ZONE TECH

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Best Institute For Assistant & Junior Engineer

# Civil Engineering

## Full Length Paper - 13

## RSMSSB - JE Test Series

## Answer key & Detailed Solution

**Test ID. 124** **Date:- 10/09/2021**

**Duration : 2:00 hr.** **Maximum Marks : 120**

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

**41. (b)**

**Bloating :-** It is the phenomenon by which spongy swoller mass over the surface of the brick is called bloating. Bloting of bricks occur due to the presence of excess carbon and sulphur in brick earth.

**Chuffs :-** The deformation on shape of bricks due to falling of rain drops on the surfae of hot bricks is called as chuffs.

**Lamination :-** The phenomenon in which thin lamina is produced on brick surface which flakes out on exposure to atmospheric condition. Lamination of brick is due to the entrapped air present in the voids of clay.

**Nodules :-** This defect due to lumps of lime or excess of water. When bricks come is contact with water, the absorbed water reacts with lime nudules causing expansion and a consequent disintegration of bricks.

**42. (c)**

Slate is obtain from metamorphisum action on shale.

**46. (d)**

$$\tau = B\left(\frac{du}{dy}\right)^2 \Rightarrow \frac{F}{A} = B\left(\frac{du}{dy}\right)^2$$

$$\therefore \quad \frac{MLT^{-2}}{L^2} = B\left(\frac{LT^{-1}}{L}\right)^2 \Rightarrow B = ML^{-1}$$

**48. (c)**

If points on the area having equal time of travel are considered and located on a map of the catchment, a line joining them is called an isochrone.

**49. (b)**

By defination,

$$\eta_c = \frac{\text{Output}}{\text{Input}} \times 100 = \frac{0.8}{1} \times 100 = 80\%$$

**50. (a)**

Given

Diameter of droplet = 0.075 mm

Surface tension = 0.000075 N/mm

Intensity of the pressure

$= ?\ (N/cm^2)$

As we know

$$\text{Pressure in droplet} = \frac{4\sigma}{d} = \frac{4 \times .0.000075}{0.075} \frac{N}{mm^2}$$

$$= 4 \times 10^{-3}\ N/mm^2$$

$$\text{or } 0.4\ N/cm^2$$

**52. (d)**

Magnetic needle is suported at its center of gravity on a hard steel pivot and the center of needle is generally provided with a cup type jewelled bearing for supporting it on the pivot.

**53. (b)**

Active earth pressure

$$= P_a = K_a\sigma_v - 2C\sqrt{K_a}$$

at depth Z,

$$\sigma_v = (\gamma z + q)$$

for $p_a = 0$

$$K_a\sigma_v = 2C\sqrt{K_a}$$

$$\sqrt{K_a} \times (\gamma z + q) = 2C$$

$$\therefore \quad Z = \frac{2C}{\gamma\sqrt{K_a}} - \frac{q}{\gamma}$$

$$k_a = \tan^2\alpha$$

$$\sqrt{k_a} = \tan\alpha$$

$$\frac{1}{\sqrt{k_a}} = \tan\alpha'$$

**56. (d)**

$$S = \frac{V_w}{V_V} \times 100$$

$V_w$ = Volume of water

$V_V$ = Volume of voids

**57. (d)**

As per IS code 800-2000, 7.6.15 - it should be take 1.05 of actual selenderness ratio.

**58. (d)**

Earth quake load and wind load will not at simutaneously.

**61. (b)**

Strut is a compression member used in the roof truss and bracing. They are of small span and may be vertical or linclined.

The principal rafter is a top chord members in a roof truss and boom is the principal compression member in a crane.

Column, stanchion or post is a vertical compression member supporting flats or girders in a building.

