SSC

Staff Selection Commission

Junior Engineer

Civil Engineering

Previous Years Solved Papers

Topicwise Objective Solved Questions ***Topicwise Conventional Solved Questions***

Also useful for Public Sector Examinations
and other Competitive Examinations

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SSC : Junior Engineer
Civil Engineering

First Edition: 2016

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 three 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 & Structural	50 Marks 50 Marks 100 Marks	2 hours
Stage 2: Paper-II Conventional Type	General Engineering : Civil & Structural	300 Marks	2 hours
Stage 3: Personal Interview		100 Marks	---
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, shortlisted candidats are called for Personal Interview.			

The first edition of this book is prepared with due care to provide complete solutions to all questions 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. I hope this book will prove as an important tool to succeed in SSC -JE and other competitive exams. Any suggestion from the readers for improvement of this book is most welcome.

With Best Wishes

B. Singh

CMD, MADE EASY

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.

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SSC

Staff Selection Commission

Junior Engineer

Section-A

Civil Engineering

Paper I : Objective Paper

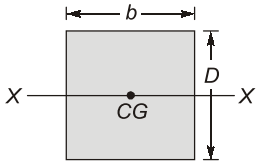
Topicwise Previous Year Solved Questions

1 Properties of Metals, Stress & Strain

1.1 The ratio of normal stress to volumetric strain in defined as
(a) Young's modulus (b) Bulk modulus
(c) Rigidity modulus (d) Tangent modulus
[SSC : JE : 2011]

1.2 A material is called ductile if it
(a) has little plastic elongation range
(b) has long plastic elongation range
(c) could be hammered into a very thin sheet
(d) shows large elastic strain
[SSC : JE : 2011]

1.3 The moment of inertia of the cross-section about X-X axis is



(a) $D^3b/3$ (b) $D^3b/12$
(c) $Db^3/3$ (d) $Db^3/12$
[SSC : JE : 2011]

1.4 Poisson's ratio is defined as
(a) longitudinal strain/lateral strain
(b) lateral strain/longitudinal strain
(c) lateral strain × longitudinal strain
(d) $\frac{1}{2}$ (lateral strain) × (longitudinal strain)
[SSC : JE : 2011]

1.5 Modulus of rigidity is expressed as
(a) compressive stress/compressive strain
(b) tensile stress/tensile strain
(c) shear stress/shear strain
(d) stress/volumetric strain
[SSC : JE : 2011]

1.6 Hooke's law is valid up to
(a) Limit of proportionality
(b) Ultimate point
(c) Elastic limit
(d) Yield point
[SSC - JE : 2012]

1.7 The ability of a material to absorb energy till the elastic limit is known as
(a) Resilience (b) Ductility
(c) Elasticity (d) Malleability
[SSC - JE : 2012]

1.8 Out of the following, which is least elastic ?
(a) Silver (b) Rubber
(c) Iron (d) Copper
[SSC - JE : 2012]

1.9 A bar, L metre long and having its area of cross-section A, is subjected to gradually applied tensile load W. The strain energy stored in the bar is given by
(a) $\frac{W^2L}{AE}$ (b) $\frac{W^2L}{2AE}$
(c) $\frac{WL}{2AE}$ (d) $\frac{WL}{AE}$
[SSC - JE : 2012]

1.10 The predominant effect of an axial tensile force on a helical spring is
(a) Compression (b) Twisting
(c) Bending (d) Tension
[SSC - JE : 2012]

1.11 Strain energy per unit volume of a solid circular shaft under axial tension is
(a) $\frac{\sigma^2}{8E}$ (b) $\frac{\sigma^2}{16E}$
(c) $\frac{\sigma^2}{2E}$ (d) $\frac{\sigma^2}{4E}$
[SSC - JE : 2012]

1.12 For a beam carrying a uniformly distributed load, the strain energy will be maximum in case the beam is
(a) Propped cantilever
(b) Fixed at both ends
(c) Cantilever
(d) Simply supported

[SSC - JE : 2012]

1.13 From a circular plate of diameter 6.0 cm, a circle is cut out whose diameter is a radius of the plate. The distance of centre fo gravity of the remainder from the centre of circular plate is
(a) 5.0 cm (b) 1.5 cm
(c) 1.0 cm (d) 0.5 cm

[SSC : JE : 2013]

1.14 The ability of a material to absorb energy till the breaking or rupture takes place is known as
(a) Hardness (b) Toughness
(c) Brittleness (d) Softness

[SSC : JE : 2013]

1.15 Poisson's ratio (μ) is defined as the ratio of
(a) axial strain to transverse strain
(b) axial strain to shear strain
(c) transverse strain to axial strain
(d) shear strain to axial strain

[SSC : JE : 2013, JE (Forenoon) : 2014]

1.16 Strain energy due to axial deformation is given by where
σ = resultant stress
P = axial load
Δ = deformation
E = modulus of elasticity
(a) $\sigma\varepsilon$ (b) $P\Delta$
(c) $\frac{\sigma^2}{2E}$ (d) $\frac{1}{2}P\Delta$

[SSC - JE (Forenoon) : 2014]

1.17 A linear force-deformation relation is obtained in materials
(a) having elastic stress-strain property
(b) having plastic stress-strain property
(c) following Hooke's law
(d) which are rigid elastic materials

[SSC - JE (Forenoon) : 2014]

1.18 The property of a material by which it can be beaten or rolled into plates, is called
(a) malleability (b) ductility
(c) plasticity (d) elasticity

[SSC - JE (Forenoon) : 2014]

1.19 The property of a material by which it gets permanent deformation under a load which is not recovered after removal of load is called
(a) elasticity (b) brittleness
(c) ductillity (d) plasticity

