SSC-JE

Staff Selection Commission

Junior Engineer

Civil Engineering

Topicwise Objective Solved Questions

Volume-I

Previous Years Solved Papers : 2007-2024

*Also useful for **RRB-JE Mains** as well as various* **public sector examinations** and other competitive examinations

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Preface

B. Singh (Ex. IES)

Staff Selection Commission-Junior Engineer has always been preferred by Engineers due to job stability. SSC-Junior Engineer examination is conducted every year. MADE EASY team has deeply analyzed the previous exam papers and observed that a good percentage of questions are repetitive in nature, therefore it is advisable to solve previous years papers before a candidate takes the exam.

The SSC JE exam is conducted in two stages as shown in table given below.

Papers	Subject	Maximum Marks	Duration
Stage 1: Paper-I : Objective type	(i) General Intelligence & Reasoning (ii) General Awareness (iii) General Engineering : Civil	50 Marks 50 Marks 100 Marks	2 hours
Stage 2: Paper-II : Objective Type	General Engineering : Civil	300 Marks	2 hours
Note: In Paper-I, every question carry one mark and there is negative marking of ¼ marks for every wrong answer. Candidates shortlisted in Stage 1 are called for Stage 2. On the basis of combined score in Stage 1 and Stage 2, final merit list gets prepared.			

MADE EASY has taken due care to provide complete solution with accuracy. Apart from Staff Selection Commission-Junior Engineer, this book is also useful for Public Sector Examinations and other competitive examinations for engineering graduates.

I have true desire to serve student community by providing good source of study and quality guidance. Any suggestion from the readers for improvement of this book is most welcome.

B. Singh (Ex. IES)
Chairman and Managing Director
MADE EASY Group

Syllabus of Engineering Subjects

(For both Objective and Conventional Type Papers)

Civil Engineering

Building Materials : Physical and Chemical properties, Classification, Standard Tests, Uses and manufacture/ quarrying of materials e.g. building stones, silicate based materials, Cement (Portland), Asbestos products, Timber and Wood based Products, Laminates, bituminous materials, Paints, Varnishes.

Estimating, Costing and Valuation : Estimate, Glossary of technical terms, Analysis of rates, Methods and unit of measurement, Items of work – Earthwork, Brick work (Modular & Traditional bricks), RCC work, Shuttering, Timber work, Painting, Flooring, Plastering. Boundary wall, Brick building, Water Tank, Septic tank, Bar bending schedule. Centre line method, Mid-section formula, Trapezodial formula, Simpson's rule. Cost estimate of Septic tank, flexible pavements, Tube well, isolated and combined footings, Steel Truss, Piles and pile-caps. Valuation – Value and cost, scrap value, salvage value, assessed value, sinking fund, depreciation and obsolescence, methods of valuation.

Surveying: Principles of surveying, measurement of distance, chain surveying, working of prismatic compass, compass traversing, bearings, local attraction, plane table surveying, theodolite traversing, adjustment of theodolite, Levelling, Definition of terms used in levelling, contouring, curvature and refraction corrections, temporary and permanent adjustments of dumpy level, methods of contouring, uses of contour map, tachometric survey, curve setting, earth work calculation, advanced surveying equipment.

Soil Mechanics: Origin of soil, phase diagram, Definitions- void ratio, porosity, degree of saturation, water content, specific gravity of soil grains, unit weights, density index and interrelationship of different parameters, Grain size distribution curves and their uses. Index properties of soils, Atterberg's limits, ISI soil classification and plasticity chart. Permeability of soil, coefficient of permeability, determination of coefficient of permeability, Unconfined and confined aquifers, effective stress, quick sand, consolidation of soils, Principles of consolidation, degree of consolidation, pre-consolidation pressure, normally consolidated soil, e-log p curve, computation of ultimate settlement. Shear strength of soils, direct shear test, Vane shear test, Triaxial test. Soil compaction, Laboratory compaction test, Maximum dry density and optimum moisture content, earth pressure theories, active and passive earth pressures, Bearing capacity of soils, plate load test, standard penetration test.

Hydraulics: Fluid properties, hydrostatics, measurements of flow, Bernoulli's theorem and its application, flow through pipes, flow in open channels, weirs, flumes, spillways, pumps and turbines.

Irrigation Engineering : Definition, Necessity, Benefits, Ill effects of irrigation, types and methods of irrigation. Hydrology – Measurement of rainfall, run off coefficient, rain gauge, losses from precipitation – evaporation, infiltration, etc. Water requirement of crops, duty, delta and base period, Kharif and Rabi Crops, Command area, Time factor, Crop ratio, Overlap allowance, Irrigation efficiencies. Different type of canals, types of canal irrigation, loss of water in canals. Canal lining – types and advantages. Shallow and deep to wells, yield from a well. Weir and barrage, Failure of weirs and permeable foundation, Slit and Scour, Kennedy's theory of critical velocity. Lacey's theory of uniform flow. Definition of flood, causes and effects, methods of flood control, water logging, preventive measures. Land reclamation, Characteristics of affecting fertility of soils, purposes, methods, description of land and reclamation processes. Major irrigation projects in India.

Transportation Engineering : Highway Engineering – cross sectional elements, geometric design, types of pavements, pavement materials – aggregates and bitumen, different tests, Design of flexible and rigid pavements – Water Bound Macadam (WBM) and Wet Mix Macadam (WMM), Gravel Road, Bituminous construction, Rigid pavement joint, pavement maintenance, Highway drainage. Railway Engineering – Components of permanent way – sleepers, ballast, fixtures and fastening, track geometry, points and crossings, track junction, stations and yards. Traffic Engineering – Different traffic survey, speed-flow-density and their interrelationships, intersections and interchanges, traffic signals, traffic operation, traffic signs and markings, road safety.

Environmental Engineering: Quality of water, source of water supply, purification of water, distribution of water, need of sanitation, sewerage systems, circular sewer, oval sewer, sewer appurtenances, sewage treatments. Surface water drainage. Solid waste management – types, effects, engineered management system. Air pollution – pollutants, causes, effects, control. Noise pollution – causes, health effects, control.

