Department of Civil Engineering

Summer term examination 2019-2020

Syllabus

Second Year B. Tech.

Fluid Mechanics WM202

Fluid Dynamics: Equation of motion, Euler's equation, Bernoulli's equation, and practical applications of Bernoulli's equation: Venturi meter, orifice meter, Pitot tube, Momentum equation. Fluid mass subjected to uniform laminar and radial acceleration. Free and forced vortex flow, Radial flow. Mach number, Mach cone, Area – Velocity relationship, Stagnation Properties.

Measurement of Flow: Orifice, mouth piece, notches, weirs - Classification, Hydraulic coefficients, Determination of hydraulic coefficients, time required to empty a reservoir and tank with triangular/rectangular notch. Ventilation of weir, Proportional Weir or Sutro Weir.

Flow Through Pipes: Minor losses, Head loss due to friction, Darcy–Weisbatch equation, H.G.L. and T.E.L., Pipes in parallel and series, Equivalent pipe siphon, Power transmission, Water hammer.
Laminar flow: Relation between shear and pressure gradient, Steady laminar flow through circular pipes, Hagens-Poiseuille law, Laminar flow through inclined pipes and between parallel plates, Flow through porous media, Laminar flow around spear.

Strength of Material WM201

Stress and Strain: Simple stress and strain due to tension ,compression and shear. Elastic constants. Stress–Strain diagrams for brittle and ductile materials. Strain Energy under gradual and impact loads, Thin cylindrical shells under internal fluid pressure stresses, strains and changes in dimensions.

Shear Force and Bending Moment in Beams:In simple beam subjected to point loads,moments,uniformly distributed loads in simply supported,cantilever and overhang beams. Relationship between shear force and bending moment ,drawing of Shear force and bending moment diagrams for simple beams loaded and support conditions as described.

Theory of simple bending: Assumptions ,Theory of Pure bending.
Compound Stress and Strain: Analysis of biaxial stress at a point, Principal planes, Principal stresses and strains.Mohr's circle, application to different cases.

Theory of Structure WM 205

Influence Lines: Influence lines for reaction, shear force and bending moment in a simply supported beam. Influence lines for force in member of statically determinate trusses.

Columns: Long columns subject to eccentric and lateral loads: Column with initial curvature.

Three Hinged Arches: Action of an arch, Eddy s theorem, Determination of horizontal thrust,

Bending moment, Normal thrust and radial shear for parabolic and segmental arches, Influence lines, Temperature effects.

Three hinged suspension bridges: Forces in load cables and hanging chains, Length of cables, different support conditions, simple suspension bridge with tree hinged stiffening girder ,bending moment and shear force diagram, influence line for bending moment and shear force.

Third Year B. Tech.

Geotechnical engineering CW 301

Introduction: Definition, scope, Historical survey, nature of problems, soil formation

Index properties of Soils: soil as phase system, Definitions: specific gravity, different densities, voids ratio, porosity, degree of saturation, moisture content, density Index, volume weight relationship, Determination of specific gravity, Determination of field density, grain size analysis; mechanical and sedimentation analysis, Particle size distribution curve, use of particle size distribution curve, consistency limits, determination of consistency limit, Use of consistency limit, Soil texture and structure

Classification of Soil: Particle size classification, Unified soil classification and ISI classification, soil Identification

Permeability of Soil: Introduction, Darcy's law, Validity of Darcy's Law, Discharge and seepage velocity, factors affecting permeability, Laboratory methods for determination of coefficient of permeability, Determination of average permeability of stratified soil mass, critical hydraulic gradient

Compaction: Introduction, standard and modified Proctor Test, factors affecting compaction, Air void line, zero air void line, field compaction

Effective stress Principle: Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuation of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition

Engineering Geology CE303/ CW 302

Mineralogy: Mineral, Origin and composition. Physical properties of minerals, Rock forming minerals, Megascopic identification of common primary & secondary minerals. Mineral, Types, Physical properties and Occurrence of minerals.

Petrology: Igneous rocks: forms and structures classification (based on mode of occurrence, mineral and Sio2% (Tabular classification) and Common rocks. Secondary Rocks: Weathering, Transportation and deposition of sediments, Classification - textures and structures of secondary rocks, Characteristics of shallow water deposits and Common rocks. Metamorphic Rock: Metamorphism, Agents and engineering properties of igneous, sedimentary and kinds of metamorphism, Minerals and structures, Common rocks. Engineering properties of igneous, sedimentary and metamorphic rocks (with reference to

exploration, targets and problems, hazards in natural and artificial slopes, escalation at surface, foundation, under ground work and groundwater).

