

## SECTION-B

[Only for candidates appearing in QURAT July'19 -DEPARTMENT OF C.E.]

51. If the fineness modulus of a sample of the fine aggregates is 4.3, the mean size of the particles in the sample is between
- 150 and 300 micron
  - 2.36mm and 4.75mm
  - 300 and 600 micron
  - 1.18mm and 2.36mm
52. The characteristic compressive strength of concrete required for a project is 25 MPa and standard deviation in the observed compressive strength expected at site is 4 MPa. The average compressive strength of cubes tested at different water-cement (w/c) ratios using the same material as is used for the project is given in the table.
- |                           |    |    |    |    |
|---------------------------|----|----|----|----|
| w/c(%)                    | 45 | 50 | 55 | 60 |
| Average compressive (MPa) | 35 | 25 | 20 | 15 |
- The water-cement ratio (in percent, round off to the lower integer) to be used in the mix is
- 46
  - 47
  - 48
  - 49
53. A solid sphere of radius,  $r$ , and made of material with density  $\rho_s$ , is moving through the atmosphere (constant pressure,  $p$ ) with a velocity,  $v$ . The net force ONLY due to atmospheric pressure ( $F_p$ ) acting on the sphere at any time,  $t$ , is
- $\frac{4}{3} \pi r^3 \rho_s$
  - Zero
  - $\pi r^2 p$
  - $4\pi r^2 p$
54. An earthen dam of height  $H$  is made of cohesive soil whose cohesion and unit weight are  $c$  and  $\gamma$ , respectively. If the factor of safety against cohesion is  $F_c$ , the Taylor's stability number ( $S_n$ )
- $\gamma H / c F_c$
  - $F_c \gamma H / c$
  - $c / F_c \gamma H$
  - $c F_c / \gamma H$
55. The setting time of cement is determined using
- Le Chatelier apparatus
  - Briquette testing apparatus
  - Vicat apparatus
  - Casagrande's apparatus
56. A structural member subjected to compression, has both translation and rotation restrained at one end, while only translations is restrained at the other end.
- as per IS 456:2000, The effective length factor recommended for design is
- 0.50
  - 0.65
  - 0.70
  - 0.80
57. Which one of the following statements is NOT correct?
- When the water content of soil lies between its liquid limit and plastic limit, the soil is said to be in plastic state.
  - Boussinesq's theory is used for the analysis of stratified soil.
  - The inclination of stable slope in cohesive soil can be greater than its angle of internal friction.
  - For saturated dense fine sand, after applying overburden correction, if the Standard Penetration Test value exceeds 15, dilatancy correction is to be applied.
58. The clay mineral, whose structural units are held together by potassium bond is
- Halloysite
  - Illite
  - Kaolinite
  - Smectite
59. Dupuit's assumptions are valid for
- artesian aquifer
  - confined aquifer
  - leaky aquifer
  - unconfined aquifer
60. For a given discharge in an open channel, there are two depths which have the same specific energy. These two depths are known as
- alternate depths
  - critical depths
  - normal depths
  - sequent depths
61. As per IS 10500:2012, for drinking water in the absence of alternate source of water, the permissible limits for chloride and sulphate, in mg/L, respectively are
- 250 and 200
  - 1000 and 400
  - 200 and 250
  - 500 and 1000
62. Bull's trench kiln is used in the manufacturing of

- a. Lime
- b. cement
- c. bricks
- d. none of these

63. The compound which is largely responsible for initial setting and early strength gain of Ordinary Portland Cement is

- a. C<sub>3</sub>A
- b. C<sub>3</sub>S
- c. C<sub>2</sub>S
- d. C<sub>4</sub>AF

64. In the consolidated undrained triaxial test on a saturated soil sample, the pore water pressure is zero

- a. during shearing stage only
- b. at the end of consolidation stage only
- c. both at the end of consolidation and during shearing stages
- d. under none of the above conditions

65. A fine grained soil is found to be plastic in the water content range of 26-48%. As per Indian Standard Classification System, the soil is classified as

- a. CL
- b. CH
- c. CL-ML
- d. CI

66. The type of flood routing (Group I) and the equation(s) used for the purpose (Group II) are given below.

- |                             |                        |
|-----------------------------|------------------------|
| Group I                     | Group II               |
| P. Hydrologic flood routing | 1. Continuity equation |
| Q. Hydraulic flood routing  | 2. Momentum equation   |
|                             | 3. Energy equation     |

