic Concepts; Need and Effectiveness
Programming Methodology and Program Development	Algorithm Development, Programming Basics, High and Low Level Languages, Creating; Compiling and Executing a Program on a Programming Language, Data Types, Variables, Constants, Expressions and Operators, Program Control Statements, Exploring Arrays and Strings, Functional Programming, Specific Applications in Construction Engineering and Management Problem-Solving.

CN-217	**BUILDING CONSTRUCTION TECHNOLOGY**

Principles of Construction: An Overview of: Project Life Cycle; Building Codes; Construction Standards; Sustainability.

Building Construction Equipment: Introduction to Equipment Used in Building Construction, General Overview of Equipment Productivity, Cost and Cost Effectiveness.

Foundation and Basement Construction: Concept of Settlement, Techniques and Processes in Shallow Foundation Works, including: Excavation; Placement; Waterproofing and Drainage; Basement Insulation; and Backfilling.

Masonry Construction: Types of Masonry, Techniques in Masonry Construction, Detailing Masonry Walls.

Concrete Construction: Overview of Concrete Processes: Formwork; Reinforcing; Concrete Pouring; and Formwork Removal, Understanding Prestressing Technology.

Construction Techniques and Processes in Cast-in-place Concrete Works, including: Slab on Grade; Column; Beam-Supported Concrete Floors and Stairs; Considerations for Selecting a Cast-in-place Concrete Framing System, Innovations.

Introduction to Precast Concrete, Assembly Concepts for Precast Concrete Buildings, Innovations.

Steel Frame Construction: Construction Techniques and Processes in Light-Gauge Steel Framing, Details of Steel Framing, Fireproofing.

Roofing Construction: Construction Techniques for Flat; Low-Slope and Steep Roofs, Sustainable Roofing.

Building Finishes: Overview of Glass and Glazing Technology, Window Performance Ratings, Window Installation Process, Classification of Doors, Installation Process of Door Frames and Panels, Fire-Rated Doors/ Windows, *Cladding:* Introduction to Exterior Wall Cladding Systems; Construction Techniques, *Curtain Wall:* Types; Standards; Construction Techniques for Glass-Aluminum Curtain Walls. *Exterior Finishes:* Overview of Construction Technology in Exterior Finishes: Protection from Weather; Building Enclosure; Finish Carpentry, *Interior Finishes:* Overview of Installation of Mechanical and Electrical Services; Sequence of Interior Finishing Operations; Selecting Interior Finish Systems. *Interior Walls and Partitions:* Types of Interior Walls; Partition Systems; Wall and Partition Facings, *Finish Ceilings and Floors:* Overview of Ceiling Types and Technologies; Overview of Flooring Types and Technologies, Considerations of Sustainability.

CN-218 **DRAWING FOR CIVIL AND CONSTRUCTION ENGINEERS**

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, General description of drawings related to civil Engineering projects.

Building Drawings: General understanding and reading of architectural, conceptual design, schematic design and working drawings and details of large residential units, commercial,

religious, industrial, hospital, and educational buildings; Details of doors, windows, staircases etc.

General understanding and reading of structural drawings and detailing, foundation plan, structural framing, slab details, staircase details, water tanks, beam and column elevations and sections mostly pertaining to reinforced concrete structures.

Preparation and Interpretation of working/ construction drawings (plans, elevations, sections, etc.) appropriate to light construction (residential, commercial, etc.) 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

Civil Engineering Drawings: General understanding and reading of alignment profiles, cross sections, geometric and intersection drawings.

General understanding and reading of plans of working drawings for industrial and heavy construction.

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.

CN-219 **STRUCTURES-I**

Structural Functions: Load Sources, Live and Dead Loads, Static and Dynamic Loads, Load Dispersion, Load Combinations, Reactions, Internal Forces, Stress and Strain, Dynamic Effects, Design for Structural Behavior, Analysis of Structural Behavior.

Introduction to Key Structural Systems: Slab and Beam Systems, Structural Walls, Rigid Frames, Truss Systems, Arch, Dome and other Structural Systems.

Theory of Elasticity: Uniaxial state of stresses and strains, Elastic Constants, Normal and shearing stresses and strains, Distribution of direct stresses on uniform and non-uniform members, Bending Stresses, Torsional Stresses, Thermal stresses, Combined effect of axial, bending and twisting forces/ moments,

Determinacy of Structure: Determinate and indeterminate structures, Static and kinematics determinacy, Compatibility and boundary conditions.

Flexural Members: Theory of simple bending, position of neutral axis, moment of resistance and section modulus, Types of Beams, Load and Support Conditions, Reactions, Bending and shearing stress distribution in beams, Relationship between load, shear force and bending moment, Rotation and Deflection, Statically Indeterminate Beams, Stresses in composite sections.

Tension Members: Axially Loaded Members, Net Section and Effective Area, Flexible Members, Spanning Cables, Combined Action: Tension Plus Bending.

Compression Members: Types of Compression Members, Relative Slenderness, Interaction: Combined Compression and Bending, Combined Stress, P-Delta Effect.

HS-202 **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**

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

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

Second Year (S.E.)

Fall Semester

CN- 220 **FLUID MECHANICS**

Basic Concepts and Definitions: Units, density, specific weight, mass, viscosity, compressibility, surface tension, vapor pressure, Continuum, Lagrange and Eulerian description

Fluid Statics:	Pascal's Law, Measurement of pressure, Pressure head, Hydrostatics forces on submerged areas (plane and curved), Manometers, Buoyancy of fluids, Simple lift and drag equations and their applications
Fluid Kinematics:	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
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.

