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USEFUL FOR

PPSC SDO CIVIL | AND OTHER PUNJAB

STATE AE|SDO CIVIL EXAMS

Preface

It gives me immense pleasure to publish this book. In this highly competitive era, good books are indispensable. Through this book we have tried to cover every possible topic relevant to the examination in a comprehensive manner. Outmost care has been taken care of while preparing this book and Last (10 years) previous year question papers have been analyzed.

This book is specially written for students preparing for Punjab Public Service Commission Sub Divisional Officer (SDO) of State Examination. Each chapter includes numerous creative solving questions to develop smart approach towards the exam.

We hope this book contributes in your success and make us proud.

Er. Nipun Syal

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Syllabus

1. SURVEY

Surveying: Definition, classification of surveys, Principle, distorted or shrunk scales, precision in surveying. Traversing: Instruments used in traversing, bearings, meridians, declination, dip of magnetic needle, bearing of lines from included angles, local attraction, closing error and its removal. Plane Table Surveying: Introduction to plane table surveying, principle, instruments, setting up the plane table, centering, leveling, Orientation, methods of plane table survey, two and three point problems, danger circle, Lehmann's Rules, errors. Leveling: Definitions of terms used in leveling, different types of levels, parallax, staves, adjustments, bench marks, classification of leveling, booking and reducing the levels, rise and fall method, line of collimation method, errors in leveling, permanent adjustments, corrections to curvature and refraction, setting out grades, longitudinal leveling. Contours: Definition, representation of reliefs, horizontal equivalent, contour interval, characteristics of contours, methods of contouring, contour gradient, uses of contour maps. Calculation of Area and Volume: Methods, area from offsets to a base line, area by coordinates, area from map measurements, volume from cross-section, prismoidal formula, trapezoidal formula, volume from spot levels and contour plan. Theodolite: Types of theodolites, measurement of angles, temporary and permanent adjustments, closed & open traverse, omitted measurements, consecutive and independent co-ordinates, closing error, Bowditch & Transit Rules Tacheometry: Principle of tacheometry, measurement of horizontal and vertical distance using tachometry. Triangulation: Methods, network, signals, base line, satellite station, reduction to centre. Trigonometric Leveling: Definitions & terms, curvature & refraction Methods: direct &reciprocal, eye and object correction, coefficient of refraction. Curves setting: Definition, elements of a simple curve, different methods of setting out a simple circular curve, elements of a compound curve, reverse curves, transition curves, their characteristics and setting out, vertical curves, setting out vertical curves, sight distances. Total Station: Working principle and survey with total station, errors in total station survey.

2. BUILDING MATERIALS AND CONSTRUCTION

Building Stones, Bricks, lime, cement, timber: -General, classification, Qualities, Deterioration, Uses and Various tests. Concrete: Introduction, properties of concrete, water cement ratio, workability, compressive strength, grades, Production of Concrete: Batching, mixing, transportation, placing, compaction and curing of concrete, quality control of concrete, concrete mix design. Introduction to High Performance Concrete, Self-Compacting Concrete and Fibre Reinforced Concrete. Asphalt and Bitumen, Masonry: Stone & Brick masonry, Bonds and junctions, load bearing & non load bearing brick masonry for multistoried constructions, brick panel walling, reinforced masonry. Metals: Manufacture of steel, market forms of steel e.g. mild steel and HYSD steel bars, rolled steel sections. Thermo Mechanically Treated (TMT) Bars. Admixtures and Superplasticizers: Functions, classification, accelerating admixture, water reducing admixture, retarding admixture, air-containing admixture. Low cost housing & hollow blocks. Prefabricated Construction, Damp proof course.

Antitermite treatment. Form Work and Scaffolding. Mix Design - factors influencing mix proportion I.S. code method. Introduction to Pre stressed Concrete: - Basic concepts, classification and types of prestressing

3. HYDRAULIC ENGINEERING

Introduction: Definition of a fluid and its properties, Types of fluids. Fluid statics: Differential equation of pressure field, Pascal law, Measurement of fluid pressure, force on submerged surfaces, Buoyancy and Flotation. Fluid kinematics: Methods of describing fluid motion, Velocity and acceleration of a fluid particle, Type of fluid flows, Displacement of a fluid particle, Continuity equation, Velocity potential and stream function, Flow net. Fluid dynamics: Euler's equation; Bernoulli's equation; Momentum equation; Applications, Kinetic energy and momentum correction factors. Flow in open channels: Introduction, analysis of uniform flow, most economical channel sections, specific energy and its applications to channel transitions, momentum equation for flow in open channels, specific force concept, analysis of non-uniform flow, water surface profiles, hydraulic jump, surges. Flow in pipes: Navier-Stokes equations for laminar flow, laminar flow through a pipe and parallel plates, laminar flow past a sphere, shear stress in turbulent flow, velocity distribution equations for turbulent flow in pipes, Resistance of smooth, rough and commercial pipes, pipe network analysis, pressure transients.

4. HYDROLOGY

Introduction: Hydrologic cycle, Scope and Applications. Precipitation: Measurement by rain gauge and other methods, estimation of missing data, consistency of records, optimum number of rain gauge station, mean precipitation, presentation and analysis of rainfall data. Abstractions from Precipitation: Evaporation, factors affecting evaporation, measurement, infiltration, factors affecting infiltration, measurement, infiltration indices. Run off: Run-off estimation, rainfall-runoff correlation, flow duration curve, hydrographs, base flow separation, unit hydrographs and its application, distribution graph, synthetic unit hydrograph. Stream flow measurement: Velocity measurement: floats, velocity rods, current meters, discharge computation: velocity area method, moving boat method, slope area method, stage discharge curve, notches, weirs, venturiflume, standing wave flume, free overfall.

5. SOLID MECHANICS

Simple Stresses and Strains, stress-strain curves for elastic materials, Hookes' Law, Young's modulus of elasticity, Bulk modulus, modulus of rigidity, temperature stresses, relation between elastic constants. Pure shear, principal stresses and Principal planes. Bending moment & shear force diagrams, Types of beams, supports and different types of loading. Relationship between Bending moment and Shear Force. Bending and Shear Stresses, assumption made in theory of simple bending. Torsion of shafts and springs, Power transmitted, sections subjected to combined bending and torsion, Deflection of Beams: Derivation of basic equation of elastic curve, deflection in beams with different end conditions and different loadings. Maxwel's reciprocal theorem. Columns and Struts, Euler's buckling loads for columns with different end conditions, limitations of Euler's formula. Virtual Work: Principle of virtual work, calculation of virtual displacement and virtual work.

6. STRUCTURE ANALYSIS

Axial Stress and Strain: Concept of stress, strain, elasticity and plasticity; one dimensional stress-strain relationships; Young's modulus of elasticity, shear modulus and Poisson's ratio; two-dimensional elasticity; isotropic and homogeneous materials; ductile and brittle materials; statically determinate and indeterminate problems, compound and composite bars; thermal stresses. Torsion of shafts; buckling of struts, concept of factor of safety. Bending & Shear Stresses in beams: Derivation of flexural formula for straight beams, concept of second moment of area, bending stress calculation for beams of simple and builtup sections, Flitched beams. Shear stress formula for beams, shear stress distribution in beams Transformation of Stress and Strain: Transformation equations for plane stress and plane strain, Mohr's stress circle, relation between elastic constants, strain measurements, strain rosettes. Deformations: Governing differential equation for deflection of straight beams having constant flexural rigidity, Double Integration, Macaulay's and Moment Area and Conjugate Beams for determining slopes and deflection. Displacements: Energy Methods: Strain energy in members, Betti's and Maxwell's Laws of reciprocal deflections, Castigliano's theorems, Unit load method for 2Dframes. Indeterminate Structures: Introduction, Static and kinematic indeterminacies, Stability of structures, Internal forces in two and three-dimensional structures. Analysis of Indeterminate Beams and Frames: Classical Methods: Methods of consistent deformation, Method of least work, and Theorem of three moments; Conventional methods of Analysis of rigid frames: Slope deflection method, Moment Distribution method; Approximate methods: Portal method, and Cantilever method. Moving Loads and Influence Line Diagrams for Statically Determinate Structures: Bending moment and shear force diagrams due to single and multiple concentrated rolling loads and uniformly distributed moving loads, Equivalent UDL, Muller Breslau principle: Influence lines for beams.

