TEST ID: 409

ACE
Engineering Academy
Head Office : Sree Sindhi Guru Sangat Sabha Association, # 4-1-1236/1/A, King Koti, Abids, Hyderabad - 500001.
Ph: 040-23234418, 040-2324419, 040-2324420, 040-24750437
Hyderabad | Kukatpally | Kothapet | Delhi | Bhopal | Patna | Pune | Bhubaneswar | Lucknow | Bengaluru | Chennai | Vijayawada | Vizag | Tirupati | Kolkata | Ahmedabad

ESE- 2020 (Prelims) - Offline Test Series Test- 17

CIVIL ENGINEERING

SUBJECT GEOTECHNICAL ENGINEERING, TRANSPORTATION ENGINEERING & ENVIRONMENTAL ENGINEERING

SOLUTIONS

01. Ans: (c)

Sol: 'Thixotropy' of a soil refers to the gradual regaining of strength of a soil with passage of time after remoulding.

02. Ans: (a)

Sol: $\Delta H_1 = 25$ mm

$$\Delta H_1 = \frac{C_c H}{1+e_o}\log\left(\frac{30}{15}\right)$$

$$\Rightarrow \frac{C_c H}{1+e_o} = \frac{25}{\log(2)}$$

$$\Delta H_2 = \frac{C_c H}{1+e_o}\log\left(\frac{60}{15}\right) \Rightarrow \frac{25}{\log(2)}\log(4)$$

$\Delta H_2 = 50$ mm

Additional settlement

$\Delta H_2 - \Delta H_1 = 50 - 25 = 25$ mm

03. Ans: (b)

Sol: In the montorillonite mineral structure, the inter layer bonding between the tops silica sheets due to van der waals forces.

All fine-grained sized particles **do not** possess plasticity

04. Ans: (b)

Sol: Unsupported height (clayey soil) $= \frac{4C}{\gamma}$

Given

C = cohesion of soil = 5 kN/m^2

γ = unit weight of soil = 20 kN/m^3

Unsupported height (critical height)

$$= \frac{4\times 5}{20} = 1.0\text{m}$$

05. Ans: (b)

Sol: 'Vibrofloatation' technique will be effective for densification of granular soil.

For many construction applications involving roadway subgrades and trench backfills, the specification specifies the minimum percent compaction or relative compaction that must be achieved.

06. Ans: (c)

Sol: Contact stress between soil grains is not effective stress. Effective stress is a fictitious parameter and cannot be measured physically at site.

07. Ans: (b)

Sol: Quicksand occurs in fine sands and is not possible in coarse grained particles.

08. Ans: (c)

Sol: It has a basement floor

$q_{gross} = 150\ kN/m^2$

$q_{net} = q_{gross} - \gamma D_f$

$= 150 - 20 \times 4 = 70\ kN/m^2$

09. Ans: (b)

Sol: Permeability of a soil is a function of the soil and also of the permeant (the fluid passing through the soil)

10. Ans: (b)

Sol: In UCC test,

Cross section area of sample before test

$A = 15\ cm^2$

Strain at failure, $\varepsilon = 25\%$

Corrected area,

$$A_C = \frac{A}{1-\varepsilon} = \frac{15}{1-0.25} = 20 cm^2$$

11. Ans: (d)

12. Ans: (c)

Sol: Total head loss = h = $h_A + h_B$

Given $h_A = 0.3h$, therefore $h_B = 0.7h$

Both soils are in series, Discharge is same in both the soils

$$k_A i_A = k_B i_B$$

$$k_A \times \frac{h_A}{z_A} = k_B \frac{h_B}{z_B}$$

$$0.5 \times 0.3\, h = k_B \times 0.7\, h$$

$$k_B = 0.214 \text{ mm/sec}$$

13. Ans: (a)

Sol: For sedimentary soil deposits, permeability is always lesser in the vertical direction to the bedding planes than in the horizontal direction.

