CE GATE 2010 Answer Keys

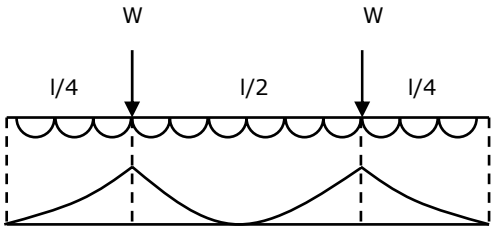
1	A	**2**	C	**3**	A	**4**	D	**5**	C	**6**	B	**7**	C
8	D	**9**	D	**10**	B	**11**	B	**12**	C	**13**	C	**14**	B
15	B	**16**	D	**17**	A	**18**	B	**19**	C	**20**	A	**21**	B
22	A	**23**	B	**24**	A	**25**	D	**26**	C	**27**	B	**28**	A
29	C	**30**	D	**31**	A	**32**	B	**33**	B	**34**	A	**35**	C
36	A	**37**	D	**38**	B	**39**	A	**40**	C	**41**	D	**42**	B
43	C	**44**	B	**45**	B	**46**	B	**47**	D	**48**	C	**49**	A
50	B	**51**	D	**52**	C	**53**	B	**54**	C	**55**	C	**56**	B
57	A	**58**	D	**59**	C	**60**	D	**61**	B	**62**	D	**63**	C
64	B	**65**	C										

Explanations:-

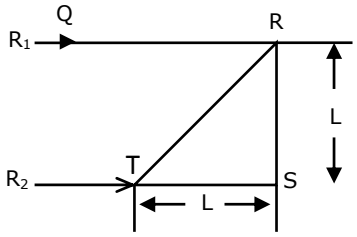
1. $\lim_{x\to 0} \frac{\sin\frac{2}{3}x}{x} = \frac{2}{3}$ (Since $\lim_{x\to 0} \frac{\sin nx}{x} = n$)

2. The probability of appearing two heads=1/4

3. $\frac{d^3y}{dx^3} + y^2 = -4\sqrt{\left(\frac{dy}{dx}\right)^3}$ $\left(\left(\frac{d^3y}{dx^3}\right) + y^2\right)^2 = 16\left(\frac{dy}{dx}\right)^3$ Order=3, Degree=2

4. 

BM=0 at centre.

5. 

$R_1 \times L \times P \times L = 0$; $R_1 = -P$

At joint Q= $\Sigma H = 0 \Rightarrow F_Q R = P$

6. $\tau_{max} = \frac{\sigma 1 - \sigma 2}{2} = \frac{3-(-3)}{2} = 3MP_a$

11. $\gamma_d = \frac{G\gamma_\omega}{1+e} = \frac{G\gamma_\omega}{1+\frac{\omega G}{s}}$ ($\because$ for zero air viod line s=100%) $= \frac{G\gamma_\omega}{1+\omega G}$

12. From plasticity Chart A

I_P=0.73 (LL-20), I_{P1}=0.73 (60-20)=29.3 For given soil LL=60; PL=20; I_P=LL-PL=40

$I_P > I_{P1}$ it falls above the A-line and for highly compressible clays LL>55

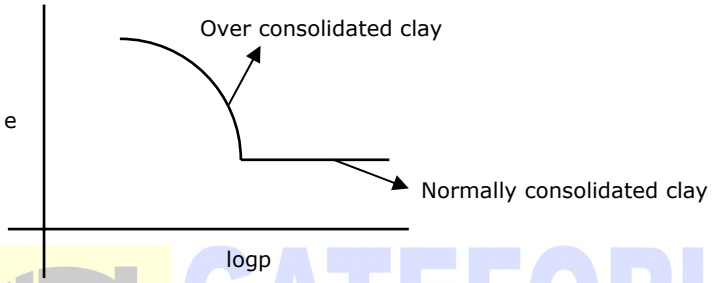
Hence it is CH.

13. For quick sand condition

$(L+L)\,\gamma_\omega A = \gamma_{sat}.L.A = \frac{(G+e)}{(1+e)}.L.A.$

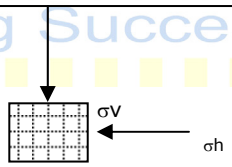
So, it is upward sample pressure soil becomes the saturated unit weight or soil.