7. DESIGN OF CONCRETE STRUCTURES

Introduction: Reinforced concrete, definition, properties of materials, grades of concrete and reinforcing steel, stress-strain curves, permissible stresses, shrinkage, creep, design philosophies working stress design, ultimate strength and limit state design method. Limit State Design Method: Introduction, Limit States, Characteristic values, characteristic strength, characteristic loads, design values for materials and loads, factored loads. Limit State of Collapse (Flexure): Types of failures, assumptions for analysis and design of singly reinforced, doubly reinforced sections, and flanged sections, Design of Lintels, Design of one-way slabs and two-way rectangular slabs, Circular slabs: Slabs with different edge conditions Limit State of Collapse (Shear, bond and torsion): Introduction - Design for shear, structural components subjected to torsion, design of rectangular beam section for torsion, development length, continuation of reinforcement (beyond cut off points). Limit State of Serviceability: Deflection, effective span to effective depth ratio, modification factors for singly reinforced, doubly reinforcement and flanged beams, crack formation and its control. Limit State of Collapse (Compression): Columns and their classification, reinforcement in columns, assumptions, short and long (both tied and helical) columns subjected to axial load, short columns subject to axial, uniaxial and biaxial bending, Interaction Diagrams Limit State Design of miscellaneous structures: Design of isolated footings, Design of staircases. Introduction to Working Stress Design Method Application of SP 16 and Detailing of

Reinforcement: Use of SP: 34, Analysis and design of square, rectangular and circular foundation. Overhead tanks, intze type tanks and their design including staging and foundation.

8. GEOTECHNICAL ENGINNEERING

Basic Soil Properties: weight-volume relationships, soil grain properties, soil aggregate properties, grain size analysis, sieve analysis, sedimentation analysis, grain size distribution curves, consistency of soils, consistency limits and their determination. Classification of soils, classification on the basis of grain size, classification on the basis of plasticity. Permeability of Soils, Darcy's law and its validity, discharge velocity and seepage velocity, factors affecting permeability. Effective Stress Principle types of head, seepage forces, quick sand condition, and critical hydraulic gradient. Compaction: laboratory determination of optimum moisture content, moisture density relationship, compaction in field, compaction of cohesionless soils, moderately cohesive soils and clays, field control of compaction. Stresses in Soils: Stresses beneath various loaded areas, Boussinesq and Westergarrd's formulae, pressure bulbs, Newmark's chart. Approximate methods. Compressibility and Consolidation: components of total settlement, consolidation process, one- dimensional consolidation test, typical void ratio-pressure relationships for sands and clays, normally consolidated and over consolidated clays. Terzaghi's theory of one-dimensional primary consolidation. Determination of coefficients of consolidation. Shear Strength: relationship between principal stresses at failure, shear tests, direct shear test, unconfined compression test, tri-axial compression tests, drainage conditions and strength parameters. Skempton's Pore pressure parameters Soil Investigation: Object of soil investigation for new and existing structures. Depth of exploration for different structures. Types of soil sample. Open Drive samples, Spilt Spoon Sampler, Bore-Hole lfor S.P.T., DCPT, SCPT, PLT Earth Pressure. Lateral earth pressure. Earth pressure at rest. Rankine states of plastic equilibrium, Coulomb's theory of earth pressure Influence of surcharge, water table, wall friction, open cuts, Stability of Retaining Walls. Bearing Capacity: Ultimate bearing capacity, safe bearing capacity and allowable bearing capacity of soil Rankine's analysis and Terzaghi's analysis. Types of Shear failures. IS6403 provisions. Settlement of soil, Settlement Calculations by various methods viz, DeBeer Marten's method, Schertmann method, Pile Foundations: Types, function, selection of piles, pile driving formulae, equipment, point, bearing and friction piles. Load carrying capacity of single pile, group action, spacing of piles, Negative skin friction, settlement of pile groups, under-reamed piles Stability of Slopes: Infinite slope, types of failure, total and effective stress analysis, Taylor's stability numbers, concept of factors of safety, method of slices, modified method of slices, Swedish's circle method, friction circle method.

9. TRANSPORTATION ENGINEERING

General: Different modes of transport, Development of Transport System, Phased development of Roads in India, Planning & Management of Highways, Various road plans developed in India, Road patterns, Highway Surveys & Alignment, Design, Drawings, Estimates & Project Report. Traffic Studies: Road user characteristics, Importance of traffic studies, spot speed, speed and delay and origin and destination studies. Traffic accident studies, Causes of accidents and Remedial Measures, Parking studies. Geometric Design of Highways: Introduction, Highways Classification, Right of way, Width

of formation, Sight Distances, Stopping site distance, overtaking sight distance, overtaking zones, camber, Road Curves, Transition Curves, Super elevation, Widening at curves, IRC codal recommendations for various geometric design parameters, Road Safety Audits, Highway capacity & Intersection design. Construction of Roads: Various types of bituminous layers constructions and their selection, specifications for embankments, subgrade, granular subbase, water bound macadam, wet mix macadam, surface dressing, premix carpet, bituminous macadam, dense bituminous macadam, bituminous concrete, mastic asphalt, stone matrix asphalt, dry lean concrete, cement concrete pavements, Importance & Principles of Highway Drainage, Surface Drainage & Sub-Surface drainage. Types of bituminous binders and Mix design: Manufacturing of bitumen, Paving bitumen specifications as per IS 73: 2013, comparison between bitumen, tar, cut back & emulsion, Modified binders and its rheology, Design of bituminous mixes: Requirement of bitumen mixes, design of bituminous mixes as per Marshall Stability & flow method, parametric evaluation of bituminous mixes, IRC & MORTH recommendations for the design mix of various layers of pavements. Pavement Design: Factors affecting design of pavements, design principles & design procedures as per IRC 37 guidelines, Design of PQC pavements as per IRC 58 & SP62, Failures of flexible and rigid pavements & Highway Maintenance: Causes of Failures and Remedial Measures, Maintenance of flexible and rigid pavements, pavement evaluation and its strengthening method, overlay design using IRC 81 & IRC115 guidelines, concept of thin & ultrathin white toppings, design & scheduling of maintenances activities, development of Pavement maintenance management systems for different categories of roads, Economic Evaluation of Highway Projects and Life Cycle Costing Concept.

10. CONSTRUCTION MANAGEMENT AND MACHINERY

Quantity Surveying and Cost Estimation: Definitions, objectives, role and functions of quantity surveyor, Pre-tender survey, Quantity measurements, Bill of quantities, analysis of rates for different items of work, Specifications of different works, General and detailed specifications for different items of work, Estimates and budgets types and their preparation, Estimate of Buildings and Roads, Building Bye Laws, Taking-off quantities, Methods of measurement, e-tendering, Bill of quantities, Common schedule of rates for different items of works.

