

Youth Competition Times

UTTAR PRADESH PUBLIC SERVICE COMMISSION

ASSISTANT ENGINEER

&

POLYTECHNIC LECTURER

CIVIL

ENGINEERING

Previous Years Solved Papers

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UPPSC
Uttar Pradesh Public Service Commission
Government of UP, Prayagraj
Combined State Engineering Services Examination
(General Recruitment/Special Recruitment)

Examination Pattern and Syllabus

PRELIMINARY PATTERN

Subject	No. of Questions	Marks	Total Marks	Time
General Hindi	25 (Each question of 2 marks)	50	300	2.00 Hours
General Knowledge	25 (Each question of 2 marks)	50		
Engineering Aptitude	100 (Each question of 2 marks)	200		

MAINS PATTERN

The following two objective type papers will be for the Combined State Engineering Services Examination.

PAPER-I

Subject	No. of Questions	Marks	Total Marks	Time
General Hindi	25 (Each question of 3 marks)	75	375	2.30 Hours
Main Subject (Civil Engg.-I)	100 (Each question of 3 marks)	300		

PAPER-II

Subject	No. of Questions	Marks	Total Marks	Time
General Studies	25 (Each question of 3 marks)	75	375	2.30 Hours
Main Subject (Civil Engg.-II)	100 (Each question of 3 marks)	300		

Personal Examination (Interview) – 100 Marks

Total – 375 + 375 + 100 = 850 Marks

MAINS SYLLABUS

General Hindi – Hindi syllabus will be made in such a way that the candidates under standing of Hindi language and efficient use of words can be checked. Its level will be of high school.

General Studies – The question paper of General Studies will include information focusing on current events and their scientific aspects of such things which come in everyday experience and which can be expected from an educated person. The question paper will also included such questions in the history, politics and geography of India, to which candidates will be able to answer without special study.

CIVIL ENGINEERING PAPER – 1

PART – A

ENGINEERING MECHANICS, STRENGTH OF MATERIALS AND STRUCTURAL ANALYSIS

Units and Dimensions, SI units, vectors, concept of force, Concept of particle and rigid body Concurrent, Non- Concurrent and parallel forces in a plane, moment of force and varignon's theorem free body diagram, conditions of equilibrium Principle of virtual work, equivalent force system.

First and second Moment of area, Mass moment of inertia, Static Friction, inclined plane and bearings, kinematics and kinetics, kinematics in Cartesian and Polar Coordinates, motion under uniform and non-uniform acceleration, motion under gravity, Kinetics of particle: Momentum and Energy principles, D' Alembert's principle, Collision of elastic bodies, rotation of rigid, bodies, simple harmonic motion.

STRENGTH OF MATERIALS

Simple Stress and Strain, Elastic constants, axially loaded compression members, Shear force and bending moment, theory of simple bending, bending stress, Shear Stress, Beams of uniform strength, Leaf Spring, close coiled helical springs, Strain Energy in direct stress, bending & shear. Deflection of beams; Macaulay's method, Mohr's Moment area method, Conjugate beam method, unit load method, Torsion of shafts, Transmission of power, Elastic stability of columns, Euler's Rankin's and Secant formulae. Principal stresses and strains in two dimensions, Mohr's Circle, Theories of Elastic Failure, Thin and Thick cylinder, Stresses due to internal and external pressure- Lame's equations.

STRUCTURAL ANALYSIS

Castiglano's theorems I and II, Unit load method of consistent deformation applied to beams and pin jointed trusses. Slope-deflection, moment distribution, Kani's method of analysis and column Analogy method applied to indeterminate beams and rigid frames. Rolling loads and influence lines: Influence lines for reactions of beam, shear force and bending moment at a section of beam criteria for maximum shear force and bending moment in beams traversed by a system of moving loads, influence lines for simply supported plane pin jointed trusses, Arches : Three hinged, two hinged and fixed arches, rib shortening and temperature effects, influence lines in arches, Matrix methods of analysis: Force method and displacement method of analysis of indeterminate beams and rigid frames. Plastic Analysis of beams and frames: Theory of plastic bending, plastic analysis, statical method, Mechanism method. Unsymmetrical bending: Moment of inertia, product of inertia, position of neutral axis and principal axis, calculation of bending stresses.

PART – B

DESIGN OF STRUCTURES : STEEL, CONCRETE AND MASONRY STRUCTURES.

STRUCTURAL STEEL DESIGN

Structural steel: Factors of safety and load factors, riveted, bolted and welded joints and its connections, Design by working stress/limit state method of tension and compression member, beams of built up section, riveted and welded plate girders, gantry girders, stanchions with battens and lacings, slab and gussetted column bases, Design of highway and railway bridges: Through and deck type plate girder, Warren girder, Pratt truss.

DESIGN OF CONCRETE AND MASONRY STRUCTURES

Reinforced Concrete: Working Stress and Limit State Method of design-Recommendations of B.I.S. codes, design of one way and two way slabs, stairs-case slabs, simple and continuous beams of rectangular, T and L sections, compression members under direct load with or without eccentricity, isolated and combined footings, Cantilever and counter-fort type retaining walls, Water tanks: Design requirements as per B.I.S. code for rectangular and circular tanks resting on ground, Pre-stressed concrete: Methods and systems of pre-stressing, anchorages, analysis and design of sections for flexure based on working stress, losses of pre-stress, Earth quake resistant design of building as per BIS code. Design of brick masonry as per I. S. Codes, Design of masonry retaining walls.

PART – C

Building Materials, Construction Technology, Planning and Management Building Materials

Physical properties of construction materials with respect to their use: stones bricks, tiles, lime, glass, cement, mortars, Concrete, concept of mix design, Pozzolans, plasticizers, super plasticizers, Special concrete: roller compacted concrete, mass concrete, self compacting concrete, Ferro cement, Fiber reinforced concrete, high strength concrete, high performance concrete, Timber: properties, defects and common preservation treatments, Use and selection of materials for various uses e.g. Low cost housing, mass housing, high rise buildings.

Constructions Technology, Planning and Management

Masonry constructions using brick, stone, construction detailing and strength characteristics paints, varnishes, plastics, water proofing and damp proofing materials. Detailing of walls, floors, roofs, staircases, doors and windows. Plastering, pointing, flooring, roofing and construction features. Retrofitting of buildings, Principle of planning of building for residents and specific uses, National Building code provisions and uses. Basic principles of detailed and approximate estimating, specifications, rate analysis, principles of valuation of real property. Machinery for earthwork, concreting and their specific uses, factors affecting selection of construction equipments, operating cost of equipments. Construction activity, schedules, organizations, quality assurance principles. Basic principle of network CPM and PERT uses in construction monitoring, cost optimization and resource allocation. Basic principles of economic analysis and methods. Project profitability: Basis principles of financial planning, simple toll fixation criterions.

PART – D

GEO TECHNICAL ENGINEERING AND FOUNDATION ENGINEERING

Types of soils, phase relationships, consistency limits particles size distribution, classifications of soils, structure and clay mineralogy. Capillary water, effective stress and pore water pressure, Darcy's Law, factors affecting permeability, determination of permeability, permeability of stratified soil deposits. Seepage pressure, quick sand condition, compressibility and consolidation, Terzaghi's theory of one dimensional consolidation, consolidation test.