The correct match is

- a. P - 1; Q - 1, 2 & 3
- b. P - 1; Q - 1 & 2
- c. P - 1 & 2; Q - 1
- d. P - 1 & 2; Q - 1 & 2

67. The pre-jump Froude Number for a particular flow in a horizontal rectangular channel is 10. The ratio of sequent depths (i.e., post-jump depth to pre-jump depth) is

- a. 12
- b. 13.65
- c. 11
- d. 0

68. Pre-cursors to photochemical oxidants are

- a) NO<sub>x</sub>, VOCs and sunlight
- b) SO<sub>2</sub>, CO<sub>2</sub> and sunlight
- c) H<sub>2</sub>S, CO and sunlight
- d) SO<sub>2</sub>, NH<sub>3</sub> and sunlight

69. Crown corrosion in a reinforced concrete sewer is caused by:

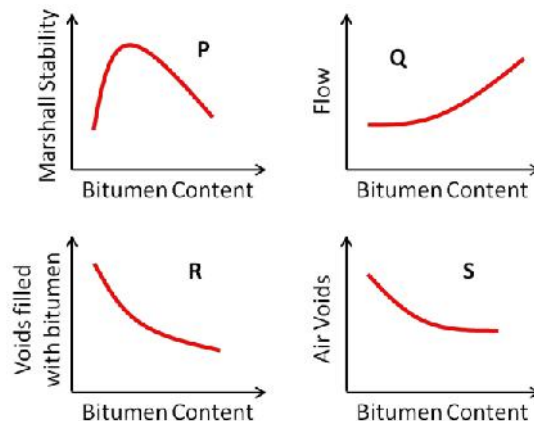
- a. H<sub>2</sub>S
- b. CO<sub>2</sub>
- c. CH<sub>4</sub>
- d. NH<sub>3</sub>

70. Match the items in Group - I with those in Group - II and choose the right combination.

- |                                |                                |
|--------------------------------|--------------------------------|
| Group - I                      | Group - II                     |
| P. Activated sludge process    | 1. Nitrifiers and denitrifiers |
| Q. Rising of sludge            | 2. Autotrophic bacteria        |
| R. Conventional nitrification  | 3. Heterotrophic bacteria      |
| S. Biological nitrogen removal | 4. Denitrifiers                |

- a. P-3, Q-4, R-2, S-1
- b. P-2, Q- R-4, S-1
- c. P-3, Q-2, R-4, S-1
- d. P-1, Q-4, R-2, S-3

71. During a forensic investigation of pavement failure, an engineer reconstructed the graphs P, Q, R and S, using partial and damaged old reports.



Theoretically plausible correct graphs according to the 'Marshall mixture design output are

- a. P, Q, R
- b. P, Q, S
- c. Q, R, S
- d. R, S, P

72. In a one-lane one-way homogeneous traffic stream, the observed average headway is 3.0s. The flow (expressed in vehicles/hr) in this traffic stream is .

- a. 1100
- b. 1000
- c. 1200
- d. 500

73. The minimum number of satellites needed for a GPS to determine its position precisely is

- a. 2
- b. 3
- c. 4
- d. 24

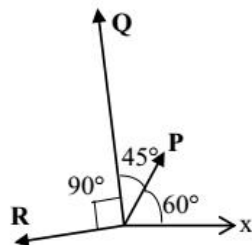
74. The system that uses the Sun as a source of electromagnetic energy and records the naturally radiated and reflected energy from the object is called

- a. Geographical Information System
- b. Global Positioning System
- c. Passive Remote Sensing
- d. Active Remote Sensing

75. The staff reading taken on a workshop floor using a level is 0.645 m. The inverted staff reading taken to the bottom of a beam is 2.960 m. The reduced level of the floor is 40.500 m. The reduced level (expressed in m) of the bottom of the beam is

- a. 44.105
- b. 43.460
- c. 42.815
- d. 41.145

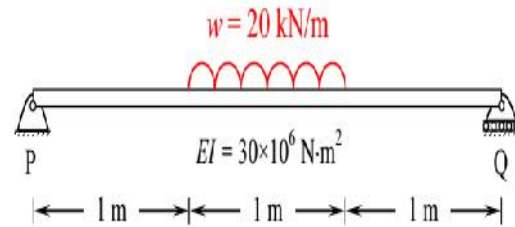
76. The magnitudes of vectors **P**, **Q** and **R** are 100 kN, 250 kN and 150 kN, respectively as shown in the figure.