Contracts: Definition, need, importance, types of contracts and their characteristics, procedure for tendering and contracts, BOT, DBFOT, PPP & HAM financial models, evaluation and examination of tenders, award of work, Joint Ventures, Concession Agreements, Valuation, its types, Determination of value of a property, Calculation of standard rent. Network Techniques: Definitions, functions & characteristics of project planning and principles of project Planning and Management, Bar milestone charts, Planning and scheduling with PERT / CPM, Time cost optimization, Probability concepts Allocation of resources and resource levelling, Updating, controlling and monitoring, Work Breakdown Schedule (WBS), Account Procedure of PWD Works: Classification of Works, Muster Roll, and Deposit works. Cash Book, Imprest, temporary Advance, Stores, Indent, Tools and Plant Plants for grading, batching, mixing, types of mixers, concrete pumps, bitumen plants.

11. WATER AND WASTER WATER ENGINEERING

Water and water supply system: Water quality, source of surface water pollution, water quality standards; Water demand, components of water supply system; water intake works; Water transmission systems Water treatment: Water treatment plants and components; Technologies for the removal of suspended, colloidal and dissolved solids and for disinfection; Design of coagulationflocculation-settling, slow sand and rapid gravity filtration, membrane filtration, ion exchange, adsorption and chlorination units. Wastewater system: Quantification of sewage; Characterization of sewage; Types of sewerage systems; Design of sewers and storm sewers, sewer outfalls and sewer appurtenances Wastewater treatment: Components; Design of screens, degritters, clarifiers and roughing filters; Activated Sludge, UASB and modified UASB reactors, and Waste stabilization pond systems, vegetated ponds and constructed wetland systems; Sewage treatment plant sludge handling facilities. Determination of pH, acidity, alkalinity and hardness testing; DO, BOD and COD; Solids (TSS, VSS and TDS); Nutrients (TKN, TN and TP); SVI and Settling tests; Chlorination, residual chlorine and MPN test; Oil and grease and pesticides; Iron, fluorides, sulfates, chlorides, sulfides and phenols

12. IRRIGATION ENGINEERING

Crop Water Requirement: Soil-moisture-irrigation relationship, depth and frequency of irrigation, irrigation efficiencies, consumptive use and its determination, duty and delta relationship. Canal Irrigation: Canal distribution system, design of stable channels by Lacey's and Kennedy's theory, design of lined channels. Design of Impervious floor: Creep theories, Khosla seepage theory. Diversion Headworks: Components, design of a weir or barrage and canal head regulator. Canal Regulation Works: Canal falls, design of a vertical drop fall and a glacis fall, roughening measures for energy dissipation, cross regulators and distributary's head regulators, canal escape. Cross Drainage Works: Need, types, selection of suitable CD work, design of CD work

13. STEEL STRUCTURAL DESIGN

Introduction: Loads, structural steels and their specifications, structural elements, steel vs. concrete and timber, design specifications as per IS: 800, structural layout, strength and stiffness considerations, efficiency of cross-section, safety and serviceability considerations.IS2062-2011 Riveted/Bolted Connection: Riveting and bolting, their types, failure of riveted joint, efficiency of a joint, design of riveted joint, concentric riveted joints, advantages and disadvantages of bolted connections, stresses in bolts. Welded Connection: Types of welded joints, design of welded joint subjected to axial loads, welded joints subjected to eccentric loads, simple, semi-rigid and rigid connections. Tension Members: Types of tension members, net area, net effective area for angles, tees, design of tension members, tension splice, and lug angles. Compression Members: Axially loaded columns, effective length, slenderness ratio, allowable stresses, general specifications, design of axially loaded members, laced and battened columns and their design, built-up compression members, eccentrically loaded columns and their design, column splice and its design, encased columns. Column Bases: Introduction, slab base, gusseted base, column base subjected to moment, grillage foundation. Flexural Members (Beams): Design criteria, permissible stresses, laterally supported beams and their design laterally unsupported beams and their design, web buckling, web crippling, built up beams, encased beams, members

subjected to bending and compression. Plastic Design: Introduction, advantages and disadvantages, strength of tension and compression members, theory of plastic bending, plastic hinge mechanism, collapse load analysis, static and mechanism method, distributed loading, design consideration.

GENERAL KNOWLEDGE & CURRENT AFFAIRS

General Knowledge and Current affairs of National and International importance including: (i) Economic issues. (ii) Polity issues. (iii) Environment issues. (iv) Geography. (v) Science and Technology. (vi) Any other current issues. (vii) (a) History of India with special reference to Indian freedom struggle movement. (b) History of Punjab- 14th century onwards.

GENERAL MENTAL ABILITY, LOGICAL REASONING & QUANTITATIVE APTITUDE

(i) Logical reasoning, analytical and mental ability. (ii) Basic numerical skills, numbers, magnitudes, percentage, numerical relation appreciation. (iii) Data analysis, Graphic presentation charts, tables, spreadsheets.

PUNJABI LANGUAGE

Index

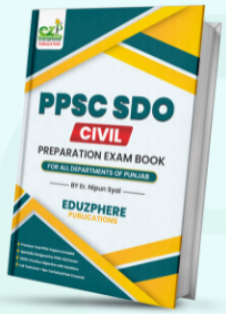
SURVEYING

Chapter

01

EDUZPHERE - ZPHERE OF EDUCATION

Weightage



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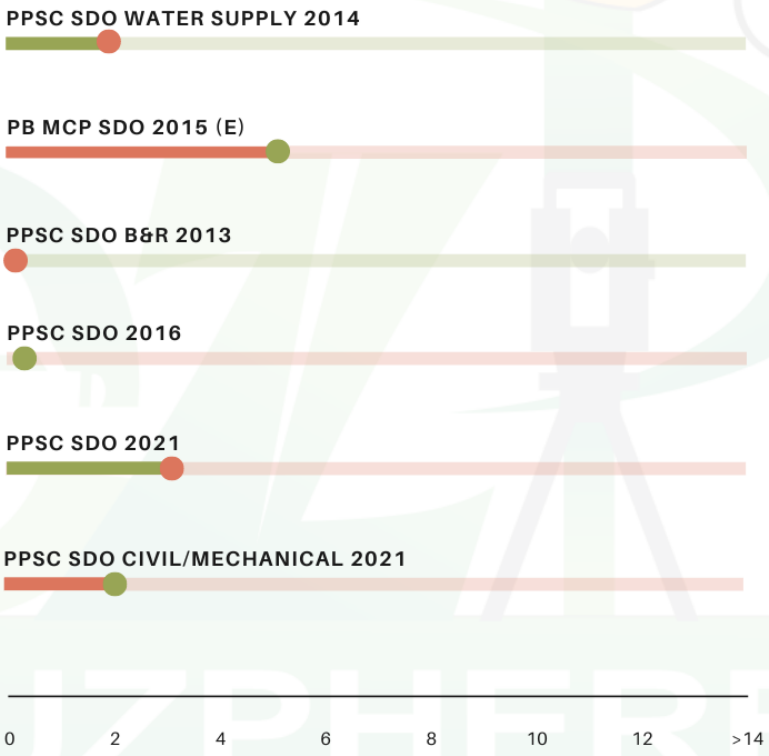


If you find any mistakes/corrections or Doubts Visit given code:

PPSC SDO WATER SUPPLY 2014

1. Conceptually, however, all designs of successful remote sensing efforts involve, at a minimum

1. Clear definition of the problem at hand and evaluation of the potential for addressing the problem with remote sensing techniques.
2. Identification of the remote sensing data acquisition procedures appropriate to the task
3. Determination of the data interpretation procedures to be employed and the reference data needed
4. Identification of the criteria by which the quality of information collected can be judged.

