UPPSC-AE 2025

UTTAR PRADESH PUBLIC SERVICE COMMISSION

Combined State Engineering
Services Examination

Assistant Engineer

Civil Engineering

Previous Years Solved Papers

- Objective Papers
- General Hindi
- General Studies
- Practice Questions

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UPPSC-AE : Civil Engineering Previous Solved Papers

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Reprint: 2024

Reprint: 2025

Preface

B. Singh (Ex. IES)

UPPSC Assistant Engineer Examination has been always preferred by Engineers due to job stability and opportunity to work in home sate. UPPSC Combined State Engineering Services examination is conducted time to time but not every year. MADE EASY team has made deep study of previous exam papers and observed that a good percentage of questions are of repetitive in nature, therefore previous year's papers are advisable to solve before a candidate takes the exam. This book is also useful for MP State Engineering Services, UPSC Engineering Services and other Competitive exams for Engineering graduates.

The current edition of this book contains complete solutions to all questions with accuracy. I have true desire to serve student community by providing good source of study and quality guidance. I hope this book will be proved an important tool to succeed in UPPSC and other competitive exams. Any suggestions from the readers for improvement of this book are most welcome.

With Best Wishes

B. Singh

CMD, MADE EASY

UPPSC : Exam Pattern

Combined State Engineering Services Examination
Assistant Engineer examination

Paper I : Objective **Maximum Time : 2½ Hours • Maximum Marks : 375** Each question carries 3 marks. There is a penalty of –1 mark for every wrong attempted answer	
General Hindi	25 Questions
Technical Paper I	100 Questions
Total	**125 Questions** (375 Marks)

Paper II : Objective **Maximum Time : 2½ Hours • Maximum Marks : 375** Each question carries 3 marks. There is a penalty of –1 mark for every wrong attempted answer	
General Studies	25 Questions
Technical Paper II	100 Questions
Total	**125 Questions** (375 Marks)

Uttar Pradesh Public Service Commission
Combined State Engineering Services Examination
Assistant Engineer
Civil Engineering

Paper-I (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 Cartesion 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 :

Castiglianios 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:

Factors of safety and load factors, rivetted, bolted and welded joints and its connections, Design by working, stress/limit state method of tension and compression member, beams of built up section, rivetted and welded plate girders, gantry girders, stancheons 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, Prestressed concrete: Methods and systems of prestressing, anchorages, analysis and design of sections for flexure based on working stress, losses of prestress, 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, fibre 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.

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, Newmarks chart, pressure bulb, contact, pressure, applicability of different bearing capacity theories, evaluation of bearing capacity from filed tests, allowable bearing capacity, settlement analysis, allowable settlement, proportioning of footing, isolated and combined footings,

rafts, pile foundation, types of piles, plies 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.

Paper-II (Part A)

Fluid Mechanics, Open Channel Flow, Hydraulic Machines and Hydro-power 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 vorties.

Flow control volume equation, continuity, momentum and energy equations, Navier- Strokes 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 nonuniform 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, Openwells and tube wells. Ground and surface water recourses 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 thoeorie, Water logging and its prevention.

Diversion head works : Compenents, 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.

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Contents

Civil Engineering

Section-A :

Section-B :

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Note: The UPPSC-AE exam was not conducted in 2023 and 2024. The most recent exam, notified in 2021, was held on May 29, 2022. This book includes solutions to all previous exam papers up to the last conducted examination (in 2022).

UPPSC-AE

Combined State Engineering
Services Examination

Section-A

Civil Engineering

Objective Previous Years Questions

1 Engineering Mechanics

2007 (II)

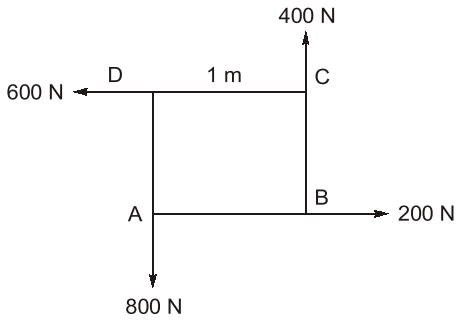
Q.1 Moment of Inertia of a triangular cross-section of height d and base width b about its centroid axis parallel to base is

(a) $\frac{bd^3}{36}$ (b) $\frac{bd^3}{24}$

(c) $\frac{bd^3}{12}$ (d) $\frac{bd^3}{6}$

2019

Q.2 Four forces having magnitudes of 200 N, 400 N, 600 N and 800 N, respectively acting along four sides (1 m each) of a square ABCD as shown in figure. Determine the magnitude and direction of the resultant force from 'A' along the line 'AB'.