Structural Geology: Strike and dip, Fold and its various types, Faults and its various types, Identification of folds and faults in the field, Unconformity and its various types. Inliers and Outliers, Overlaps and Joints. Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

Engineering Geology: Preliminary geological investigations, Use of geological map, Aerial photo interpretation and remote sensing. Types of geological maps, Agricultural soil maps, Drainage and Erosional patterns in aerial photos, Core borings, Drill holes and Test pits, Core and logging of drill core, Limitations of drilling, Engineering significance of geological structures such as stratification, Dip and strike, Faults, Folds, Joints, Dykes, Crush zones etc. Engineering properties of rocks, Porosity, Permeability, Compressive strength, Tensile strength Mechanics of shear in rocks and Modulus of elasticity for rock.

Groundwater: Source and types, Water table types and its fluctuations, Types of Aquifers, Springs and its types, artesian well and artesian conditions. Engineering problems and groundwater. Scope of groundwater investigations in Civil engineering: Groundwater survey, Direction of groundwater flow, Pumping test, Groundwater recharge and conservation. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence.

Design of Structure-I (Steel) CW 303

General Considerations: Advantages and disadvantages of steel structures, rolled steel sections, types of loads, design methods

Connections: Riveted, Welded connections, design of concentric and eccentrically loaded riveted and welded connectio

Tension Members: Introduction, types, permissible stresses, net sectional area, design of tension members

Beams: Introduction, Types of sections, design of simple and built-up beams

Design of Structure-II (RCC) CW 303

Design Philosophies: Introduction, Introduction to working stress method, ultimate load method, and detailed philosophy of limit state method. Types & classification of Limits states, Stress – strain relationship for concrete and steel. Characteristic strength, characteristic load, partial factor of safety

Beams: Introduction, Assumptions, modes of failure, moment of resistance; Flexural shear; Diagonal tension, Design for shear reinforcement in beams, Concept of development length & bond, Design of beams: singly, doubly reinforced Rectangular beams and flanged beams for flexure, shear, bond and torsion: Simply supported, continuous, cantilever.

Slabs: Introduction, Design of one way, two way, cantilever and continuous slabs

Theory of Structure -II CW307

Slope Deflection Method: Introduction, development of slope deflection equations, application to Beams
Moment Distribution Methods: Introduction, concept of moment distribution, Application to beams, frames and frames with and without side sway.

Kani's Methods: Introduction, Basic concepts, application to beams and frames, with and without side sway

Design of Hydraulic Structure -I CW 308

Reservoir: Site selection, Demand analysis, Estimation of storage capacity from mass curve, Area-elevation curve, Life of reservoir, Reservoir losses, Reservoir economics.

Gravity Dam: Suitability, Forces acting on it, Modes of failure, Factor of safety, Elementary profile, Principal and shear stress, Stability analysis, Galleries in dams.

Earth Dams: Types, Criteria for safe design, Phreatic line, Slope protection works, Seepage control, Stability of slope.

Spillways: Necessity, Types, Factors affecting design, Ogee spillway.

Environmental Engineering CW 310

Introduction to Water Supply: Various components of environment, Necessity and importance of water works, components of water supply scheme
Quantity of Water: Daily rate of water consumption for various purposes, factors affecting consumption, fire allowance, Variation in the demand of water and its effect on the design of water supply units, population forecast, Design capacity of scheme.
Sources of Water: Comparative study of various sources with respect to quality and quantity, Selection of source from view point of service provider, Economics of scheme
.**Raw water conveyance:** Intake structures, various conveyance systems, Pressure pipes, Different types of valves, pressure regulating valves, Fire hydrants, services, Testing of pipes and pipe fittings.
Treatment of water: Quality standards, physical, chemical and bacteriological aspects of water, typical layout of water purification plant for domestic and industrial supply, details and design of various treatment units:

a) Screens
b) Plain sedimentation – Principle and types
c) Mechanical sedimentation – Principle, coagulant, dosing and mixing, coagulation,
d) flocculation, clarification, sludge removal.
e) Filtration – Theory, working, trouble shooting and design of rapid sand gravity filters,
f) pressure filters, portable filters.
g) Disinfection – Different methods, pre, post and super chlorination, break point
h) chlorination, chlorine demand, residual chlorine, Dechlorination.
i) Miscellaneous methods – Aeration, activated carbon, hardness removal, fluoride
j) removal, reverse osmosis.

Final Year B.Tech.

Open Channel Hydraulics CE405C/ CW 410

Basic Principles: Open channel flow and its classification, Comparison between open channel flow and pipe flow, energy and momentum principles, critical flow and its computations, transitions, geometrical parameters of a channel, Velocity Distribution of channel section

Uniform Flow: Computation of uniform flow, surface roughness, Characteristics of uniform flow, Chezy‟s formula, Manning's formula. Factors affecting Manning's Roughness Coefficient, Computation of Uniform flow, Normal depth.