CN-221 **GEOTECHNICAL ENGINEERING-I**

Rocks:	Structure of Earth, Geological Cycle, Important Rock Minerals, Classification of Rocks Based on Origin, Lithological, and Engineering.
Defects in Rock Mass:	Fracture, Cracks, Fissures, Bedding Planes (Strike and Dip), Stratification, Joints, Faults, Folds and Cavities.
Rock Properties:	Overview of Physical and Mechanical Properties of Rock.
Nature of Soils:	Origin, Formation, Soil minerals, Soil structures, Particle shapes and sizes.
Soil 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 (Clay mineralogy).
Soil 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
Soil Property Modification:	Mechanical (Compaction) and Chemical Stabilization methods.
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.

CN-222 **CONSTRUCTION ESTIMATING**

General:	Overview of the Scope of Civil Engineering Works, Discussion on General Practice in Government Departments for Schedule of Rates and Specifications, Rate Analysis Procedure and Application to Concrete, Description of Schedule of Values, Introduction to Specifications for Various Items in Construction.
Estimating Introduction:	Concept, Need and Significance, Estimate Categories and Project Life Cycle (PLC), Role of Estimates in PLC, Estimate Types, Estimate Accuracy vs. Time.
Developing Preliminary Estimates	Development Process and Illustrative Examples of Conceptual, Assemblies and Definitive Estimates.
Bid Estimating Basics:	Overview, Scheduling the Estimating Process, Bid Record and Bid Documents Review, Query List, Team Approach, Site Visit, Estimating Considerations, Estimating Procedure, Computerized Estimating Overview.
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.
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, Finishes, Electrical, Plumbing and HVAC Works; Overview and Discussion of Estimating Procedures and Considerations for Concrete Retaining Wall, 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.

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	Introduction, Population, Parameter & Statistic, Objects of sampling, Sampling

Distributions:	distribution of Mean, Standard errors, Sampling & Non-Sampling Errors, Random Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems.
Statistical Inference and Testing of Hypothesis:	Introduction, Estimation, Types of estimates, Confidence interval, Tests of Hypothesis, Chi-Square distribution/test, one tails & two tails tests, Application in related problems.
Probability:	Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability, Conditional probability, Baye's rule, Related problems in practical significance.
Random Variables:	Introduction, Discrete & Continuous random variables, Random Sequences and transformations, Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F) Markove random walks chain/Related problems.
Probability Distributions:	Introduction, Discrete probability distributions, Binomial, Poisson Hyper geometric & Negative binomial distributions, Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance.

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

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.

CN- 223 **FUNDAMENTALS OF APPLIED ECONOMICS FOR ENGINEERING**

Introduction	Basic Concepts and principles of Economics, Branches of Economics, Macro- and Micro-economics theory, 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.
Macroeconomics	Introduction, National Income Accounting, Theories of Income and Employment (Classical and Keynessian), Consumption Function, Theory of Investment.
Microeconomics	Introduction, Consumer Theory, Theory of Cost, Theory of Production, Theory of Firm.
Economic Applications of Maximization and Minimization	An Overview of Mathematical Optimization for Engineers; Profit Maximization, Cost Minimization; Linear Programming Problems, Graphic Solution, Simplex Method, Duality.

Third Year (T.E.)

Spring Semester

CN-320 **FUNDAMENTALS OF CONSTRUCTION PROJECT MANAGEMENT**

The Construction Industry:	Introduction, Scope, Size, Manufacturing versus Construction, Economy and the Construction Industry, Industry Sectors, Research & Development, Industry Organizations, Public and Private Works, Opportunities and Trends.
Construction Projects and Players:	Attributes of Construction Projects, Project Goals and Objectives, Construction Project Life Cycle Phases, Linear Tracking versus Fast tracking Project Organizational Structure, Primary Players, Secondary Players, Construction as a Team Activity, Roles and Responsibility of the Primary and Secondary Players.
Introduction to Construction Management:	Construction Management Objectives and Processes, Body of Knowledge, Contractor's and Owner's Project Managers, Overview of Key Construction Management Functions: Planning & Scheduling, Cost Engineering, Quality Management, Safety Management, Risk Management, Productivity Improvement.
Management Concerns in Preconstruction Phases:	Overview of Processes and Management Functions in Preconstruction including; Value Engineering; Constructability Review; Cost Estimation; Analysis of Alternatives; Early Procurement; Contract Development; Schedule Development; Cash Flow; Coordination; Verification of Site Conditions; etc., Contractor's Site Organization, Mobilization.
Management Concerns in Construction Phase:	Overview and Brief Description of Processes and Management Functions in Construction Phase including; QA; Coordination and Reviews; Conflict Management; Safety; etc., General Discussion on Site Management Issues.
Management Concerns in Close-Out Phase:	Overview and Brief Description of Processes and Management Functions in Project Close-Out, Participant Roles, Post-Construction Services, Facility Evaluation, Project Feedback.

Project Delivery Systems: Overview of Design-Bid-Build; Design-Build; Agency CM; CM at Risk; Multiple Primes; BOT; Turnkey; JV; PPP; Partnering; Lean; and Other Arrangements, Nature of Relationships among Participants, Advantages and Disadvantages, Application, Management Concerns in Various Delivery Methods.

Construction Contract Types: Overview of Lump Sum, Cost-Plus, Unit-Price, GMP, Contracts with Quantities, Other Contracts, Risk Allocation and Impact, Considerations for Selection of Right Delivery System and Contract Type.