14. Ans: (a)

Sol: We know that

$K = C D_{10}^{\,2}$

Where K = Permeability of soil

D_{10} = Effective side of particle

$$\frac{k_A}{k_B} = \frac{(D_{10}^{\,2})_A}{(D_{10}^{\,2})_B}$$

$$= \frac{0.6^2}{0.3^2}$$

$$= 4.0$$

15. Ans: (b)

Sol: We know that

$$\text{Vertical permeability } (k_v) = \frac{h_1 + h_2}{\frac{h_1}{k_1} + \frac{h_2}{k_2}}$$

$\therefore$ Given

$h_1 = h$

$h_2 = h$

$k_1 = k$

$k_2 = 5k$

$$k_v = \frac{h+h}{\frac{h}{k} + \frac{h}{5k}} = \frac{2k}{\frac{1}{1} + \frac{1}{5}} = \frac{5k}{3}$$

16. Ans: (b)

Sol: Secondary consolidation accounts for the majority of the settlement in an organic soil.

17. Ans: (c)

18. Ans: (b)

Sol:

$K_o = 1 - \sin 30^o = 0.5$

$P_B = K_o \sigma_v = 0.5 \times 17 \times 2 = 17 \text{ kN/m}^2$

$P_C = K_o\, \sigma_v' + \gamma_w \times 2$

$= 0.5 \times (17 \times 2 + (19 - 10) \times 2) + 10 \times 2$

$= 46\ kN/m^2$

Total Pressure

$$= \left[\frac{1}{2}\times 17\times 2\right]+\left[\frac{46+17}{2}\right]\times 2$$

$= 80\ kN/m$

19. Ans: (d)

Sol: Pneumatic tired roller can be used for highways, construction of dams and for both fine grained and non-cohesive soils.

20. Ans: (c)

Sol: $A_r = \frac{40^2-30^2}{30^2}\times 100 = 78\%$

21. Ans: (d)

Sol: The failure will occur at the same deviator stress irrespective of the confining pressure (because ϕ=0) which means extra confining pressure will not mobilize extra frictional shear strength. The deviatoric stress remains same as 60 kPa since it is UU test

22. Ans: (c)

Sol: Given

Weight of soil sample W = 200 gm

Weight of soil particles (W_s) = 100 gm

We know that

$W = W_s + W_w$

$\therefore W_w = W - W_s$

$= 200 - 100$

$= 100$ gm

$\therefore$ Water content (w) = $\frac{W_W}{W_S} = \frac{100}{100} = 1$ or 100%

23. Ans: (a)

Sol: Time factor = $T_v = \frac{C_v t}{d^2}$

Here $d = \frac{H}{2} = \frac{20}{2} = 10m$

$$0.196 = \frac{(0.002)\times t}{10^2}$$

$$t = \frac{0.196\times 10\times 10}{0.002}$$

t = 9800 seconds

24. Ans: (d)

Sol: Dispersed structure has face to face or parallel orientation of soil particles.

25. Ans: (c)

Sol: A soil with a uniformity coefficient of 50 and a coefficient of curvature of 0.5 is poorly graded. Cc coefficient of curvature should be between 1 to 3 for well graded soil.

26. Ans: (a)

Sol: We know that

$e \times S = G \times w$

$\therefore\ 0.3\times 0.9 = 2.7\times w$

$w = 0.1$ or 10%

TEST YOUR PREP

IN A REAL TEST ENVIRONMENT

Pre GATE - 2020

Date of Exam : **18th January 2020**
Last Date to Apply : **31st December 2019**

Highlights:

- Get real-time experience of **GATE-20** test pattern and environment.
- Virtual calculator will be enabled.
- Post exam learning analytics and All India Rank will be provided.
- Post **GATE** guidance sessions by experts.
- Encouraging awards for **GATE-20** toppers.

