GATE 2015 – A Brief Analysis

(Based on student test experiences in the stream of CE on 8th February, 2015 – (Forenoon Session))

Section wise analysis of the paper

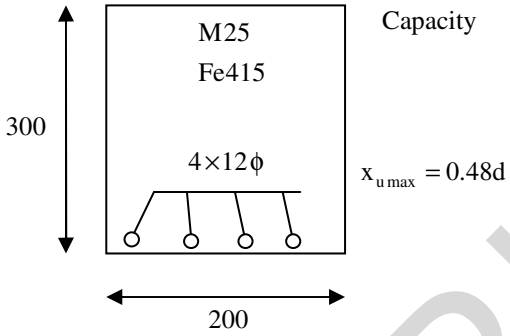
Section Classification	1 Mark	2 Marks	Total Number of Questions
Engineering Mathematics	3	5	8
Mechanics	1	3	4
Structural Analysis	2	2	4
Concrete Structures	4	2	6
Steel Structures	0	1	1
Soil Mechanics	3	2	5
Foundation Engineering	2	3	5
Fluid Mechanics & Hydraulics	2	3	5
Hydrology	0	2	2
Irrigation	1	0	1
Environmental Engineering	3	2	5
Transportation Engineering	2	3	5
Surveying	2	2	4
Verbal Ability	3	2	5
Numerical Ability	2	3	5
	30	**35**	**65**

Questions from the Paper

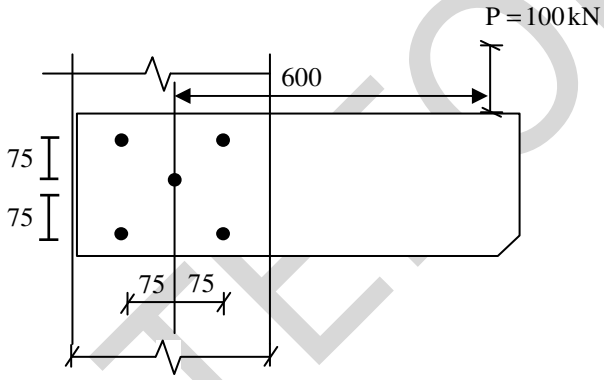
1. Find maximum ordinate of S-curve of the 4-hr unit hydrograph given below.

0	2	4	6	8	10	12	14	16	18	20	22	24
0	0.6	3.1	10	13	9	5	2	0.7	0.3	0.2	0.1	0

2. Concrete, find maximum capacity moment carrying



3.



Find maximum strength for which bolt has to be designed

4. $f(z) = \dfrac{9}{(z-1)(z+2)^2}$ which of the following is one of the residues of the given function

(A) -1 (B) 9/16 (C) 2 (D) 9

5. $\begin{bmatrix} 3 & -2 & 2 \\ 4 & -4 & 6 \\ 2 & -3 & 3 \end{bmatrix}$

Which one of the following are its smallest and largest eigen values?

(A) 1.5,2.5 (B) 0.5,2.5 (C) 1,3 (D) (1,2)

6. For 2m wide rectangular channel n = 0.01, s = 1/10000, discharge $4m^3/s$ in GVF profile, find rate of change of slope $\frac{dy}{dx}$ at y = 0.2 m.

7. Find directional derivative of x^2-3yz in direction $\hat{i}+\hat{j}-2\hat{k}$ at (2,-1,4) .

8. Find the value of $x^2+4x-4 = 0$ by Newton Raphson method, after second approximation.

9.

Compound	Composition(%)	Density
	C_1	ρ_1
	C_2	ρ_2

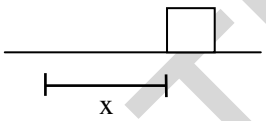
If the combined composition is 100%, what is the equivalent density?

(A) $\frac{100}{\frac{C_1}{\rho_1}+\frac{C_2}{\rho_2}}$ (B) $100\left(\frac{\rho_1}{C_1}+\frac{\rho_2}{C_2}\right)$ (C) $100\left(C_1\rho_1+C_2\rho_2\right)$ (D) $100\frac{\rho_1\rho_2}{\left(C_1\rho_1+C_2\rho_2\right)}$

Key: (A)

10. $\frac{dv}{dt}=\left(\alpha-\beta t_0\right)e^{-\beta t}$ for slow vehicle, whose acceleration varies with this equation and V_0 is initial velocity. $\frac{dv}{dt}=\alpha+\beta v$ for vehicle that is overtaking. If $\frac{dv}{dt}=2$ at 3sec. α = 0.005, β = 0.01 at t = 45s find distance

11.