Compaction of soil, field control of compaction total stress and effective stress parameters, pore pressure parameters, shear strength of soils, Mohr Coulomb failure theory, shear tests.

Earth pressure at rest, active and passive pressures, Rankin's theory Coulomb's wedge theory, Graphical method of earth pressure on retaining wall, sheetpile walls, braced excavation, bearing capacity, Terzaghi and other important theories, net and gross bearing pressure.

Immediate and consolidation settlement, stability of slope, total stress and effective stress methods, conventional methods of slices, stability number.

Subsurface exploration, methods of boring, sampling, penetration tests, pressure meter tests, essential features of foundation, types of foundation, design criteria, choice of type of foundation, stress distribution in soils, Boussinessq's theory, Westergaard method, Newmark's chart, pressure bulb, contact, pressure, applicability of different bearing capacity theories, evaluation of bearing capacity from field tests, allowable bearing capacity, settlement analysis, allowable settlement, proportioning of footing, isolated and combined footings, rafts, pile foundation, types of piles, piles capacity, static and dynamic analysis, design of pile groups, pile load test, settlement of piles lateral loads, foundation for bridges, Ground improvement techniques: sand drains, stone columns, grouting, soil stabilization geotextiles and geomembrane, Machine foundation: Natural frequency, design of machine foundations based on the recommendation of B.I.S. codes.

CIVIL ENGINEERING PAPER- II

Part – A

FLUID MECHANICS, OPEN CHANNEL FLOW, HYDRAULIC MACHINES AND HYDROPOWER ENGINEERING

Fluid Mechanics: Fluid properties and their roles in fluid motion, fluid statics including forces acting on plane and curved surfaces, Kinematics and Dynamics of Fluid flow:

Velocity and acceleration, stream lines, equation of continuity, irrotational and rotational flow, velocity potential and stream functions, flownet, methods of drawing flownet, source and sink, flow separation, free and forced vortices.

Flow control volume equation, continuity, momentum and energy equations, Navier-Stokes equation, Euler's equation of motion and application to fluid flow problems, pipe flow, plane, curved, stationary and moving vanes sluice gates, weirs, orifice meters and Venturi meters.

Dimensional Analysis and Similitude: Buckingham's Pi-theorem, dimensionless parameters, similitude theory, model laws, undistorted and distorted models.

Laminar Flow: Laminar flow between parallel, stationary and moving plates, flow through pipes.

Boundary Layer: Laminar and turbulent boundary layer on a flat plate, laminar sub-layer, smooth and rough boundaries, submerged flow, drag and lift and its applications.

Turbulent flow through pipes: Characteristics of turbulent flow, velocity distribution, pipe friction factor, hydraulic grade line and total energy line, siphons, expansion and contractions in pipes pipe networks, water hammer in pipes and surge tanks.

Open Channel Flow: Flow types, uniform and non uniform flows, momentum and energy correction factors, Specific energy and specific force, critical depth, resistance equations and roughness coefficient, rapidly varied flow, flow in transitions, Brink flow, Hydraulic jump and its applications, waves and surges, gradually varied flow, classification of surface profiles, control section, Integration of varied flow equation and their solution.

HYDRAULIC MACHINES AND HYDROPOWER

Centrifugal pumps-Types, characteristics, Net Positive Suction-head (NPSH), specific speed, Pumps in series and parallel.

Reciprocating pumps, Air vessels, Hydraulic ram, efficiency parameters, Rotary and positive displacement pumps, diaphragm and jet pumps.

Hydraulic turbines: types, classification, Choice of turbines, performance parameters, controls, characteristics, specific speed.

Principles of hydropower development: Types, layouts and component works, surge tanks, 'types and choice, Flow duration curves and dependable flow, Storage and pondage, Pumped storage plants, Special types of hydel plants.

Part – B

Hydrology and Water Resources Engineering

Hydrology: Hydrologic cycle, precipitation, evaporation, transpiration, infiltration, overland flow, hydrographs, flood frequency analysis, flood routing through a reservoir, channel flow routing- Muskingam method.

Ground Water flow: Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, radial flow into a well under confined and unconfined conditions, Open wells and tube wells.

Ground and surface water resources single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation.

Water requirements of crops consumptive use, duty and delta, irrigation methods, Irrigation efficiencies.

Canals: Distribution systems for cannal irrigation, canal capacity, canal losses, alignment of main and distributory canals, Design of cannal by kennedy's and Lacey's theorie, Water logging and its prevention.

Diversion head works: Components, Principles and design of weirs on permeable and impermeable foundations, Khosla's theory, Bligh's creep theory Storage works.

Cross drainage works.

Types of dams, design principles of gravity and earth dams, stability analysis. Spillways: Spillway types energy dissipation.

River training: Objectives of river training, methods of river training and bank protection.

Part – C Transportation Engineering

Highway Engineering: Principles of Highway alignments, classification and geometric design, elements and standards for roads. Pavement: flexible and rigid pavements Design principles and methodology. Construction methods and materials for stabilized soil. WBM, Bituminous works and Cement Concrete roads.

Surface and sub-surface drainage arrangements for roads, culvert structures. Pavement distresses and strengthening by overlays.

Traffic surveys and their application in traffic planning, Typical design features for channelized, intersection, rotary etc., signal designs, standard traffic signs and markings.

Railway Engineering: Permanent way, ballast, sleeper, chair and faslenings, points, crossings, different types of turn outs, cross-over, setting out of points, Maintenance of track, super elevation, creep of rails ruling gradients, track resistance tractive effort, curve resistance, Station yards and station buildings, platform sidings, turn outs, Signals and interlocking, level crossings.

Air port Engineering: Layouts, Planning and design.

Part – D Environmental Engineering

Water supply: Estimation of water demand, impurities in water and their significance, physical, chemical and bacteriological parameters and their analysis, waterborne diseases, standards for potable water.

Water collection & treatment: Intake structures, principles and design of sedimentation tank, coagulation cum flocculation units slow sand filter, rapid sand filter and pressure filter, theory & practices of chlorination, water softening, removal of taste and salinity, Sewerage Systems, Domestic and industrial wastes, storm, sewage, separate and combined systems, flow through sewers, design of sewers.

Waste water characterization: Solids, Dissolved oxygen (DO), BOD COD, TOC, and Nitrogen, Standards for disposal of effluent in normal water course and on to land.

Waste water treatment: Principles and design of wastewater Treatment units--Screening, grit chamber, sedimentation tank activated sludge process, trickling filters, oxidation ditches, oxidation ponds, septic tank; Treatment and disposal of sludge; recycling of waste water.

Solid waste management: Classification, Collection and disposal of solid waste in rural and urban areas, Principles of solid waste management.

Environmental pollution: Air and water pollution and their control acts. Radioactive waste and their disposal Environmental impact assessment of Thermal power Plants, mines and river valley projects, Sustainable development.

Part – E Survey and Engineering Geology

(a) **Surveying:** Common methods and instruments for distance and angle measurements in Civil Engineering works, their use in plane table traverse survey, levelling, triangulation, contouring and topographical maps. Survey layouts for culverts canal, bridge, roads, railway alignment and buildings.

Basic principles of photogrammetry and remote sensing.

Introduction to Geographical information system.

Engineering Geology :

Basic concepts of Engineering geology and its applications in projects such as dams, bridges and tunnels.