The correct statements are:

(A) All of these (B) Only 1, 3 and 4
(C) Only 1 and 3 (D) Only 1, 2 and 4

Sol. (A)

2. The staff reading at a distance 80 m from a level with the bubble at its centre is 1.52 m and when the bubble is moved 5 divisions out of the centre, the reading is 1.60 m. The angular value of 1 division of bubble is

(A) 20.62 s (B) 41.25 s
(C) 14.53 s (D) 25.05 s

Sol. (B)

$$\alpha = \left(\frac{S}{nD}\right) \times 206265$$

$$\frac{S}{d} = 206265$$

S = 1.39 – 1.31 = 0.08 m/s div

$$\alpha = \frac{(206065 \times 0.08)}{80}$$

= 206.265 sec/5 div

$$= \frac{(206.265 \times 1)}{5} = 41.253 \text{sec/ div}$$

PB MCP SDO 2015 (E)

3. If the true bearing of the line AB is 269°30' then the azimuth of the line AB is

(A) 0°30' (B) 89°30
(C) 90°30' (D) 269°30'

Sol. (B)

True bearing is always less than 90° and also should have prefix N or S and suffix E or W.

Azimuth is the angle which is usually measured clockwise from the N-S meridian.

So, if Azimuth of a line is 269°, it's bearing will be S 89° W.

4. The following consecutive readings were taken with a dumpy level:

0.695, 1.525, 2.395, 0.635, 0.605, 0.805, 0.125

The instrument was shifted after the third and fifth readings. The readings 2.395 and 0.635 respectively represent

(A) F.S. and B.S. (B) F.S. and I.S.
(C) B.S. and F. S. (D) I.S. and B.S.

Sol. (A)

B.S = 0.695

I.S = 1.525

F.S = 2.395

B.S = 0.635

F.S = 0.605

5. If the intercept on a vertical staff is observed as 0.75m from a tacheometer, the horizontal distance between tacheometer and staff station is

(A) 7.5 m (B) 25 m

(C) 50 m (D) 75 m

Sol. (D)

S = 0.75

= 100.S + O

100 × .75 = 75 m

6. The radial offset at a distance X from the point of commencement of curve of radius R is given by

(A) $\sqrt{R^2 - X^2} - R$ (B) $R - \sqrt{R^2 - X^2}$

(C) $R - \sqrt{R^2 + X^2}$ (D) $\sqrt{R^2 + X^2} - R$

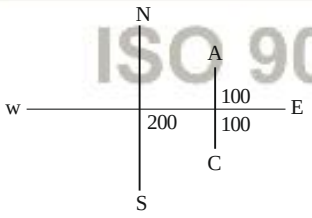
Sol. (D)

7. If the coordinates of A are 100N and 200E, and those of C are 100S and 200E. then the length AC is

(A) 400.00 (B) 282.84

(C) 244.94 (D) 200.00

Sol. (D)



Given, line A = 100 North, = 200 East

Line C = 100 south, = 200 East

Length of AC = 100 + 100 = 200 m

PPSC SDO CIVIL 2021

8. Which of the following is not a basic component of a total station?

(A) Electronic theodolite

(B) Vernier scale

(C) EDMI

(D) Field computer

Sol. (B)

While total station is an electronic 1 optical instrument used for surveying and building construction. It is composed of four main components:

i. EDM (Electronic Distance measurement)

ii. Electronic Theodolite

iii. Microprocessor

iv. Electronic Display

9. On a diagonal scale, it is possible to read up to

(A) two dimensions. (B) one dimension

(C) four dimensions. (D) three dimensions.

Sol. (D)

Diagonal scale are there dimension and plane scale also two dimension. Diagonal scale can read upto three dimensions.

PRACTICE QUESTIONS

1. The formula for difference in elevation can be given as_____

(A) D = V + (I - R) (B) D = V + (I + R)

(C) D = V – (I - R) (D) D = V × (I - R)

Sol. (A)

The difference in elevation can be given as D = V + (I - R) where, V= vertical difference

between two points, I = instrument height, R = height of centre of reflector.

2. In which direction it is best to place the total station for obtaining the best output?

(A) East (B) West

(C) South (D) North

Sol. (D)

The best procedure while using a Total Station is to set a convenient "north" and carry this through the survey by using back sight process when the instrument is moved.

3. The data obtained from total station can be used in which among the following software directly?

(A) Primavera (B) STAAD PRO

(C) Autodesk Revit (D) Surfer

Sol. (D)

The data obtained from the total station can be indirectly used in STAAD Pro, Autodesk Revit, Primavera but it can be directly used in software's like Arc GIS, Surfer, Auto CAD etc., as they are linked with it.

4. Calculation the elevation difference if the vertical distance is 14.89m, instrument height is 9.2m, ground is at 2.8m.

(A) 21.29 m (B) 12.29 m

(C) 21.92 m (D) 41.29 m

Sol. (A)

The elevation difference in total station can be calculated as $dz = V_d + (I_h - R_h)$. On substitution, we get

$dz = 14.89 + (9.2-2.8)$

$dz = 21.29$ m.

5. Find the vertical distance if the value of slope distance can be given as 12.98 and the angle is 1°23'.

(A) 21.97m (B) 12.97m

(C) 12.79m (D) 21.79m

Sol. (B)

The vertical distance can be calculated by using the formula,

$V_d = S_d \times \cos Z_a = 12.98 \times \cos (1°23')$ $V_d =$ 12.97m.

6. 13. Find the elevation of ground beneath the reflector, if the known elevation of instrument is 12.76m, slope distance = 3.76m, angle is about 3˚43', instrument height = 2.93m, ground is at 0.987 m.

(A) 18.54m (B) 81.54m

(C) 18.45m (D) 18.97m

Sol. (C)

The elevation of ground beneath the reflector can be given as

$R_z = I_z + S_d \times \cos Z_a + I_h - R_h$. On substitution, we get

$R_z = 12.76 + (3.76 \times \cos (3˚43')) + 2.93 - 0.987$

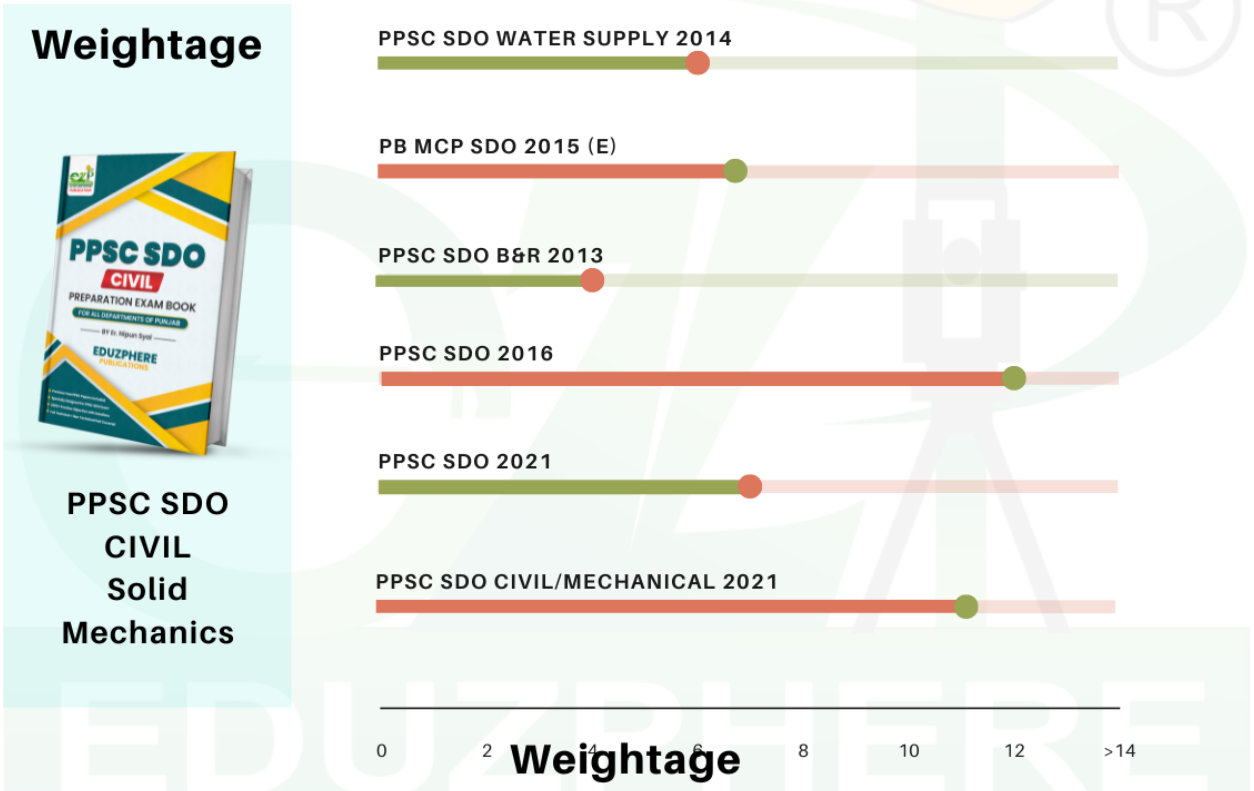
$R_z = 18.45$ m.