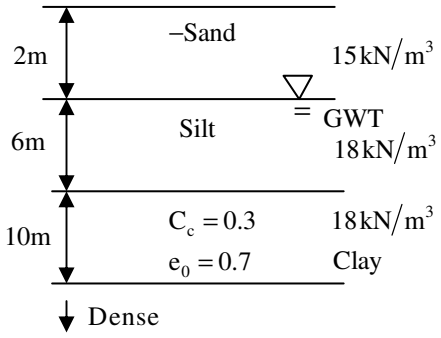
If x=48 m is the distance where sign should be placed for 6/6 eyes, what would be x for 6/9 vision?

12. Solve $\left(xdx+ydy\right)\cos\frac{y}{x}=xy\left(ydx-xdy\right)\sin\frac{y}{x}$

Key: $xy\cos\frac{y}{x}=c$

13. SO_2 - 30µg/m^3 at ambient pressure and temperature, Find its volume in ppm. If weight of SO_2 = 64, and $\frac{PR}{T}=41.6\,mol$

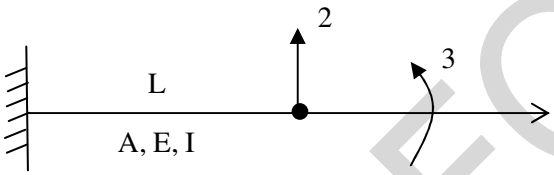
14. If circular footing of 3m diameter is placed at 1m depth.



Find compression of clay layer if a load of 1500 kN is applied from top. Stress distribution is of 2 vertical to 1 horizontal. Unit weight of water is 10.

15. Find ratio of horizontal and vertical permeability
If t_{sand} = 3 times t_{clay}
t_{silt} = 2 time t_{clay}
permeability of sand is 10 times of silt and permeability of clay is 1/10th of silt

16.



Find k_{22} (stiffness)

Key: $k_{22} = \frac{12EI}{L^3}$

17. Concentration of SO_2 is $30\,\mu g/m^3$

Under same condition above SO_2 concentration expressed in ppm is _____

$P/RT = 41.6\ mol/m^3$ Mol. wt. of $SO_2 = 64$

18. Which of the following is true?
(A) Thinner the soil sampler wall, lower the degree of disturbance.
(B) Thicker the soil sampler wall, lower the degree of disturbance.
(C) No relation between thickness and degree of disturbance
(D) None of these

19. What is value of K in formula of development length $\frac{\phi\sigma_s}{k\tau_{bd}}$ for deformed bars as per IS:456?

20. Although the tamil version of _____ John Abraham starrer Madras Café _____ cleared by the censor board with no cuts, film distributors _____ no takers for releasing _____ this Friday

(Mr., was, found, on)

21. Children: Pediatrician

(A) Kidney: Nephrologist
(B) Female: Gynecologist
(C) Skin dermatologist
(D) ..

22. ROAD – URDG: SWAN – _____

Key: VZDQ

23. f(x) = 29,at x = -2 f(x) = 39,at x = 3

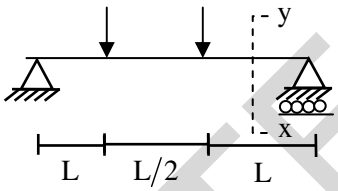
Find f(x) ,at x = 5

Key: 43

24. Extreme focus on syllabus and studying for test has become such a dominant concern of Indian students that this has closed their minds to anything _____ to the requirements of the exam

(A) related (B) extraneous (C) outside (D) useful

25.



For a simply reinforced beam shown above

(A) Variation of stress is linear and strain non-linear
(B) Variation of strain is linear and stress non-linear
(C) Both linear
(D) Both non-linear

26. What is the relationship between seepage velocity and discharge velocity?

Key: (B)

Exp: $V_S = \frac{V}{n}$ V_S never be smaller than discharge velocity

27. Penetration of bitumen sample tested at 25°C is 80. When heated to 60°C, penetration is measured as 'd' mm – d value cannot be lesser than ____ mm.