Uttar Pradesh Public Service Commission

Assistant Engineer (Mains) Civil Exam-2024

Paper-I

Part-I General Hindi

1. निम्नलिखित में से 'पर्वत' के ऊपर की समतल भूमि' वाक्यांश के लिए एक शब्द है:

(a) अधित्यका (b) उपत्यका
(c) अथाह (d) आधिपत्य

Ans. (a) : पर्वत के ऊपर के समतल भूमि वाक्यांश के लिए एक शब्द अधित्यका है जबकि 'पर्वत' के पास की भूमि' वाक्यांश के लिए एक शब्द 'उपत्यका' होगा।

2. 'अन्वीक्षण' का संधि-विच्छेक है:

(a) अनु + इक्षण (b) अनु + ईक्षण
(c) अन् + इक्षण (d) अना + ईक्षण

Ans. (b) : 'अन्वीक्षण' का संधि - विच्छेद 'अनु + ईक्षण' है, यह यण संधि का उदाहरण है। यण संधि- यदि ई, इ, उ, ऊ और ऋ के बाद कोई भिन्न स्वर आए, तो इनका परिवर्तन क्रमशः इ, ई का य, उ, ऊ का व और ऋ का र में हो जाता है।

3. वाक्यांश के लिए उपयुक्त शब्द की दृष्टि से निम्नलिखित युग्मों में से गलत युग्म की पहचान कीजिए:

(a) जो जीता न जा सके - अजेय
(b) अण्डे से जन्म लेने वाला - अण्डज
(c) जिसकी थाह न मिले - अथाह
(d) जिसके पास कुछ न हो - निर्धन

Ans. (d) : 'जिसके पास कुछ न हो - निर्धन' वाक्यांश के लिए उपयुक्त शब्द की दृष्टि की असंगत युग्म है। इसका संगत युग्म होगा 'जिसके पास कुछ न हो-अकिञ्चन'। अन्य सभी युग्म संगत हैं।

4. 'विभागाध्यक्ष' शब्द में समास है:

(a) करण तत्पुरुष
(b) कर्मधारय
(c) सम्प्रदान तत्पुरुष
(d) संबंध तत्पुरुष

Ans. (d) : 'विभागाध्यक्ष' शब्द का समास विग्रह 'विभाग का अध्यक्ष' होगा। अतः यह संबंध तत्पुरुष समास का उदाहरण है। संबंध तत्पुरुष- संबंध तत्पुरुष समास वह समास है जिसमें दो संज्ञाएँ आपस में संबंध दर्शाती हैं और का, के, की, जैसे चिह्न विग्रह के समय आते हैं, जबकि समस्त पद बनाते समय लुप्त हो जाते हैं।

5. 'कृत्' प्रत्यय किसके साथ जुड़ते हैं?

(a) क्रिया अथवा धातु के
(b) सर्वनाम के
(c) संज्ञा के
(d) विशेषण के

Ans. (a) : क्रिया या धातु के अंत में प्रयुक्त होने वाले प्रत्ययों को 'कृत्' प्रत्यय कहते हैं और उनके मेल से बने शब्द को 'कृदंत' जबकि संज्ञा, सर्वनाम और विशेषण के अंत में लगने वाले प्रत्ययों को 'तद्दित' कहा जाता है।

6. 'उल्लंघन' शब्द में कौन-सा उपसर्ग है?

(a) उ (b) उल्
(c) उल्ल (d) उत्

Ans. (d) : 'उल्लंघन' शब्द में उत् उपसर्ग है।

उपसर्ग- उपसर्ग उस शब्दांश या अव्यय को कहते हैं, जो किसी शब्द के पहले आकर उसका विशेष अर्थ प्रकट करता है।

7. निम्नलिखित विकल्पों में से सुमेलित नहीं है:

(a) ईद का चाँद-बहुत दिनों बाद दिखाई देने वाला
(b) आधा तीतर आधा बटेर-एक जैसी चीजों का सम्मिश्रण होना
(c) एक आने के बर्तन-सब एक जैसे
(d) उल्टे बैंस बरेली को -विपरीत कार्य करना

Ans. (b) : 'आधा तीतर आधा बटेर' - एक जैसी चीजों का सम्मिश्रण होना 'लोकोक्ति' और अर्थ का सही सुमेलन नहीं है, इसका संगत अर्थ 'बेढ़ंग' अथवा बेमेल होगा जबकि अन्य सभी युग्म संगत हैं।

8. 'सिव ब्रोही मम दास कहावा। सो नर सपनेहुँ मोहि न भावा। संकर बिमुख भगति चह मोरी। सो नारकीय मूढ़ मति थोरी।' उपर्युक्त काव्यांश में कौन-सा छंद है?

(a) बरवै (b) दोहा
(c) सोरठा (d) चौपाई

Ans. (d) : प्रश्नगत काव्यांश में 'चौपाई' छंद है।

चौपाई- यह मात्रिक सम छंद है। इसके प्रत्येक चरण में 16 मात्राएँ होती है।

बरवै- यह मात्रिक अर्द्धसम छंद है। इस छंद के विषम चरणों (प्रथम और तृतीय) में 12 और सम चरणों (दूसरे और चौथे) में 7 मात्राएँ होती है।

दोहा- यह मात्रिक अर्द्धसम छंद है। इस छंद के विषम चरणों (प्रथम और तृतीय) में 13 मात्राएँ और सम चरणों (द्वितीय और चतुर्थ) में 11 मात्राएँ होती है।

9. निम्नलिखित में से 'छछूँदर से सिर पर चमेली का तेल' लोकोक्ति का अर्थ है:

(a) अयोग्य व्यक्ति को अपमानित करना
(b) अयोग्य व्यक्ति को अच्छी चीज मिलना
(c) कुरुप काया को सुगंध के द्वारा सुंदर बनाने का प्रयास करना
(d) छछूँदर को मारने के बजाय उसे बचाना

22. निम्नलिखित में से 'कर्पट' शब्द का तद्दव रूप है:

(a) कडुआ (b) कपूर
(c) कपड़ा (d) कपट

Ans. (c) : 'कर्पट' शब्द का तद्दव रूप 'कपड़ा' है तथा 'कर्पूर' शब्द का तद्दव रूप 'कपूर' होगा।

23. 'इतिवृत्त' शब्द के लिए निम्नलिखित में से कौन-सा एक वाक्यांश प्रयोग किया जाता है?