(a) $400\sqrt{3}$ N, 3.2 m from A

(b) $400\sqrt{2}$ N, 2.5 m from A

(c) $300\sqrt{2}$ N, 2 m from A

(d) $300\sqrt{3}$ N, 2.5 m from A

Q.3 A bullet of mass 30 gm leaves the barrel of a gun with a velocity of 500 m/s. Suppose, the force lasted, for 0.0018 seconds, the average impulsive force is

(a) 5333.33 N (b) 6333.33 N

(c) 7333.33 N (d) 8333.33 N

Q.4 A particle undergoes a simple harmonic motion, the acceleration of the particle at a distance of 1.5 m from the centre of motion being 6 m/s^2, the time of oscillation in seconds is

(a) 2.00 (b) 4.00

(c) 3.14 (d) 6.28

Q.5 The coefficient of friction is the ratio of

(a) Limiting friction force to the normal reaction

(b) Limiting friction force to the weight of body to be moved

(c) Sliding friction force to the normal reaction

(d) None of the above

Q.6 The D'Alembert principle

(a) is a hypothetical principle

(b) provides no special advantage over Newton's law

(c) is based upon the existence of inertia force

(d) allows a dynamical problem to be considered as a static problem

2021

Q.7 Which theorem/principle may be stated as the net external forces acting on the system and the resultant reversed effective forces (internal force) are in equilibrium?

(a) Lami's theorem

(b) Varignon's theorem

(c) D'Alembert's principle

(d) None of the above

Q.8 If a particle is moving with simple harmonic motion, the velocity is ____ at the mean position.

(a) Maximum (b) Zero

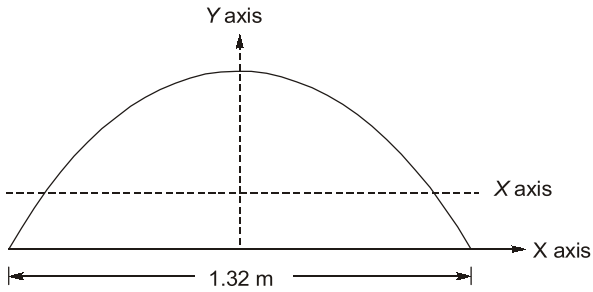
(c) Minimum (d) None of these

Q.9 The ratio of distance moved by effort to distance moved by load is called
(a) Resistance of machine
(b) Mechanical advantage
(c) Effect ratio
(d) Velocity ratio

Q.10 The forces which meet at one point, but their line of action do not lie in a plane are called
(a) Intersecting forces
(b) Coplanar non-concurrent forces
(c) Non-coplanar non-concurrent forces
(d) Non-coplanar concurrent forces

Q.11 Ball A of mass 2 kg moving with a velocity of 2 m/s, strikes directly on a ball B of mass 4 kg at rest. The ball A, after striking comes to rest. Find the coefficient of restitution after the collision.
(a) 1.00 (b) 0.5
(c) 0.67 (d) 0.33

Q.12 The Y axis of centre of gravity of semicircular plate 1.32 m diameter from its base as shown in figure.



(a) 0.14 m (b) 0.21 m
(c) 0.28 m (d) None of these

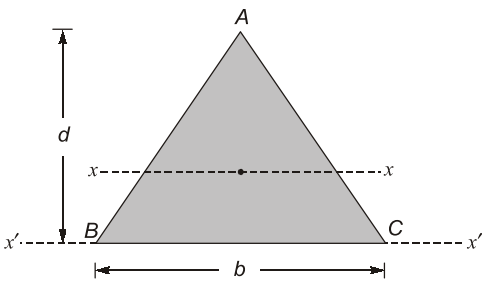
Answers | Engineering Mechanics

1.	(a)	2.	(b)	3.	(d)	4.	(c)	5.	(a)	6.	(d)
7.	(c)	8.	(a)	9.	(d)	10.	(d)	11.	(b)	12.	(c)

Explanations | Engineering Mechanics

1. (a)