Key: 8

28. A vehicle is moving in a circular curve and it has a super elevation of e when it does not slide inwards. When friction factor is f

(A) $e \le f$ (B) $e \ge f$ (C) $e = f$ (D) Cannot be determined

Key: (A)

29. Which of these are non dimensional parameters?

Key: $\frac{F_d}{\rho VD^2}, \frac{\rho VD}{\mu}$

30. Which of these statements is false?

(1) Plumb line is along direction of gravity

(2) Mean Sea Level in reference surface for establishing horizontal control

(3) Mean Sea Level is simplification of geoid

(4) Geoid is an equi potential surface of gravity.

31. If velocity of flow is 1m/s, depth =0.8m, take g =10m/s^2, find velocity post jump for wide rectangular channel width B=2m.

Key: 2.73

Exp: $F_1 = \frac{V}{\sqrt{gy}} = \frac{1}{\sqrt{8}}$

$$F_2 = \frac{8F_1^2}{\left[-1+\sqrt{1+8F_1^2}\right]^3}, \frac{V_2}{\sqrt{gy_2}} = F_2.$$

$$\frac{y_2}{y_1} = \frac{1}{2}\left[-1+\sqrt{1+8F_1^2}\right]$$

Solving using above formula $V_2 = 2.73\ m/s$

32. Selection incorrect statement.

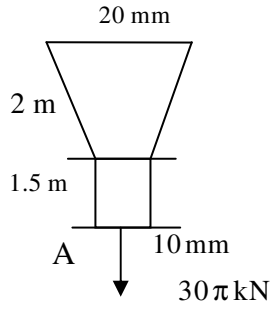
(A) Shear strength of loose soil increases on shearing

(B) Dense sand develops negative pore pressure

(C) Cotton soil is collapsible soil.

(D) Liquefaction of sheet pile occurs at downstream due to hydraulic gradient.

33.



$E = 2\times10^5$ MPa

Find deflection at point A(in mm)

34. In a survey work, three independent angles x,y,z were observed with weights W_x, W_y, W_z respectively the weight of sum of angles x,y,z is

(A) $\dfrac{1}{\left(\dfrac{1}{W_x}+\dfrac{1}{W_y}+\dfrac{1}{W_z}\right)}$ (B) $\left(\dfrac{1}{W_x}+\dfrac{1}{W_y}+\dfrac{1}{W_z}\right)$ (C) $W_x+W_y+W_z$ (D) $W_x^2+W_y^2+W_z^2$

35. A= N77°50', magnetic bearing, binary magnetic declination 2^o, Due to local attrition, error in AO is free from local attrition OA, magnetic bearing S52°20'W, AO=55°40', Find true Bearing of A.

Key: N84°10° E

36. For what values of 'p' the set of equations $2x+3y=5, 3x+py=10$ has no solution

37. P.M.F of random variable x if $P(x,q)=\begin{cases} q & \text{if } x=0 \\ 1-q & x=1 \\ 0 & \text{otherwise} \end{cases}$

If q=0.4, the variance of x is _____.

38. 1. As slump increases, the vebe time increases.
2. As slump increases, the compaction factor increases.

(A) 1 is correct (B) 2 is correct (C) Both are correct (D) None

39. Which of these can not be used to describe free flow speed of traffic stream?

(A) U_f is speed when flow is negligible

(B) U_f is speed when density is negligible

(C) Affected by geometry and surface condition of road

(D) Flow is maximum and density is optimum

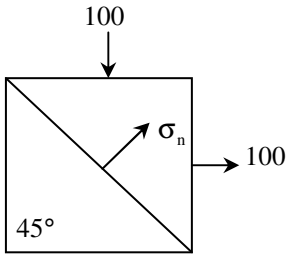
40. Which of the following is not correct?

Key: (B) Dense sand when sheared under undrained condition may lead to generation of negative pore pressure

41. Kjeldahl Nitrogen is combination of

(A) Ammonia + nitrate in sewer
(B) organic nitrogen + nitrate.
(C) ..
(D) ..

42.



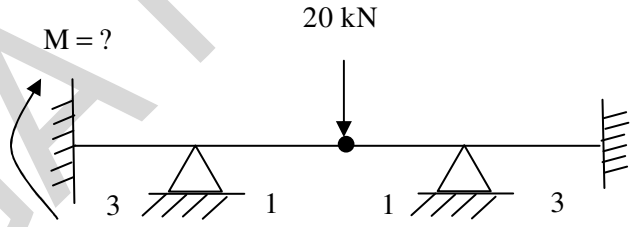
Find σ_n, normal stress on plane 45^o to major principal axis

43. 60% of silt is fine-grained. The soil is semisolid at water content of 15% and 28% and fluid like when water content when water content is greater than 40%. What is the activity?