**62. (c)**

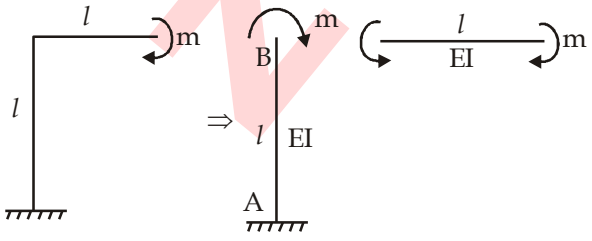
$$\frac{dm}{dx} = SF \qquad ....(i)$$

$$\frac{dSF}{dx} = W \qquad ....(ii)$$

$y$ = deflection

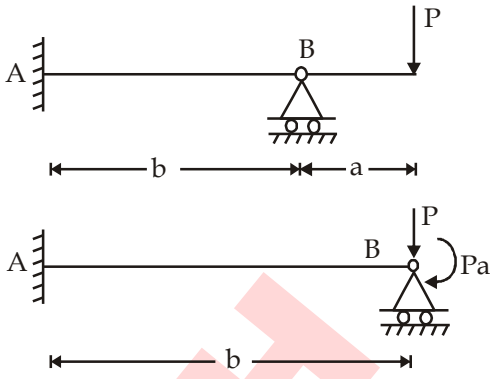
$$\frac{d^2y}{d^2x} = \frac{M}{EI} = \frac{1}{R} = \text{curvature}$$

**64. (a)**




Horizontal defleciton of C = horizontal deflection of B $= \frac{ML^2}{2EI}$

**65. (b)**




Load to be transferd to B point

Pa moment will be carry over to A support = Pa/2

**67. (b)**

$I_{xx} = I_{yy}$ is available in (b) only thereby giving the maximum value of $r_{min.}$

**68. (d)**

Permissible values

Axial tensile stress $= 0.6f_y$

Bearing stress $= 0.75f_y$

Maximum shear stress $= 0.45f_y$

Stress in slab base = 185 MPa for all type of steels.

**70. (a)**

For an isolated T-beam

Effective width of flange.

$$b_f = \frac{l_0}{\left(\frac{l_0}{B} + 4\right)} + b_w$$

$$= \frac{6 \times 1000}{\frac{6000}{1000} + 4} + 300 = 900\,\text{mm}$$

**71. (d)**

Wind and earthquake effects are not considered simultaneously.

(i) Design moment when wind effect is considered

$$= 1.2(DL + LL + WL)$$

$$= 1.2(50 + 80 + 120)$$

$$= 300\,\text{kN-m}$$

(ii) Design moment when earthquake effect is considered

$$= 1.2(DL + LL + EL)$$

$$= 1.2(50 + 80 + 180)$$

$$= 372\,\text{kN-m}$$

**72. (a)**

The material factor of safety in limit state method is less as compared to that in working stress method.

**73. (c)**

The slabs supported directly on columns without beams are known as flat slabs. In such slabs, large bending moments and shear forces are induced in the vicinity of columns. Therefore the columns are flared at the top called column heads or column capitals and slab are thickened around the column capitals called drops for reducing the stresses due to moments and shears. The drops primarily resist shear.

**74. (d)**

The amount of torsion in a member depends upon the magnitude of the torsional stiffness of the member itself in relation to the stiffness of the interconnecting members. In reinforced concrete structures, the stiffness decreases considerably after the formation of cracks if the continuity at the joint are not considered in the design.

The presence of reinforcement in the form of longitudinal and transverse steel increases the torsional moment carrying capacity of beams.

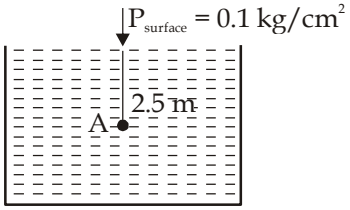
**75. (b)**

$$P_{water} = P_{liquid}$$

$$\rho_w \times g \times (100) = 0.8 \times \rho_w \times g \times h$$

$$h = \frac{100}{0.8} = 125\,\text{m}$$

**76. (c)**




Given

$$P_{surface} = 0.1\frac{kg}{cm^2} = 9.81 \times 10^4 \times 0.1\frac{N}{m^2}$$

$$s.g = 0.8$$

So $\rho_{oil} = 800\,kg/m^3$

Now we calculate the pressure at depth of 2.5m

$$= P_{surface} + \rho g(2.5)$$

$$= (9.81 \times 10^4 \times 0.1) + (800 \times 9.81 \times 2.5)$$

$$= 9810 + 19620 = 29430\,N/m^2$$

Pressure head at depth of 2.5 m in terms of water.