Structural Engineering

Theory of structures: Elasticity constants, types of beams - determinate and indeterminate, bending moment and shear force diagrams of simply supported, cantilever and over hanging beams. Moment of area and moment of inertia for rectangular & circular sections, bending moment and shear stress for tee, channel and compound sections, chimneys, dams and retaining walls, eccentric loads, slope deflection of simply supported and cantilever beams, critical load and columns, Torsion of circular section.

Concrete Technology: Properties, Advantages and uses of concrete, cement aggregates, importance of water quality, water cement ratio, workability, mix design, storage, batching, mixing, placement, compaction, finishing and curing of concrete, quality control of concrete, hot weather and cold weather concreting, repair and maintenance of concrete structures.

RCC Design: RCC beams-flexural strength, shear strength, bond strength, design of singly reinforced and doubly reinforced beams, cantilever beams. T-beams, lintels. One way and two way slabs, isolated footings. Reinforced brick works, columns, staircases, retaining walls, water tanks (RCC design questions may be based on both Limit State and Working Stress methods).

Steel Design: Steel design and construction of steel columns, beams roof trusses plate girders.

■■■■

SSC-JE : Paper-I

Contents

Civil Engineering : Volume-I
Previous Years Objective Solved Papers

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CHAPTER 1

Building Materials

1. Bricks

1.1 Clay and silt content in a good brick earth must be at least
(a) 20% (b) 50%
(c) 35% (d) 70%
[SSC-JE : 2007]

1.2 The standard size of a masonry brick is
(a) 18 cm × 8 cm × 8 cm
(b) 19 cm × 9 cm × 9 cm
(c) 20 cm × 10 cm × 10 cm
(d) 21 cm × 11 cm × 11 cm
[SSC-JE : 2008]

1.3 Crushing strength of first class bricks should not be less than
(a) 35 kg/cm^2 (b) 70 kg/cm^2
(c) 100 kg/cm^2 (d) 150 kg/cm^2
[SSC-JE : 2009]

1.4 The size of modular bricks are :
(a) 20 × 10 × 9 cm
(b) 19 × 9 × 9 cm
(c) 22.5 × 10 × 8.5 cm
(d) 22.5 × 8.0 × 9 cm
[SSC-JE : 2010]

1.5 King closers are related to
(a) doors and windows
(b) king post truss
(c) queen post truss
(d) brick masonary
[SSC - JE : 2011]

1.6 The water absorption for good brick should not be more than
(a) 10 % of its dry weight
(b) 15% of its dry weight
(c) 10% of its saturated weight
(d) 15% of its saturated weight
[SSC - JE : 2012]

1.7 Clay bricks are made of earth having
(a) Nearly equal proportion of silica and alumina
(b) Nearly equal proportions of alumina silica and lime
(c) 35 – 70% silica and 10 – 20% alumina
(d) 10 – 20% silica and 35 – 70% alumina
[SSC - JE : 2012]

1.8 The plasticity to mould bricks in suitable shape is contributed by
(a) Alumina (b) Lime
(c) Magnesia (d) Silica
[SSC : JE : 2013]

1.9 The crushing strength of a first class brick is
(a) 3 N/mm^2 (b) 5.5 N/mm^2
(c) 10.5 N/mm^2 (d) 7.5 N/mm^2
[SSC - JE : 2013]

1.10 Strength based classification of brick is made on the basis of
(a) IS : 3101 (b) IS : 3102
(c) IS : 3495 (d) IS : 3496
[SSC - JE (Forenoon) : 2014]

1.11 Water absorption of class I brick after 24 hours of immersion in water should not exceed _____of self weight
(a) 25% (b) 18%
(c) 20% (d) 22%
[SSC - JE (Afternoon) : 2014]

1.12 The compressive strength of common building bricks should not be less than
(a) 3.5 N/mm^2 (b) 5.5 N/mm^2
(c) 7.5 N/mm^2 (d) 10.5 N/mm^2
[SSC-JE : 2015]

1.13 The number of standard bricks in one cubic metre of brick masonry is
(a) 300 (b) 500
(c) 700 (d) 1000
[SSC-JE : 2015]

1.14 The standard size of a masonry brick is
(a) 18 cm x 8 cm x 8 cm
(b) 18 cm x 9 cm x 9 cm
(c) 19 cm x 9 cm x 9 cm
(d) 19 cm x 8 cm x 8 cm
[SSC-JE : 2015]

1.15 The indentation provided in the face of the brick is called
(a) frog (b) pallet
(c) strike (d) None of the these
[SSC - JE (Forenoon) 1.3.2017]

1.16 A layer of dry bricks put below the foundation concrete, in the case of soft soils, is called
(a) soling (b) shoring
(c) D.P.C. (d) None of these
[SSC - JE (Forenoon) 1.3.2017]

1.17 Hollow bricks are generally used with the purpose of_____.
(a) reducing the cost of construction
(b) providing insulation against heat
(c) increasing the bearing area
(d) ornamental look
[SSC - JE (Afternoon) 1.3.2017]

1.18 The shape of the brick gets deformed due to rain water falling on hot brick. This defect is known as_____.
(a) chuffs (b) bloating
(c) nodules (d) lamination
[SSC - JE (Afternoon) 1.3.2017]

1.19 The operation of removal of impurities of clay adhering to iron ore is known as
(a) calcination (b) purification
(c) dressing (d) refining
[SSC - JE (Afternoon) 1.3.2017]

1.20 The number of bricks required per cubic metre of brick masonry is_____.
(a) 480 (b) 500
(c) 520 (d) 540
[SSC - JE (Afternoon) 1.3.2017]

1.21 The standard size of brick as per Indian standards is
(a) 20 cm × 10 cm × 10 cm
(b) 23 cm × 12 cm × 8 cm
(c) 19 cm × 9 cm × 9 cm
(d) 18 cm × 9 cm × 9 cm
[SSC - JE (Forenoon) : 2.3.2017]

1.22 A brick masonry could fail due to_____.
(a) Rupture along a vertical joint in poorly bonded walls
(b) Shearing along a horizontal plane
(c) Crushing due to overloading
(d) Any of these
[SSC - JE (Forenoon) : 2.3.2017]