The respective values of the magnitude (in kN) and the direction (with respect to the x-axis) of the resultant vector are

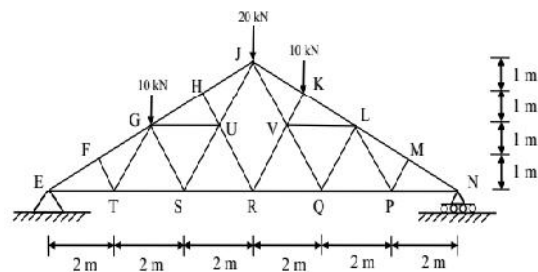
- a. 290.9 and 96.0°
- b. 368.1 and 94.7°
- c. 330.4 and 118.9°
- d. 400.1 and 113.5°

77. A 3 m long simply supported beam of uniform cross section is subjected to a uniformly distributed load of  $w = 20 \text{ kN/m}$  in the central 1 m as shown in the figure. The deflection (in radians) of the deformed beam is



- a.  $0.681 \times 10^{-7}$
- b.  $0.943 \times 10^{-7}$
- c.  $4.310 \times 10^{-7}$
- d.  $-3.19 \times 10^{-7}$

78. A plane truss with applied loads is shown in the figure.



The members which do not carry any force are

- a. FT, TG, HU, MP, PL
- b. ET, GS, UR, VR, QL
- c. FT, GS, HU, MP, QL
- d. MP, PL, HU, FT, UR

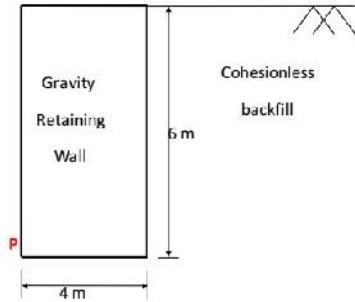
79. For M25 concrete with creep coefficient of 1.5, the long-term static modulus of elasticity (expressed in MPa) as per the provisions of IS:456-2000 is

- a) 1000
- b) 1200
- c) 0
- d) 300

80. The porosity ( $n$ ) and the degree of saturation ( $S$ ) of a soil sample are 0.7 and 40%, respectively. In a  $100 \text{ m}^3$  volume of the soil, the volume (expressed in  $\text{m}^3$ ) of air is

- a. 40
- b. 41
- c. 42
- d. 44

81. A homogeneous gravity retaining wall supporting a cohesion less backfill is shown in the figure. The lateral active earth pressure at the bottom of the wall is 40 kPa.



The minimum weight of the wall (expressed in kN per m length) required to prevent it from overturning about its toe (Point P) is

- 120
- 180
- 240
- 360

82. The number of parameters in the univariate exponential and Gaussian distributions, respectively, are

- 2 and 2
- 1 and 2
- 2 and 1
- 1 and 1

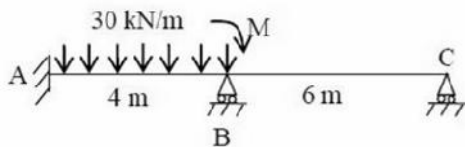
83. The wastewater from a city, containing a high concentration of biodegradable organics, is being steadily discharged into a flowing river at a location S. If the rate of aeration of the river water is lower than the rate of degradation of the organics, then the dissolved oxygen of the river water

- is lowest at the location S.
- is lowest at a point upstream of the location S.
- remains constant all along the length of the river.
- is lowest at a point downstream of the location S.

84. Which one of the following is NOT present in the acid rain?

- $\text{HNO}_3$
- $\text{H}_2\text{SO}_4$
- $\text{H}_2\text{CO}_3$
- $\text{CH}_3\text{COOH}$

85. The value of M in the beam ABC shown in the figure is such that the joint B does not rotate.



The value of support reaction (in kN) at B should be equal to \_\_\_\_\_

- 60

- 70
- 80
- 50

86. The laboratory test on a soil sample yields the following results: natural moisture content = 18%, liquid limit = 60%, plastic limit = 25%, percentage of clay sized fraction = 25%. The liquidity index and activity (as per the expression proposed by Skempton) of the soil, respectively, are

- 0.2 and 1.4
- 0.2 and 1.4
- 1.2 and 0.714
- 1.2 and 0.714

87. The equivalent sound power level (in dB) of the four sources with the noise levels of 60 dB, 69 dB, 70 dB and 79 dB is \_\_\_\_\_

- 79.9
- 80
- 81.1
- 83

88. A 1 m wide rectangular channel has a bed slope of 0.0016 and the Manning's roughness coefficient is 0.04. Uniform flow takes place in the channel at a flow depth of 0.5 m. At a particular section, gradually varied flow (GVF) is observed and the flow depth is measured as 0.6 m. The GVF profile at that section is classified as