$$h = \frac{P}{\rho_w g} = \frac{29430}{1000 \times 9.81} = 3\,\text{m of water}$$

**77. (b)**

For fully submerged body of homogeneous composition the centre of buoyancy always coincides with centroid of the volume of fluid displaced.

**80. (a)**

Economic spacing of the truss is the spacing that makes the overall cost of trusses, purlins, roof coverings, columns etc. minimum. It depends upon the relative cost of trusses, purlins, roof coverings, spacing of columns, etc. For economic spacing the cost of trusses,

t = 2p + r

p → cost of purlins

r → cost of roof coverings

**81. (d)**

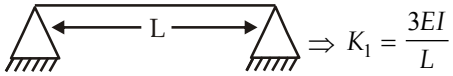
Delign wind speed depents apon

(a) Risk coefficient

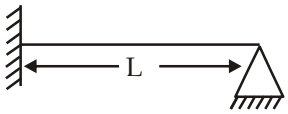
(b) Topography of area

(c) Size of structure,

**83. (b)**



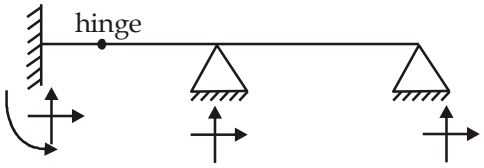

$$\Rightarrow K_1 = \frac{3EI}{L}$$




$$\Rightarrow K_2 = \frac{4EI}{L}$$

$$\Rightarrow \frac{K_1}{K_2} = \frac{3}{4}$$

**84. (c)**




$$D_s = D_{se} + D_{si}$$
$$D_{se} = R_e - 3$$
$$= 7 - 3 = 4$$
$$D_{si} = 3C - r_r$$
$$= 0 - \Sigma(m-1)$$
$$= -1$$
$$D_S = 4 - 1$$
$$D_S = 3$$

**86. (c)**

Every object in the sky has two numbers that fix its location called right ascension and declination, more generally referred to as the object's celestial coordinates. Declination corresponds to latitude and right ascension to longitude.

**87. (a)**

$$\text{Crop water use efficiency} = \frac{\text{yield}}{\text{Evapotranspiration}}$$

**89. (b)**

Evaporation losses can be minimized by sprinkling acetyl alcohol

**90. (c)**

**Drainage Density:-** Ratio of total channel length to the total drainage area.

**Stream Density:-** Ratio of number of streams of all orders within basin to the catchment area.

**91. (a)**

Minimum thickness of footing = 150 mm (when footing rests on soil)

**92. (d)**

The texture of sand stone is clastic (only noticeable with a microscope)

**93. (b)**

The expansion in portland cement can be tested by soundness test. Soundness of cement can be tested by

(i) Autoclave test

(ii) Le chatelier test

**94. (c)**

Tricalcium silicate ($C_3S$) is known as ALITE

Dicalcium silicate ($C_2S$) is known as BELITE

Tricalcium aluminate ($C_3A$) is known as CELITE

Tetracalcium alumino ferrite ($C_4AF$) is known as FELITE

**95. (c)**

Excess of lime causes the brick to melt and brick looses its shape.

**97. (c)**

**Hip Roof -** Slope in all four directions with no break.

**98. (a)**

English bond is the strongest bond. Hence, it is generally used for load bearing constructions.

**99. (d)**

Partial safety factor for limit state of serviceability.