1.23 Which of the following statements is correct?
(a) Excess of alumina in the clay makes the brick brittle and weak.
(b) Excess of alumina in the clay makes the brick crack and warp on drying.
(c) Excess of alumina in the clay leaves high power deposit on the brick.
(d) Excess of alumina in the clay improves impermeability and durability of the brick.
[SSC - JE (Forenoon) : 2.3.2017]

1.24 The portion of the brick without a triangular corner is equal to half the width and half of the length is called_____.
(a) Closer (b) queen closer
(c) King closer (d) squint brick
[SSC - JE (Afternoon) 2.3.2017]

1.25 When a brick is cut into two halves longitudinally, one part is called:
(a) king closer (b) cornice brick
(c) queen closer (d) voussoir
[SSC - JE (Forenoon) 3.3.2017]

1.26 The red colour obtained by the bricks is due to the presence of
(a) lime (b) silica
(c) manganese (d) iron oxide
[SSC - JE (Forenoon) 3.3.2017]

1.27 The brick work is measured in square metre, in case of
(a) Honey comb brick work
(b) Brick flat soling
(c) Half brick walls or the partition .
(d) All options are correct
[SSC - JE (Forenoon) 3.3.2017]

1.28 Brick walls are measured in square metre if the thickness of the wall is
(a) 10 cm (b) 15 cm
(c) 20 cm (d) None of these
[SSC - JE (Forenoon) 3.3.2017]

1.29 Which of the following is good for making the bricks?
(a) Silted soil (b) Weathered clay
(c) Soil (d) None of these
[SSC - JE (Afternoon) 3.3.2017]

1.30 The process of mixing clay, water and other ingredients to make bricks is known as
(a) Tempering (b) Kneading
(c) Pugging (d) Moulding
[SSC - JE (Afternoon) 3.3.2017]

1.31 Excess of silica in the clay_____.
(a) makes the brick brittle and weak
(b) makes the brick crack and warp on drying
(c) changes the colour of the brick from red to yellow
(d) improves the impermeability and durability of the brick
[SSC - JE (Afternoon) 3.3.2017]

1.32 The term frog means_____.
(a) an apparatus to lift the stone
(b) a depression on a face of brick
(c) vertical joint in a brick work
(d) soaking brick in water
[SSC - JE (Forenoon) 4.3.2017]

1.33 The minimum compressive strength of 2nd class bricks should be_____.
(a) 70 kg/cm^2 (b) 90 kg/cm^2
(c) 100 kg/cm^2 (d) 120 kg/cm^2
[SSC - JE (Forenoon) 4.3.2017]

1.34 A pug mill is used for_____.
(a) softening brick earth
(b) moulding brick earth
(c) tempering brick earth
(d) providing brick earth
[SSC - JE (Forenoon) 4.3.2017]

1.35 A bull nose brick is not used for_____.
(a) rounding off sharp corners
(b) pillars
(c) decoration purpose
(d) arches
[SSC - JE (Forenoon) 4.3.2017]

1.36 The defect that is caused by falling of rain water on the hot surfaces of the bricks is known as_____.
(a) bloating (b) chuffs
(c) cracks (d) lamination
[SSC-JE : (Evening) 22.01.2018]

1.37 Which one of the following brick is suitable for the high-class brick masonry?
(a) Bull nose bricks (b) Jhumb bricks
(c) Modular bricks (d) Under burnt bricks
[SSC-JE : (Forenoon) 23.1.2018]

1.38 Which of the following is the correct reason for soaking the brick in water before its use?
(a) For preventing adsorption of moisture from mortar by bricks
(b) For reducing air void
(c) For reducing efflorescence
(d) For cleaning
[SSC-JE : (Forenoon) 23.1.2018]

1.39 Refractory bricks are generally used to resist
(a) chemical action
(b) dampness
(c) high temperature
(d) weathering action
[SSC-JE : (Forenoon) 23.1.2018]

1.40 In the composition of good bricks, the total content of silt and clay, by weight, should not be less than:
(a) 20% (b) 30%
(c) 50% (d) 75%
[SSC-JE : (Forenoon) 23.1.2018]

1.41 What is the percentage content of silica in a good quality brick earth?
(a) 20–30% (b) 30–40%
(c) 40–50% (d) 50–60%
[SSC-JE : (Evening) 23.1.2018]

1.42 Which of the following defect appears due to presence of alkalies in the bricks?
(a) Bloating (b) Black core
(c) Cracks (d) Efflorescence
[SSC-JE : (Afternoon) 24.01.2018]

1.43 What is the actual size (mm) of the standard modular brick as per Indian Standards?
(a) $190 \times 90 \times 90$ (b) $200 \times 90 \times 90$
(c) $200 \times 100 \times 100$ (d) $229 \times 114 \times 76$
[SSC-JE : (Afternoon) 24.01.2018]

1.44 In which of the following process, pug mill is used?
(a) Burning of bricks (b) Drying of bricks
(c) Moulding of clay (d) Preparation of clay
[SSC-JE : (Forenoon) 25.01.2018]

1.45 Which of the following is the main reason to provide frog in the bricks?
(a) Print manufacturer's name
(b) Form keyed joint between brick and mortar
(c) Improve thermal insulation
(d) Reduce the weight of brick
[SSC-JE : (Forenoon) 25.01.2018]

1.46 Which of the following represents the nominal size (mm) of a modular brick?
(a) $100 \times 100 \times 100$ (b) $100 \times 100 \times 50$
(c) $200 \times 100 \times 100$ (d) $200 \times 200 \times 100$
[SSC-JE : (Forenoon) 25.01.2018]

1.47 Calculate the number of bricks required for a 5 cubic metre brick wall?
(a) 250 (b) 600
(c) 1500 (d) 2500
[SSC-JE : (Forenoon) 25.01.2018]

1.48 What is the thickness of one and half brick wall made up of standard modular brick?
(a) 20 (b) 30
(c) 40 (d) 50
[SSC-JE : (Forenoon) 25.01.2018]