(a) किसी देश या समाज के सार्वजनिक क्षेत्र की घटनाओं, तथ्यों आदि का विवरण
(b) किन्हीं घटनाओं का कालक्रम में किया गया यथात्थ वर्णन
(c) घटनाओं को बढ़ा-चढ़ाकर बताने वाला
(d) इतिहास का जानकार

Ans. (b) : किन्हीं घटनाओं का कालक्रम में किया गया यथात्थ वर्णन वाक्यांश के लिए एक शब्द 'इतिवृत्त' होगा जबकि किसी देश या समाज के सार्वजनिक क्षेत्र की घटनाओं, तथ्यों आदि का विवरण के लिए एक शब्द - समाचार होगा तथा इतिहास का जानकार - इतिहासज्ञ कहलाता है।

24. निम्नलिखित में से 'चिकुर' शब्द का अर्थ है:

(a) केश (b) रंग
(c) दृष्टि (d) हाथ

Ans. (a) : 'चिकुर' शब्द का अर्थ-सिर के बाल, केश है।

25. निम्नलिखित में से एक 'देशज' शब्द नहीं है:

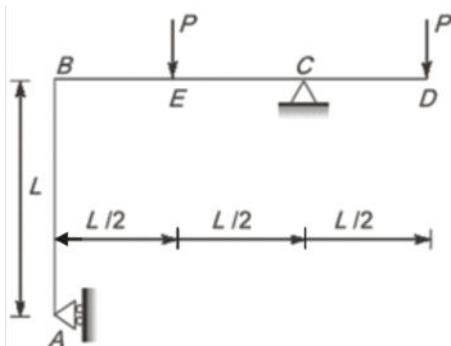
(a) कटोरा (b) फुनगी
(c) लोटा (d) फैसला

Ans. (d) : 'फैसला' देशज शब्द नहीं है, बल्कि यह एक विदेशज शब्द है, जो फारसी भाषा से आया है। जबकि कटोरा, फुनगी तथा लोटा देशज शब्द हैं।

Part-II Civil Engineering

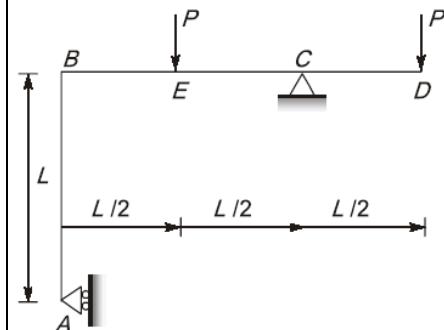
1. A frame ABCD is supported by a roller at 'A' and is on a hinge at 'C' as shown in the figure the reaction at the roller end 'A' is:

एक फ्रेम ABCD को 'A' पर एक रोलर और 'C' कब्जे (हिंज) द्वारा समर्थित (support) किया गया है जैसा कि चित्र में दिखाया गया है। रोलर छोर 'A' पर प्रतिक्रिया होगी—



(a) 2 P (b) P
(c) P/2 (d) Zero/शून्य

Ans. (d) :



Find reaction at the roller end 'A'-
Sum of moment about $\Sigma M_C = 0$

$$R_A \times \left(\frac{L}{2} + \frac{L}{2}\right) - P \times \frac{L}{2} + P \times \frac{L}{2} = 0$$

$$R_A \times L - P \times \frac{L}{2} + P \times \frac{L}{2} = 0$$

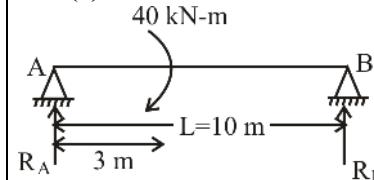
$$R_A = 0$$

2. A beam 10 m long, hinged at both ends is subjected to a clockwise moment of 40 kNm at a distance of 3 m from one end. Shear force at centre of beam is:

एक 10 m लंबी धरन, जो दोनों सिरे पर कब्जे द्वारा लगी है, को एक सिरे से 3 m की दूरी पर 40 kNm का दक्षिणावर्त (घड़ी की दिशा में) बल-आघूर्ण लगा है। धरन केन्द्र पर कर्तन (अपरूपण) बल कितना होगा?

(a) 4 kN (b) 6 kN
(c) 3 kN (d) 2 kN

Ans. (a) :



Find shear force at centre of beam is = ?

Apply equilibrium equation-

(i) $\Sigma F_V = 0$ $R_A + R_B = 0 \quad \dots \dots \text{(i)}$

(ii) $\Sigma M_A = 0$

$R_B \times 10 - 40 = 0$

$R_B \times 10 = 40$

$R_B = 4 \text{ kN}$ and $R_A = -4 \text{ kN} \rightarrow$ downward direction

$SF_B = 4 \text{ kN}$ (down ward)

$SF_{\text{at (centre)}} = 4 \text{ kN}$ (down ward)

$SF_{\text{at (A)}} = 4 \text{ kN}$ (up ward)

Shear force at centre of beam = 4kN

3. The angular velocity (in rad/s) of a body rotating at 'N' revolutions per minute is _____.

प्रति मिनट 'N' चक्कर पर घूमने वाले पिण्ड का कोणीय वेग (rad/s में) है।

(a) $2\pi N/60$ (b) $\pi N/60$
(c) $\pi N/180$ (d) $2\pi N/180$

Ans. (a) : Complete angle in one revolution = 2π
 in N revolution per minute angle complete = $2\pi N$ Rad/Min
 Angular velocity $\left[\omega = \frac{2\pi N}{60} \right]$ rad/sec
 N = Revolution / min

4. The permissible load for short column with helical reinforcement shall be _____ times as compared to load in a similar member with lateral ties.

कुंडलित सुदृढीकरण वाले लघु स्तंभ के लिए अनुज्ञेय (स्वीकार्य) भार पार्श्व छल्ले वाले समान अवयव में भार की तुलना में गुना होगा।

(a) 1.41 (b) 2
 (c) 1.05 (d) 1.01

Ans. (c) : According to IS : 456 : 2000 clause 39.4. The permissible load for a short column with helical reinforcement is increased by 5% compared to a column with lateral ties. So permissible load factor is 1.05.

5. In T-section ISNT 100, 100 represents _____ of tee bar (in mm).

T-section — ISNT 100, 100 टी बार की का प्रतिनिधित्व करता है (mm में)

(a) Length/लम्बाई
 (b) Depth/गहराई
 (c) Width/चौड़ाई
 (d) None of the above/उपर्युक्त में से कोई नहीं

Ans. (b) :

T-section \rightarrow ISNT 100 represent-
 ISNT \rightarrow Indian standard normal tee section
 and 100 represent depth of section (mm).

6. According to IS 456, the maximum strain in concrete at the outermost compression fibre is taken as :

IS 456 के अनुसार, सबसे बाहरी संपीड़न फाइबर पर कंक्रीट में अधिकतम तन्यता (विकृति) हो सकती है।

(a) 0.002 (b) 0.003
 (c) 0.0035 (d) 0.0025

Ans. (c) : According to IS : 456 : 2000 (Clause no. 38.1) the maximum strain in concrete at the outermost compression fibre is taken as 0.0035 in bending.

As per IS 456 : 2000 clause no. 39.1 the maximum compressive strain in concrete in axial compressive is taken as 0.002.

7. According to IS 456, spacing of longitudinal bars measured along the periphery of the column shall not exceed _____ mm.

IS 456 के अनुसार, स्तंभ (कॉलम) की परिधि के साथ मापी गई अनुदैर्घ्य बार (सलाखों) की दूरीmm से अधिक नहीं होगी।

(a) 250 (b) 300
 (c) 350 (d) 200

Ans. (b) : As per IS 456 : 2000, clause 26.5.3.1, spacing of longitudinal bars measured along the periphery of the column should not exceed 300 mm.

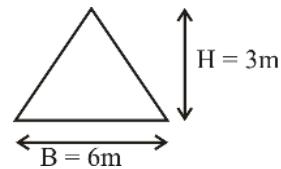
- A reinforcement column having helical reinforcement shall have at least six bars of longitudinal reinforcement within the helical reinforcement.