PAN INDIA
PRESENCE AVAILABLE IN MORE THAN
30 CITIES

SSC-JE (Paper-I)

Online Test Series

Staff Selection Commission - Junior Engineer

No. of Tests : 20

Subject Wise Tests : 16 | Mock Tests - 4

Civil | Electrical | Mechanical

AVAILABLE NOW

All tests will be available till **SSC 2019 Examination**

040 - 48539866 / 040 - 40136222 testseries@aceenggacademy.com

27. Ans: (c)

Sol: **Peak hour factor (PHF)** is the hourly volume during the maximum-volume hour of the day divided by the peak 15-minute flow rate within the peak hour. Peak hour factor 1 indicates that traffic volume in a 15 minute interval is same i.e., consistent during the peak hour.

The peak hour factor is used in level of service analysis to account for the variation in traffic volumes during the peak hour.

28. Ans: (a)

Sol: Speed and delay studies are carried out by

- Floating car method
- Interview technique
- Elevated observations
- Photographic technique
- License plate method.

Note: Mechanical counters are used for counting traffic volume.

Note: Contour lines are used for presenting Origin and Destination surveys

29. Ans: (d)

Sol:

Effective green time = green time + amber time – lost time

= 28 + 4 – 3 = 29 sec

Green ratio = 29/64 = 0.45

Traffic capacity of the lane = green ratio × (3600/h)

= 0.45 × (3600/3) = 543.75veh/hr

30. Ans: (c)

Sol: $\text{Speed} = V = V_f\left(1-\frac{K}{K_j}\right)$

$$\text{i.e., } K = K_j\left(1-\frac{V}{V_f}\right)$$

$$K = 150\left(1-\frac{60}{80}\right) = \frac{37.5\text{veh}}{\text{km}}$$

Traffic flow = VK = 60 × 37.5 = 2250 veh/km

31. Ans: (b)

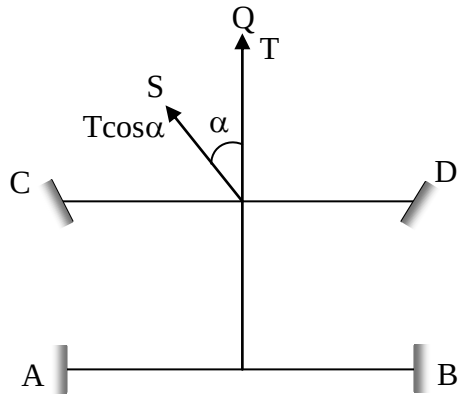
Sol: Height of object in the calculation of OSD is 1.2m.

32. Ans: (a)

Sol: When a vehicle negotiates a horizontal curve by turning front wheels, the rear wheels do not turn. i.e direction of rotation of front wheels and rear wheels are different.

A and B are the driving wheels which give a tractive force 'T' in the direction PQ and the front wheels CD are turned to traverse a horizontal curve. The tractive fore available for front wheels is Tcosα in the direction of PS. This is less than the actual tractive force T applied. This loss in tractive fore when

negotitating a horizontal curve is called as curve resistance and is given by (T – Tcosα).



33. Ans: (c)

Sol: Camber is the transverse slope provided to the pavement to provide drainage. Hence it protects the subgrade. Since it enhances quick drying of the pavement, road safety is increases.

Making the camber more steeper is not preferred as it erodes the surface.

34. Ans: (b)

$e + f = V^2/127R$

If no superelevation is provided,

$f = V^2/127R = 0.204$

35. Ans: (a)

Sol: Deviation angle = – 4 – (2) = – 6 %

(Negative. Hence valley curve is designed)

Length of the valley curve 'L' = 280m

Location of the deepest point in the valley curve from initial tangent is $X = \frac{N_1 L}{N}$

N_1 = gradient of initial tangent = 4%

N = deviation angle = 6%

$$X = \frac{4 \times 280}{6} = 186.67 \text{ m}$$

36. Ans: (c)

Sol: Standard axle load = 80kN

ESAL

$$= \left(2 \times 120 \times \left(\frac{80}{80}\right)^4\right) + \left(2 \times 100 \times \left(\frac{60}{80}\right)^4\right)$$

= 303.28

37. Ans: (a)

Sol: In open graded mix, fine aggregates and filler are absent. Hence, it is porous and has low strength.