SOLID MECHANICS

Chapter

03

EDUZPHERE - ZPHERE OF EDUCATION



PPSC SDO WATER SUPPLY 2014

1. In a strained body, three principal stresses at a point are denoted by 'σ_1', 'σ_2' and 'σ_3' such that $\sigma_1 > \sigma_2 > \sigma_3$. If σ_0 denoted yield stress, then according to the maximum shear stress theory

(A) $\sigma_1 - \sigma_2 = \sigma_0$ (B) $\sigma_1 - \sigma_3 = \sigma_0$

(C) $\sigma_2 - \sigma_3 = \sigma_0$ (D) $\frac{\sigma_1 + \sigma_3}{2} = \sigma_0$

Sol. (B)

Tresea critearia attributes yielding to slip phenomenon which occurs with max shear stress exceeds a value, characteristic to the material

Mathematically

$\sigma_1 - \sigma_3 = \sigma_0$

2. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I

(Condition of beam)

(I) Subjected to bending moment at the end of a cantilever

(II) Cantilever carrying uniformly distributed load over the whole length

(III) Cantilever carrying linearly varying load from zero at the free end to maximum at the support

(IV) A beam having load at the centre and supported at the ends.

List-II

(Bending moment diagram)

1. Triangle
2. Cubic parabola
3. Parabola
4. Rectangle

Codes:

	(i)	(ii)	(iii)	(iv)
(A)	4	1	2	3
(B)	4	3	2	1
(C)	3	4	2	1
(D)	3	4	1	2

Sol. (B)

1. Subjected to BM at the end of a cantilever – Rectangular.

2. Cantilever carrying UDL over the whole length - Parabola

3. Cantilever carrying linearly varying load from zero at the face end to maximum at the support– Cubic parabola.

4. A beam having load at the centre and supported at the ends – Triangle.

3. A thin walled hollow square and circular section having same thickness and area, are subjected to same torque. Which of the following statement is true?

(A) Square section is stronger than circular section

(B) Circular section is stronger than square section

(C) Both square and circular section have same strength

(D) Strength cannot be judged from given data

Sol. (A)

Square section is stiffer than circular section.

4. Tensile stresses of 60 kN/m^2 and 50 kN/m^2 are acting at right angles to each other on a piece of material. Find the resultant stress on a plane, the normal of which makes an angle of 45° with 60 kN/m^2 stress.

(A) 55.23 kN/m^2 (B) 45 kN/m^2

(C) 5 kN/m^2 (D) 55 kN/m^2

Sol. (A)

$\sigma_1 = 60T$

$\sigma_2 = 30T$

Radius of mohr circle = $\frac{60-50}{2} = 5cm$

$R = \sqrt{\sigma x^2 + \tau_x 0^2}$

$\sqrt{55^2 + 5^2}$

= 55.23 kN/m^2

5. Ration of torsional strain energy for solid and hollow shaft of internal diameter d and external diameter D of same material and volume is

(A) $\frac{D^2 + d^2}{D^2}$ (B) $\frac{D^2 - d^2}{D^2}$

(C) $\frac{D^2}{D^2+d^2}$ (D) $\frac{D^2}{D^2-d^2}$

Sol. (A)

6. In an unconfined compression test on a saturated clay the untrained shear strength was found to be 6 t/m^2. If a sample of the same soil is testes on an undrained condition in triaxial compression at a cell pressure of 20 T/m^2, the major principal stress at failure will be

(A) 48 t/m^2 (B) 32 t/m^2

(C) 24 t/m^2 (D) 12 t/m^2

Sol. (B)

Major principle stess in undrained test = cell pressure + undrained shear strength × 2)

= 20 + 6 × 2 = 32 t/m^2

PB MCP SDO 2015 (E)

7. Ratio of Young's modulus of high tensile steel to that of mild steel is about

(A) 0.5 (B) 1.0

(C) 1.5 (D) 2.0

Sol. (B)

$$\frac{\text{Young modulus of high tensile steel}}{\text{Young modulus of mild steel}} = \frac{215\text{GPA}}{210\text{GPA}}$$

$\simeq$ 1.02 = 1

8. The variation of the bending moment in the portion of a beam carrying linearly varying load is

(A) linear (B) parabolic

(C) cubic (D) constant

Sol. (C)

9. For an isotropic, homogeneous and elastic material obeying Hooke's law, number of independent elastic constants is

(A) 2 (B) 3

(C) 9 (D) 1

Sol. (A)

For an isotropic, homogeneous and elastic material obeying hooke's law, number of independent elastic constants is 2.

10. If the length of a simply supported beam carrying concentrated load at the centre is doubled, the deflection at the centre will become

(A) Two times (B) Four times

(C) Eight times (D) Sixteen times

Sol. (C)

11. The effective length of a chimney of 20m height is taken as

(A) 10m (B) 20m

(C) 28.28m (D) 40m

Sol. (D)

$l = 2l$

= 2 × 20 = 40m

12. Slenderness ratio of 5m long column hinged at both ends and having a circular cross-section with diameter 160mm is

(A) 31.25 (B) 62.50

(C) 100 (D) 125

Sol. (D)

r = d/2 160/2 = 80

$\lambda = l/rm = 5000/80 = 125$

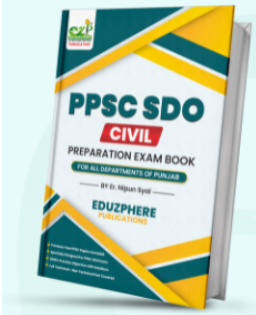
$l = 1.0l \Rightarrow 5 \times 1 = 5$ m or 5000 mm