1. DL + LL
2. DL + WL/EQL
3. DL + 0.8LL + 0.8 WL/EQL

**100. (b)**

The gross diameter in general refers to the diameter of the rivet hole. Initially the rivet is of a lesser diameter than the hole. But the riveting process involves pressing against the rivet in a hot condition (mostly). This pressing process compresses and expands the rivet. Now it fills the hole completely. Hence the diameter of the rivet is now equal to the diameter of the hole.

**102. (b)**

By making laterally restrained compression flange of beam its lateral buckling can be avoided due to bending compression.

**103. (a)**

**Vertical stiffners :** These stiffners are provide to resist chances of web buckling due to shear.

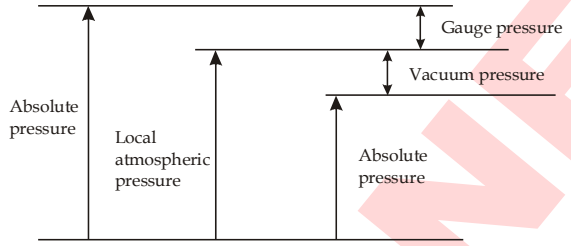
**Horizontal stiffness :** These are provided in compression zone to reduces chances of lateral buckling of web due to bending compression. These are called as longitudinal stiffner.

**Load Bearing stiffners:** load bearing stiffners are used to avoid cripling by transferring load from are flange to another flange.

**105. (c)**

In the case of compression, there is no need to deduct hole area from the section to compute strength.

**108. (d)**




**109. (b)**

For three dimensional steady incompressible flow the continuity equation is

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=0$$

or $$\frac{\partial}{\partial x}\left(-\frac{\partial \phi}{\partial x}\right)+\frac{\partial}{\partial y}\left(-\frac{\partial \phi}{\partial y}\right)+\frac{\partial}{\partial z}\left(-\frac{\partial \phi}{\partial z}\right)=0$$

or $$\frac{\partial^2 \phi}{\partial x^2}+\frac{\partial^2 \phi}{\partial y^2}+\frac{\partial^2 \phi}{\partial z^2}=0$$

Which is nothing but $\Delta^2\phi = 0$. The "Laplace equation". Thus any function that satisfied Laplace equation is a possible case of fluid flow.

**111. (d)**

$$\text{Number of divisions } n = \frac{\text{Main scale L.C.}}{\text{Combined L.C.}}$$

$$= \frac{0.5}{0.05} = 10$$

**113. (b)**

Mean sea level (MSL) is used as a reference surface for establishing the vertical control.

**114. (b)**

Thiessen Polygon Method: In this method the rainfall recorded at each station is given a weightage on the basis of an area closest to the station.

$$P_{avg} = \frac{P_1A_1 + P_2A_2 + .....P_nA_n}{A_1 + A_2 + ..... + A_n}$$

where, $P_1$, $P_2$, ..... $P_n$ are the rainfall data of areas $A_1$, $A_2$, .....$A_n$.

The Thiessen-polygon method of calculating the average precipitation over an area is superior to the arithmetic average method.

**115. (a)**

If the zeros of the verniers A and B are not at the ends of the same diameter and exactly 180° apart, the error occurs. In that case the difference between the two vernier readings will be constant but slightly different from 180°. The error can be eliminated by taking the readings of both the verniers and taking the mean of the two readings. It may be noted that if the vernier is eccentric, no error is introduced in the angle so long as the same vernier is used for the initial and final reading. It is clear from the above discussion that by taking the mean of the two vernier readings, the error due to eccentricity of the centres and that due to eccentricity of verniers both are eliminated.

**116. (a)**

For 1 : 6 bricks masonary mortar

Required quantity for 1 $m^3$ is

Cement $\Rightarrow$ 0.045 $m^3$ (1.35 bags of cement)

So for 50 $m^3$ brick work $\Rightarrow$ total cement of bags required is $\Rightarrow$ 67.5

So nearly option is 72 bags