14.

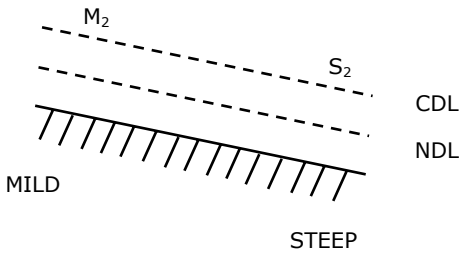


15. Coefficient of earth the pressure at rest

$K_0 = \frac{\sigma h}{\sigma' v}$

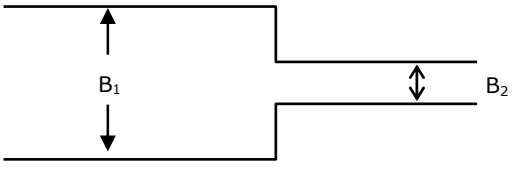


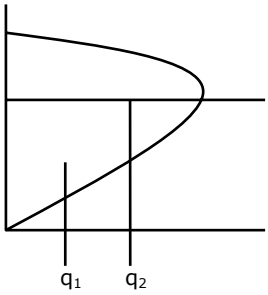
16.



Profiles are M_2, S_2

17.





$q_1 = \frac{Q}{B_1}$; $q_2 = \frac{Q}{B_2}$ $q_2 > q_1$

From discharge diagram, it can be seen that, for subentical flow as 'q' increases 'depth' decreases. Therefore the reduced section, depth decreases.

18. P -1, Q-4, R-2, S-3

19. P-2, Q-1, R-4, S-3

20. MSW management technique is composting since waste contains good amount or organic matter.

21. Day time 55db, night time 45 db

22. Adiabatic lapse out = 0.98°c per 100m
For 500m decrease in temp =0.9805=4.9° ≈ 5°c
Therefore at 400m elevation, the air parcel temperature is 40-5=35°c

26. y''+y'-6y=0
$m^2+m-6=0$
(m+3)(m-2)=0
m=-3; m=2
$y=C_1e^{-3x}+C_2e^{2x}$

27. Determinant = $(3+2i)(3-2i)+(i^2)=9+4-1=12$

$$A^{-1} = \frac{1}{12}\begin{bmatrix}(3-2i) & -i \\ i & (3+2i)\end{bmatrix}$$

28. h=0.25
Sample sin rule

$= \frac{h}{3}$ [First+last+2(odd)+4(even)]

$= \frac{0.25}{3}[1+0.50+2(0.8)+4(0.9412+0.64)] = 0.7854$

29. Z=ax+by+ab; p=a; q=b
Z=pz+qy+pq.

30. $\frac{ds}{dx} = \sqrt{1+\left(\frac{dy}{dx}\right)^2}$

$L = 2\int_0^{l_{12}} \frac{ds}{dx}.dx = 2\int_0^{l_{12}} \sqrt{1+\frac{dy^2}{dx}}.dx$

$y = 4h.\frac{x^2}{L^2}$
$\frac{dy}{dx} = \frac{8hx}{L^2}$

$\therefore$ $L=2\int_0^{l_{12}} \sqrt{1+\frac{64h^2x^2}{L^4}}.dx$

31. $f(x,y)=4x^2+6y^2-8x-4y+8$

$\frac{df}{dx} = 8x - 8 = 0 \quad x = 1$

$\frac{df}{dy} = 12y - 4 = 0 \quad y = 3$

$rf^2-s^2=4x12-0=48>0$ minima. $f(1,3) \Rightarrow 10/3$

32. $Ps = 2x\frac{\pi}{4}xd^2x\tau \sim f = 2x\frac{\pi}{4}x(21.5)^2x100 = 72.61KN$