CN-321 **STRUCTURES-II**

REINFORCED CONCRETE STRUCTURES

Basic Principles of Reinforced Concrete: Concrete Constituent Materials and their mechanical properties; Control of Concrete Properties and Quality, Reinforcement, General Requirements for RCC Structures, Basic Principles of RCC Design and Assumptions, Design Methods.

Flexure and Shear: Behavior of RCC Members in Flexure, Design Philosophy, Design Codes, Working Stress and Ultimate Strength Methods, Analysis and Design of Beams, Shear Situations in RCC Structures, Development of Shear and Diagonal Stresses, Design for Beam Shear, General discussion on different types of slab systems and identification of available design methods.

Bond and Development: Bond Stress and Bar Development, Hooks, Bar Development in Beams, Splices.

Columns & Footings: Analysis of sections in pure compression, Short and long columns, Classification and general procedure of designing columns, Design of isolated footings, Discussion of different types of footings and identification of design procedure.

Introduction to Prestressed Concrete: General Introduction to Principles of Prestressing, Overview of Post and Pretensioning.

STEEL STRUCTURES

Introduction to Steel Structures: Steel properties, design load and load factors, Types and shapes of structural steel members, Specifications and design codes.

Design: Overview of Design of Bolted and welded tension members of steel, Flexure Design for beams, Stability Concerns, Design & analysis of axially loaded steel columns, Approximate Design of Columns with Bending, Design of Bolted Connections, Design of Welded Connections.

CN-323 **CONSTRUCTION CONTRACTS**

Introduction to Contracts: General Description, Construction Contracts, Elements, Form, Intent, Privity, Format and Major Components, Key Drafting Considerations.

Contract Award Mechanisms: Open vs. Sealed Bids, Bids vs. Negotiated Best Value Awards, General Considerations in Bids for Public Projects, Overview of PPRA Bidding Rules,

	Responsible and Responsive Bidder, Lowest Cost Bidding, Multi-Parameter Bidding, General Considerations in Bids for Private Projects, Bid Bonds, Bidding Advantages and Disadvantages, Bid Issues.
The Bidding Process:	Bid Advertisement, Prequalification, Bid Decision, Bidding Period, Bid Package, Accuracy of Bidding Information, Instructions to Bidders, Addenda, Alternates, Modification and Withdrawal of Bids, Award, Mistakes in Bids, Bid Qualification.
Subcontractors & Subcontracts:	GC-Sub and Owner-Sub Relationships, Subcontractor Bidding and Selection Process, Bid Shopping, Advantages and Disadvantages. of Subcontracting, Insurance and Bonding Requirements, Subcontract Agreement and Terms, *Subcontract Management:* Contract Provisions; Flow-Down Clauses; Back charges; Changes; Extra Work; Delays; Safety and Waste Management, Supplier Contracts.
Contract Conditions:	General and Supplementary Conditions of Contract, Overview and Discussion on Use of Standard Contracts in Construction – PEC, AIA, FIDIC, etc.
Contract Specifications:	Role; Relationship with Drawings; Organization; Types; CSI Divisions; Basic Writing Principles; Division 01 – General Requirements, Sample Specifications from other CSI Divisions, Specifications Resources, Writing Procedures.
Contract Interpretations and Modifications:	Interpreting Contract Documents, Common Rules of Contract Interpretation, Contract Modifications, Substitutions, Feedback.

CN-324	**ACCOUNTING AND FINANCIAL MANAGEMENT**
Introduction to Construction Financial Management	Overview of Financial Management, Description of Construction Financial Management, Responsibilities of a Financial Manager.
Construction Accounting Systems	Cost Reporting, General Ledger, Methods of Accounting, Balance Sheet, Income Statement, Job Cost Ledger, Equipment Ledger.
Accounting Transactions	Accounting various types of Construction Job Transactions.
Analysis of Financial Statements	Depreciation and Financial Analysis, Quick Ratio and various others Ratios, Collection Period, Average Age of Accounts Payable, Profit Margin, Return on Assets, Return on Equity.
Managing Costs and Profits	Monitoring and Controlling Construction Material, Labor, Subcontract, Equipment, General Overhead, and Other Costs; Determining Labor Burden; General Overhead Budget, Estimating General Overhead; Setting Profit Margins for Bidding; Profit Center Analysis.
Managing Cash Flows	Cash Flows for Construction Projects with Progress Payments and with a Single Payment; Cash Flows for Construction Companies: Incorporating Construction Operations, General Overhead, Income Taxes, Interests, Loan Payments, Cash Balance, Determining the Minimum Monthly Balance, Fine Tuning, What-If and Sensitivity Analysis.

Uncertainty and Future Events: Expected Value, Economic Decision Trees, Risk versus Return.

Capital Allocation Capital Budgeting, Allocation of Capital Among Independent Projects, An overview of a Typical Construction Corporation Capital Budgeting Process.

AR-310 **Architectural Studies for Engineers**

General: Concepts and terminologies, Fundamentals of aesthetics and relevance to engineering.

Architectural Design: Architectural design principles and applications, Architectural design and building systems, Innovations in architectural detailing.

Linkage with Construction Engineering: Architectural Restoration and Conservation and its Impact on Construction, Case studies to establish the linkage of architectural principles with construction engineering.

HS-304 **BUSINESS COMMUNICATION AND ETHICS**

Communication Skills: Definitions and Conditions, Modes: verbal, non-verbal, vocal, non-vocal, sender, Receiver, en-coding, decoding, noise, context, emotional maturity, relationships, etc, Language, perception, Non-verbal, body language, physical appearance, cultural differences etc., Personal and interpersonal skills/ perceptions, Communication dilemmas and problems, Public Speaking – speaking situation, persuasion, Making presentations, Interviews.