CONCRETE STRUCTURE DESIGN

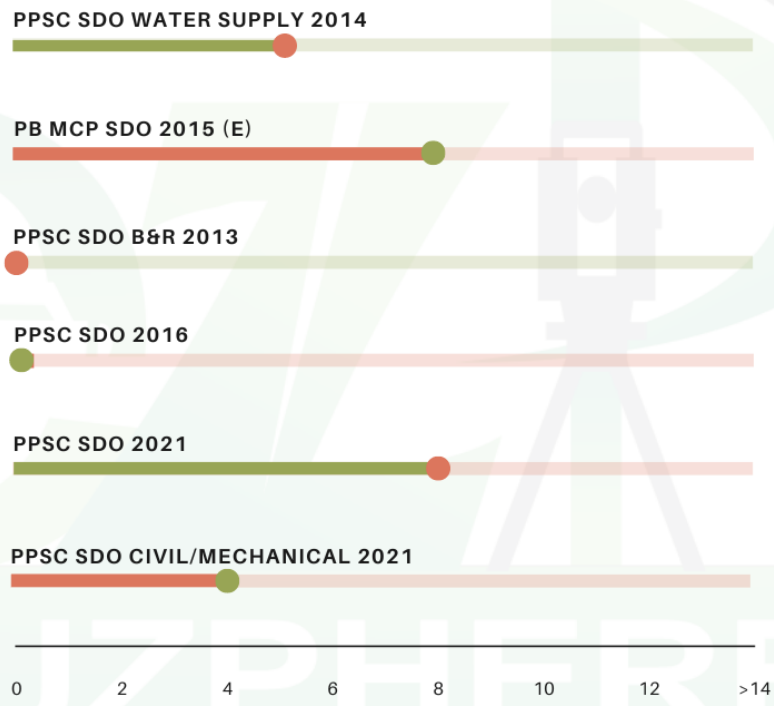
Chapter

04

EDUZPHERE - ZPHERE OF EDUCATION



PPSC SDO CIVIL Concrete Structure Design



PPSC SDO WATER SUPPLY 2014

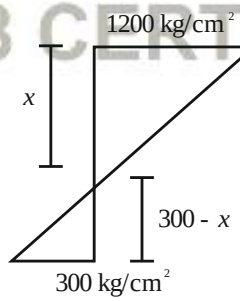
1. An I-section beam, made of structural steel has an overall depth of 30 cm. If the developed flange stresses at the top and bottom of the beam are 1200 kg/cm^2 and 300 kg/cm^2 respectively, then the depth of the neutral axis from the top of the beam would be

(A) 25 cm (B) 24 cm

(C) 20 cm (D) 18 cm

Sol. (B)

The variation of stress in bending is shown



$$\frac{x}{50} = \frac{300 - x}{200}$$

$$x = 1200 - 4x$$

$$x = \frac{1200}{250}$$

x = 240 mm

x = 24 cm

2. The fundamental assumptions involved in the method based on elastic theory are

1. At any cross-section, plane sections before bending remain plane after bending
2. All tensile stresses are taken up by the reinforcements and none by concrete
3. The stress strain relationship of steel and concrete under working load is linear
4. There is proper bond between steel and concrete. This means that the tensile strain in the concrete surrounding the steel is equal to the tensile strain in the steel reinforcements.

Choose the correct answer from the following:

(A) All the four above

(B) 1, 2 and 3 only

(C) 1 and 3 only

(D) 2 and 4 only

Sol. (D)

Relationship between the stress-strain distribution in concrete is assumed to be parabolic.

3. The width of flange of a T-beam depends on

1. Spacing of beams & span of beams
2. Depth of neutral axis
3. Nature of supporting
4. Dimension of beam

Choose the correct answer from the following:

(A) 1, 2 and 3 only

(B) 1, 3 and 4 only

(C) 1 and 4 only

(D) All of above four

Sol. (B)

The effective width of flange mainly depends upon the span of beams, thickness of slab and the breadth of the web. It also depends upon the type load and support condition.

4. A rectangular simply supported prestressed concrete beam of spam L is subjected to a prestressing force of P acting centrally at end sections and the prestress tendons are parabolically draped with maximum eccentricity of a max at the mid-point section. The uniformly distributed upward load (w) on the beam due to prestressing will be

(A) $\frac{16 P e\max}{L^2}$ (B) $\frac{4 P e\max}{L^2}$

(C) $\frac{12 P e\max}{L^2}$ (D) $\frac{8 P e\max}{L^2}$

Sol. (D)

$M_{max} = wl^2/8$

$M_{max} = Pe_{max}$

5. A 200 mm thick wall made of modular bricks is 5 m long between cross walls and 3.8 m clear height between RCC slabs at top and bottom. The slenderness ratio of the wall is

(A) 19 (B) 20

(C) 15 (D) 25

Sol. (A)

Slenderness ratio = h/t or l/t

h/t = 3800 / 200 = 19

l/t = 5000 / 200 = 25

so answer in A

PB. MCP SDO 2015 (E)

6. For a cantilever of effective span 0.5m, the maximum span to satisfy vertical deflection limit is

(A) 3.5 m (B) 4.0 m

(C) 4.5 m (D) 5.0 m

Sol. (A)

Span = A × L_{eff}

= 7 × 0.5 = 3.5

7. According to Whitney's theory, ultimate strain of concrete is assumed to be

(A) 0.03 % (B) 0.10 %

(C) 0.30 % (D) 3.00%

Sol. (C)

8. With the increase in rate of loading during testing, compressive strength of concrete

(A) Increases (B) decreases

(C) Remains same (D) None of these

Sol. (A)

9. In a doubly reinforced rectangular

(A) equal to the permissible stress in tension in steel

(B) more than to the permissible stress in tension in steel

(C) less than to the permissible stress in tension in steel

(D) Not related to the permissible stress in tension in steel

Sol. (C)

Less than to the permissible stress in tension in steel.

10. Loss of stress with time at constant strain in steel is called

(A) Relaxation (B) creep

(C) Shrinkage (D) ductility

Sol. (A)

11. In limit state design, permissible bond stress in case of deformed bars is more than that in plain bars by

(A) 60% (B) 50%

(C) 40% (D) 25%

Sol. (A)

For deformed bars the bending stress shall be increase by 60% of the values of plainbars in tension.

12. Direct load carrying capacity of a brick masonry wall standing freely as against when it supports RC slab will be

(A) More

(B) Less

(C) The same in both the cases

(D) 100%

Sol. (B)

The slenderness ratio of free standing wall will be more than that when it support RC Slab so the allowable stresses will be less for free standing wall and the load carrying capacity will be less.

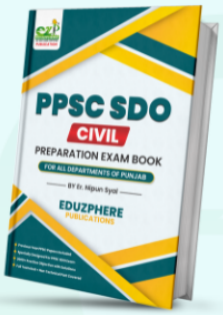
STEEL STRUCTURAL DESIGN

Chapter

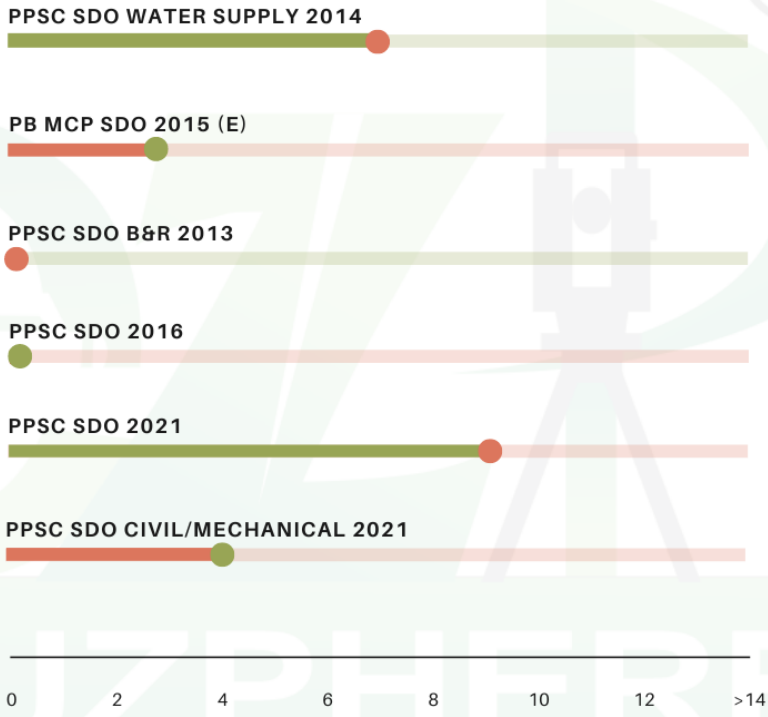
06

EDUZPHERE - ZPHERE OF EDUCATION

Weightage



PPSC SDO CIVIL Steel Structural Design



PPSC SDO WATER SUPPLY 2014

1. Which one of the following statements is correct?

(A) The tensile strengths of both structural and rivet steels are the same

(B) The tensile strength of rivet steel is slightly higher than that of structural steel

(C) The tensile strength of rivet steel is slightly lower than that of structural steel

(D) The tensile strength of structural steel should be much less when compared to that of rivet steel

Sol. (C)

The tensile strength of rivet steel ie (55000 psi) is slightly lower than that of structural steel ie (46,000 psi).

