GATE 2022 Examination* (Memory Based)

Civil Engineering (Forenoon Paper)

Test Date: 12-2-2022

Test Time: 9:00 a.m.

Stream Name: Civil Engineering (Forenoon Paper)

Q1. Thin cylindrical pressure vessel, hoop stress is given, $T_h = 30$mpa. Find $T_{max} = ?$

Q2. The iron concentration of calcium, magnesium & bicarbonates are 400, 100 & 122 mg/l respectively. What will be the temporary hardness?

Q3. The soil sample with volume $V_1 = 10000m^3$ and $V_2 = 7500m^3$. If the void ratio of sample 1 is equals to 1. Find value of void ratio for sample 2

Q4. 2% sewage sample
3 Days 27°C, $K_{27^\circ} = 0.23$/day (Basic)
$(D_{oc} - D_{of}) = 10$ mg/L, $L_o = 2$

Q5. During particulat state of growth of the crop consumptive use = 2.8 $\frac{MM}{day}$. The amount of water available in the soild is 50% of filed capacity. Roor zone depth is 80 mm. Find frequency of irrigation if efficiency of irrigation is 70%

Q6. What will be the order & degree of the differenitial equation given below:

$$\frac{d^3y}{dx3} + x\left(\frac{dy}{dx}\right)^{3/2} + x^2y = 0$$

A) order 3, degree 2
B) degree 3, order 2
C) degree 2, order 2
D) degree 3, order 3

Q7. Given a matrix $M = \begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix}$. If $Q = M^3 - 4m^2 - 2M$, then the eigenvalue of Q = …..

Q.8 Match the following

List I	List II
I. Reynold's No.	A) Compressibility
II. Froude's No.	B) Gravity
III. Mach No.	C) Viscosity
IV. Euler No.	D) Velocity of sound

A) I-C, II-B, III-D, IV-A
B) I-B, II-C, III-A, IV-D
C) I-D, II-C, III-A, IV-B
D) I-D, II-A, III-B, IV-C

Q9. $$\frac{dy^3}{dx^3} + x\left(\frac{dy}{dx}\right)^{3/2} + x^2.y = 0$$

Find order and degree of differential equation

A) O-2, D - $\frac{3}{2}$
B) O-2, D – 3
C) O-3, D - 3
D) O-3, D – 2

Q10. Given that z = sin (y + it) + cos (y – it), where z independent variable and y & t are independent variable. Then which of the following is correct?

a) $\frac{\partial^2 z}{\partial t^2} - \frac{\partial^2 z}{\partial y^2} = 0$

b) $\frac{\partial z}{\partial p} + i\frac{\partial z}{\partial y} = 0$

c) $\frac{\partial z}{\partial p} - i\frac{\partial z}{\partial y} = 0$

c) $\frac{\partial^2 z}{\partial p^2} + \frac{\partial^2 z}{\partial y^2} = 0$

Q11. What is correct reaction for pozzolana?

Q12. The dimension of tank are H = 3m, B = 5m, L = 40 m Vs = 1m/hr, Q = 500 m^3/hr. The percentage removal will be …… (upto two decimal point).

Q13. If the bearing is N31°17'm. The azimuth will be…..

Q14. For given differential eq^n

$\frac{dy}{dx} = 4(x + 2) - y$

y = h = 0.2 y(1) = 3, then y(1.4) = ……

Q15. For given differential equation

$\frac{dy}{dx} = 4(x + 2) - y$

If h = 0.2 y(1) = 3, then y (1.4) = ……..

Q16. Let max {a, b} be max real number a and b. Which of the following is/are true for max {3 – x, x – 1}
A) Continuous in its domain
B) local maxima at x = 2
C) local maxima at x = 2
D) differentiable in its domain

Q17. For a slope to be steeper to steep, the GVF profile to be considered

a) S_1 b) S_2
c) S_3 d) May be S_1, S_2, S_3

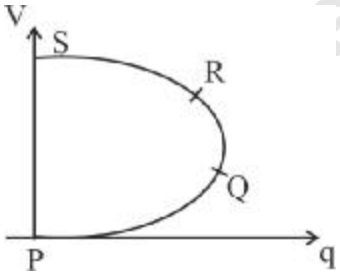
Q18. $F(x) = \sum Fn \cos nx$

for $f(x) = \cos^4 x$

Numerical value of

$(f_4 + f_5)$ is _____

Q19.



The order of density will be
A) $K_P > K_Q > K_R > K_S$
B) $K_Q > K_P > K_S > K_R$
C) $K_Q > K_R > K_S > K_P$
D) $K_R > K_Q > K_P > K_S$

Q20. Arrange in increasing order of hydranlic conductivity to the following
I) SW II) SP III) ML IV) CH
A) II > I > III > IV
B) I > II > III > IV
C) IV > III > II > I
D) IV > I > II > III

Q21.

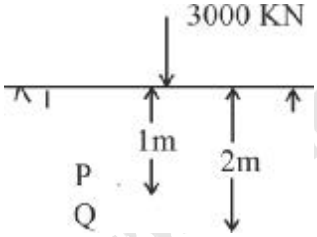
- P is sister of Q
- Q is husband of R
- T is husband of P
- R has 1 children as 'S'

How is T related as 'S'?

A) Uncle B) Brother C) Sister D) Grand father

Q22. There was a point load of 3000 KN. There are two points P & Q which are ϕ 1m & 2. Below respectively.