Business Writing: Formal / Business letters, e-mails: a) job applications and resumes / CV, b) enquiries, c) complaints / adjustments, d) orders, e) quotations, f) banking etc. Memos: layout, language, style. Meeting management: notice, agenda, conducting/ participating, writing minutes. Contracts and agreements (basic theoretical knowledge and comprehension), Research / scientific reports: types, structure, layout / presentation, writing process etc, Tenders (basic theoretical knowledge and comprehension)

Engineering / Business Ethics: Need and objectives for code of ethics and its importance, Types of ethics, involvement and impact in daily life, Problems / conflicts / dilemmas in application (case studies), Sexual Harassment / discrimination in the workplace: a) why it occurs, b) myths regarding sexual harassment, c) how to deal with it, d) gender equality e) respect etc. Codes of conduct: Code of Pakistan Engineering Council, Code for Gender Justice, Brief study of other codes of conduct.

Third Year (T.E.)

Fall Semester

CN-326 **CONSTRUCTION PLANNING, SCHEDULING AND CONTROL**

Introduction to Planning and Scheduling: Reasons for Planning in Construction, Aspects, Dynamic Nature, Scheduling, Scheduling Prerequisites: Project Scope, Priority Matrix, WBS, Work Packages.

Bar Chart Schedules:	Creating and Updating Bar Charts, Showing Progress, Using Look-Ahead Bar Charts, Bar Chart Shortcomings, Bar Chart Value, Other Scheduling Approaches.
CPM Scheduling:	Features, Advantages and Disadvantages, Development Process, Defining Activities, Sequencing Activities, Assigning Durations, Time Calculations on Arrow Networks, Time Calculations on Precedence Networks with and without lags, Floats, Schedule Review, *Activity Duration Estimations:* Examples; Factors Influencing Choice of Schedules; Weather; Uncertainty in Duration Estimation.
Resource Allocation and Resource Leveling:	Resource Allocation, Manual Solution, Brooks Method, Resource Leveling, Series and Parallel Methods, Resource Curves and Profiles.
Cost Loaded Schedules and Cash Flows:	Cost Loaded Schedule, S-Curve, Cash Flow, Contract Provisions and Owner Practices Impacting Cash Flow, Cash-Flow Analysis and its Value.
Project Monitoring and Control:	Monitoring Project Status, Difficulties in Assessing Progress, Updating the Schedule, Controlling the Project, Time-Cost Trade-offs, As-Built Schedules, *Earned Value: A Means for Integrating Costs & Schedule:* Concept, C/SCSC, SV, CV, SPI, CPI, Target Performance Levels, Graphical Representation, Difficulties in Integrating Cost and Schedule Systems.
Impact of Scheduling Decisions on Productivity:	Impact of Overtime; Crowding; Increasing the Number of Starting Points; and Interruption on Productivity, Other Sources of Lost Productivity.
Other Scheduling Techniques:	*Short-Interval Schedules:* Introduction; Use; Types, *Linear Scheduling:* Definition; Production Rate Diagrams; Buffers; Generating the Linear Schedule, *PERT:* Uncertainty in Activity Duration Estimates, PERT scheduling; Advantages and limitations; PERT today in construction.

CN-327 **TRANSPORTATION ENGINEERING**

Introduction:	Introduction to various modes of Transportation in Pakistan.
Highway Engineering:	Basic concepts of Geometric design of highways, Calculation of cut and fill volumes, Classification of types of highway construction, Suitability of each type under various environmental conditions, Earthwork, Construction phases of different types of highway pavements, Field and laboratory tests for quality control, Properties, requirements and specifications of materials, Choice of binders under different conditions, Joint filler and sealer materials, Types of pavement distresses and their remedies.
Airport Engineering:	Component of air transportation; Aircraft characteristics affecting airport airside; Airport site Selection; Airside configuration; Distribution concepts of terminal buildings, Geometric design of airside.
Coastal Engineering:	Classification of harbors; Ports and harbors of Pakistan; Design principles and requirements of harbors; Wharves and jetties; Breakwaters and groynes; Channel regulation and demarcations; Classification of docks and their construction; Transit sheds and warehouses.

Railway Engineering: 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.

Construction Planning: Different phases of the transportation infrastructure planning process with emphasis on construction specifications, Production planning, Timetables, Planning of activities for given transportation infrastructure.

CN-328 **GEOTECHNICAL ENGINEERING-II**

Stress Acting in Soils: Soil mass stresses, effective stress and neutral stress, stress at a point and Mohr's circle, Westergard's and Boussinesq's solutions, Pressure distribution in the soil mass resulting from different vertical surface loadings, Newmark's influence charts.

Shearing Strength of Soils: Basic principle relating to friction between solid bodies, Coulomb's law, Shear strength parameters, Shearing strength of granular and cohesive soils, Shearing strength tests and their results, effect of strain, rate and drainage conditions on shearing strength.

Compressibility and Consolidation: Mechanics of consolidation, One - dimensional consolidation equation, coefficient of consolidation, compression index, Consolidation tests and graphical representation of data, Degree of consolidation. Determination of pre-consolidation pressure, swelling clays and clay-shale.

Sub Soil Investigation: Purpose, Preliminary and detailed investigation, Boring methods, spacing and depth of borings, soil sampling, In situ testing, 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 analyses, 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 vs. Pile 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.