2. Consider the following assumptions:

1. The shearing stress in all the rivets is uniform

2. The bearing stress is not uniform
3. Bending of rivets can be neglected

The assumptions made while designing a riveted joint would include

(A) 1, 2 and 3 (B) 1 and 2
(C) 2 and 3 (D) 1 and 3

Sol. (D)

Bearing stress is uniform between plates & rivets.

3. A steel plate is 30 cm wide and 10 mm thick. A rivet of nominal diameter 18 mm is driven. The net sectional area of the plate is

(A) Curvature is infinite
(B) Moment is infinite
(C) Flexural stress is infinite
(D) Radius of curvature is infinite

Sol. (C)

Diameter of hole = 18 + 1.5 = 19.5

Net sectional area = (30 – 1.95) × 1.0

= 28.05 cm^2

4. At the location of plastic hinge

(A) Curvature of infinite
(B) Moment is infinite
(C) Flexural stress is infinite
(D) Radius of curvature is infinite

Sol. (A)

Curvature at plastic hinge is infinite & moment is equal to plastic moment capacity. It means the infinite rotation can occur at fully plastic section.

5. For an I beam the shape factor is 1.12. The factor or safety in bending is 1.5. If the allowable stress is increased by 20% for wind and earthquake loads, then the load factor is

(A) 1.10 (B) 1.25
(C) 1.35 (D) 1.40

Sol. (D)

The factor of safety is given as

F1 = Yield stress/Allowable stress = 1.5

When the allowable stress is increased by 20%, then factor of safety will be

F2 = Yield stress/1.2 × Allowable stress

⇒ F2 = 1/1.2 × Yield stress/Allowable stress

⇒ F2 = 1/1.2 × 1.5/1.25

Load factor = Shape factor × Factor of safety

= 1.12 × F2 = 1.12 × 1.25 = 1.40

6. If 8 mm rivets are used in lacing bars, then minimum width of lacing bars should be

(A) 45 mm (B) 50 mm
(C) 55 mm (D) 60 mm

Sol. (C)

	Rivets	Min width
1.	16mm	50 mm
2.	18mm	55 mm
3.	20mm	60 mm
4.	22 mm	65 mm

7. The best arrangement to provide unified behavior in built up steel column is by

(A) Lacing
(B) Battening
(C) Tie plates
(D) Perforated cover plates

Sol. (A)

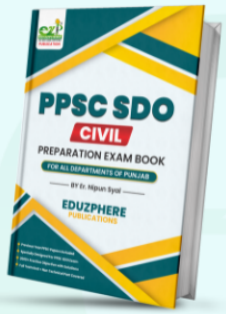
GEOTECHNICAL ENGGINEERING

Chapter

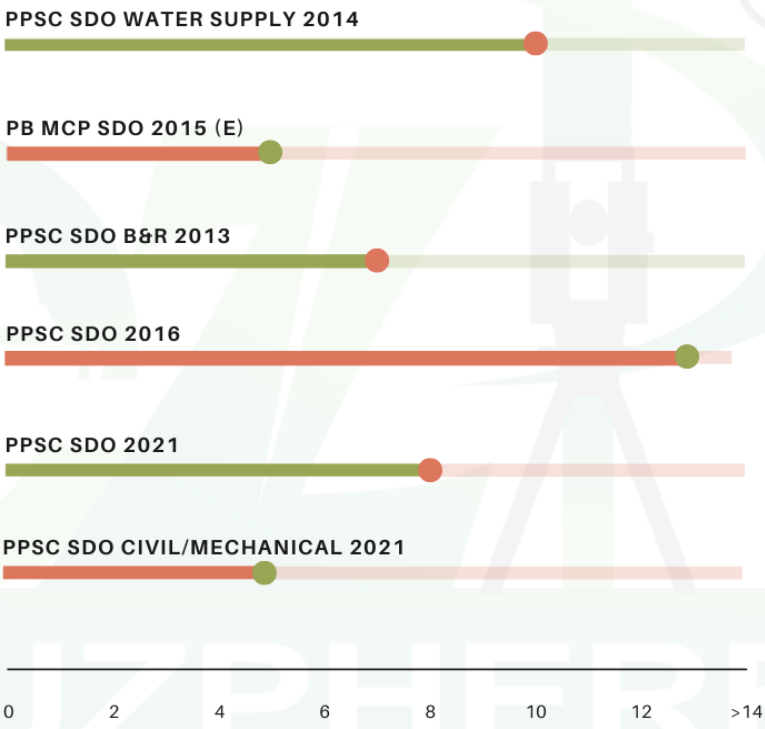
11

EDUZPHERE - ZPHERE OF EDUCATION

Weightage



PPSC SDO CIVIL Geotechnical Enggineering



PPSC SDO WATER SUPPLY 2014

1. Which of the following statement of wrong?

(A) Quick sand and liquefaction of soil are same

(B) Sheet piles are used to improve soil capacity

(C) Permeability of soil is important in earth dams

(D) Uniform velocity of flow is assumed in flow

Sol. (D)

2. Which of the following statement is correct?

(A) The black cotton soil is highly expansive and low shrinkage soil

(B) The water content is defined as mass of water in one C.C. of solids

(C) Field testing for permeability is as reliable as the laboratory tests

(D) The assumptions in Terzaghi's theory also includes the validity of Darcy's law

Sol. (D)

Darcy's law is valid for all hydraulic gradient in assumption of Terazaghi principle.

3. Which of the following statements is FALSE?

(A) Sheet piles are used for twin purpose of load bearing and ground water cutoff

(B) Dowel bars are used to reduce the punching shear of R.C. columns in base foundation for thin columns

(C) The cantilever beams have lesser depth at free end as both S.F. and B.M. are zero at the free edge

(D) Purlins transfer the load of roofing to rafters of a trussed roof

Sol. (D)

4. A soil sample has the following grain size analysis: -

< 2.00 mm – 80%

< 0.66 mm – 60%

< 0.075 mm – 30%

< 0.005 mm – 10%

< 0.002 mm – 2%

The soil is

(A) Uniformly graded (B) Well graded

(C) Skip graded (D) Average graded

Sol. (B)

5. A soil has discharge velocity 6×10^{-7} m/s and a void ration 0.5. Its seepage velocity is

(A) 12×10^{-7} m/s (B) 6×10^{-7} m/s

(C) 3×10^{-7} m/s (D) 18×10^{-7} m/s

Sol. (D)

Porosity = e/1+e

= 0.5/1.5

= 5/15 = 1/3

Seepage discharge = discharge velocity/porosity

$$\frac{6\times10^{-7}}{(1/3)} = 18\times10^{-7}\ \text{m/s}$$

6. The permeability of individual layers of A, B and C of soil in a three layer system is in the ratio of 2, 3 and 1 respectively. The thickness of the layer A, B and C are in the ratio of 2, 1 and 2 respectively. The ratio of average permeability parallel and perpendicular to the bedding planes is

(A) 115/100 (B) 100/115

(C) 90/75 (D) 75/90

Sol. (C)

$$\frac{kx}{ky} = \frac{k_1h_1 + k_2h_2 + k_3h_3}{(h_1 + h_2 + h_3)^2}$$

$$\left(\frac{h_1}{k_1} + \frac{h_2}{k_2} + \frac{h_3}{k_3}\right)$$

$$= \frac{2\times2 + 3\times1 + 1\times2}{2+1+2}\left(\frac{2}{2} + \frac{1}{3}\times\frac{2}{1}\right)$$

$$= \frac{180}{150} = \frac{90}{75}$$

7. A soil sample has been found to have natural moisture content of 40% and liquid limit 60% and plastic limit of 30%. It can be said to posses