8. Moment of inertia of a triangle of base 6 m and height 3 m is _____ m^4 .

एक त्रिभुज जिसका आधार 6 m और ऊँचाई 3 m है, का जड़त्व आधूर्ण m^4 होगा।

(a) 13.5 (b) 27.0
 (c) 9.0 (d) 4.5

Ans. (*) :



Moment of inertia of a triangle about its C.G.—

$$I_G = \frac{BH^3}{36}$$

$$= \frac{6 \times 3^3}{36} = 4.5 \text{ } m^4$$

Moment of inertia of a triangle about its base—

$$I_{\text{base}} = \frac{BH^3}{12} = \frac{6 \times 3^3}{12} = 13.5 \text{ } m^4$$

9. As per IS 456, maximum shear stress (τ_c max) is _____ N/mm² for concrete grade of M40 and above.

IS 456 के अनुसार, कंक्रीट ग्रेड M40 और उससे ऊपर के लिए अधिकतम कर्तन (अपरूपण) प्रतिबल (τ_c max) N/mm² होगा।

(a) 2.5 (b) 1.5
 (c) 3.0 (d) 2.0

Ans. (a) : As per IS 456 : 2000, table 20. The maximum shear stress ($\tau_{c,\text{max}}$) for concrete-

Grade Concre- te	M15	M20	M25	M30	M35	M40 and above
τ_c max N/mm ² (LSM)	2.5	2.8	3.1	3.5	3.7	4.0
τ_c max N/mm ² (WSM)	1.6	1.8	1.9	2.2	2.3	2.5

10. A structure is to be constructed where basic wind speed is 47 m/s, risk factor = 1.0, terrain and size factor = 0.98, topographic factor = 1. Basic wind pressure will be _____ N/mm² (approximately).

एक संरचना का निर्माण वहाँ किया जाना है जहाँ मूल वायु की गति 47 m/s है, जोखिम कारक = 1.0 भूभाग और आकार कारक = 0.98, स्थलाकृति कारक = 1 है।

मूल वायु दबाव N/mm^2 होगा (लगभग)

(a) 2120 (b) 46
(c) 1272 (d) 15.6

Ans. (c) : Given,

$V_b = 47 \text{ m/sec}$

Risk factor $k_1 = 1.0$

Terrain & size factor $k_2 = 0.98$

topographic factor (k_3) = 1

$$\text{Design wind speed } (v_z) = v_b \times k_1 \times k_2 \times k_3 \\ = 47 \times 1 \times 0.98 \times 1 = 46.06$$

$$\text{Design wind pressure } P_z = 0.6 V_z^2 = 0.6 \times (46.06)^2 \\ = 1272.91 \text{ N/mm}^2$$

11. In reinforced concrete beam, concrete is assumed to take no.....

प्रबलित कंक्रीट बीम में, यह माना जाता है कि कंक्रीट _____ नहीं लेगा।

(a) Shear/कर्तन (अपरूपण)
(b) Tension/तनाव
(c) Compression/संपीड़न
(d) None of the above/उपर्युक्त में से कोई नहीं

Ans. (b) : In reinforced concrete beam, concrete is assumed to take no tension and therefore only resist compressive forces and the steel reinforcement take all the tensile forces.

12. For connecting lacing flats to column sections with 18 mm diameter bolt, the minimum width of flat should be _____ mm.

18 mm व्यास बोल्ट के साथ लेसिंग फ्लैट्स को स्तंभ खण्ड से जोड़ने के लिए, फ्लैट की न्यूनतम चौड़ाई mm होनी चाहिए।

(a) 60 (b) 59
(c) 54 (d) 36

Ans. (c) : According to IS 800:2007

Dia of bolt	Min width of flat
16 mm	50 mm
18 mm	55 mm
20 mm	60 mm
22 mm	65 mm

The minimum width of lacing bars as per IS 800:2007 for bolted/riveted construction 3d.

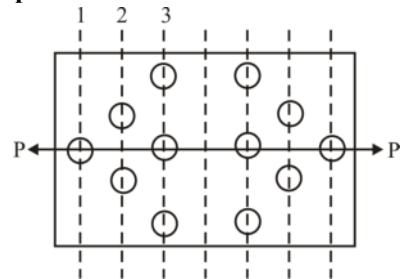
13. In a bolted connection, _____ pattern will give maximum efficiency.

बोल्टेड संयोजन (जुड़ाव) में, नमूना (पैटर्न) अधिकतम दक्षता होगा।

(a) Chain/चेन
(b) Staggered/टेंडा-मेडा (स्टैगर्ड)
(c) Diamond/डायमण्ड
(d) None of the above/उपर्युक्त में से कोई नहीं

Ans. (c) : In a bolted connection, diamond pattern will give maximum efficiency.

Diamond pattern-



• The diamond pattern is most efficient and economical.

• Maximum efficiency $\eta = \frac{\text{Strength of joint}}{\text{Strength of plate}} \times 100$

14. A steel plate is 30 cm wide and 10 mm thick. If the diameter of the bolt hole is 20 mm, then the net section area of the plate is _____ cm^2 .

एक इस्पात (स्टील) प्लेट 30 cm चौड़ी एवं 10 mm मोटी है। यदि बोल्ट छिद्र का व्यास 20 mm है, तो प्लेट का शुद्ध (net) काट क्षेत्रफल _____ cm^2 है।

(a) 280 (b) 300
(c) 28 (d) 32.42

Ans. (c) : Given,

$$d = 2 \text{ cm} = 20 \text{ mm}$$

$$B = 30 \text{ cm} = 300 \text{ mm} \quad t = 10 \text{ mm}$$

$$\text{Net section area} = (B - n d_o) \times t$$

$$\text{Diameter of one rivet hole } (d_o) = (20 + 1.5) \\ = 21.5 \text{ mm}$$

$$\text{Net sectional area} = (300 - 21.5) \times 10$$

$$= 278.5 \times 10$$

$$= 2785 \text{ mm}^2$$

$$\approx 2800 \text{ mm}^2$$

$$= 28 \text{ cm}^2$$

15. Butt weld is also known as

बट वेल्ड को भी कहते हैं।

(a) Lap weld/लैप वेल्ड
(b) Green weld/ग्रीन वेल्ड
(c) Groove weld/ग्रूव वेल्ड
(d) None of the above/उपर्युक्त में से कोई नहीं

Ans. (c) :

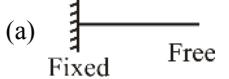
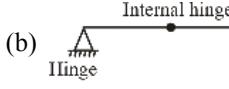
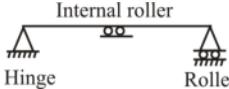
- Butt weld is also known as groove weld.
- A square butt weld is provided for section up to 8mm thickness only.
- For sections with thickness greater than 8mm, a single U, V or double U, V etc. butt weld are provided.
- Butt weld is mainly designed for direct compression or tension and occasionally for shear also.
- The advantage with butt weld is that it involves no change in section at the location of joint and is thus the most preferred type of weld for transmitting alternating stresses.

16. In a conjugate beam, the free end of a real (actual) beam will become the _____ end.

एक संयुगमी धरन में, एक वास्तविक धरन का मुक्त छोर बन जाएगा।

(a) Hinged/हिंज्ड (b) Free/मुक्त
(c) Fixed/स्थिर (फिक्स्ड)
(d) None of the above/उपर्युक्त में से कोई नहीं

Ans. (c) :

Conjugate beam	Real beam
(a) 	
(b) 	

17. The top chord of a roof truss is inclined at an angle of 22° . No access is provided for maintenance. The live load to be considered for design will be _____ kN/m².