CN-329 **CONSTRUCTION JOBSITE MANAGEMENT**

Project Team Responsibilities Roles, Responsibilities, and Authority of Project Participants during

During Construction:	Construction Operations for: 1) Traditional Project Delivery System; 2) CM Delivery System; and 3) Design-Build Delivery System, Communications.
Use of Construction Documents on the Jobsite:	Use of Construction Documents, Familiarization with a Project, Contract Requirements for Site Visits and Associated Responsibilities for A/E; Contractor; Owner; and Authorities having Jurisdiction, Preparing Crew Assignments.
Submittals, Samples, and Shop Drawings:	Types; Requirements; and Review of Submittals, Shop Drawings and Samples, Procurement Schedule, Subcontractor Submittals.
Documentation and Record Keeping at the Jobsite:	Record Types and Content, Event and Conversation Documentation, Periodic Reports, Diaries, Logs, Accident Reports, Progress Photographs, Video Recordings, Time-lapse Photography, Progress Schedules and Schedule Updates, Cost Documentation, Labor, Material, Equipment, Correspondence, RFIs, Change Order Logs, etc., Contractual Requirement for Documentation.
Jobsite Layout and Control:	Material and Equipment Handling, Labor Productivity, Equipment Constraints, Site Constraints, Elements of the Jobsite Layout Plan, Material Storage, Temporary Facilities, Jobsite Offices, Jobsite Security, Perimeter Fencing, Access Roads, Signs and Barricades, Organizing Jobsite Layout.
Meetings, Negotiations, and Dispute Resolution	Types of Meetings, Partnering Meeting, Preconstruction Meetings – Contractors; Subcontractors; Project, Construction Phase Meetings, Staff Meetings, Specialized Meetings, Closeout Meetings, Post-project Evaluation, Partnering, Negotiations.
Jobsite Labor Relations and Control:	Impact of Changes on Labor Productivity, Poor Weather, Material Problems, High Labor Turnover, Accidents and Unsafe Conditions, Working Overtime, Projects in Existing Facilities or Congested Areas, Jobsite Labor Organization, Labor Supervision and Control, Supervisor, Foreman, Employee Relations, Employee Training, Labor Records.
Site Management:	Owner Relations, Subcontractor Relations, Conduct at the Project Site, Coordinating Construction Activities, Sequencing the Work on Site, Jobsite Quality Control Team, Testing and Inspection, Coping with Defective and Nonconforming Work, Quality Control in Subcontracted Work, Jobsite Safety Plan, Safety Management in Subcontracted Work, Cleaning and Construction Waste Management, Noise Control, Dust and Mud Control, Environmental Protections, Protecting Installed Construction.
Project Closeout:	The Closeout Process. Punch Lists, Substantial Completion. Paperwork Requirements, System Testing and Documentation, Operating and Maintenance Manuals and Inspection, Miscellaneous Certifications and Releases, Consent of Surety, Financial Resolution of the Project, Subcontractor Payment, Resolution with the Owner, Cost Control Completion, As-Built Drawings, Affidavits of Payment, Archiving Records.

CN-330 **HYDRAULIC ENGINEERING AND WATER RESOURCE MANAGEMENT**

Climate: Rain, Surface and sub-surface water, Reservoirs, Dams, Lakes, Water conveyance by canals, Evaporation and transportation, Run-off., Air

Hydrology: Types of run-off-hydrographs, Stream flow, Baseflow, Water budget at field and watershed scale

Open Channels: Design of open lined and unlined channels, Uniform flow equations (Chezy and Manning), Stability of sides and beds, flow in regime, accretion and sedimentation (Particles properties, fall velocity, movement of bed and surface bed load)

Irrigation: Soil-Water relationship, Irrigation Method and technique for conserving the water losses (including sprinkler, drip); Design of alluvial canal and outlet; Water requirement for the garden lawn etc., Lift irrigation

Dams & Barrages: Types of storage dams and barrages, Principles of design.

Drainage: Land drainage for reducing water levels, Types of land drainage.

Ground Water: Occurrence, Ground water hydraulics, wells, yields, tube wells

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

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

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

Water Resources Management: Sustainable tapping Resources, Principles of planning and development, Development of water streams, rivers for permanent recharging basins and use the facility for recreational Waterways, Effect of Climate change on Water Resources, Present and Future

Final Year (B.E.)

Spring Semester

CN-416 **LEGAL AND REGULATORY ENVIRONMENT IN THE CONSTRUCTION INDUSTRY**

Legal Context of Construction: Introduction to Legal System and Maxims of Law, Legal Relations, Law; Ethics and Morality, *Contract Law:* Express Terms; Implied Terms; Breach of Contract; Liability for Negligence, Statutory and Regulatory Laws affecting Construction, *Rights and Liabilities of:* Owner; A/Es; CMs; GCs; Subs and Suppliers.

Preparation to Work: Overview of: Engineering and Professional Registration, Contractor Licensing, Building Permits and Codes, *Insurance and Bonds:* Types, Contract Requirements, Overview of Payment Bonds and Performance Bonds, Discussion on Current Insurance and Bonding Scenario in the Pakistani Construction Industry, Comparison with Developed Nations (e.g. US).

Matters of Time: Notice to Proceed, Construction Duration, Calendar Days, Working Days, Concept of Liquidated Damages and Penalty/ Bonus Clauses, Introduction to: Types of Delays; Acceleration; Suspension of Work Clauses; Termination.

Payments: Schedule of Values, Payments in Unit Price Contracts; Cost-Plus Contracts; Lump Sum Contracts, Payment Obligations, Payment Intervals, Progress Payments, Retainage, Changes, Fluctuations, Subcontractor Payments, Concept of Liens, Substantial Completion, Partial Occupancy, Final Acceptance and Payment.