38. Ans: (d)

Sol: Capacity of the dowel system depends upon Subgrade modulus, Pavement thickness, Size and spacing of dowel bars, radius of relative stiffness.

39. Ans: (b)

Sol: Range of angularity number is 0 to 11. Impact test evaluates the toughness of aggregates.

40. Ans: (c)

Sol:

Docks which are used for repair and maintenance purpose are

- Dry dock or graving dock
- Floating dry dock
- Slipway and marine railway
- Ship lift

Moorings are anchors for ships

41. Ans: (c)

Sol: Coning of wheels is done to

1. Provide smooth ride
2. Help vehicle negotiate curve smoothly
3. Reduce wear and tear of wheel flange.

42. Ans: (b)

Sol: Windrose diagram is mainly used for runway orientation. It gives the direction of the head wind which affects the length of the runway.

43. Ans: (b)

Sol: Length of the side of the diamond crossing

$= G \operatorname{cosec}\alpha$

$\text{Cot } \alpha = N = 10$

$\text{Cosec } \alpha = \sqrt{101} = 10.05$

Length of the side $= 1.676 \times 10.05$

$= 16.84\text{m}$

44. Ans: (d)

Sol: Tunneling is carried out in a small section called drift and then widened subsequently. Drift can be centre drift or side drift or bottom drift etc.

Since it is carried out in stages, speed of construction is slow.

45. Ans:(c)

46. Ans: (b)

Sol: pH = 10

pOH = 14 – 10

= 4.0

$\therefore OH^- = 10^{-4.0}$ mol/*l*t

1 mole of OH = 17 gm = 17000 mg

$OH^- = 10^{-4.0} \times 17000$

= 1.7 mg/*l*

47. Ans: (a)

Sol: Settling velocity, $V_s = 0.2$ mm/s

Overflow rate = 12 $m^3/day/m^2$

$$V_o = \frac{12 \times 10^3}{24 \times 60 \times 60}$$

= 0.139 mm/sec

$$\eta = \frac{V_s}{V_o} \times 100$$

$$= \frac{0.2}{0.139} \times 100 = 144 > 100\%$$

Maximum efficiency allowed is 100%

$\therefore \eta = 100\%$

ACE Engineering Academy

HEARTY CONGRATULATIONS TO OUR ESE - 2019 TOP RANKERS

TOTAL SELECTIONS in Top 10: 33

(EE: 9, E&T: 8, ME: 9, CE: 7) and many more...

ACE

DIGITAL CLASSES

for

ESE 2020/2021
General Studies &
Engineering Aptitude

GATE 2020/2021
Computer Science &
Information Technology

Access the Course at

www.deep-learn.in

48. Ans: (c) **49. Ans:(a)**

50. Ans:(b)

51. Ans:(c)

Sol: TH > TA

$\therefore$ CH = TA

52. Ans: (c) **53. Ans: (a)**

54. Ans: (c)

Sol: $\text{SVI} = \dfrac{200}{\frac{4000}{1000}} = 50 \text{ m}l/\text{gm}$

Sludge recycle ratio $\dfrac{Q_R}{Q} = \dfrac{X}{\frac{10^6}{SVI} - X}$

$= \dfrac{\frac{4000}{10^6}}{50} - 4000$

$= 0.25$

55. Ans: (c)

56. Ans: (a)

Sol: $\text{D.F} = \dfrac{100}{2} = 50$

$y_5^{20°C}$ = Depletion of oxygen × D.F

= 4 × 50

= 200

$y_5^{20°C} = y_{\text{ultimate}}\left[1 - e^{-K\times 5}\right]$

$\dfrac{200}{[1-0.316]} = y_{\text{ultimate}}$

y_{ultimate} = 292 mg/lit

57. Ans: (d) **58. Ans: (c)**

59. Ans: (a)

Sol:

The residual chlorine for each 0.2 mg/*l* of applied chlorine is as computed.