- S1
- S2
- M1
- M2

89. The following observations are made while testing aggregate for its suitability in pavement construction:

- Mass of oven-dry aggregate in air = 1000 g
- Mass of saturated surface-dry aggregate in air = 1025 g
- Mass of saturated surface-dry aggregate under water = 625 g

Based on the above observations, the correct statement is

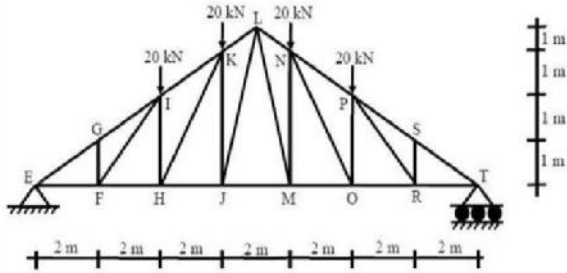
- bulk specific gravity of aggregate = 2.5 and water absorption = 2.5 %
- bulk specific gravity of aggregate = 2.5 and water absorption = 2.4 %
- apparent specific gravity of aggregate = 2.5 and water absorption = 2.5 %
- apparent specific gravity of aggregate = 2.5 and water absorption = 2.4 %

90. An elastic isotropic body is in a hydrostatic state of stress as shown in the figure. For no change in the volume to occur, what should be its Poisson's ratio?

- 0.00

- b. 0.25
- c. 0.50
- d. 1.00

91. A plane truss is shown in the figure (not drawn to scale).



Which one of the options contains ONLY zero force members in the truss?

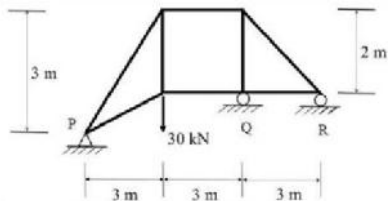
- a. FG, FI, HI, RS
  - b. FI, FG, RS, PR
  - c. FI, HI, PR, RS
  - d. FG, FH, HI, RS
92. Which one of the following is a secondary pollutant?

- a. Ozone
- b. Carbon Monoxide
- c. Volatile Organic Carbon (VOC)
- d. Hydrocarbon

93. If the path of an irrigation canal is below the bed level of a natural stream, the type of cross-drainage structure provided is

- a. Aqueduct
- b. Sluice gate
- c. Super passage
- d. Level crossing

94. Consider the pin-jointed plane truss shown in the figure (not drawn to scale). Let RP, RQ, and RR denote the vertical reactions (upward positive) applied by the supports at P, Q, and R, respectively, on the truss. The correct combination of (RP, RQ, and RR) is represented by



- a. (30,-30,30)KN
- b. (10,30,-10)KN
- c. (20,0,10)KN
- d. (0.60,-30)KN

95. A simple mass-spring oscillatory system consists of a mass  $m$ , suspended from a spring of stiffness  $k$ .

Considering  $z$  as the displacement of the system at any time  $t$ , the equation of motion for the free vibration of the system is

- a.  $k/m$
- b.  $\sqrt{(m/k)}$
- c.  $\sqrt{(k/m)}$
- d.  $m/k$

96. The method of orientation used, when the plane table occupies a position not yet located on plate load test was conducted the map, is called as

- a. traversing
- b. radiation
- c. levelling
- d. resection

97. Consider the following statements related to the pore pressure parameters, A and B:

- P. A always lies between 0 and 1.0
- Q. A can be less than 0 or greater than 1.0
- R. B always lies between 0 and 1.0
- S. B can be less than 0 or greater than 1.0

For these statements, which one of the following options is correct?

- a. P and R
- b. P and S
- c. Q and R
- d. Q and S

98. Let the characteristic strength be defined as that value, below which not more than 50% of the results are expected to fall. Assuming a standard deviation of 4 MPa, the target mean strength (in MPa) to be considered in the mix design of a M25 concrete would be

- a. 18.42
- b. 21.00
- c. 25.00
- d. 31.58

99. The on a clayey strata by using a plate of 0.3m x 0.3 m dimensions, and the ultimate load per unit area for the plate was found to be 180 kPa. The ultimate bearing capacity (in KPa) of a 2 m wide square footing would be

- a. 27
- b. 180
- c. 1200
- d. 2000

100. The most important type of species involved in the degradation of organic matter in the case of activated sludge process is

- a. Autotrophs
- b. Heterotrophs
- c. Prototrophs
- d. Photo-autotrophs