(A) Stiff consistency

(B) Medium consistency

(C) Very soft consistency

(D) Soft consistency

Sol. (B)

LL = 60%

PL = 30%

Natural MC = 40%

$I_P = WI - W_1$

= 60 – 30 = 30

Liq. Index = W – PL/I_P

= 40 – 30/30 = 0.33

Classification	Liquidity index
1. Liquid	>1
2. Very soft	0.75-1.0
3. Soft	0.5-0.75
4. Medium stiff	0.25-0.50
5. Stiff	0-0.25
6. Semi solid	<0

8. A soil sample has a shrinkage limit of 15% and specific gravity of soil solids 2.5. The porosity of the soil at shrinkage limit is

(A) 27% (B) 36%

(C) 20% (D) 18%

Sol. (A)

$e = W_S G$

$= 0.15 \times 2.5 = 0.375$

$$n = \frac{e}{1+e} = \frac{0.375}{1.375} = 0.27$$

= 27 %

9. The two criteria for the determination of allowable bearing capacity of a foundation are

(A) Tensile failure and compression failure

(B) Tensile failure and settlement

(C) Bond failure and shear failure

(D) Shear failure and settlement

Sol. (D)

Both determine allowable bearing capacity.

10. Pile caps are used on a group of piles to

(A) Increase the load bearing capacity of each pile

(B) Protect the piles from lateral displacement

(C) Protect the case of offshore structure

(D) Spread the vertical and horizontal loads to all piles.

Sol. (D)

PB MCP SDO 2015 (E)

11. If the volume of voids is equal to the volume of solids in a soil mass, then the values of porosity and void ratio respectively are

(A) 1.0 and 0.0 (B) 0.0 and 1.0

(C) 0.5 and 1.0 (D) 1.0 and 0.5

Sol. (C)

$V_V = V_S$

$$n = \frac{V_V}{V} = \frac{V_V}{V_V + V_S}$$

$$= \frac{1}{2} = 0.5$$

$$\text{void ratio} \quad e = \frac{V_V}{V_S} = 1$$

12. Undisturbed soil samples are required for conducting

(A) hydrometer test

(B) shrinkage limit test

(C) consolidation test

(D) specific gravity test

Sol. (C)

Consolidation test is used to determine the rate and magnitude of soil consolidation when the soil is restrained laterally and loaded axially. The Consolidation test is also referred to as Standard Oedometer test or One-dimensional compression test.

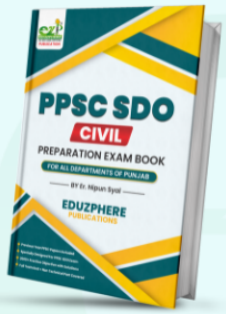
ESTIMATION & COSTING

Chapter

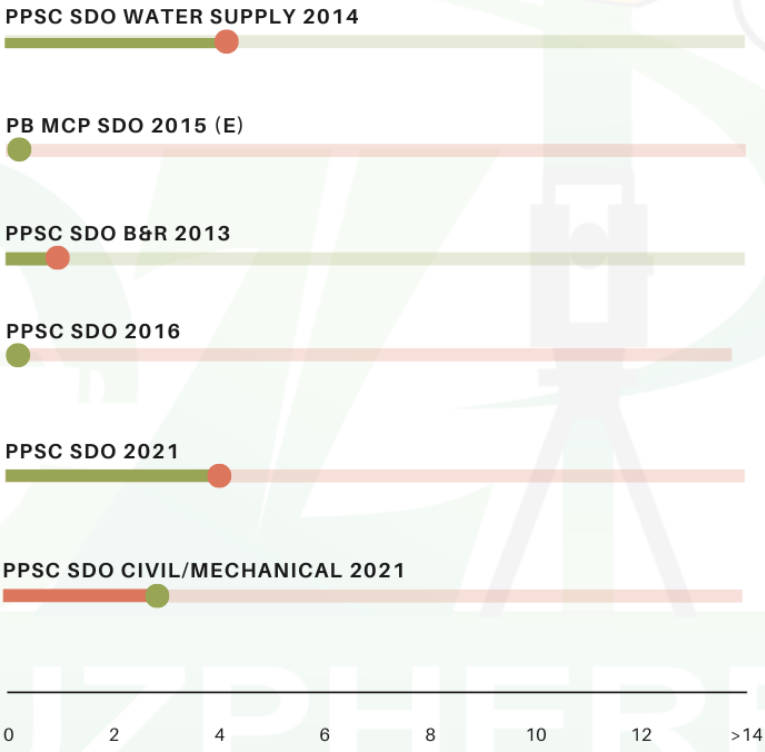
14

EDUZPHERE - ZPHERE OF EDUCATION

Weightage



PPSC SDO CIVIL Estimation & Costing



PPSC SDO WATER SUPPLY 2014

1. The normal earthwork is estimated for

(A) 30m lead and 1 m lift

(B) 30 m lead and 1.5 m lift

(C) 25 m lead and 1.5 m lift

(D) 30 m lead and 2 m lift

Sol. (B)

Normal rate for earth work is for 30m lead & 1.5 m lift.

2. The total cost of brick work masonry is computed by using centre line method. We can compute

1. Total C.L. length (L) of each wall thickness (t) separately
2. The number of junctions are counted (N)
3. The height of walls is important (H)

The total quantity (Q) is___. Choose the correct answer from the following options:

(A) $(L \times t + N)H$

(B) $(L \times t + N \times t)H$

(C) $(L \times t + N \times t \times 0.5)H$

(D) $(L + N)(0.5H \times t)$

Sol. (C)

3. In estimation of cost of R.C.C. work, which of the following choices is wrong?

(A) No deduction is made for volume of reinforcement in R.C.C works

(B) No provision is made for overlapping of bars

(C) The hooks and bent up bars are accounted for

(D) The centering, shuttering and binding of bars are also accounted for

Sol. (C)

4. A machine costs Rs. 16000 by constant rate of declining balance method of depreciation, its salvage value after an expected life of 3 year is Rs. 2000. The rate of depreciation is

(A) 0.25 (B) 0.30

(C) 0.40 (D) 0.50

Sol. (D)

$$\text{Rate of depreciation} = \left(1 - \frac{C_S}{C}\right)^{1/3}$$

$$= \left(1 - \frac{16000}{2000}\right)^{1/3} = 0.5$$

PB SDO B&R 2013

5. Security deposit deducted from different bills of a contractor is

(A) Refunded just before completion of work

(B) Refunded just after completion of work

(C) Refunded after defect liability period

(D) None of the above

Sol. (C)

Security deposit may be refunded without interest after satisfactory completion of work.

PPSC SDO 2021

6. In case of two-bid system, if bidder fails to qualify for technical bid,

(A) the work will be awarded to him.

(B) he may be asked to correct his bid.

(C) his financial bid need not be opened.

(D) he may be asked to resubmit his technical bid.

Sol. (C)

(His financial bid need not to be opened) in double bid system first tender opening officials assign the tender to a technical member (convener) for evaluation of technical bides. Technical members evaluate the technical bids submitted by venders and marks either technically unsuitable against each & every vendor.

At the time of financial bid opertical only those vendors will be considered for evaluation veno had submitted financial bids and found technically suitable by the technical members.

7. The plinth area of building does not include

(A) lift and walls.

(B) internal shaft for sanitary installations.

(C) area of cantilevered porch.

(D) area of walls at floor level.

Sol. (C)

Plinth area is covered built up area measured at the floor level of any storey or at the floor level of the basement.