We know that

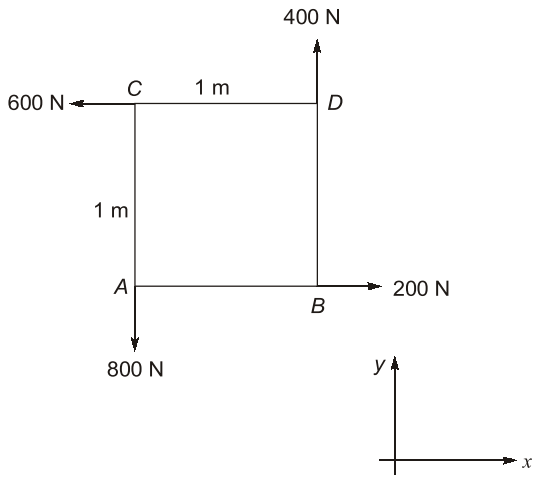


$$I_x' = \frac{bd^3}{12}$$

$$I_x = \frac{bd^3}{36}$$

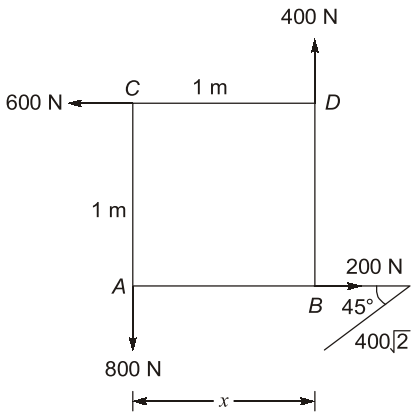
Hence option (a) is correct.

2. (b)



$$\Sigma F_x = -400\ N$$
$$\Sigma F_y = -400\ N$$

So resultant force = $400\sqrt{2}$ N



$$\Sigma M_A = 0$$
$$\left(400\sqrt{2}\sin 45°\right)x = 4w + 600$$
$$x = 2.5\ m$$

3. (d)

Average impulsive force,

$$I = \frac{MW}{dt} = \frac{30\times10^{-3}\times500}{0.0018}$$
$$= 8333.3\ N$$

4. (c)

$$F = ma$$
Spring force = kx
$$6\ m = 1.5\ k$$
$$k/m = 4$$

Time of oscillation (sec)

$$= 2\pi\left(\sqrt{\frac{m}{k}}\right) = 2\pi\sqrt{\frac{1}{4}}$$
$$= \frac{2\pi}{2} = \pi = 3.14\ sec$$

5. (a)

$$f = \frac{\text{Limting friction force}}{\text{Normal reaction}}$$

7. (c)

Lami's theorem relates the magnitudes of three coplanar, concurrent and non-collinear vectors, which keeps an object in static equilibrium, with the angles directly opposite to the corresponding vectors.

Varignon's theorem states that the moment of any force is equal to the algebraic sum of the moments of the components of that force.

D'Alembert's principle states that the net external forces acting on the system and the resultant reversed effective forces are in equilibrium.

8. (a)

At mean position, velocity is maximum and acceleration is 0.

10. (d)

Concurrent → Passing through same point

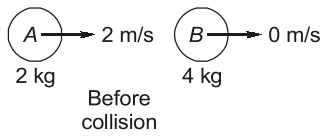
Coplanar → Lying in the same plane

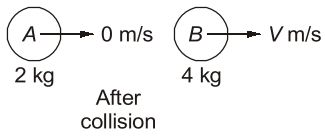
Collinear → Having a common line of action

11. (b)

Coefficient of restitution (e)

$$= \frac{\text{Velocity of Separation}}{\text{Velocity of Approach}}$$





Applying Momentum Conservation:

$$\Rightarrow\ M_Au_A + M_Bu_B = M_AV_A + M_BV_B$$
$$\Rightarrow\ 2(2) + 4(0) = 2(0) + 4(V)$$
$$\Rightarrow\ 4 = 4\ V$$
$$\Rightarrow\ V = 1\ m/s$$

Now, $$e = \frac{V_B - V_A}{u_A - u_B} = \frac{V - 0}{2 - 0} = \frac{1}{2} = 0.5$$

12. (c)

y-co-ordinate of C.G of semi-circle

$$= \frac{4R}{3\pi}$$

$$R = \text{Radius} = \frac{1.32}{2} = 0.66\ m$$

$$y = \frac{4\times0.66}{3\pi} = 0.28\ m$$

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UPPSC-AE

Combined State Engineering
Services Examination

Section - D

Civil Engineering

Model Practice Sets

UPPSC-AE

UTTAR PRADESH PUBLIC SERVICE COMMISSION

Combined State Engineering Services Exam : Assistant Engineer

CIVIL ENGINEERING

Model Practice Set : 1

Paper-I

Duration: 2.30 hr. Maximum Marks: 375

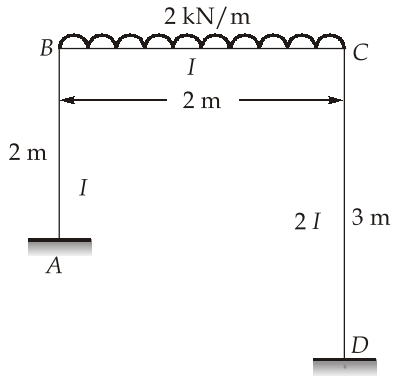
Read the following instructions carefully