1.49 Which of the following is the most important characteristic of the alumina in the brick earth?
(a) Maintain plasticity
(b) Increase strength of bricks
(c) To manufacture impermeable bricks
(d) Reduce wrapping when heated
[SSC-JE : (Forenoon) 27.01.2018]

1.50 What is the thickness (cm) of a two brick wall made up of standard modular brick?
(a) 9 (b) 10
(c) 20 (d) 40
[SSC-JE : (Forenoon) 27.01.2018]

1.51 What is the thickness (inches) of the one brick wall made up of traditional brick?
(a) 9 (b) 10
(c) 18 (d) 20
[SSC-JE : (Evening) 27.01.2018]

1.52 Efflorescence in bricks is caused due to ____
(a) excessive burning of bricks
(b) high content of silt in brick clay
(c) high porosity of the bricks
(d) present of soluble salt in parent clay
[SSC-JE : (Forenoon) 29.01.2018]

1.53 How many bricks are required for 1 cubic meter of brick masonry work?
(a) 300 (b) 500
(c) 1000 (d) 1500
[SSC-JE : (Forenoon) 29.01.2018]

1.54 Which of the following mineral is responsible for the red colour in bricks?
(a) Iron oxide (b) Lime
(c) Magnesia (d) Silica
[SSC-JE : (Forenoon) 29.01.2018]

1.55 Tempering is the process used in the manufacturing of_____.
(a) bricks (b) bitumen
(c) cement (d) paints
[SSC-JE : (Evening) 29.01.2018]

1.56 Which of the following is burnt in the Hoffman's kiln during the process of manufacturing?
(a) Bitumen (b) Bricks
(c) Clinker (d) Varnishes
[SSC-JE : (Evening) 29.01.2018]

1.57 Water absorption for class A type of roof tiles is:
(a) 14%-19% (b) 20%-24%
(c) 26%-29% (d) 4%-9%
[SSC-JE : (Afternoon) 23.9.2019]

1.58 The dimensions for special shape of clay bricks are given in:
(a) IS 1464-1969 (b) IS 3951-1975
(c) IS 3461-1966 (d) IS 6165-1971
[SSC-JE : (Afternoon) 23.9.2019]

1.59 Good brick earth should contain _____ of Alumina.
(a) 35% - 40% (b) 20% - 30%
(c) 15% (d) 9% - 10%
[SSC-JE : (Afternoon) 23.9.2019]

1.60 When the deposits of efflorescence is more than 10 per cent but less than 50 percent of the exposed areas of brick, the presence of efflorescence is classified as:
(a) Slight (b) Moderate
(c) Heavy (d) Serious
[SSC-JE : (Forenoon) 25.9.2019]

Answers Building Materials

1. Bricks

1.1 (b) 1.2 (b) 1.3 (c) 1.4 (b) 1.5 (d) 1.6 (b) 1.7 (c) 1.8 (a) 1.9 (c)
1.10 (b) 1.11. (c) 1.12 (a) 1.13 (b) 1.14 (c) 1.15 (a) 1.16 (a) 1.17 (b) 1.18 (a)
1.19 (c) 1.20 (b) 1.21 (c) 1.22 (d) 1.23 (b) 1.24 (c) 1.25 (c) 1.26 (d) 1.27 (d)
1.28 (a) 1.29 (b) 1.30 (b) 1.31 (a) 1.32 (b) 1.33 (a) 1.34 (c) 1.35 (d) 1.36 (b)
1.37 (c) 1.38 (a) 1.39 (c) 1.40 (c) 1.41 (d) 1.42 (d) 1.43 (a) 1.44 (d) 1.45 (b)
1.46 (c) 1.47 (d) 1.48 (b) 1.49 (a) 1.50 (b) 1.51 (a) 1.52 (d) 1.53 (b) 1.54 (a)
1.55 (a) 1.56 (b) 1.57 (b) 1.58 (d) 1.59 (b) 1.60 (b) 1.61 (a) 1.62 (b) 1.63 (c)
1.64. (b) 1.65 (a) 1.66. (a) 1.67 (b) 1.68 (a) 1.69 (d) 1.70 (a) 1.71 (a) 1.72 (b)
1.73 (b) 1.74 (c) 1.75 (c) 1.76 (c) 1.77 (c) 1.78 (b) 1.79 (a) 1.80 (d) 1.81 (a)
1.82 (b) 1.83 (a) 1.84 (c) 1.85 (b) 1.86 (a) 1.87 (b)

2. Stones

2.1 (c) 2.2 (b) 2.3 (b) 2.4 (a) 2.5 (b) 2.6 (b) 2.7 (a) 2.8 (d) 2.9 (d)
2.10 (b) 2.11 (c) 2.12 (d) 2.13 (a) 2.14 (a) 2.15 (c) 2.16 (c) 2.17 (c) 2.18 (b)
2.19 (a) 2.20 (b) 2.21 (d) 2.22 (b) 2.23 (b) 2.24 (b) 2.25 (a) 2.26 (c) 2.27 (a)
2.28 (b) 2.29 (b) 2.30 (a) 2.31 (c) 2.32 (c) 2.33 (a) 2.34 (d) 2.35 (d) 2.36 (c)
2.37 (c) 2.38 (d) 2.39 (a) 2.40 (d) 2.41 (d) 2.42 (b) 2.43 (c) 2.44 (b) 2.45 (d)
2.46 (a) 2.47 (c) 2.48 (c) 2.49 (a) 2.50 (d) 2.51 (d) 2.52 (c) 2.53 (c) 2.54 (a)
2.55 (d) 2.56 (a) 2.57 (a) 2.58 (d) 2.59 (c) 2.60 (c) 2.61 (a) 2.62 (c) 2.63 (a)
2.64 (c) 2.65 (d) 2.66 (c) 2.67 (c) 2.68 (b) 2.69 (d) 2.70 (a) 2.71 (b) 2.72 (b)
2.73 (c) 2.74 (a) 2.75 (a) 2.76 (a)

