

Syllabus for regularization of Degree holders (Civil Engineering)

WATER AND WASTE WATER ENGINEERING

Types of demand, water quality, forecasting of design demand, types of intakes, types of conveyance of water, types and layout of distribution system, discharge through open channel, economical cross-sections, condition for maximum discharge through channel of trapezoidal section, hydraulics of pressure conduits, capacity of distribution reservoirs.

Treatment of water – design of conventional water treatments systems

Determination of design quantity of domestic sewage, industrial sewage, storm water runoff, hydraulic design of sewers, principles of design of treatment systems, effluent disposal.

HIGHWAY ENGINEERING

Classification of highways, types of surveys, cross-section and profiles, soil investigation

Elements of right of way and standards, gradient, speed, sight distances, curves

Testing of aggregate, bitumen and cement

California bearing ratio method for design of flexible pavement.

Design of concrete pavement, pavement joints, preparation of the sub-grade and sub- base

RAILWAY ENGINEERING

Types of alignment survey, parameters of speed, loading and permanent way for various classes of railway line, schedule of dimensions.

Curves, gradient, earthwork and permanent way – rails, sleepers, ballast, fastenings and fixtures, points and crossings, level crossing.

Daily maintenance, periodical maintenance, maintenance of track alignment, maintenance of drainage, maintenance of track components, maintenance of points and crossings, maintenance of level crossing.

PORTS AND HARBOURS

Criteria for design of waterway, aids to navigation, dredging methods

Design criteria for design of berths and harbor protective structures, planning considerations for port roads, port railways and buildings, types of cargo handling equipment.

URBAN TRANSPORT

Measures of traffic management, types and design criteria of intersections of roads, types and criteria of mass transit systems, types of bus networks, measures of fleet utilization.

Planning of route alignment for mass rapid transit systems – underground and elevated, planning standards of stations.

Standards of construction of track and underground and elevated structures.

SURVEYING

Levelling lines, planes and surfaces, sights, types of leveling instruments, temporary and permanent adjustments. Booking and reducing of levels by plane of collimation and rise and fall methods, checking the leveling work, longitudinal section, cross sections, error due to curvature and refraction, reciprocal levelling. Adjustments of level circuits, precision of differential leveling.

Theodolite surveying - measurement of horizontal angles, methods of closed traverse and open traverse survey by theodolite, checks in open traverse, checks in closed traverse, balancing the traverse, permanent adjustments of a transit theodolite, errors in theodolite and their elimination.

Trigonometrical leveling – heights and distances, base of the object accessible, base of the object inaccessible, instrument stations not in the same vertical plane as the elevated object, geodetical observations, determination of difference in elevation.

Triangulation systems, the strength of figure, base line measurement, calculations of length of base, measurement of horizontal angles.

Contours and contour interval, procedure in topographic surveying, methods of locating contours, interpolation of contours.

Route surveying – reconnaissance survey, preliminary survey, location survey, construction survey.

Simple, compound, reverse and transition curves, Vertical curves for roads and railways. Setting out curve by offset and by method of deflection angles, Length of curve calculation.

Total station/GPS Survey- Features of total station and GPS, Principles of working with GPS, adjustment of errors, Open and closed traverse and their application to engineering problems

Hydrographic survey- sounding, charting, cross section of streams and rivers, gauging of discharges and survey of shore lines

Principles and utility of Aerial photogrammetric and remote sensing

BUILDING CONSTRUCTION

Assessment of Allowable Soil Pressure, Settlement in Clay, Settlement in Sand, Differential Settlement, Types of Foundations, Deep foundations, Pile foundations, Well foundations and Caissins, Foundations in Special Conditions foundation failures, Durability of foundation, Excavations for Foundation trenches and Basements, Schedules, Bar Chart, Perk Network, CPM Network.

STRUCTURAL ANALYSIS

Beam, Types of Loads, Types of Supports, Shear Force and Bending Moment, Sign Convention, Shear Force and Bending Moment Diagrams, S.F. and B.M. Diagrams for Simply Supported Beams, S.F. and B.M. Diagrams for Overhanging Beams, Relationship between Rate of Loading, Shear force and Bending Moment, Graphical Method of Plotting S.F. and B.M. Diagrams, Uniformly Distributed Loads

Beams- Relationship between Curvature, Slope and Deflection, deflection Curves, Macaulay's Method, Deflection Curve by Macaulay's Method, Propped Cantilevers. Deflections by Moment Area Method and Conjugate Beam Method, Slope and Deflection for Cantilever and simply Supported Beam, Impact Loading on Beams

Moments for a Fixed Beam of Uniform Section, Effect of Sinking of Support, Effect of Rotation of a Support, Slope and Deflection at a point by Moment Area Method, Analysis of continuous Beams, Reactions at the supports, Effect of Sinking of Supports

Column with One End Free and the Other End Fixed, Column with both ends fixed, Column with one End Fixed and the other Hinged, Limitation of Euler's formula, Column with Initial Curvature, Column Carrying Eccentric Load, Laterally Loaded Columns, Empirical Formulae.