1. Immediately after the commencement of the examination, you should check that this booklet **does not** have any unprinted or torn or missing pages or items etc. If so, get it replaced by a complete test booklet.
2. Encode clearly the test booklet series **A, B, C** or **D,** as the case may be, in the appropriate place in the answer sheet using ball point pen (blue or black).
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside.

   DO NOT write **anything else** on the Test Booklet.
4. This Test Booklet contains 125 questions. Each question comprises four responses (answers). All questions carry equal marks. There is provision of negative marking of 1 mark for every wrong answer attempted.
5. Use of calculator is not permitted.
6. Attempt **ALL** questions. Your total marks will depend **Only** on the number of correct responses with corresponding reduction for wrong answers marked by you.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to invigilator **Only the Answer Sheet**. You are permitted to take away with you the Test Booklet.

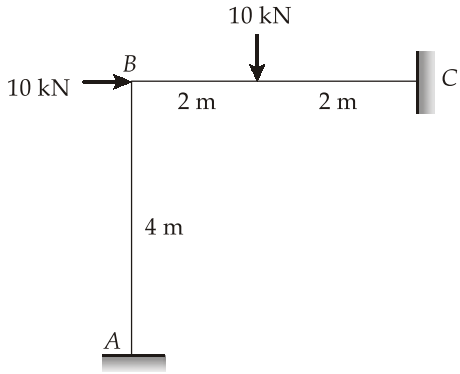
DO NOT OPEN THIS BOOKLET UNTIL YOU ARE ASKED TO DO SO

Q.1 The slope deflection equation at end *B* of the member *BC* for the portal frame shown in the figure is



(a) $M_{BC} = 0.67 + EI\theta_B + 2EI\theta_C$
(b) $M_{BC} = -1 + 2EI\theta_B + EI\theta_C$
(c) $M_{BC} = -0.67 + 2EI\theta_B + EI\theta_C$
(d) $M_{BC} = 0.67 + 2EI\theta_B + EI\theta_C$

Q.2 Number of point of contraflexure in the given structure is



(a) 1 (b) 2
(c) 3 (d) 4

Q.3 For a 2 hinged parabolic arch, *V* is sum of the vertical forces in upward direction and *H* is horizontal thrust on the left hand side of section *A-A*. If α is the angle of tangent at the point on arch with horizontal, the normal thrust at section *A-A* from left hand side is given by

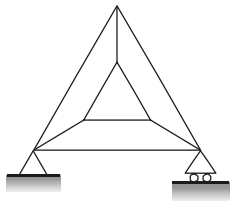
(a) $V\sin\alpha - H\cos\alpha$ (b) $V\cos\alpha - H\sin\alpha$
(c) $V\sin\alpha + H\cos\alpha$ (d) $V\cos\alpha + H\sin\alpha$

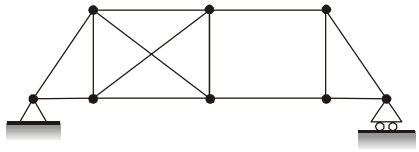
Q.4 A symmetrical parabolic arch of span *L* and rise *h* is hinged at both ends. The arch carries a UDL along the entire span. Which of the following has non-zero value?

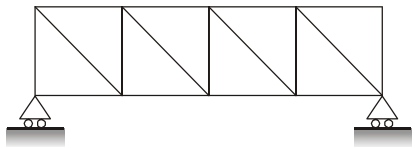
1. Horizontal thrust.
2. Radial shear.
3. Bending moment.
4. Vertical reaction at support.

(a) 1, 2 and 3 only (b) 2 and 3 only
(c) 1 and 4 only (d) 3 and 4 only

Q.5 Which of the following trusses is/are unstable?

1. 

2. 

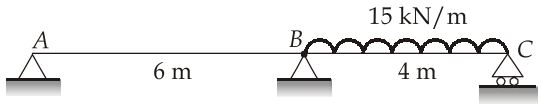
3. 