Gradually Varied Flow: Theory and analysis, methods of computations flow profiles in channels, Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Step method and Graphical Integration

Rapidly Varied Flow: hydraulic jump and its use in energy Dissipation. Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types ,applications and location of hydraulic jump.

Design of Structure-III CE 401/ CW 404

PART – A: REINFORCED CEMENT CONCRETE

Working stress method: Introduction, flexure analysis and design of various R.C.sections.

Water Tanks: Circular water tanks with flexible & rigid bases resting on ground, rectangular water tanks resting on ground & underground.

Flat Slabs: Design of flat slab with or without drop -direct design method.

Foundation Engineering CE 402/ CW 409

Bearing Capacity: Theoretical Bearing Capacity Analysis - Failure Modes, Terzaghi's Analysis, Specialization of Terzaghi's Equations, Skempton Values for Nc, Meyerhof's Analysis, I.S. Code Method of Bearing Capacity Evaluation, Effect of Water Table, Eccentricity of load, Safe Bearing Capacity and Allowable Bearing Pressure, Settlement Analysis: Causes and control of settlement, immediate settlement, consolidation settlement, differential settlement, prediction of foundation settlement from plate load test, settlement tolerance of superstructures.

Shallow Foundations: Assumptions & Limitations of Rigid Design Analysis, Safe Bearing Pressure, Settlement of Footings, Design of Isolated, Combined, Strap Footing (Rigid

analysis), Raft Foundation (Elastic Analysis), I. S. Code of Practice for Design of Raft Foundation.

Lateral Earth Pressures Theories: applications of earth pressure theories, different types of earth pressure at rest, active and passive pressure. Rankine‟s Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal and inclined backfill including the direction of failure Planes for cohesion-less and cohesive soils. Coulomb's Wedge Theory: Coulomb's active pressure in cohesionless soils, expression For active pressure, Coulomb's passive earth pressure. Rebhann's Construction for Active Pressure, Culmanns graphical solutions for active soils, Wedge Method, passive pressure by friction circle method for cohesion-less and cohesive soils. Earth Retaining Structures- Rigid and flexible retaining structures, stability analysis of retaining walls, cantilever retaining Walls, construction details, drainage and wall joints.

Project Planning and Management CW 402

Introduction: Project, Project life cycle.

Project appraisal techniques: Appraisal criteria: Net present value, Benefit cost ratio, Internal rate of return, Payback period.

Network techniques for project management: Development of project network, Activity, Event, Activity and event times, Float: (Start, Finish, Total, Free and Independent), Critical path analysis, CPM and PERT model & Precedence network, Resource allocation, crashing and leveling

Project implementation: Forms of project organization, Matrix organization, Project planning, Project control & Pre-requisite for successful project implementation.

Project cost management: Types of project cost (Direct and Indirect Cost), Cost duration curve, Basic principles for measuring project cash flows.

Project quality management: Quality control & Quality control charts.

Human resources management: Recruitment, Training, Motivation and Team work

Principles of engineering economics: Time value of money, Design period, Elasticity of demand and Demand and supply curves.

Design of Hydraulic Structure-II CW 403

Hydraulic Design of Channels: Manning's equation, Kennedy's silt theory, Lacey's silt theory, Design of non-silting and non-scouring channels.

Hydraulic Jump: Definition, Types of hydraulic jumps, Loss of energy.

Theories of Seepage: Bligh's creep theory, Khosla's theory. anal Regulatory Works: Head Regulator, Cross Regulator.

Cross Drainage Works: Aqueduct, Super passage.

Elective 1 Hydropower Engineering CW 405D

Introduction to Hydropower: Sources of energy, status of power, hydropower in India, importance of hydropower, hydropower in multipurpose reservoir system, estimation of water power potential, load curve, load factor capacity factor utilization factor, load duration curve, firm power, secondary power, prediction of load

Hydroelectric Plants: Classification of hydel plants, run-of river plants, alley dam plants, historical development of pumped storage power plants, types of pump storage plant, advantages of pumped plants, two unit and three unit arrangement relative merits, reversible pump – Turbines, problems of operations topography, reservoirs and water conveyance, power house, efficiency of pumped storage plant, Small and micro hydropower.

Penstocks: Classifications of penstocks, Design criteria for penstocks, Economical diameter of penstocks, blocks, Conduit valves, Bends and manifolds, Water hammer, Resonance in penstock channel, surges, surge tanks.