Warranty: Contractor's Obligations after Project Completion, Express Warranty, Implied Warranty, Owner's Acceptance of Work, Uncovering and Correction of Work.

Changes, Claims and Disputes: *Introduction to Changes:* Changes Clauses; Change Orders; Minor Changes; Constructive Changes; Cardinal Changes, Documentation of Changes. *Introduction to Claims:* Entitlement; Time Extension; Disputes and their Nature.

Dispute Resolution: Negotiation, *Overview of ADR Techniques:* Partnering; Mediation; Arbitration; Adjudication; Disputes Review Board; Mini-trials, Importance of Documentation, Concept of Litigation.

Introduction to Regulatory Environment: Local Industry Organizations Regulating Construction Business, Coordination between Civic Agencies, Consultation with Authorities; Line departments and Allied Agencies, Approvals; Completion Certificate.

CN-417 TEMPORARY STRUCTURES IN CONSTRUCTION

Introduction: Defining Temporary Structures, Why Used?, Where and When to Use?, Loads on Temporary Structures, Design and Building Codes.

Earth-Retaining Structures: Methods for Determining Lateral Earth Pressures, including Use of Tables and Charts, Determining the Factors of Safety against Overturning and Sliding, Description and Design Overview of Various Kinds of Earth-Retaining Systems.

Tower Cranes: Design of Temporary Reinforced Concrete Foundation for Tower Crane, Load Carrying Capacity of Lift Beams.

Concrete Formwork: General objectives in formwork building, Overall Planning for Formwork, Slab Form Design, Beam Form Design, Wall Form Design, Column Form Design, Design Tables, Building and Erecting the Formwork.

Shoring and Scaffolding: Design, hardware and installation of shoring and scaffolding.

Construction Dewatering: Dewatering as a Temporary Procedure, Choosing the Right System.

Other Temporary Structures: Design of Temporary Safety Rails, Design of Temporary Project Signs, Design of Temporary Construction Ramps, etc., Safety Issues.

CN-418 **SYSTEMS IN BUILDING CONSTRUCTION**

Concepts in Building Science: Building Science, Building Envelope, Thermal Insulation, Windows, Thermal Testing, Quality of Indoor Air, Ventilation, Moisture in Buildings.

HVAC Systems: *An Introduction to Equipment used in HVAC Systems:* HVAC; Space Heating; Refrigeration; Ventilation; Air Humidification; and Air Dehumidification, *Overview of HVAC Systems in Buildings:* Air Distribution; Water (Hydronic); Electric Heating; and Solar Thermal, Safety Considerations.

Electrical Systems: Overview of Building Electrical Materials; Equipment; and Lighting Systems, Safety Considerations.

Other Systems: *Life Safety Systems:* Fire in Buildings; Passive Fire Protection; Active Fire Protection and Suppression; Overview of Fire Detection and Alarm Systems; Building Security. *Telecommunication Systems:* Overview of Structured Building Telecommunication Systems. *Acoustical Control Systems:* Fundamentals of Sound; Sound Ratings; Overview of Acoustical Systems in Buildings. *Conveying Systems:* Introduction to Installation of Elevators, Escalators, Walkways; Ramps; and Other Systems, Safety Considerations.

CN-419 **LEADERSHIP, HUMAN AND ENTREPREUNERSHIP SKILLS IN MANAGEMENT**

Leadership Definition, Influence, Social Network Building, Leadership and Ethics, Building Trust, Qualities of an Effective Leader, Leadership Skills: Inherited or Learned?, Motivation and Inspiration, Leadership Styles, Building and Maintaining a Following, Leadership vs. Management, Leadership and Change.

Team Building and Teamwork: Team Building Approaches, Situational Factors, Building High Performance Project Teams, Character Traits and Teamwork, Handling Conflict, Inhibitors of Teamwork, Rewarding Team Performance, Multicultural Teams, Team Pitfalls.

Effective Communication: Inhibitors, Establishing a Conducive Communication Climate, Improving Communication, Improving Interpersonal Skills, Personality and Communication.

Education and Training: Training Needs Assessment, Effective Training Provision, Evaluating Training, Managers as Trainers and Trainees, Workforce Literacy, Improving Learning, Inhibitors, Performance Appraisal.

Overcoming Politics, Negativity, and Conflict in the Workplace:	Power and Politics, Organizational Structure and Internal Politics, Impact of Internal Politics on Project Quality, Controlling Internal Politics, Overcoming Negativity in Organizations, Managing Conflict.
Motivating Others:	Using Positive Reinforcement to Motivate Others, Using Recognition to Motivate Others, Motivation Theories, Techniques for Self-Motivation.
Helping Others Develop and Grow:	Being a Nurturing; Positive Person, Mentoring Coworkers, Characteristics and Types of Mentoring, Specific Mentoring Behaviors, Coaching Skills and Techniques, Helping Difficult People, Types of Difficult People, Tactics for Dealing with Difficult People.
Stress Management and Personal Productivity:	Understanding and Managing Stress, Improving Personal Productivity.
Introduction to Entrepreneurship Skills:	Entrepreneurial Mind-Set, Corporate Entrepreneurship, Entrepreneurial Strategy, Creativity and the Business Idea, Identifying and Analyzing Opportunities, Intellectual Property and Other Legal Issues for the Entrepreneur, Knowing the Competition, Construction Business Plan, Organizational Plan, Understanding Investment Risk, Financial Plan, Strategies for Growth and Managing the Implication of Growth.