(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q.6 For a stiffness matrix $[S] = \frac{EI}{63}\begin{bmatrix} 4 & -9 \\ -9 & 36 \end{bmatrix}$, what is its flexibility matrix?

(a) $[F] = \frac{63}{EI}\begin{bmatrix} 36 & 9 \\ 9 & 4 \end{bmatrix}$
(b) $[F] = \frac{1}{EI}\begin{bmatrix} 36 & -9 \\ -9 & 4 \end{bmatrix}$
(c) $[F] = \frac{1}{EI}\begin{bmatrix} 36 & 9 \\ 9 & 4 \end{bmatrix}$
(d) $[F] = \frac{1}{EI}\begin{bmatrix} 4 & -9 \\ -9 & 36 \end{bmatrix}$

Q.7 A continuous beam with uniform flexural rigidity is shown below.

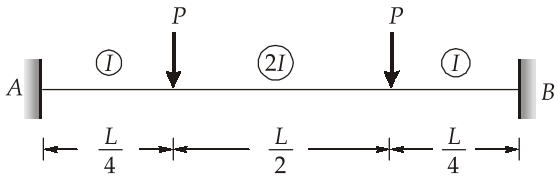


Moment at *B* is

(a) 12 kN-m (b) 14 kN-m
(c) 16 kN-m (d) 18 kN-m

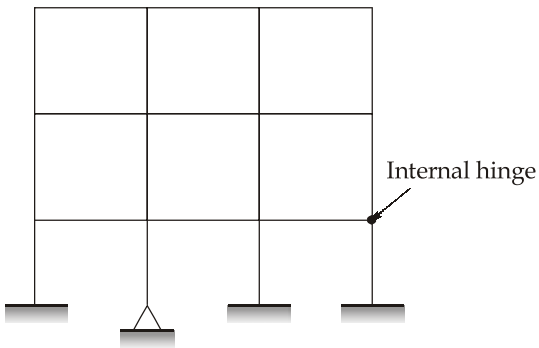
Q.8 Which of the following is not a force method of analysis of structure?
(a) Method of consistent deformation
(b) Kani's method
(c) Column analogy method
(d) Clapeyron's theorem

Q.9 What are the fixed end moments at *A* and *B* of a beam *AB* fixed in direction and position at *A* and *B* when acted upon by loading such as shown in the figure below?



(a) $\frac{PL}{2}$ (b) $\frac{PL}{4}$
(c) $\frac{PL}{3}$ (d) $\frac{PL}{6}$

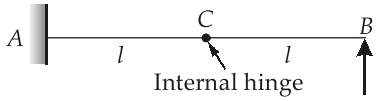
Q.10 What is the total degree of static indeterminacy, both internal and external of the plane frame shown below?

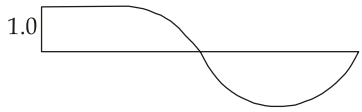


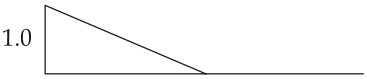
(a) 21 (b) 22
(c) 23 (d) 24

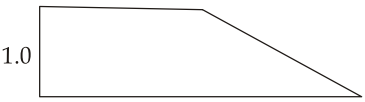
Q.11 The maximum bending moment caused by a set of concentrated moving loads is
(a) Always at a midpoint from where the adjacent load and centroid of set of loads are equidistant.
(b) Always between the mid-point and adjacent load.
(c) Always between the mid-point and centroid of set of the loads.
(d) Always under the adjacent load.

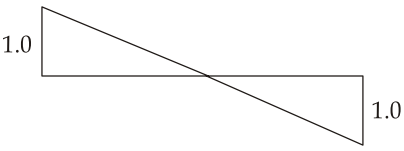
Q.12 The influence line for vertical reaction at *A* of the beam shown below is



(a) 

(b) 

(c) 

(d) 

Q.13 Consider the following statements:
1. Horizontal thrust is same throughout the entire length of cable.
2. Greatest tension in a cable occurs at the lowest point.
3. Cable between two supports takes up the catenary shape if no load is acting on it.

Which of these statement(s) is/are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q.14 Which are the unknowns to be determined in the flexibility method?
(a) Displacements (b) Bending moments
(c) Forces (d) Internal work done

Q.15 The artificial activity which indicates that an activity following it, cannot be started unless the preceding activity is completed, is known as
(a) Event (b) Free float
(c) Dummy (d) Constant

Q.16 Consider the following statements:
1. PERT analysis is event oriented.
2. CPM does not make any allowance for the uncertainties in the duration of time.
3. In CPM, indirect cost decreases with time.