एक छत कैंची का शीर्ष कॉर्ड (ऊपरी सिरा) 22° के एक कोण पर झुका हुआ है। रखरखाव के लिए पहुँच प्रदान नहीं है। डिजाइन के लिए चल भार kN/m² होगा।

(a) 0.75 (b) 0.61
(c) 1.50 (d) Zero/शून्य

Ans. (*) : As per IS 875 (Part -2), when the slope of a roof is greater than 10° and access is not provided, the live load to be considered is 0.75 kN/m^2 less 0.02 kN/m^2 for every degree increase in slope over 10° .

$$\text{Live load} = 0.75 - (22^\circ - 10^\circ) \times 0.02$$

$$= 0.75 - 12 \times 0.02 \\ = 0.51 \text{ kN/m}^2$$

18. As per IS 456, the ratio of allowable bond stress in tension in deformed bars to that of plain bars is about:

IS 456 के अनुसार, तनाव में विकृत छड़ों में स्वीकार्य बंधन प्रतिबल का सादे छड़ों में स्वीकार्य बंधन प्रतिबल से अनुपात लगभग है।

(a) 1.2 (b) 1.3
(c) 1.6 (d) 1.4

Ans. (c) : According to clause 26.2.1.1 of IS 456 : 2000, the design bond stress value for plain bar shall be increased by 60% for deformed bars. So ratio of 1.6.

19. When geotextiles are placed under water, the minimum overlap should be _____ mm.

जब जियोटेक्स्टाइल्स को जल के नीचे रखा जाता है, तो न्यूनतम अतिव्यापन (ओवरलैप) mm होना चाहिए।

(a) 750 (b) 600
(c) 900 (d) 450

Ans. (c) : The geotextiles are placed under water, the minimum overlap should be 900 mm.

- Geotextiles have a high tensile strength. These can be used to increase local carrying capacity.
- Geotextiles are used as reinforcement in the soil which is poor in tension but good in compression.

20. If flownet of a cofferdam foundation has $H = 6 \text{ m}$, $N_f = 6$, $N_d = 18$ and $K = 4 \times 10^{-5} \text{ m/min}$, then discharge (in m^3/day) per m length will be _____.

यदि एक कॉफरडम नींव के प्रवाह जाल में $h = 6 \text{ m}$, $N_f = 6$, $N_d = 18$ और $K = 4 \times 10^{-5} \text{ m/min}$ है, तो उसका रिसन विसर्जन (m^3/day में) प्रति m लंबाई होगा।

(a) 1.2304 (b) 2.304
(c) 0.1152 (d) 1.0368

Ans. (c) : Given,

$$H = 6 \text{ m}$$

$$N_f = 6$$

$$N_d = 18$$

$$K = 4 \times 10^{-5} \text{ m/min}$$

We know that,

$$Q = KH \frac{N_f}{N_d} [\text{Discharge per meter length}]$$

$$Q = 4 \times 10^{-5} \times 6 \times \frac{6}{18}$$

$$Q = 8 \times 10^{-5} \frac{\text{m}^3}{\text{min}} \quad [1 \text{ day} = 24 \times 60 \text{ min}]$$

$$Q = 8 \times 10^{-5} \times 60 \times 24 \text{ m}^3/\text{day}$$

$$Q = 0.11520 \text{ m}^3/\text{day}$$

21. Test pit in a plate load test at foundation level is generally of width _____ times the test plate.

प्लेट लोड परीक्षण में नींव तल पर परीक्षण गर्त की, परीक्षण प्लेट से सामान्यतः चौड़ाई गुना होती है।

(a) 3 (b) 6
(c) 4 (d) 5

Ans. (d) :

- The allowable bearing pressure can be determined by conducting a plate load test at site.
- It conduct a plate load test, a pit of the size $5B_p \times 5B_p$ where B_p is the size of the plate is excavated to a depth equal to the depth of foundation (D_f).
- Test pit in a plate load test at foundation level is generally of width 5 times the test plate.

22. Electro-osmosis for a clayey soil generally leads to:

चिकनी मिट्टी (मृत्तिका) के लिए विद्युत-परासरण से सामान्यतः होती है—

(a) Increase in water content/जलांश में वृद्धि
(b) Increase in plasticity/सुधृद्यता में वृद्धि

(c) Decrease in shear strength/कर्तन (अपरुपण)
सामर्थ्य में कमी

(d) Increase in shear strength/कर्तन (अपरुपण)
सामर्थ्य में वृद्धि

Ans. (d) : Electro-osmosis is a ground improvement technique often used for soft clay soil.

- In this applying on electric current to the soil which cause water move to negative electrode and away from positive electrode. The process lead to reduction of water content and consolidation of soil (clay) then increase shear strength of soil (clay).
- Electro-osmosis also helps in increasing the shear strength of the cohesive soil.

23. For a standard proctor compaction test, the mass of hammer (in kg) and drop of hammer (in mm) are respectively:

मानक प्रॉक्टर संहनन (संधनन) परीक्षण के लिए, हथौड़े का द्रव्यमान (kg में) और हथौड़े का ड्रॉप (पात) (mm में) क्रमशः हैं—

(a) 2.6 and 450/2.6 और 450
(b) 4.5 and 310/ 4.5 और 310
(c) 4.89 and 450/4.89 और 450
(d) 2.6 and 310/2.6 और 310

Ans. (d) :

	Standard proctor compaction Test	Modified proctor composition Test
1.	Mass of hammer (in kg)	2.6 kg
2.	Drop of hammer (mm)	310 mm
3.	No. of layer	3
4.	No. of flow	25
5.	Volume	1000 cc

24. A soil has a liquid limit of 30. The corresponding plasticity index given by A-line is:

किसी मूदा की द्रव सीमा 30 है। A-रेखा द्वारा दिया गया संगत सुधृत्यता सूचकांक है—

(a) 9.5 (b) 9.8
(c) 7.3 (d) 7.6

Ans. (c) : Given,

$$\text{Liquid limit} = (w_L) = 30$$

Plasticity index given by A-line

$$I_p = 0.73 (w_L - 20)$$

$$I_p = 0.73 (30 - 20)$$

$$I_p = 0.73 \times 10 = 7.3$$

25. A soil sample has LL = 45%, PL = 25% and SL = 15%. For a natural water content of 30%, the consistency index will be :

एक मिट्टी का नमूना है जिसकी LL = 45%, PL = 25% और SL = 15% है। प्राकृतिक जलांश 30% के लिए संगत सूचकांक होगा

(a) 25% (b) 40%
(c) 50% (d) 75%

Ans. (d) : Given,

$$LL = 45\%$$

$$PL = 25\%$$

$$SL = 15\%$$

$$w = 30\%$$

We know that, consistency index -

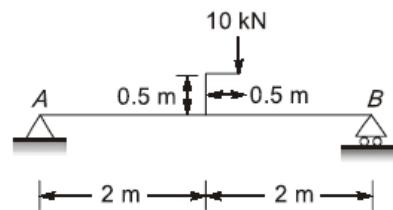
$$I_C = \frac{w_L - w}{w_L - w_p} \text{ or } \frac{LL - w}{LL - PL}$$

$$I_C = \frac{45 - 30}{45 - 25} = \frac{15}{20} = \frac{3}{4} = 0.75$$

$$I_C = 75\%$$

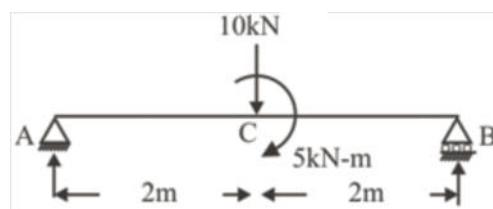
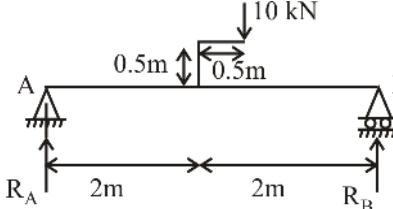
26. The reaction at support 'B' of the statically determinate beam shown below is _____ kN.