CN-420 **QUALITY AND SAFETY MANAGEMENT IN CONSTRUCTION**

Quality:	Concepts, Principles, Views, Relationship with Value and Organizational Excellence, Supporting Elements, Process Analysis and Improvement, Quality and Global Competitiveness, Cost of Poor Quality, Quality and Contractor Selection, Quality Management Practices in Pakistani Construction Industry.
Quality Assurance and Quality Control:	Examples of Quality Assurance and Quality Control, Concurrent Quality Assurance/Quality Control Processes, Quality Established by the Contract, Quality Control in Subcontract Work, Team Approach, Introduction to ISO 9000.
Total Quality:	From QA to TQM, TQM Approach, Key Elements, Relation of TQM with Trust; Values; Integrity; and Responsibility, Establishing and Maintaining a Total Quality Culture, Innovative Alliances and Partnerships, ISO 9000 and TQM.
Partnering, Customer Satisfaction and Employee Empowerment:	**Partnering–** Internal; with Suppliers; with Customers; with Potential Competitors, Understanding Customer-Defined Quality, Identifying External and Internal Customer Needs, Communicating with Customers, Customer Satisfaction Process, Customer Retention, Value Perception and Customer Loyalty, *Employee Empowerment:* Rationale, Inhibitors, Management's Role.

Overview of Quality Tools: Pareto Charts, Cause-and-Effect Diagrams, Check Sheets, Histograms, Scatter Diagrams, Run Charts and Control Charts, Stratification, Other Tools, Selecting the Right Tool for the Job.

Construction Safety: Safety and Health in the local and International Construction Industries, OSHA in the USA, Overview of Cost of Accidents, Roles of Construction Personnel in Safety, Overview of Accident Causation Theories, Ethics and Safety, Insurance and Safety, Compliance to Safety Standards.

Safety Application on the Job: Construction Safety & Health Program, Plans and Policies, Components of the Plan, Roles, Safety Rules and Regulations, Example of Safe Work Procedures, Jobsite Inspections, Accident Prevention, Medical and First Aid Facilities and Services, Protection of the General Public, Fire Protection, Substance Abuse, Personal Protective Equipment, Site Safety and Hazard Analysis, Safety Communications, Accident Reporting and Investigation, Recording Injuries and Illnesses, Training, Emergency Response.

Strategic Safety Improvement: Promoting Safety by Example, Employee Participation in Promoting Safety, Safety Training, Safety Committees, Employee and Management Participation, Incentives, Teamwork Approach to Promoting Safety, Establishing a Safety-First Corporate Culture, Total Safety and its Components, a Brief Discussion of Zero Accident Strategies, Continuous Safety Improvement.

CN-425 CONSTRUCTION ENGINEERING PROJECT

Final Year (B.E.)

Fall Semester

CN-421 SUSTAINABLE TECHNOLOGIES AND DISASTER MANAGEMENT

Foundations of Sustainability: Defining Sustainable Construction**,** Whole Systems Thinking, Collaboration as Sustainability in Action, Key Features of Sustainable Construction, The Green Construction Movement, Emerging Directions.

Material Technologies: Recycling of Conventional Construction Materials, Overview of Emerging Construction Materials and Products with Specific Reference to their Effectiveness towards Sustainable Construction.

Construction Technologies: Overview of Latest Developments in Construction Technology, such as Trenching e.g. Trench-less Technology; Specialized Formworks; Technologies for Building

	Deep Waterproof Basements; Mechanized Construction Methods & Equipment, Slip Forms, Effectiveness of Technologies towards Sustainable Construction.
Disaster Management:	Monitoring of Infrastructure facilities; strategies for protection against possible damages; maintenance for different infrastructure facilities. Rehabilitation and repair strategies for reinforced concrete, repair and rehabilitation of pipe networks; sewers; roads and drainage facilities, Predications and preparedness strategies for natural disasters such as Earthquakes etc; Emergency management; Awareness Programs; Follow-on Disasters; Recovery plans; Strategies for protection; Loss estimation; Risk and Vulnerability Analysis; Disaster Mitigation.

CN-422 **CONSTRUCTION ECONOMIC ANALYSIS**

Making Economic Decisions	Nature of Economic Problems, Role of Engineering Economic Analysis, The Decision-Making Process, Engineering Decision Making for Current Costs
Nature of Construction Costs	Fixed, Variable, Marginal and Average Costs, Sunk Costs, Opportunity Costs, Recurring and Non-Recurring Costs, Incremental Costs, Cash Costs versus Book Costs, Life-Cycle Costs
Cash Flow Diagrams	Categories of Cash Flows, Drawing a Cash Flow Diagram
Interest and Equivalence	Computing Cash Flows, Time Value of Money, Rate of Return, Equivalence, Compound Interest Formulas, Relationships between Compound Interest Factors, Arithmetic and Geometric Gradients, Nominal and Effective Interest, Continuous Compounding
Selections Between Alternatives:	Present Worth Analysis, Future Worth Analysis, Annual Cash Flow Analysis, Rate of Return Analysis, Incremental Analysis, Cost-Benefit Analysis, Payback Period, Sensitivity and Breakeven Analysis.
Depreciation and Taxes:	Basic Aspects of Depreciation, Methods of Depreciation, Depreciation and Asset Disposal, Capital Gains and Losses for Non-Depreciated Assets, Depreciation as a Tax shield, Depletion
Replacement Analysis:	The Replacement Problem, Decision Maps, Replacement Analysis
MARR:	Sources of Capital, Cost of Funds, Opportunity Cost, Selecting a Minimum Attractive Rate of Return (MARR), Adjusting MARR to Account for Risk and Uncertainty.
Economic Analysis in the Public Sector	Investment Objective, Viewpoint for Analysis, Selecting an Interest Rate, Benefit-Cost Ratio, Incremental Benefit-Cost Analysis.