Which of the above statement(s) is/are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q.17 A revised estimate is prepared if the sanctioned estimate exceeds
(a) 4% (b) 5%
(c) 6% (d) 8%

Q.18 Which method of depreciation is more suitable for finding depreciation of civil engineering structures such as a building?
(a) Sinking fund method
(b) Straight line method
(c) Sum of year digit method
(d) Double declining balance method

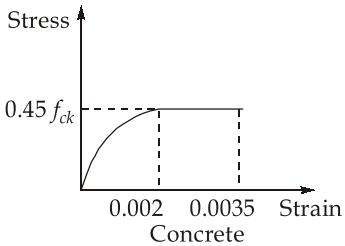
Q.19 Item of work which is not included in the Plinth area estimate will be
(a) Wall thickness
(b) Balcony
(c) Service staircases
(d) Water supply and sanitary shaft

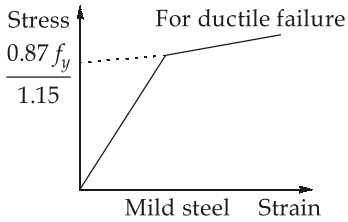
Q.20 Critical section for shear in a RCC beam when support reaction is creating compression is at:
(a) Face of support
(b) $d/2$ distance from face of support
(c) d distance from face of support
(d) Middle of the support

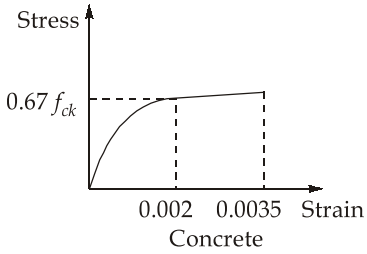
Q.21 Limit state of serviceability does not include
(a) Deflection (b) Cracking
(c) Flexure (d) Vibration

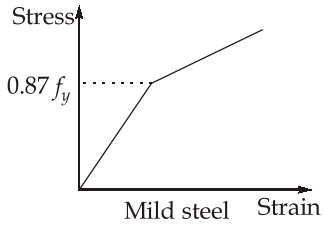
Q.22 The permissible value of bearing stress of concrete in RCC footing design as per LSM and WSM respectively when M25 concrete used is _____.
(a) 18.75 N/mm^2 and 10 N/mm^2
(b) 11.25 N/mm^2 and 6.25 N/mm^2
(c) 6.25 N/mm^2 and 11.25 N/mm^2
(d) 10 N/mm^2 and 18.75 N/mm^2

Q.23 As per limit state method, correct representation of stress-strain curve of steel or concrete in a structure is

(a)


(b)


(c)


(d)


Q.24 A rectangular isolated footing of a square column of side 600 mm carrying axial factored load of 2500 kN, have area 25 m^2. If depth of footing provided is 900 mm then punching shear acting at a distance of 450 mm from the face of column is
(a) 0.60 N/mm^2 (b) 0.42 N/mm^2
(c) 0.56 N/mm^2 (d) 0.25 N/mm^2

Q.25 Minimum reinforcement to be provided in a water tank when its size is restricted to 15 m and deformed bars are used:
(a) 0.4% of surface zone
(b) 0.64% of surface zone
(c) 0.24% of surface zone
(d) 0.35% of surface zone

Q.26 Which of the following statement is incorrect about secondary compression failure?
(a) strain in steel is more than $0.002 + \frac{0.87 f_y}{E_s}$
(b) Neutral axis move downward.
(c) Crack start to develop in concrete.
(d) Neutral axis moves upward.