Then ratio of $\frac{\sigma ZP}{\sigma ZQ}$ = _____



Q23. 500 mg/l of caco3 = _ _ _ _ _ _ _ milli equivalent per liter.

Q24. A rectangular beam, B = 300 mm, effective depth is 580 mm, concrete is m - 30. Percentage of longitudinal tensile reinforcement is 1%. Design shear strength is 0.66 mpa. 2-Legged 10 mm dice bar. Find the spacing of shear stirrups.

Q25. A square concrete pile of 10 m length is driven into a deep layer of uniform homogeneous clay average unconfined compressive strength of the clay, determined through laboratory test on undisturbed samples extracted from the clay layer is 100 kpa, If the ultimate compressive load capacity of the driven pile is 632 kN, the required width of the pile is _____ mm (Nc = 9, a = 0.7 given)

Q26. Condition to be satisfied for a soil element under passive earth condition

A) $\sigma_v^n < \sigma_v^n$ B) $\sigma_v^n = \sigma_v^n$ C) $\sigma_v^n + \sigma_v^n$ D) $\sigma_v^n > \sigma_v^n$

Q27. Let represent soil suction head and K represent hydraulic conductivity of the soil. If the moisture content increases, which one of the following statements is true.

A) Both ψ and K increases
B) ψ increases and K decreases
C) Both ψ and K decreases
D) ψ decreases and K increases

Q28. Match the following

A. Normally consolidated clay	P. sensitivity > 16
B. Quick clay	Q. Dilation angle = 0
C. Sand in critical state	R. $w_L > 50$
D. Clay of high plasticity	S. OCR = 1

Q29. An aerial photograph is takne from a height of 3.5 km, from a camera of focal length of 152 mm. The average hegith above the MSL is 460 m. Find the scale of the photograph.

Q30. In the contact of cross-drainage structure, the correct statement(s) regarding the relative position of a natural drain (stream/river) and an irrigation canal is/are

A) In a canal syphon, natural train water goes through the irrigation canal
B) In an aqueduct, natural drain water goes under the irrigation canal whereas in a super-passage, natural drain water goes over the irrigation canal.
C) In an aqueduct, natural drain water goes over the irrigation canal, whereas in super-passage, naturaldrain water goes under the irrigation canal.
D) In a level crossing, natural drain water goes through the irrigation canal.

Q31. Consider following itenation scheme

$x_{n+1} = \frac{1}{2}\left(x_n + \frac{P}{x_n}\right)$ n = 1, 2, 3, 4, 5 …

$x_0 = 1$

If for P = 2, $x_5 = 1.414$

P = 3, $x_5 = 1.732$

Then for P = 10, x_5 = ….

Q32. Two reservoirs are connected by 2 branched pipe running parallel to each other. The pipes are equal in length. The diameter of the pipes are 20 cm and 10 cm. The difference in reservoir level is 5 m. For the same friction factor, calculate the ratio of discharge of larger pipe and smaller pipe.

Q33. A two phase signalized intersection is designed with a cycle of 100s. The amber and red time for each phase are 4s & 50s respectively if clearance loss time = 2sec. then the effective green time of each phase is _____ (S).

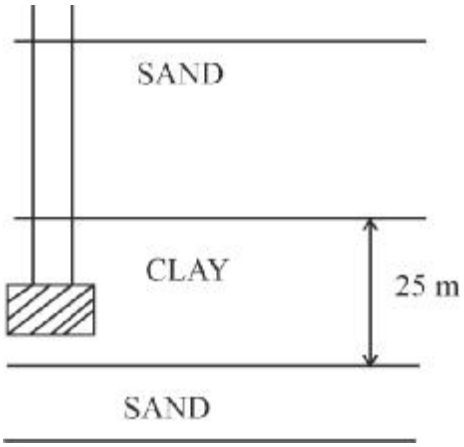
Q34. An angle section of 100 mm x 100 mm x 100 mm is connected to gusset plate. The allowable stress in angle section is 150 MPa and allowable shear stress in weld is 108 MPa. Area of angle section is 1903 mm^2. Find values of I_1 and I_2.

A) 380 mm and 380 mm
B) 541 mm and 219 mm
C) ____ and 380 mm
D) 219 mm and 541 mm

Q35. A raft foundation of 30 × 25m is proposed to be constructed at a depth of 8m in a send layer. A 25m thick saturated clay layer exists 2m below the base of the raft foundation. Below the clay layer a dense sand layer exist at the site. A 25mm thick undisturbed sample was collected from the mid depth of the clay and tested in laboratory odometer under double drainage condition it was found that the soil sample had undergone 50% consolation settlement in 10 min. The time (in days) required for 25% consolidation settlement of the raft foundation will be

Q36. Two rolling loads of magnitude 200 KN & 100 KN, 3m apart moves on a simply supported girder AB 5m long. What will be maximum bending moment to occur at 1m from A.

Q37.



Sample t = 25mm (Double drainage)
T = 10 minutes, u = 50%
T = P → U = 25% Clay

Q38. If Nitrogen is present in form of Ammonia & Nitrate

$N_2 = NH_3$ & $No\bar{3}$

NH_3 has concentration of 34 mg/lt & $No\bar{3}$ has concentration of 6.2 mg/lt

The concentration of Nitrogen will be _ _ _ _ _ _.