नीचे दिखाई गई स्थैतिक रूप से निर्धारित धरन में 'B' सपोर्ट (समर्थन) पर प्रतिक्रिया (रिएक्शन) kN होगी।



(a) 4.25 (b) 5.75
(c) 3.75 (d) 6.25

Ans. (d) :



Find the reaction at support 'B' = ?

Apply equilibrium equation

$$(i) \Sigma V = 0 \\ R_A + R_B = 10 \text{ kN} \quad \dots \dots \dots (i)$$

$$\begin{aligned}
 \text{(ii)} \sum M_A &= 0 \\
 R_B \times 4 - 10 \times 2 - 5 &= 0 \\
 R_B \times 4 &= 25 \\
 R_B &= \frac{25}{4} \\
 R_B &= 6.25 \text{ kN}
 \end{aligned}$$

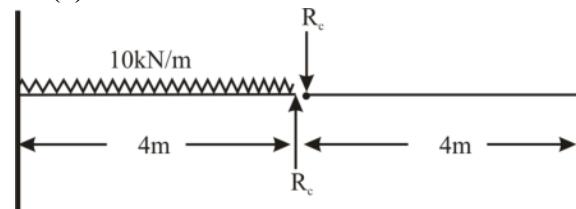
27. Determine the reactions at 'C' of the beam shown below:

नीचे दिखाई गई धरन में 'C' पर प्रतिक्रिया (रिएक्शन) क्या होगी?



(a) 6.5 kN (b) 7.5 kN
 (c) 8.5 kN (d) 5.5 kN

Ans. (b) :



$$\begin{aligned}
 \frac{Wl^4}{8EI} - \frac{R_c L^3}{3EI} &= \frac{R_c L^3}{3EI} \\
 \frac{10 \times (4)^4}{8EI} - \frac{R_c (4)^3}{3EI} &= \frac{R_c (4)^3}{3EI}
 \end{aligned}$$

$$\frac{320}{EI} = 2 \times R_c \times \frac{64}{3EI}$$

$$R_c = \frac{320 \times 3}{2 \times 64}$$

$$\boxed{R_c = 7.5 \text{ kN}}$$

28. A simply supported beam is acted upon by a concentrated load at the centre. It causes a maximum deflection of 10 mm and slope at ends of 0.002 radians. The span of the beam is _____ m.

एक सिम्पली सपोर्टेड बीम (सरल समर्थित धरन) के केन्द्र पर एक संकेन्द्रित भार लगा हुआ है। उस भार से उसमें अधिकतम नीचे का झुकाव (विक्षेपण) 10 mm तथा किनारे की ढलान 0.002 रेडियन है। धरन का स्पैन (लम्बाई) m होगा।

(a) 10 (b) 15
 (c) 16 (d) 12

Ans. (b) : Given,

Maximum deflection (δ) = 10 mm

Slope at end (θ) = 0.002 radians

$$\text{Deflection of SSB} = \frac{w\ell^3}{48EI}$$

$$10 \text{ mm} = \frac{w\ell^3}{48EI}$$

$$\frac{10 \times 48}{l} = \frac{w\ell^2}{EI}$$

$$\text{Slope of end for SSB} = \frac{w\ell^2}{16EI}$$

$$= \frac{1}{16} \frac{w\ell^2}{EI}$$

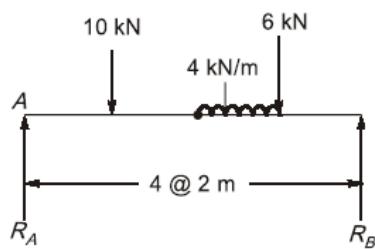
$$0.002 = \frac{1}{16} \times \frac{10 \times 48}{l}$$

$$0.002 = \frac{30}{l}$$

$$l = 15000 \text{ mm} = 15 \text{ m}$$

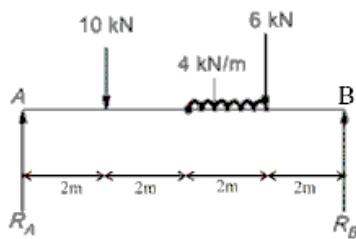
29. The ratio of reactions R_A and R_B in the simply supported beam shown in the figure _____.

चित्र में दिखाई गई एक सिंपली सपोर्टेड बीम (सरल समर्थित धरन) में प्रतिक्रिया R_A और R_B का अनुपात है।



(a) 1.50 (b) 0.75
 (c) 0.50 (d) 1.00

Ans. (d) :



$$\begin{aligned}
 R_A + R_B &= 10 + 6 + 4 \times 2 \\
 &= 24 \text{ kN}
 \end{aligned}$$

Moment at A

$$R_B \times 8 - 10 \times 2 - 6 \times 6 - 4 \times 2 \times (5) = 0$$

$$R_B = \frac{20 + 36 + 40}{8} = \frac{96}{8}$$

$$R_B = 12 \text{ kN}$$

$$\begin{aligned}
 R_A &= 24 - R_B \\
 &= 24 - 12 = 12 \text{ kN}
 \end{aligned}$$

$$\text{Ratio} = \frac{R_A}{R_B} = \frac{12}{12} = 1$$

30. The capillary rise in silt is 50 cm and that of fine sand is 30 cm. The difference in pore size of these two soils is:

गाद (सिल्ट) में केशिकीय उन्नयन 50 cm है और महीन बालू में केशिकीय उन्नयन 30 cm है। इन दोनों मृदाओं में छिद्र (पोर) के आकार में अंतर है।

- (a) 6.00×10^{-3} cm
- (b) 3.00×10^{-3} cm
- (c) 8.00×10^{-3} cm
- (d) 4.00×10^{-3} cm

Ans. (d) : Given,

Height in capillary rise in silt (h_c)_{silt} = 50 cm

Height in capillary rise in sand (h_c)_{sand} = 30 cm

From Jurin's law

$$h_c = \frac{4T \cos \theta}{\rho g d} \quad (\text{for water})$$

$$T = 0.072 \text{ N/m}$$

$$\rho = 1000 \text{ kg/m}^3$$

$$g = 9.81 \text{ m/sec}^2$$

$$\cos \theta \approx 1$$

$$h_c = \frac{4 \times 0.072 \times 1}{1000 \times 9.81 \times d}$$

$$h_c = \frac{0.3}{d} \text{ cm}^2 \quad (d \text{ in cm})$$

Find pore diameter

For silt

$$(h_c)_{silt} = \frac{0.3}{d_{silt}} \Rightarrow 50 = \frac{0.3}{d_{silt}}$$

$$d_{silt} = 0.006 \text{ cm}$$

For sand

$$(h_c)_{sand} = \frac{0.3}{d_{sand}} \Rightarrow 30 = \frac{0.3}{d_{sand}}$$

$$d_{sand} = 0.01 \text{ cm}$$

Difference in pore size

$$\Delta d = d_{sand} - d_{silt} = 0.01 - 0.006$$

$$\Delta d = 0.004 = 4 \times 10^{-3} \text{ cm}$$

31. The re-compression index is about _____ of the compression index.

पुनःसंपीडन सूचकांक, संपीडन सूचकांक का लगभग होता है।

- (a) 1/2
- (b) 1/20
- (c) 1/10 to 1/5
- (d) 5 times/5 गुना

Ans. (c) :

Recompression index (C_r) –

The recompression index is the slope of the recompression curve obtained during reloading when void ratio is plotted against effective stress on semi-log scale.

$$C_r = \frac{-\Delta e}{\log_{10} \left(\frac{\bar{\sigma} + \Delta \bar{\sigma}}{\bar{\sigma}} \right)}$$

The recompression index is appreciably smaller than compression index. It is usually in the range of $\frac{1}{10}$ to $\frac{1}{5}$ of the compression index.