UPPSC-AE

Model Practice Set : 1

Civil Engineering

Answer Key

Paper-I

1. (c)	26. (b)	51. (a)	76. (c)	101. (c)
2. (c)	27. (c)	52. (c)	77. (c)	102. (a)
3. (c)	28. (c)	53. (c)	78. (a)	103. (d)
4. (c)	29. (c)	54. (c)	79. (d)	104. (c)
5. (d)	30. (c)	55. (b)	80. (c)	105. (a)
6. (c)	31. (c)	56. (b)	81. (b)	106. (d)
7. (a)	32. (a)	57. (d)	82. (d)	107. (d)
8. (b)	33. (d)	58. (d)	83. (d)	108. (c)
9. (d)	34. (c)	59. (a)	84. (d)	109. (b)
10. (d)	35. (a)	60. (c)	85. (c)	110. (c)
11. (d)	36. (d)	61. (d)	86. (d)	111. (c)
12. (c)	37. (c)	62. (a)	87. (c)	112. (d)
13. (c)	38. (d)	63. (b)	88. (d)	113. (d)
14. (c)	39. (c)	64. (d)	89. (c)	114. (c)
15. (c)	40. (b)	65. (c)	90. (a)	115. (d)
16. (a)	41. (b)	66. (b)	91. (c)	116. (b)
17. (b)	42. (a)	67. (a)	92. (c)	117. (b)
18. (b)	43. (d)	68. (d)	93. (b)	118. (c)
19. (c)	44. (a)	69. (d)	94. (d)	119. (d)
20. (c)	45. (c)	70. (b)	95. (b)	120. (a)
21. (c)	46. (b)	71. (b)	96. (d)	121. (a)
22. (b)	47. (a)	72. (a)	97. (a)	122. (c)
23. (a)	48. (c)	73. (b)	98. (c)	123. (c)
24. (b)	49. (c)	74. (a)	99. (a)	124. (d)
25. (c)	50. (a)	75. (c)	100. (d)	125. (c)

DETAILED EXPLANATIONS

1. (c)

$$M_{F_{BC}} = \frac{-2\times 2^2}{12} = -\frac{2}{3} = -0.67\ \text{kNm}$$

Now, slope deflection equation at B:

$$M_{BC} = M_{F_{BC}} + \frac{2EI}{L}\left(2\theta_B + \theta_C - \frac{3\delta}{L}\right)$$

$$M_{BC} = -0.67 + \frac{2EI}{2}(2\theta_B + \theta_C - 0)$$

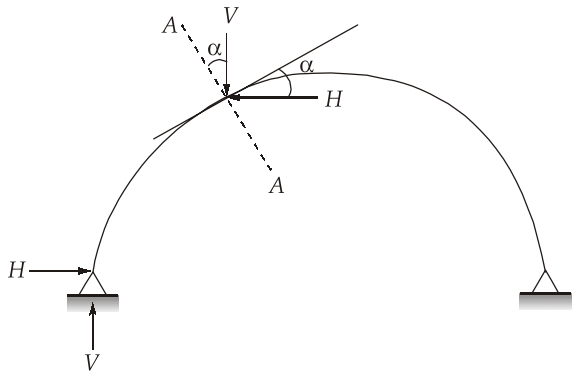
$$M_{BC} = -0.67 + 2EI\theta_B + EI\theta_C$$

2. (c)

For the member BC, P.O.C = 2 due to fixation of supports at both ends.

For the member BA, P.O.C = 1 due to carry over moment concept.

3. (c)



Normal thrust at section A-A = $H\cos\alpha + V\sin\alpha$

4. (c)

This arch will act as a theoretical arch or linear arch in which bending moment and radial shear both are zero along the entire arch.

5. (d)

- In 1st structure, rigid body rotation of inner triangle.
- In 2nd structure, there is no inclined member to resist shear force in one of the part of given truss.
- In 3rd structure, rigid body translation of whole structure.

6. (c)

Flexibility matrix is inverse of stiffness matrix.

$$[F] = \frac{1}{[S]}$$

$$[F] = \frac{1}{EI}\begin{bmatrix} 36 & 9 \\ 9 & 4 \end{bmatrix}$$

7. (a)

Distribution factor:

		Stiffness	Total stiffness	D.F.
B	BA	3 EI/6	5EI/4	2/5
	BC	3 EI/4		3/5

FEM's: $M_{F_{BA}} = 0, \quad M_{F_{AB}} = 0$

$$M_{F_{BC}} = \frac{-15\times 4^2}{12} = -20\text{kNm}$$

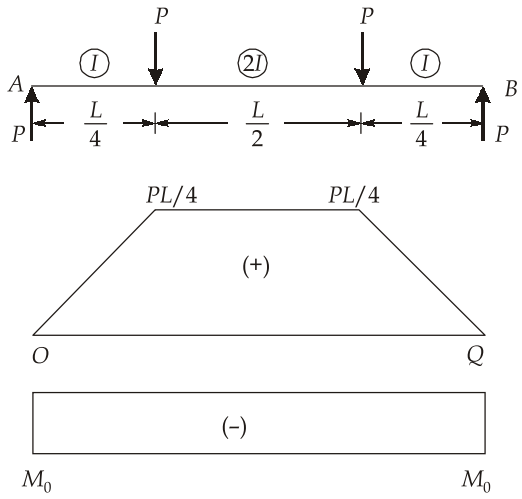
$$M_{F_{CB}} = +20\ \text{kN-m}$$

Joints:	A	B		C
Members:	AB	BA	BC	CB
D.F.:	1	2/5	3/5	1
FEM's:	0	0	–20	20
Release and Co:	0	0	–10	–20
Net FEM's	0	0	– 30	0
Release	0	+12	+18	
Final end moments	0	+12	–12	0

8. (b)

Kani's method is displacement method of analysis.