CN-423 **MANAGEMENT AND MARKETING OF CONSTRUCTION SERVICES**

Introduction:	Nature of Construction Business, Primary Causes of Business Failure, Business Strategies to Minimize Failure Risk, Leadership Challenges, Introduction to Organizational Behavior.
Company Organization:	Alternative Forms of Business Organization: Proprietorships; General and Limited Partnerships; Corporations; Limited Liability Companies; Joint Ventures.

Strategic Planning and Management:	Introduction, *Planning Process:* Mission Statement; Vision; Strategic Assessment; Strategic Objectives; Company Strategies and Short-Term Goals; Action Plans; Performance Measurement, Situation Analysis, Strategy Formulation, Strategy Implementation, Strategy Evaluation, Organization Strategy and Project Selection, Project Portfolio Management, Project Screening Matrix.
Organizational Structures and Culture:	Functional Structure, Dedicated Project Teams, Matrix Structure, Network Organization, Advantages and Disadvantages, Choosing the Right Structure, Organizational Culture, Culture Diagnosis, Dimensions, Sustaining Mechanism.
Human Resources Management:	Job Design and Analysis, HR Planning, Recruiting Employees, Selecting Employees, Performance Management, Employee Retention, Safety and Wellness**.**
Business Development:	Marketing Construction Services, Marketing Process, *Market Analysis:* Demand Assessment; Customer Satisfaction Assessment; Competition Assessment, Marketing Strategies, Marketing Tools, Marketing Plan, Acquisition of Work.
Financing a Company's Financial Needs:	Sources of capital; Equity and borrowed capital; Financing with debt capital; Financing with bonds; Financing through retained profit; Financial and Funding Institutions; *Loans:* Long-Term, Short-Term, Amortization Schedule, Early Payoffs and Closing Costs; Lines of Credit; Leasing; Trade Financing; Credit Cards; Equity Financing; Financial Documents.
Managing Inter-Organizational Relations:	Sustaining Collaborative Relationships, The Art of Negotiating, Managing Customer Relations.
Problem Solving and Decision Making:	Problem Solving, The Decision-Making Process, Objective Versus Subjective Decision Making, Scientific Decision-Making Tools, Employee Involvement, Role of Information, Using MIS, Creativity in Decision Making.
Knowledge and Information Management in Construction:	Overview of the Nature and Dimensions of Knowledge Management, Construction as Knowledge Based Industry, Knowledge Management Process, Overview on Application of Knowledge Management to Construction Business.

CN-424 **HEAVY CONSTRUCTION EQUIPMENT AND OPERATIONS**

General:	Introduction to Heavy Construction Operations, Heavy Construction Divisions.
Introduction to Bulk Excavation Operations:	Preparing for Earthwork, Earthmoving Methods, Protection of Excavations, Protection of Adjacent Structures, Compaction Equipment and Methods, Confined Compaction, Rock moving Methods, Mass Diagrams.
Trenching, Pipe laying and Tunneling Operations:	Trenching Excavation; Pipe laying; Tunneling in Soft Soils; **and** Tunneling in Hard Rocks.
Concrete and Asphalt	*Paving Operations:* Concrete Paving; Asphalt Paving; Rehabilitating Old

Paving Operations: Pavements.

Placing of Vertical Concrete: Crane and Bucket, Concrete Pumps, Concrete Conveyors.

Piles and Pile driving: Introduction to Pile driving Operations; and Pile Operation Economics.

Equipment: Brief Discussion on Use, Productivity and Economics of Equipment for Heavy Construction Operations, including; Tractors, Dozers, Scrapers, Motor Graders, Power Shovels, Off-Road Haulers, Front-End Loaders, Backhoes, Draglines, Trenchers, Rock Drilling Equipment, Crushers, Conveyors.

CN-425 **ENVIRONMENTAL ISSUES IN CONSTRUCTION**

Environment: Definition, Climatic factors, soil-air-water relationship.

Environmental Pollution: Sources, Pollutants, Effects and remediation of air, water, land, noise and radiation pollution, Toxic/hazardous wastes, Wastes related to construction activities.

Environmental Impact Assessment: Requirement, Implication and significance, International; Federal and Provincial EPA Standards, Bye-laws and legislation, EIA of big and small projects as per National and International guidelines.

Water Demand & Supply: Population forecast, Water uses & consumption, Types & variations in demand, Maximum demand & fire demand, Urban & rural water supply, Technology.

Water Quality and Treatment: Water impurities & their health significance, Water quality standards, (U.S. & WHO, Pakistan etc.), Water quality monitoring, Various methods of treatment of surface & ground waters including screening, sedimentation, coagulation, filtration, disinfection and water softening methods, Emergency treatment methods.

Sewage and Sewerage Systems: Wastewater types, Separate and combined sewer systems, Types, sizes and materials of sewers, Sewer appurtenances, pipe strength and tests.

Building Water Supply and Drainage: Layout of water supply arrangement, Fixtures and their installation, Tapping of water mains, Requirements and arrangement of building drainage, Soil pipes, Antisyphon pipes and waste water pipes, Sanitary fixtures and traps.

Construction Waste Disposal: Types, characteristics and sources of construction wastes, Collection disposal and recycling.

Energy Conservation: Effective utilization and management of energy services in construction activities, Green building concepts.

CN-426 **CONSTRUCTION ENGINEERING PROJECT**