Riveting, Bolted joints, Types of riveted and bolted joints, Definition, Failure of a riveted joint, Strength of riveted/bolted joint, Assumptions in the theory of riveted joints Efficiency of a joint, Design of riveted joints for axially loaded members. Advantages of welded joints, Disadvantages of welded joints, Types of weld and their symbols, Design of fillet welds, Design of butt weld, Design of plug and slot welds.

Deflection of framed structures, Moving loads on simply supported beams, Influence lines for bending moment and shear force in members of framed structure by Moment distribution and slope deflection methods.

Analysis of frames by moment distribution for non-prismatic members with two degree of freedom (sway as well as no sway), Beams curved in plan, Influence lines for forces in members of statically indeterminate structures.

Stress complementary shear stress, simple shear the state of pure shear, principal stresses and principal planes, sign convention, Mohr's circle for biaxial stresses, Mohr's circle.

Strain on an Oblique Plane, Mohr's Circle of Strain, and Compatibility Equations

Hooke's Law, Poisson's Ratio, Differential Equation of Equilibrium, The Stress Function-Plane Stress

Theory of Failure – Maximum Principal Stress Theory, Maximum Shearing Stress Theory, Maximum Strain Theory, Significance of Theories of failure, Factor of Safety

Elastic Stability – Euler's Column Theory, Limitation of Euler's Formula, Empirical formulae for columns.

DESIGN OF REINFORCED CONCRETE STRUCTURES

Working stress method, ultimate load method, Limit State Method, Limit State Method vs Working Stress Method, Building Code, Accuracy of Computations, types of Construction

Singly Reinforced Structure – Bending of Beams Cracked Concrete Stage, Ultimate Strength Stage, Assumptions, Moment of Resistance, Modes of Failure, Minimum and Maximum Tension Reinforcement, Effective Span

Doubly Reinforced Sections – Stress in Compression Reinforcement, Design Steps, Minimum and Maximum Reinforcement, Design Tables , Flanged Beams, Effective Width of Flange.

Shear Stress, Diagonal Tension, Shear Reinforcement, Development Length, Anchorage Bond, Flexural Bond

Torsional stiffness of homogeneous sections, torsional stiffness of r. C. Sections torsional reinforcement, distribution of torsion reinforcement, torsion in beams curved in plan

Columns – effective height of a column, minimum eccentricity, short column under axial compression, short columns under axial load and uniaxial bending, construction of design charts, short columns under axial load and biaxial bending, slender columns

Retaining Walls – stability requirements, proportioning of cantilever walls, development length

Prestressing System, Loss of Prestress, Steel for prestressing, Basic Concepts of Prestressed Concrete, Homogeneous Beam Concept, Pressure Line, Load Balancing Concept, Shear and Principal Stresses

Concept of Limit State of Design

DESIGN OF STEEL STRUCTURES

Stress- strain curve for mild steel, rolled steel sections, Loads, Permissible stresses, working stresses, Factor of safety, Minimum thickness of structural members, Design methods.

Compression Members – Effective length, Slenderness ratio, Column design formula, Types of section, Assumption, Design of axially loaded compression members

Tension Members – Net sectional area, Permissible stress, Design of axially loaded tension member

Economical depth and self-weight of plate girder, Design of web, Design of flanges

FOUNDATION ENGINEERING

Soil as a three phase system, water content, density and unit weights, specific gravity, voids ratio, porosity and degree of saturation, density index

Classification of soils, compaction, standard proctor test, equivalent for standard proctor test., water- density relationship, modified proctor test, field compaction methods, field compaction control, proctor needle, calibration curve, factors affecting compaction, shear strength

Stress Distribution – Concentrate force: boussinesq equation, concentrated load: boussinesq, analysis, pressure distribution diagrams, equivalent point load method, Newmaks's influence chart

Surface Tension and Capillarity- Modes of occurrence of water in soil, adsorbed water, absorbed water and pore water, capillary water, surface tension and formation of meniscus, capillary rise, values of unit weight, dynamic viscosity and surface tension for water, capillary heights of soil, stress conditions in soil : effective and neutral pressures, capillary siphoning.