Sample	Residual chlorine
1	0.19
2	0.36 – 0.19 = 0.17
3	0.50 – 0.36 = 0.14
4	0.48 – 050 = –0.02
5	0.2 – 0.48 = –0.28
6	0.4 – 0.2 = 0.2
7	0.6 – 0.4 = 0.2
8	0.8 – 0.6 = 0.2

After sample (5), which has dosage of 1 mg/*l*, applied chlorine becomes residual chlorine.

$\therefore$ Break point dosage = 1.0 mg/*l*.

60. Ans: (c) **61. Ans: (c)**

62. Ans: (c)

SSC-JE (Paper-II) MAINS 2018

OFFLINE TEST SERIES

Streams: Civil | Electrical | Mechanical

FULL LENGTH MOCK TEST-1

Exam Date: **01.12.2019**

Exam Timing: **6:00 pm to 8:00 pm**

FULL LENGTH MOCK TEST-2

Exam Date: **15.12.2019**

Exam Timing: **6:00 pm to 8:00 pm**

- All tests will be conducted in **Question Paper Booklet** format.
- Test Series will be conducted at all our centres.

Hyderabad | Delhi | Pune | Bhubaneswar | Bengaluru | Chennai | Vijayawada | Vizag | Tirupathi | Kukatpally | Kolkata | Ahmedabad

040 - 48539866 / 040 - 40136222 testseries@aceenggacademy.com

ISRO

इसरो isro

ONLINE TEST SERIES

No. of Tests : 15

Subject Wise Tests : 12 | Mock Tests : 3

Indian Space Research Organisation (ISRO)
Recruitment of Scientist/Engineer 'SC'

ELECTRONICS | MECHANICAL | COMPUTER SCIENCE

☑ Starts from **5th November 2019**

All tests will be available till 12-01-2020.

040 - 48539866 / 040 - 40136222 testseries@aceenggacademy.com

63. Ans: (b)

Sol:

$$\frac{V_2}{V_1}=\frac{100-P_1}{100-P_2}=\frac{100-97}{100-91}=\frac{3}{9}=\frac{1}{3}$$

$$V_2=150\times\frac{1}{3}=50\,m^3$$

Sludge volume reduced by = 150 – 50 = 100 m^3

64. Ans: (c)

65. Ans: (b)

Sol:

$$DO_{mix}=\frac{1\times1.5+8\times8.5}{1.5+8.5}=6.95\,mg/l$$

Initial deficit

$$DO_o=(DO)_{sat}-(DO)_{mix}$$

$$=9.0-6.95$$

$$=2.05\ mg/l$$

66. Ans: (b) **67. Ans:(b)**

68. Ans: (a) **69. Ans: (b)**

70. Ans: (b) **71. Ans: (a)**

72. Ans: (d)

Sol: Granular soils are the best backfill materials for because of their high permeability and also they are easily compactable.

Hence statement (I) is wrong and (II) is true.

73. Ans: (a)

74. Ans: (d)

Sol: In a rotary, the vehicles are forced to reduce their speeds, merge with the existing traffic (i.e. traffic flow is regulated to one direction only) and negotiate the intersection. Since the vehicles are slowed down (even during low traffic), the cumulative delay is higher than channelized intersection.

75. Ans: (b)

Sol:

Since, high binder content gives a thicker binder film on the aggregate, resistance to water damage is increased.

Stability is defined as the resistance of the paving mix to deformation under traffic load. Stability depends on aggregates and cohesion offered by bitumen. With increase in the binder content, stability decreases.