$Pb = d.t\sigma pf = 21.5x14x300 = 90.3$

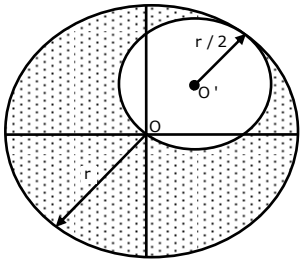
Least value is 72.61 KN=R_v=Rivet value

Temple sample = NR_v=12x72.61=817.32KN

33. Well size S=10-1.5=8.5 mm

[0.7x8.5xl]110=150x100x10

l=229.2mm

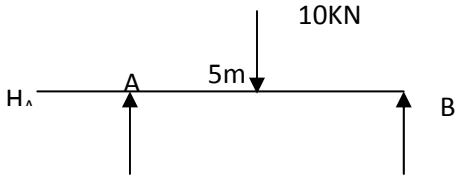


34. B.M at centre = ML/2 – ML/2 = 0

35. $\bar{x} = \frac{\pi r^2 x0 - \pi\left(\frac{r}{2}\right)^2\left(\frac{r}{2}\right)}{\pi r^2 - \pi\left(\frac{r}{2}\right)^2}$

$= \frac{-\frac{\pi r^2}{4}\cdot\frac{r}{2}}{\frac{3\pi r^2}{4}} = \frac{-r}{6}$

36.



V_A=7.5KN

$V_A = \frac{10x15}{2} = 7.5KN$

To calculate HA, $\Sigma M_c=0 \Rightarrow -H_Ax5+7.5x10-10x5=0$

H_A=5KN

$\therefore R_A=\sqrt{HA^2+VA^2} = 9.01KN$

$Tan\theta = \frac{V_A}{H_A} = 56.31^o$

37. $\sigma z_1 = \frac{3\phi}{2\pi z^2}\left[\frac{1}{1+\left(\frac{r}{z}\right)^2}\right]^{3/2}$ (Given)

for z=z/2; r=r/2; $\sigma z_1 = \frac{3\phi}{2\pi x\left(\frac{z}{2}\right)^2}\left[\frac{1}{1+\left(\frac{r}{z}\right)^2}\right]^{3/2}$ $\sigma z = 4\sigma z_1$

38. $K = 2.303\ \frac{aL}{At}\log_{10}\frac{h_1}{h_2}$ $10^{-2} = 2.303\frac{1}{t}\log_{10}\frac{1.0}{0.75}$ $t = 75\text{sec.}$

39. $Q_{wt}=Q_e+Q_{sf}$ [since pile is in clay so, friction pile $Q_e=0$]

$Q_{wt}=Q_{st}$

$700K_N=q_{sf}.As$ [L.C] x 4x0.5x1.0 (for square pile)

As=4xBxL=4x0.25x20 (LC) =700/2=350KN

40. A=By $\Rightarrow$ B=A/y

P=B+2y

$P = \frac{A}{y} + 2y \Rightarrow \frac{dp}{dy} = 0 \Rightarrow \frac{-A}{y^2} + 2 = 0$

$B=2y_e$

As B=T; Top width= 2ye

$R = \frac{A}{P} = \frac{By}{B+2y} = \frac{2y^2}{2y+2y} = \frac{y}{2}$

$R = \frac{A}{P} = \frac{By}{B+2y} = \frac{2y^2}{2y+2y} = \frac{y}{2}$

$R = \frac{ye}{2}$ Hydraulic Radius

$Q=\frac{A}{T} = \frac{By}{B} = Y_e$ = Hydraulic depth

Perimeter = B+2y = 2y+ey=4ye

Hence P-3, Q-4, R-1, S-2

41. $Fr^2 = \frac{q^2}{g.y_1^3} = \frac{y_c^3}{y_1^3}$

$(0.8)^2 = \frac{y_c^3}{(1.5)^3} \Rightarrow y_c = 1.29\text{m}$

42. D=0.2m; Q=2720 Lit/min; $Q=0.0453m^3/s$

R1=10m; S1=3m; r_2=100m; S_2=0.5m

$Q = \frac{2.72T(S_1 - S_2)}{\log_{10}\left(\frac{r_2}{r_1}\right)} = 0.0453 = \frac{2.72T(2.5)}{\log_{10}\left(\frac{100}{10}\right)}$