Permeability – Darcy's law, discharge velocity and seepage velocity, validity of Darcy's law, factors affecting permeability, constant head permeability test, falling head, permeability test, permeability of stratified soil deposits.

Seepage Analysis – Head gradient and potential, seepage pressure, upward flow : quick Sand condition, Terzaghi's theory of one dimensional consolidation, determination of coefficient of consolidation, shear strength, Mohr's stress circle, Mohr-coulomb failure theory, the effective stress principle, measurement of shear strength, direct shear test, triaxial compression test, vane shear test, shear strength of cohesive soil.

Earth Pressure – plastic equilibrium in soils: active and passive states, active and passive states of plastic equilibrium, active pressure: Rankine's theory, backfill with uniform surcharge, active earth pressure of cohesive soils, passive earth pressure: Rankine's theory, coulomb's wedge theory.

Stability of Slopes - stability analysis of infinite slopes, stability analysis of finite slopes, the Swedish slip circle method.

Subsoil Exploration – site reconnaissance, site exploration, methods of site exploration, soil samples and samplers, disturbed sampling undisturbed sampling, penetration and sounding tests geophysical methods.

Shallow Foundation – Types of foundations, spread footing, safe bearing pressure, settlement of footings, combined footing and strap footing, mat or raft footing, IS Code of practice for design of raft foundations, modulus of subgrade reaction K.

Well Foundation – caissons, shapes of wells and component parts, depth of well foundation and bearing capacity, forces acting on a well foundation, analysis of well foundation,

Mat Foundations – combined footings, common types of mat foundations, differential settlement of mats, field settlement observations for mat foundations, compensated foundation

Pile Foundation – types of piles and their structural characteristics, estimating pile length, installation of piles, load transfer mechanism, estimating pile capacity, fractional resistance, allowable pile capacity, pile load tests, elastic settlement of piles, laterally loaded piles stress on piles during driving, pile capacity for vibration- driven piles, negative skin friction, group efficiency, ultimate capacity of group piles in saturated clay, piles in rock, elastic settlement of group piles, consolidation settlement of group piles

Foundations of Difficult Soils- procedure for calculating collapse settlement, foundations design in soils not susceptible to wetting, foundation design in soils susceptible to wetting, laboratory measurement of swell, classification of expansive soil on the basis” of index tests foundation considerations for expansive soils.

Soil Improvement and Ground Modification- principles of compaction, correction for compaction of soils with oversized particles, field compaction, compaction control for clay, hydraulic barriers, vibro-flotation, pre-compression, sand drains, prefabricated vertical drains, cement stabilization, fly-ash stabilization stone columns, sand compaction piles, dynamic compaction.

ENVIRONMENT ENGINEERING

Noise Sources and Control, Planning, design and operation of sanitary land fill.

Elements of Environmental Impact, Project Design and Construction, Project Operations, Socioeconomic Analysis, Environment Impact Assessment and impact mitigation measures.

QUANTITY SURVEYING AND CONTRACT & TENDERS

Data Required for Preparation of an estimate, Type of Estimate, Items of Work, Description of an Item of Work, Measurement of Works, Guidelines for Measurements I.S. mode or Units of Measurements, Plinth Area, Floor Area, Carpet and F.S.I.

General procedure of measurement of works, Methods of taking out Quantities Comparison of English and P.W.D. method, Various items of works, Prime Costs and Provisional Sums, Provisional Quantities, Spot Items, Contingencies, Work-charged Establishment, Centage Charges, Building Estimate Methodsm, Checks over the Accuracy od Detailed Estates.

Analysis Of Rates- quantities of Materials and labour Required for different items of Works, Approximate Rates of Equipment/Machinery required for works, Transportation of Materials and cost, Rates specified for various categories of Laborers in Building Industry, Analysis of Rates of Principal Items of Work in Building Construction.

Type of Specifications, Detailed Specification, Standard Specification

Type and characteristics of Contracts and Tenders.

AIRPORT ENGINEERING

Airport Site Selection, Estimate of Future Air Traffic Needs.

Runway Orientation, Runway Configuration, Basic Runway Length, Correction for Elevation, Temperature and Gradient Airport Classification Airport Capacity, Runway Capacity, gate Capacity, Taxiway Capacity, Airport Layout

Design of Flexible and Rigid air field Pavements.