[SSC - JE (Afternoon) : 2014]

1.20 Strain energy due to sudden axial load is given by:
σ : resultant stress
P : Axial load
Δ : detornator
ϵ : strain
E : modulous of elasticity
(a) $\frac{1}{2}P\Delta$ (b) $\sigma.\varepsilon$
(c) $P\Delta$ (d) $\frac{\sigma^2}{2E}$

[SSC - JE (Afternoon) : 2014]

1.21 The ratio of normal stress to normal strain within elastic limits is called :
(a) Young's modulus (b) Shear modulus
(c) Poisson's ratio (d) Bulk modulus

[SSC - JE (Afternoon) : 2014]

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Answers Properties of Metals, Stress & Strain

1.1	(b)	1.2	(b)	1.3	(b)	1.4	(b)	1.5	(c)	1.6	(a)	1.7	(a)	1.8	(b)	1.9	(b)
1.10	(b)	1.11	(c)	1.12	(c)	1.13	(d)	1.14	(b)	1.15	(c)	1.16	(d)	1.17	(d)	1.18	(c)
1.19	(d)	1.20	(d)	1.21	(a)												

Explanations Properties of Metals, Stress & Strain

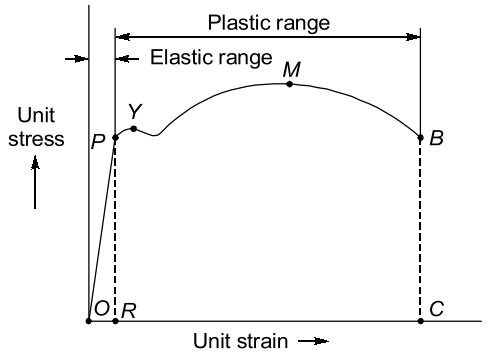
1.1 (b)

$$\text{Young's modulus} = \frac{\text{Tensile stress}}{\text{Tensile strain}}$$

$$\text{Rigidity modulus} = \frac{\text{Shear stress}}{\text{Shear strain}}$$

Tangent modulus = Slope of the stress-strain curve at any specified stress or strain.

1.2 (b)



Stress-strain diagram for a Ductile Material

1.4 (b)

Poisson's ratio,

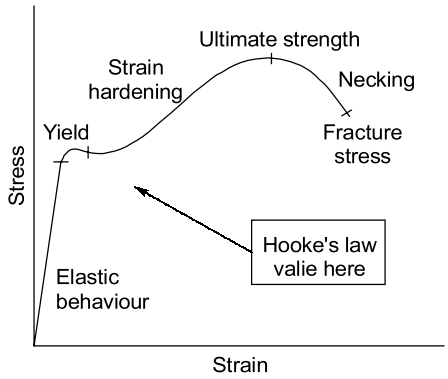
$$\mu = \frac{\text{Unit lateral contraction}}{\text{Unit axial elongation}}$$

1.5 (c)

The shear modulus is concerned with the deformation of a solid when it experiences a force parallel to one of its surfaces while its opposite face experiences an opposing force (such as friction.)

1.6 (a)

Limit of proportionality.



1.7 (a)

$$\text{Resilience} = \text{Area under } P\text{-}\delta \text{ curve} = \frac{1}{2} \times P \times \delta$$

1.8 (b)

Elasticity is measured as ratio of stress to strain. For a given stress, strain is much smaller in steel than in rubber.

1.9 (b)

$$\text{Strain energy stored} = \frac{1}{2} P \times \delta$$

$$= \frac{1}{2} \times W \times \frac{WL}{AE}$$

$$= \frac{W^2 L}{2AE}$$

1.10 (b)

A spring may be defined as an elastic member whose primary function is to deflect or distort under the action of applied load and it recovers its original shape when load is released. A helical spring is made of wire coiled into a helical form, the load being applied along the axis of the helix.

In these type of springs the major stresses are torsional shear stress due to twisting. They are both used in tension and compression.

1.11 (c)

Strain energy per unit volume

$$= \frac{P^2L}{2AE \times AL} = \frac{(P/A)^2}{2E} = \frac{\sigma^2}{2E}$$

1.12 (c)

Strain energy stored = Work done by external force.

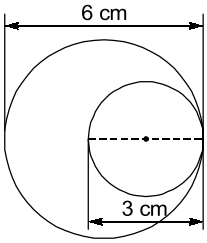
But work done by external force is maximum in case of a cantilever.

Alternatively, for the same span and loading (uniformly distributed), cantilever has maximum bending moment (at support) and these has maximum strain energy since,

$$\text{Strain energy} = \int_0^L \frac{M^2 dx}{2EI}$$

i.e., Strain energy $\propto M^2$

1.13 (d)



Distance of C.G. of remainder portion from centre of circle

$$= \frac{\pi\left(\frac{R}{2}\right)^2 \times \frac{R}{2}}{\pi R^2 - \pi\left(\frac{R}{2}\right)^2} = \frac{R}{8} = \frac{4}{3} = \frac{3}{8} \times \frac{4}{3} = 0.5 \text{ cm}$$

1.14 (b)

Hardness: It is the ability of a material to resist indentation or surface abrasion.

Brittleness: It is lack of ductility. Brittleness implies that it cannot be drawn out by tension to smaller section.

Softness: Higher the softness, lesser is the force required to make a scratch in the material.

1.16 (d)

Strain energy due to axial deformation = $\frac{1}{2}(P\Delta)$

Strain energy per unit volume = $\frac{\sigma^2}{2E}$

1.17 (d)

Hooke's law is valid for material having linear stress and strain relationship.

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