3. Timbers

3.1 (b) 3.2 (b) 3.3 (a) 3.4 (b) 3.5 (b) 3.6 (d) 3.7 (b) 3.8 (c) 3.9 (c)
3.10 (c) 3.11 (d) 3.12 (b) 3.13 (d) 3.14 (b) 3.15 (d) 3.16 (a) 3.17 (d) 3.18 (d)
3.19 (d) 3.20 (c) 3.21 (a) 3.22 (d) 3.23 (a) 3.24 (b) 3.25 (b) 3.26 (b) 3.27 (b)
3.28 (a) 3.29 (c) 3.30 (d) 3.31 (c) 3.32 (c) 3.33 (d) 3.34 (c) 3.35 (b) 3.36 (b)
3.37 (b) 3.38 (d) 3.39 (c) 3.40 (d) 3.41 (a) 3.42 (d) 3.43 (a) 3.44 (d) 3.45 (c)
3.46 (a,c) 3.47 (b) 3.48 (b) 3.49 (d) 3.50 (b) 3.51 (c) 3.52 (a) 3.53 (d) 3.54 (a)
3.55 (a) 3.56 (b) 3.57 (c) 3.58 (d) 3.59 (b) 3.60 (b) 3.61 (a) 3.62 (a) 3.63 (a)
3.64 (b) 3.65 (a) 3.66 (c) 3.67 (b) 3.68 (d) 3.69 (b) 3.70 (a) 3.71 (a) 3.72 (b)
3.73 (b) 3.74 (b) 3.75 (d) 3.76 (d) 3.77 (a) 3.78 (a) 3.79 (b) 3.80 (a) 3.81 (b)
3.82 (d) 3.83 (b) 3.84 (c)

4. Cement & Lime

4.1 (d) 4.2 (c) 4.3 (a) 4.4 (b) 4.5 (a) 4.6 (b) 4.7 (b) 4.8 (d) 4.9 (c)
4.10 (a) 4.11 (a) 4.12 (b) 4.13 (b) 4.14 (a) 4.15 (b) 4.16 (b) 4.17 (c) 4.18 (d)
4.19 (c) 4.20 (a) 4.21 (a) 4.22 (c) 4.23 (c) 4.24 (d) 4.25 (d) 4.26 (c) 4.27 (c)
4.28 (d) 4.29 (c) 4.30 (d) 4.31 (d) 4.32 (d) 4.33 (c) 4.34 (d) 4.35 (b) 4.36 (c)
4.37 (a) 4.38 (d) 4.39 (b) 4.40 (b) 4.41 (c) 4.42 (b) 4.43 (c) 4.44 (b) 4.45 (b)
4.46 (a) 4.47 (a) 4.48 (a) 4.49 (b) 4.50 (a) 4.51 (a) 4.52 (a) 4.53 (b) 4.54 (c)
4.55 (c) 4.56 (b) 4.57 (a) 4.58 (c) 4.59 (a) 4.60 (d) 4.61 (a) 4.62 (a) 4.63 (b)
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5. Concrete Technology

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6. Paints

6.1 (c) 6.2 (d) 6.3 (b) 6.4 (c) 6.5 (a) 6.6 (c) 6.7 (c) 6.8 (b) 6.9 (d)
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7. Miscellaneous

7.1 (c) 7.2 (b) 7.3 (a) 7.4 (b) 7.5 (d) 7.6 (*) 7.7 (d) 7.8 (c)
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Explanations **Building Materials**

1. Bricks

1.1 (b)

Clay and silt contains silica primarily. The silica content in good brick earth should be 50-60%.

1.2 (b)

- Based on dimensions bricks are of two types, the traditional bricks and the modular bricks.
- The traditional bricks vary in size from place to place.
- Bureau of Indian standards specifies standard size of bricks as 20 cm × 10 cm × 10 cm, which includes thickness of mortar.
- Size of standard brick also known as modular brick should be 19 cm × 9 cm × 9 cm.
- However, a bricks available in most part of the country still are $9'' \times 4\frac{1}{2}'' \times 3''$ and are known as traditional bricks or field bricks.

1.3 (c)

Clay bricks are classified as first class, second class, third class and fourth class based on their physical and mechanical properties:

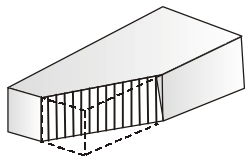
Particular	Remarks
First class bricks	• Crushing strength ≯ 10 N/mm^2 • Water absorption = 12-15% of its dry weight when immersed in cold water for 24 hours
Second class bricks	• Crushing strength ≯ 7 N/mm^2 • Water absorption about 16-20% of its dry weight
Third class bricks	• Water absorption is about 25% of its dry weight • Crushing strength ≯ 5 N/mm^2

1.4 (b)

A brick of standard size 19 cm × 9 cm × 9 cm is recommended by the BIS. With mortar thickness, the size of such a brick becomes 20 cm × 10 cm × 10 cm and it is known as the nominal size of the modular brick. Thus the modular brick size includes the mortar thickness.

1.5 (d)

- King closer is a portion of brick which is cut in such a way that the width of one of its end is half that of a full brick, while the width at the other end is equal to the full width.



King Closer

- It is thus obtained by cutting the triangular piece between the centre of one end and the centre of the other side. It has half header and half stretcher face.

1.6 (b)

As per clause 7.2 of IS 1077 : 1992, water absorption should not be more than 20% by weight up to class 12.5 (crushing strength ≥ 12.5 N/mm^2) and 15% by weight for higher class.

1.7 (c)

Composition of good brick earth and their function are:

(i) **Alumina:** Content of 20% to 30% is necessary. It imparts plasticity to the earth, so it helps in moulding of brick.

(ii) **Silica:** A good brick earth contains about 50% to 60% of silica. It prevents shrinkage, cracking and warping of raw bricks. It thus imparts uniform shape to the brick. Excess of silica makes the brick brittle.

(iii) **Lime:** Less than 5% of lime is desirable. It prevents shrinkage of raw bricks.

(iv) **Iron Oxide:** It helps in fusing of sand and provides red colour to the bricks.

1.8 (a)

Alumina is the chief constituent of a good brick. A content of about 20% to 30% is necessary to form the brick earth of a good quality. It imparts plasticity to the earth so it helps in the moulding of the brick earth. If alumina is present in excess with inadequate quantity of sand then the raw bricks shrink and warp during drying, and on burning they become too hard.