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

एक मिट्टी का विसर्जन (निर्वहन) वेग 6×10^{-7} m/s है

और रिक्त अनुपात 0.5 है। इसका रिसाव (अवस्थण) वेग m/s है।

- (a) 12×10^{-7}
- (b) 18×10^{-7}
- (c) 36×10^{-7}
- (d) 24×10^{-7}

Ans. (b) : Discharge velocity (v) = 6×10^{-7} m/sec

Void ratio (e) = 0.5

Seepage velocity (v_s) = ?

$$\text{Porosity (n)} = \frac{e}{1+e} = \frac{0.5}{1+0.5}$$

$$n = \frac{0.5}{1.5} = 0.33$$

$$v_s = \frac{v}{n}$$

$$v_s = \frac{6 \times 10^{-7}}{0.33}$$

$$= 18.18 \times 10^{-7} \square 18 \times 10^{-7} \text{ m/sec}$$

33. The range of optimum moisture content for the standard Proctor test for clayey soil is:

चिकनी मिट्टी के लिए मानक प्रॉक्टर परीक्षण हेतु इष्टतम नमी की मात्रा की सीमा है।

- (a) 14% to 20%/14% से 20%
- (b) 12% to 16%/12% से 16%
- (c) 6% to 10%/6% से 10%
- (d) 8% to 12%/8% से 12%

Ans. (a) :

Type of soil	Optimum water content (%)
Sand	6-10
Sandy silt or silty sand	8-12
Silt	12-16
Clay	14-20

34. A concentrated load of 50 kN acts on the surface of ground. The vertical stresses directly below the load at a depth of 4 m will be kN/m². The value of influence factor is 0.48.

भूमि की सतह पर 50 kN का एक संकेंद्रित भार लगाया गया है। भार के ठीक नीचे 4 m की गहराई पर

ऊर्ध्वाधर तनाव (प्रतिबल) kN/m^2 होगा।
 प्रभाव कारक का मान 0.48 है।
 (a) 1.5 (b) 15.0
 (c) 150.0 (d) 0.15

Ans. (a) : Given,
 Concentrated load (Q) = 50 kN
 Depth (z) = 4 m

$$\text{Vertical stress } (\sigma_z) = 0.4775 \frac{Q}{z^2}$$

$$\sigma_z = 0.4775 \times \frac{50}{4^2}$$

$$\sigma_z = 1.492 \approx 1.5 kN/m^2$$

35. For a highly over-consolidated clay, the pore water pressure coefficient ' A_f ' is in the range of:

अत्यधिक समेकित मिट्टी के लिए, छिद्र जल दब गुणांक ' A_f ' की सीमा है।
 (a) 0.7 to 1.3/0.7 से 1.3
 (b) -1.0 to -0.5/ -1.0 से -0.5
 (c) -0.5 to 0.0/-0.5 से 0.0
 (d) 0.3 to 0.7/0.3 से 0.7

Ans. (c) :

Soil Type	A_f
Very loose, fine saturated sand, saturated clay:	2 to 3
Extra-sensitive to quick	1.2 to 2.5
Normally consolidated	0.7 to 1.3
Lightly preconsolidated	0.3 to 0.7
Heavily preconsolidated	-0.5 to 0
Compacted sandy clays	0.25 to 0.75
Compacted clay gravels	-0.25 to 0.35

36. For finding final setting time of cement by Vicat Apparatus, diameter of the needle used is mm.

विकेट उपकरण में सीमेंट का अंतिम सेटिंग समय निकालने के लिए जो सुई प्रयोग की जाती है, उसका व्यास mm होता है।

(a) 1 (b) 0.1
 (c) 0.5 (d) 5

Ans. (*) : Vicat apparatus is used to determine the setting time and consistency of cement and other hydraulic binders.

Vicat apparatus for different test-

- 10 mm diameter plunger - Consistency test
- 1 mm² needle - Initial setting time
- 5 mm diameter annular collar - Final setting time

37. Barken's Relation (formula) is given by:

बर्कन का संबंध (सूत्र) है।

[where/जहाँ :

K = Stiffness/दुर्नियता (स्टिफनेस)

E = Young's Modulus/यंग का मापांक

μ = Poisson's Ratio/प्वासो अनुपात

A = Base area of machine/मशीन का आधार
 क्षेत्रफल]

$$(a) K = \left(\frac{1.13E}{1 - \mu^2} \right) A \quad (b) K = \left(\frac{1.13E}{1 + \mu^2} \right) A$$

$$(c) K = \left(\frac{1.13E}{1 - \mu^2} \right) \sqrt{A} \quad (d) K = \left(\frac{1.13E}{1 + \mu^2} \right) \sqrt{A}$$

Ans. (c) : Barken's relation-

The stiffness can also be obtained from the value of E using following relation given by

$$K = \left(\frac{1.13E}{1 - \mu^2} \right) \sqrt{A}$$

Where,

K = Stiffness

E = Young modulus of elasticity

μ = Poission ratio

A = Base area of machine

38. To find the efficiency of the utilization of resources on the project, cost performance indicator (CPI) can be calculated as:

परियोजना पर संसाधनों के उपयोग की दक्षता का पता लगाने के लिए लागत प्रदर्शन संकेतक (CPI) की गणना निम्नलिखित में से कैसे की जा सकती है?

[where/जहाँ :

PV = Planned value/नियोजित मूल्य

AC = Actual cost/वास्तविक लागत

EV = Earned value/अर्जित मूल्य]

- (a) Ratio of EV and AC/EV और AC का अनुपात
- (b) AC/PV
- (c) AC/EV
- (d) PV/AC

Ans. (a) : Cost performance index (CPI)- The cost performance index is a measure of cost efficiency of budgeted resources, expressed as a ratio of earned value to actual cost.

$$CPI = \frac{\text{Earned value (EV)}}{\text{Actual cost (AC)}}$$

Schedule performance index (SPI)- Schedule performance index is a measure of schedule efficiency expressed as the ratio of earned value to planned value.

$$SPI = \frac{\text{Earned value (EV)}}{\text{Planned value (PV)}}$$

39. As per IS code, the depth of well foundations should not be less than times the maximum scour depth.

IS कोड के अनुसार, कुएँ नींव की गहराई, अधिकतम कटाव/अपक्षय (स्काउटर) गहराई की गुना से कम नहीं होनी चाहिए।