$T=576m^2/day$

43. BOD_3=75 mg/lt; K^1=0.345/day

$BOD_3=L_0[1-10^{-kt}]$

$$K=\frac{K'}{2.303}=\frac{0.345}{2.303}=0.1498046$$

$$75=L_0[1-10^{-0.1498x3}]$$

$$L_0=116.33\text{ppm}$$

$$BOD_{10}=116.33[1-10^{-0.1498x10}]=112.635$$

BOD remaining = 116.33-112.635 = 3.69ppm ≃ 3.70ppm

45. V=80 Kmph; l=6.6m; W_m=0.096m

We=total widening or carrying way on the

Curve = W_m+W_{psy}

$$Wpsy=\frac{80}{9.5\sqrt{230}}=0.555$$

Total winding = 0.096+0.555=0.651m

47. RL or Plinth =100.000-B.S-F.S

=100.000-2.105-1.105=96.790 m

48. Total hardness = Ca^{2+} ions $x\frac{50}{20}+Mg^{2+}$ ions $x\ \frac{50}{12}=100x\frac{50}{20}+6x\frac{50}{12}=275\text{ppm}$

49. Alkalinity = $HCO_3^- x\frac{50}{61}=250x\frac{50}{61}=204.92$ ppm

Total harness > alkalinity

Carbonate hardness = alkalinity = 204.92 ppm = 205 ppm

50. AMC=18 cm/m or 6.48cm/m

100 hectares ---------- 18

$$36\text{ hectares}=36x\frac{18}{100}=6.48cm/m$$

$$d\omega=3.24\text{ cm}$$

$$f\omega=\frac{3.24}{0.5}=6.48\text{ days}$$

$$Q=\frac{3.24}{100}x\frac{36x10^4}{(6.48x10)(3600x0.75)}=0.067m^3/s=67\text{ Lt/s}$$

51. Available moisture content = 0.8x18=14.4 cm

RAM = 14.4/2 = 7.2 cm

Frequency of irrigation = 7.2/0.4 = 18 days

$$Q=\frac{d\omega xA}{t}$$

$$40x10^{-3}=\frac{7.2}{100}x\frac{A}{18x10x3600}x\frac{1}{0.75}$$

$$A=27x10^4m^2$$

A= 27 ha

52. To find N.A. define the in D.R. beams

0.36 fic b x_4 + Asc (fsc-fec)=0.87

0.36x20x300xx_4+628(0.87x250)=0.82x250x2200

x_4=160.91 mm.

53. Since $x_4 < x_4$ max=0.53x500=265mm

It is under reinforced

M.R=0.36 feic b x_4(d-0.42x_4)+ Asc (fsc-fce) (d-d^1)

[0.36x20x300x160.91(500-0.42x160.91)+628x0.87x250(500-50)]x10^{-6}=209.20 KNm

54. Cohesion = $\frac{\text{unconlined comp. sample the } (q_4)}{2} = \frac{54}{2} = 27K_{pa}$

55. Given footing is square D_f=0

For clay = ϕ =0

N_c=5.7; N_q=1.0; N_r=0 or

For square footing

q_{wt}=1.3C N_C+$r_{Df}N_q$+½ r_BN_r = 1.3 C N_C =1.3x27x5.70 (since Cu=q_4/2) =200 K_{pa}

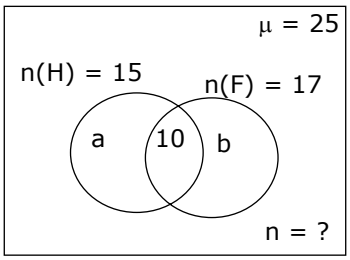
56. Circuitous means round about or not direct. Therefore the closest in meaning will be indirect

57. A worker who is inactive or not working is termed as unemployed, similarly land which is inactive or not in use is called Fallow.

58. The clue in this sentence is 'If we manage to _____our natural resources' and 'better planet'. This implies that the blank should be filled by a word which means 'preserve' or 'keep for long time'. Therefore the word 'conserve' is the right answer.

59. The key words in the statement are 'casual remarks' and 'lack of seriousness'. The blank should be filled with a word meaning 'showed' or 'revealed'. Hence, 'betrayed' is the correct answer.

60. Representing the given information in the Venn diagram, we have



Let the number of people who play only hockey = a

The number of people who play only football = b

Now, a = n(H) – 10 = 15 – 10 = 5

b = n(F) – 10 = 17– 10 = 7

Clearly, a + b + 10 + n = 25 $\Rightarrow$ n = 25 – 7 - 5 -10 $\Rightarrow$ n = 3

$\therefore$ The number of people who play neither Hockey nor Football is 3

61.

i) H + G > I + S

ii) |G - S| = 1

Meaning G & S will be next to each other in the order. So the option A is ruled out.