Constituent	Function
(i) Silica (50-60)%	Provides strength hardness and durability of bricks.
(ii) Alumina (20-30)%	Imparts plasticity of bricks.
(iii) Lime (75)%	Causes silica to fuse during burning and binding particles together.
(iv) Magnesia (<1%)	Imparts yellow tint to bricks.
(v) Iron oxide (5-6%)	Provide red colour and improves impermeability and durability.

1.9 (c)

Clay bricks are classified as first class, second class, third class and fourth class based on their physical and mechanical properties:

Particular	Remarks
First class bricks	• Crushing strength ≮ 10 N/mm^2 • Water absorption = 12-15% of its dry weight when immersed in cold water for 24 hours
Second class bricks	• Crushing strength ≮ 7 N/mm^2 • Water absorption about 16-20% of its dry weight
Third class bricks	• Water absorption is about 25% of its dry weight • Crushing strength ≮ 5 N/mm^2

1.10 (b)

IS : 3101 – Aluminium collapsible tubes.
IS : 3102 – Classification of burnt clay brick.
IS : 3495 – Method of test of burnt clay brick.
IS : 3496 – Specification for dobby lags and pegs.

1.11 (c)

The method of determination of water absorption of burnt clay building bricks is covered as per IS : 3495 (Part-II) 1992.

- 1st class brick–Not more than 20% by dry weight.
- 2nd class brick–Not more than 22% by dry weight.
- 3rd class brick–Not more than 25% by dry weight.

1.12 (a)

Types of bricks	Compressive strength (N/mm^2)
Common building bricks	3.5
Third class bricks	5
Second class bricks	7
First class bricks	10.5

1.13 (b)

The nominal size of a brick is

$= 20\text{ cm} \times 10\text{ cm} \times 10\text{ cm}$

$\therefore$ Volume of one brick

$= 0.2 \times 0.1\text{ m} \times 0.1\text{ m} = 2 \times 10^{-3}\text{ m}^3$

$\therefore$ The number of bricks in one cubic meter of brick masonry

$$= \frac{1}{2\times10^{-3}} = 500$$

1.14 (c)

- Based on dimensions bricks are of two types, the traditional bricks and the modular bricks.
- The traditional bricks vary in size from place to place.
- Bureau of India standards specifies standard size of bricks as 20 cm × 10 cm × 10 cm, which includes thickness of mortar.
- Size of standard brick also known as modular brick should be 19 cm × 9 cm × 9 cm.
- However, a bricks available in most part of the country still are $9'' \times 4\frac{1''}{2} \times 3''$ and are known as traditional bricks or field bricks.

1.15 (a)

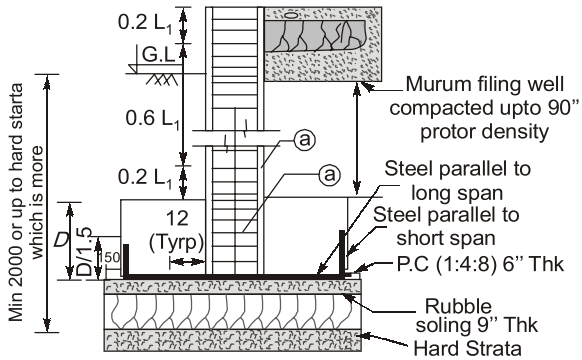
An indent called frog, 1-2 cm deep is provided:

- The purpose of providing frog is to form a key for holding the mortar and therefore, the bricks are laid with frogs on top.

1.16 (a)

Soling: It is the bottom most layer of any component of structure.

- It is done before laying the foundation, to provide batter strength to the foundation.

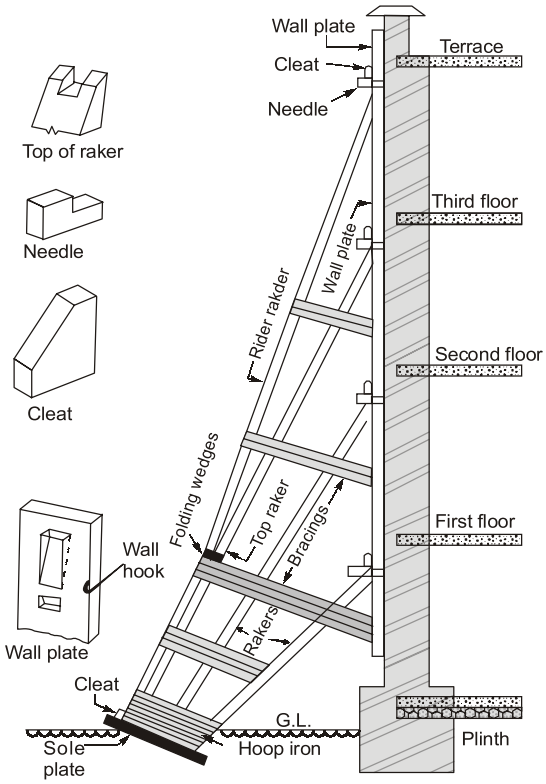


Typical detail of column and column links

Soling

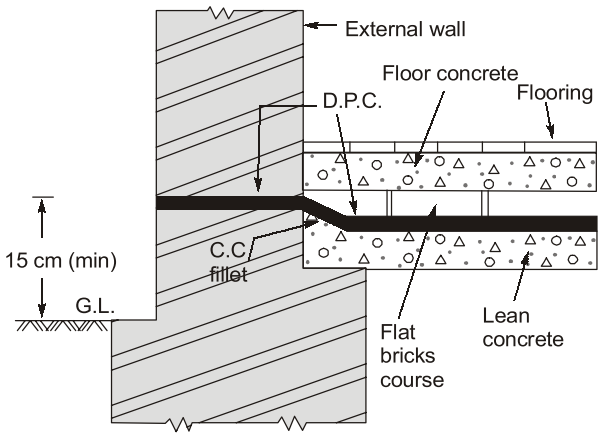
Shoring: It is the technique of using a temporary support, usually from prop, to make a structure stable and safe.