Intakes: Intakes, types of intakes, Losses in intakes, Air entrainment at intakes, Inlet aeration, Canals fore bay tunnels.

Turbines: Main types, Arrangements, Suitability and adaptability, Layouts

Water Resource System Engineering CW 407

Nature of Water Resource Systems: Technological, economical, social, environmental, and political aspects.

Systems Engineering: Need, role and scope of systems engineering, definition. Concept of system, characteristics of system, hierarchy of systems.

Systems approach and systems analysis: Steps in the application of systems approach. Optimal policy analysis - introduction to optimization, overview of operations research techniques. System models and their role in systems engineering.

Systems Analysis Techniques:, classical optimization techniques - differential calculus methods, linear and nonlinear optimization, introduction to nonlinear programming methods – Lagrange Multiplier method, Khun Tucker conditions.

Linear Programming: General form of LP problem – terminology and notation, graphical solution, Simplex method of solution, solution to problems, applicability and limitations. Introduction to sensitivity analysis. Introduction to Duality.

Dynamic Programming: Concept, principle of optimality, terminology, recursive relationship, simple applications to resource allocation and network problems.

Professional Practice CW 408

Introduction of IS-1200: For Modes of Measurements. Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, Earthwork Calculations Taking out quantities: Methods of Taking Out Quantities

Approximate Estimates- importance, purpose, different methods.

Specifications: Detailed specification (Reference to be made to PWD handbook and IS. 1200) for typical Civil Engineering works. Brief specifications. Principles of writing specifications. Types, requirements and importance, detailed specifications for the buildings.

Analysis of rates: Analysis of Rates for Various Items of Construction. Introduction of District Schedule of Rates. Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment.

Contracts: Various Agencies Involved In Construction Industry. Essentials of valid contracts. Contract Documents. Conditions of Contract. Role of Engineer in Govt. Works in Contract, Breach of Contract, Termination of Contract. Types of Contract: Item Rate, Percentage Rate,

Lump Sum, Cost plus Percentage. Cost Plus Fixed Fee, Target, and Piece. Tender: Definition, Tender Notice, Earnest Money, Security Deposits, Preparation and Submission of Security and Acceptance of Tenders.

Valuation: Definition, Nature of Value Factors Affecting Value of Land And Buildings, Salvage Value, Book Value, Market Value, Prospective Value, Sinking Fund, Depreciation, Methods of Working out Sinking Fund Installation & Depreciation

Elective-II solid Waste Management CW 411 B

Definition of Solid Waste
Domestic garbage, ash, rubbish, dust, debris. Commercial: wastes form offices, shops and markets, Industrial waste, Hazardous waste, Supreme Court directives about solid waste, MSW-
2000 rules.
Sources of Solid Wastes
Household wastes, waste from commercial establishments, office, vegetable markets, fish and meat markets, stables, solid waste from construction activities, industries, hospital wastes and dead animals.
Quantity Composition and Properties of Solid Waste
Per capita municipal solid waste, quantity of industrial solid waste per unit produced, composition: physical, chemical and biological constituents, sampling and characterization of solid wastes. Engineering design principles, materials balance analysis.
Effects of Solid Waste on Environment
Effects on air, soil, water (surface and ground), public health hazards.

M.Tech. Structure

Finite Element Analysis of Structures PCC-SE501

Principles and discretization, Elements stiffness formulation based on direct and, variational techniques, Rayleigh Ritz Method for Bar and Beam analysis.

Shape functions, Finite Element Formulation using Cartesian Coordinates, Application to 1D problems, Convergence criteria.

Triangular and Rectangular element formulation using Cartesian Coordinates, Application to 2D stress analysis.

Structural Dynamics PCC-SE503

Introduction to structural Dynamics, Static and Dynamic load types, Basic definitions, Degree of freedom, SHM, Vibrations of SDOF system- undamped free vibrations, Derivation and solution of equation of motion, Natural frequency and time period.

Vibrations of SDOF system- Damped free vibrations, Types of damping, Measurement of damping Logarithmic decrement method. Damped force vibrations, Response of SDOF system to harmonic excitation, Damped and undamped harmonic excitations.

Response to periodic Loading- Fourier series, Response to impulsive loading- Duhamel integral Rectangular and triangular impulse. Two Degree of freedom system- free vibrations of undamped system, damped free vibrations.

Theory of Plates & Shells PCC-SE511

Classification of Shells. Membrane theory of cylindrical shells with different directrix such as circular, cycloidal, catenary, and parabolic.

Bending theory of cylindrical shells, Finster walder, Schorer's, and D-K-J theory.

Approximate analysis of cylindrical shells by beam arch method.