9. (d)



$$\frac{\text{Area of BMD}_1\text{(+ve area)}}{EI} = \frac{\text{Area of BMD}_2\text{(–ve area)}}{EI}$$

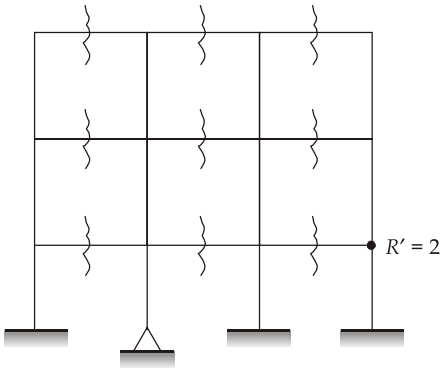
$$\frac{\frac{1}{2}\times 2\times\frac{L}{4}\times\frac{PL}{4}}{EI} + \frac{\frac{PL}{4}\times\frac{L}{2}}{2EI} = \frac{2\times M_0\frac{L}{4}}{EI} + \frac{M_0\frac{L}{2}}{2EI}$$

$$\frac{PL^2}{16} + \frac{PL^2}{16} = \frac{M_0L}{2} + \frac{M_0L}{4}$$

$$\frac{PL^2}{8} = \frac{3M_0L}{4}$$

$$M_0 = \frac{PL}{6}$$

10. (d)



$$D_s = 3C - R'$$
$$= 3(9) - (1 + 2)$$
$$= 27 - 3 = 24$$

16. (a)

In CPM, direct cost increases with decrease in time, whereas indirect cost increases with increase in time.

18. (b)

Straight line method is used for all the assets which do not face obsolensce during its utility period.

21. (c)

Flexural comes under limit state of collapse.

22. (b)

Permissible bearing stress,

As per LSM

$0.45\, f_c = 0.45 \times 25 = 11.25$ N/mm^2

As per WSM

$0.25\, f_{ck} = 0.25 \times 25 = 6.25$ N/mm^2

24. (b)

Punching shear,

$$\tau_p = \frac{P_u - w_v(a+d)(b+d)}{2[(a+d)d + (b+d)d]}$$

$\Rightarrow$ $a = b = 600$ mm {for square column}

$$\Rightarrow \quad w_u = \frac{P_u}{A} = \frac{2500}{25} = 100 \text{ kN/m}^2$$

$\Rightarrow$ $d = 900$ mm

$$\tau_p = \frac{2500 - 100(0.6+0.9)^2}{4[(600+900)\times 900]} \times 10^3 \text{ N/mm}^2$$

$$\tau_p = 0.42 \text{ N/mm}^2$$

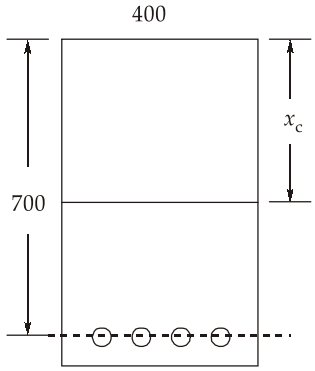
25. (c)

As per IS 3370,

Minimum reinforcement when size is less than 15 m.

- 0.24% of surface zone in case of deformed bars.
- 0.4% in case of plane bars.

28. (c)



We know that for WSM,

$$\frac{x_c}{d} = \frac{m\sigma_{cbc}}{m\sigma_{cbc} + \sigma_{st}} \qquad \text{...(i)}$$

Also, $$m = \frac{280}{3\sigma_{cbc}}$$

$\Rightarrow$ $$m\sigma_{cbc} = \frac{280}{3}$$

Put $m\sigma_{cbc} = \frac{280}{3}$ in eq. (i)

$$\frac{x_c}{d} = \frac{\frac{280}{3}}{\sigma_{st} + \frac{280}{3}} = 0.289$$

$$x_c = 0.289 \times 700 = 202.3 \text{ mm}$$