- Shoring is often used to provide lateral support.



DPC (Damp Proof Course): It is a horizontal barrier in a wall designed to resist moisture rising through the structure by capillary action.

- It is used to stop dampness in a buildings.
- To avoid water from reaching to the walls DPC is laid at plinth level.



1.17 (b)

The air present in the hollow area of these bricks make them thermal insulators. They keep the interiors cool in summer and warm in winter especially the 'clay hollow bricks'. They also provide more sound insulation as compared to solid bricks.

1.18 (a)

Deformation of the shape of bricks caused by the rain water falling on the hot bricks is called chuffs.

Bloating: This defect occurs as a spongy swollen mass over the surface of the burnt bricks.

Nodules: When bricks come in contact with water, the absorbed water reacts with lime nodules causing expansion and a consequent disintegration of bricks.

Lamination: It is due to entrapped air in the voids of clay.

1.20 (b)

Size of a modular brick is

$= 20\text{ cm} \times 10\text{ cm} \times 10\text{ cm}$

$= 0.2\text{ m} \times 0.1\text{ m} \times 0.1\text{ m}$

$\therefore$ Number of bricks per m^3 of brick masonry

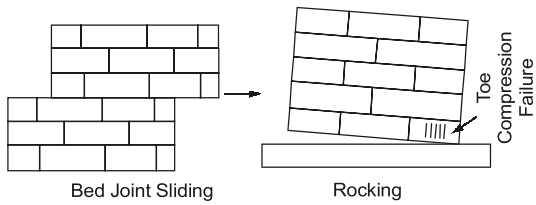
$$= \frac{1\text{m}^3}{0.2\text{ m} \times 0.1\text{m} \times 0.1\text{m}} = 500$$

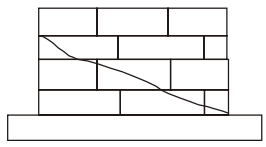
1.21 (c)

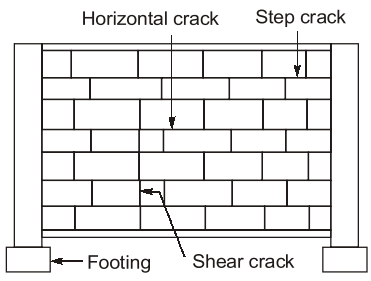
As per Indian standard, Standard size of a brick is 19 cm x 9 cm x 9 cm. The nominal size (brick + mortar) of a brick is 20 cm x 10 cm x 10 cm.

1.22 (d)

Various failure modes of brick masonry.







Types of cracks in brick masonry

1.23 (b)

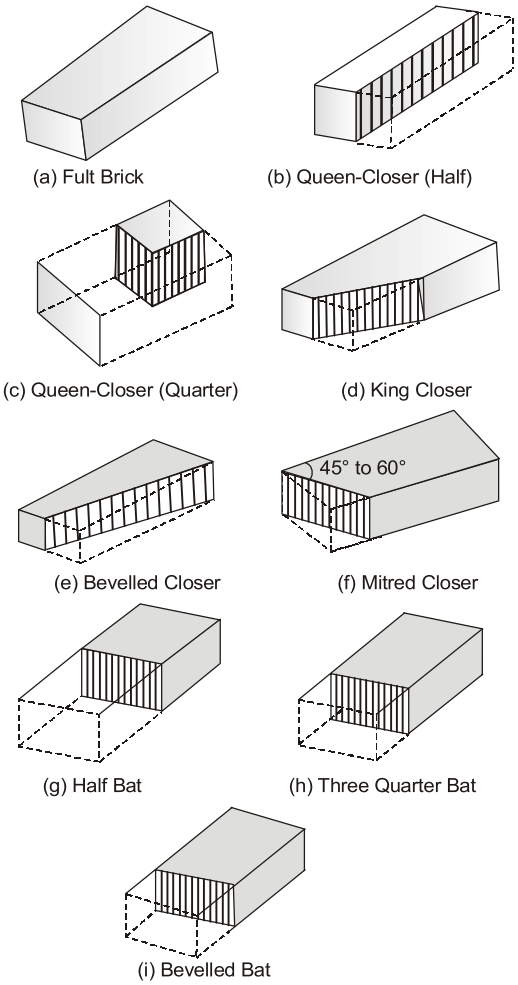
Alumina in bricks is responsible to impart plastic qualities so that the brick can be moulded. However excess of alumina in the clay causes cracks and warps in bricks on drying and becomes too hard when burnt.

1.24 (c)

Closer : It is a portion of a brick with the cut made longitudinally, and is used to close up bond at the end of the course. A closer helps in preventing the joints of successive sources (higher to lower) to come in a vertical line.

Queen Closer : It is a portion of a brick obtained by cutting a brick lengthwise into two portions. Thus, a queen-closer is a brick which is half as wide as the full brick.

King Closer : It is the portion of a brick which is so cut that the width of one of its end is half that of a full brick. While the width at other end is equal to the full width.

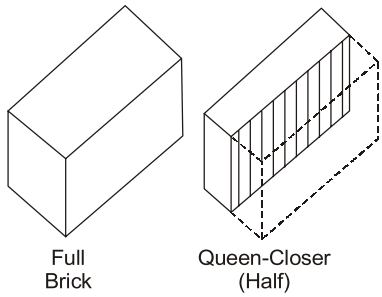


Note:

Squint Junction : A squint junction is formed when an internal wall meets on external continuous wall at an angle other than 90°.

1.25 (c)

When a brick is cut along its length, making it two equal halves then it is called *queen closer*. Thus a queen closer is a broken brick portion whose width is half as wide as the original brick.



1.26 (d)

Importance of Iron Oxide in bricks.

- A good brick earth should contain about 5% to 7% of iron oxide.
- It gives red colour to the bricks.
- It improves impermeability and durability and gives strength and hardness.
- If present in excess, then the colour of brick becomes dark blue or blackish.
- If the quantity of iron oxide is comparatively less, the brick becomes yellowish in colour.

1.27 (d)

As per IS 1200-3: (Method of Measurement of Building and Civil Engineering work, Part-III: Brickwork), brickworks shall be measured in cubic metres unless otherwise specified.