G not oldest

S not youngest

iii) No twins.

Going by the options, we will try to solve the equation,

Taking an example with youngest aged 1, we can try to solve the equation,

and correct the age (started with ages 4,3,2,1) to suit condition (i) and (ii) which gives 5,4,3,1

S	I +4	Generalizing, we can take their ages in terms of I's age,
G	I + 3	In this case, H + G > I + S
H	I + 2	Since 2I + 5 > 2I + 4
I	I	

I	In this order, G is always less than I and H is always less than S.
G	So G<I and H<S
S	Implies G+H < I + S, all values are positive
H	Defies condition i) Hence incorrect.

I	In this order H< I, G<S
H	Hence H +G < I + S
S	Defies Condition i)
G	Hence incorrect.

62. Given,

5 skilled workers can build a wall in 20 days i.e., 1 skilled worker can build the same wall in 100 days

$\therefore$ The capacity of each skilled worker is $\frac{1}{100}$

8 semi-skilled workers can build a wall in 25 days

i.e., 1 semi-skilled worker can build the same wall in 200 days

$\therefore$ the capacity of each semi-skilled worker is $\frac{1}{200}$

Similarly, the capacity of 1 unskilled worker is $\frac{1}{300}$.

Now, the capacity of 2 skilled+6 semi-skilled+5 unskilled workers is $2\left(\frac{1}{100}\right) + 6\left(\frac{1}{200}\right) + \frac{5}{300}$

$= \frac{2}{100} + \frac{3}{100} + \frac{5}{100} = \frac{20}{300} = \frac{1}{15}$

$\therefore$ The required numbers of days is 15

63. Among the answer choices, the three options B, C and D can be inferred from the passage. But the main essence of the passage is that chemical agents are being used my military establishments in warfare which is not desirable. Therefore option C is the statement which best sums up the meaning of the passage.

64. The given digits are 2,2,3,3,3,4,4,4,4 we have to find the numbers that are greater than 3000
∴ The first digit can be 3 or 4 but not 2.
Now, let us fix the first, second and third digits as 3, 2, 2 and then the fourth place can be filled in 3 ways.
i.e.,

3	2	2	2 or 3 or 4	3 ways

∴ the number of ways is 3.
Similarly, we fix first, third and fourth places as 3, 2 and 2 respectively, so the second place can be filled in 3 ways again

i.e.,

3	2 or 3 or 4	2	2

The number of ways is 3.
Now, we fix first, second and fourth places just as previous cases and we obtain the same result.
∴ The number of ways is 3 so; the total number of ways is 9.
Similarly this can do by fixing the numbers as 3 and 4 (instead of 2) and thereby we obtain the 9 ways in each case.
∴ The number of numbers greater than 3000 starting with 3 is 27
Similarly by taking 4 as the first digit and applying the same process, we get 27 numbers
∴ The total number of numbers that are greater than 3000 is 27 + 27 = 54
But, 3222 and 4222 is not possible as there are only two 2's (given), 3333 is also not possible as there are only three 3's (given)
∴ The total number of numbers that are greater than 3000 is 54 – 3 = 51.

65. Given, 137 + 276 = 435
Adding units digits i.e. 7 + 6 = 13, but given as 5, which is 13 – 8 and also 1 is carry forwarded to the tens place.
i.e.,

```
      +1
      7     6
      3     7
    ------------
          05
```

Here, 7 + 3 + 1 = 11 i.e., 11 – 8 = 3 and 1 is carry forwarded to hundreds place

```
      +1    +1
      1     7     6
      2     3     7
    ------------------------
            3     5
```

Now, the sum of digits in hundred's place is 1 + 1 + 2 = 4

i.e.,

```
      1     7     6
      2     3     7
    ------------------------
      4     3     5
    -------------------------
```

Using the same logic, we have

```
            +1
      +1    7     3     1
            6     7     2
    ---------------------------------
      1     6     2     3
    ---------------------------------
```

Sum of units digits 1+2 = 3, sum of tens digit = 3 + 7 = 10 i.e. 10 -2 and + 1 carry forward and
Sum of hundreds digits= 1 + 7 + 6 = 14 i.e., 14 – 8 = 6 and one carry forward.