However, if measured in square metres then, walls one brick thick or less shall be measured separately in square metres specifying the thickness. Generally, brickwork of thickness below half brick thickness (i.e. 10 cm) is measured in square metres.

Also, the honey-combed walls should be measured in square metres stating the wall thickness and type of honeycombing.

1.28 (a)

Generally, brickwork of thickness below half brick thickness (i.e. 10 cm) is measured in square metres.

1.29 (b)

Weathering is generally done so that the clay can absorb adequate amount of moisture from the atmosphere. It helps to keep the clay plastic and workable.

1.30 (b)

Kneading : It is a process which is making a uniform mixture by pressing, folding and stretching of clay, water and other ingredients.

Tempering : Tempering consist of kneading the earth with feet so as to make the mass stiff and plastic.

For manufacturing quality bricks, tempering is done in pug mills and the operation is called pugging.

Moulding : It is a process of giving a required shape to the brick from the prepared brick earth.

1.31 (a)

The presence of silica prevents the shrinkage, cracking and warping of raw bricks. It thus imparts uniform shape to the bricks. The durability of bricks depends upon proper composition of silica in brick earth. The excess of silica destroys the cohesion b/w particles and brick become brittle.

1.32 (b)

Frog is an indentation or depression on the top face of a brick made with the object of forming a key for the mortars.

1.33 (a)

The minimum compressive strength of bricks in kg/cm^2 is:

1st class bricks - 105

2nd class bricks - 70

3rd class bricks - 35

1.34 (c)

- Tempering of brick is done in pug mills and the operation is called pugging.
- Tempering is the process where whole mass of brick earth is kneaded to obtain a homogeneous mass.

1.35 (d)

Bull nose brick is a style of brick that has one, some or all of its corners rounded off. These brick can be used to create soft and attractive curved edges to steps, sills, or in capping walls. These bricks are generally used for decorative and exterior purposes.

Arches are subjected to high lateral thrust and thus needs more competent bricks.

1.36 (b)

Chuffs : Deformation of the shape of bricks caused by rainwater falling on hot bricks is chuffs.

1.37 (c)

Modular bricks is standard brick of size 19 cm × 9 cm × 9 cm used for high class masonry works.

- **Jhumb brick :** These are overburnt bricks not suitable for construction works, these are used as ballast, filling works etc.
- **Under burnt bricks :** When bricks are not burnt properly, the clay is not softened because of insufficient heat and the pores are not closed. These bricks are not suitable for construction works.
- **Bull nose:** It is a special moulded brick with one edge rounded (single bull nose) or with two edges rounded (double bull nose). These are used in copings or in such positions where rounded corners are preferred to sharp arises.

1.38 (a)

- The bricks before placing in masonry are soaked in water so that they don't absorb water from mortar.
- The bricks should not have free moisture on their surface otherwise the water content of the mortar will be altered thereby as the strength of mortar will be affected.

1.39 (c)

Refractory bricks:

- Fire-clay bricks are made from fire-clay and

are also known as refractory bricks.

- The process of manufacturing is as of an ordinary brick, burnt at very high temperature in special kiln's. Hence these bricks are capable of resisting very high temperature upto 1700°C without melting or softening.
- These are used for lining blast furnaces, ovens, kilns, boilers and chimneys.

1.40 (c)

Percentage of various ingredients in a good brick earth is as below:

Silica	50 - 60%
Alumina	20 - 30%
Ferric oxide	5 - 6%
Lime	> 5%
Magnesia	< 1%
CO_2, H_2O, SO_3	Very small percentage

1.41 (d)

50 – 60% → Silica
20 – 30% → Alumina
>5% → Lime
5 – 6% → Ferric Oxide

1.42 (d)

Alkalis forming less than 10 percent of the raw clay are of great value as fluxes, especially when combined with silicates of alumina.

- These are mainly in the form of soda or potash.
- When bricks come in contact with moisture, water is absorbed and alkalies crystallise.
- On drying, the moisture evaporates, leaving behind grey or white powder deposits on the brick surfaces which spoils the appearance, this phenomenon is called efflorescence.

1.43 (a)

The actual size of modular brick is 190 mm × 90 mm × 90 mm.

1.44 (d)

Tempering of clay is done is plug mill and procedure is called pugging.

1.45 (b)

An indent called frog, 1-2 cm deep is provided:

- The purpose of providing frog is to form a key for holding the mortar and therefore, the bricks are laid with frogs on top.

1.46 (c)

Nominal size of brick is
200 mm × 100 mm × 100 mm and actual size of brick is 190 mm × 90 mm × 90 mm

1.47 (d)

Number of brick is 1 $m^3 = \frac{10^6}{20\times10\times10} cm^3$
= 500 No.
Thus number of bricks in 5 m^3
= 5 × 500 = 2500 No.

1.48 (b)

Thickness of 1 brick thick wall = 20 cm
Thickness of 2 brick thick wall = 40 cm
Thickness of half brick thick wall = 10 cm
Thickness of one and half brick thickwall = 30 cm

1.49 (a)

Alumina is the chief constituent of a good brick. A content of about 20% to 30% is necessary to form the brick earth of a good quality. It imparts plasticity to the earth so it helps in the moulding of the brick earth. If alumina is present in excess with inadequate quantity of sand then the raw bricks shrink and warp during drying, and on burning they become too hard.

Constituent	Function
(i) Silica (50-60)%	Provides strength hardness and durability of bricks.
(ii) Alumina (20-30)%	Imparts plasticity of bricks.
(iii) Lime (75)%	Causes silica to fuse during burning and binding particles together.
(iv) Magnesia (<1%)	Imparts yellow tint to bricks.
(v) Iron oxide (5-6%)	Provide red colour and improves impermeability and durability.

1.50 (b)

Nominal size of brick is 20 cm × 10 cm × 10 cm.
Thus, two brick thick wall thickness
= 2 × 20 cm = 40 cm

1.51 (a)

Nominal size of traditional brick is 23 cm × 11.4 cm × 7.6 cm and 1 inch = 2.54 cm