44. 20 m thick soil is between silty sand and gravel sand and found 30 mm settlement in 2 years

$C_v - 0.003\,cm^2/s$, total settlement – 50mm. What is the time required (in years) for final settlement?

45.



(EI)

46. For steady incompressible flow through a closed conduit of uniform c/s the direction of flow will always be

(A) Higher to lower elevation
(B) Higher to lower Pressure
(C) Higher to lower Velocity
(D) Higher to lower Piezometric head

47. In closed loop traverse of 1 km total length, the closing error in departure and latitude are 0.3 m and 0.4 m respectively. The relative precision of this traverse will be

(A) 1:5000 (B) 1:4000 (A) 1:3000 (A) 1:2000

48. In an x-y plane, the velocity in x- direction is x^2, and the fluid density is $\frac{1}{x}$, then what is the velocity in y-direction?

(A) $\frac{-x}{y}$ (B) x/y (C) $-xy$ (D) xy

49. Match the following

P	Graph Command Area	1-100 ha/cumec
Q	Permanent Wilting Point	2. $6^{o}C$
R	Duty	3. 1000 ha
S	Delta	4. 1000 cm
		5. 40 cm
		6. 0.12

50. In a soil test, confined pressure is increased from-150 to 250 kPa, its pore pressure is increased by 80 kPa, and its deviatory stress is increased by 25 kPa. Skempton's pore pressure parameter B is _____.

(A) 0.5 (B) 0.625 (C) 0.8 (D) 1

51. A circular pipe of 1 m diameter is laid on a bed slope 1 in 1000. Its Manning's coefficient is 0.01 and the flow is upto its crest and the discharge is referred as Q_{full}. When is half full the discharge is referred as Q_{half}. Then find the ratio of Q_{full}/ Q_{half}

(A) 1 (B) $\sqrt{2}$ (C) 2 (D) 4

Key: (A)

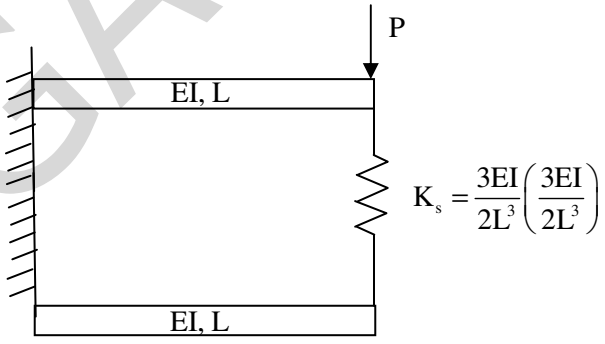
52. The below statements are related to air entrained concrete

(1) reduces water demand at given workability

(2) cyclic freezing and thawing at any environment

(A) 1 is correct (B) 2 is correct (C) Both are correct (D) None

53.



Find percentage load taken by spring

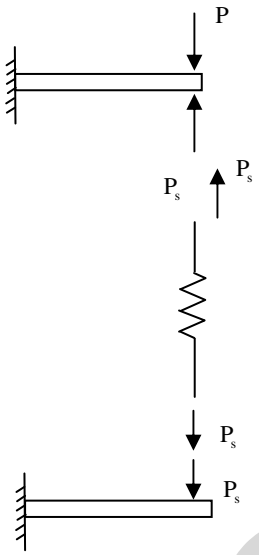
Key: 25

Exp: Let force is spring be P_s

Total Extension in spring =x= $\frac{P_s}{K_s}$ … (1)

Also $x = \left[\frac{PL^3}{3EI} - \frac{P_sL^3}{3EI}\right] - \frac{P_sL^3}{3EI} = \frac{P_s}{K_s}$ … (2)

solving (1) & (2)

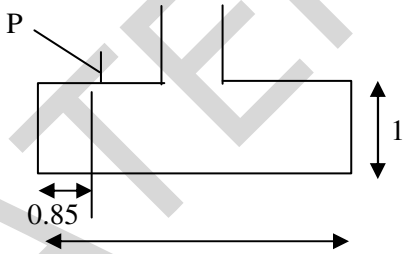


Free body diagram

$\frac{P_s}{P} = \frac{1}{4}$

$\therefore 25\%$.

54.



$F_{dl} = F_{dr} = 1.134$

$F_{si}F_{sr} = 1.113$

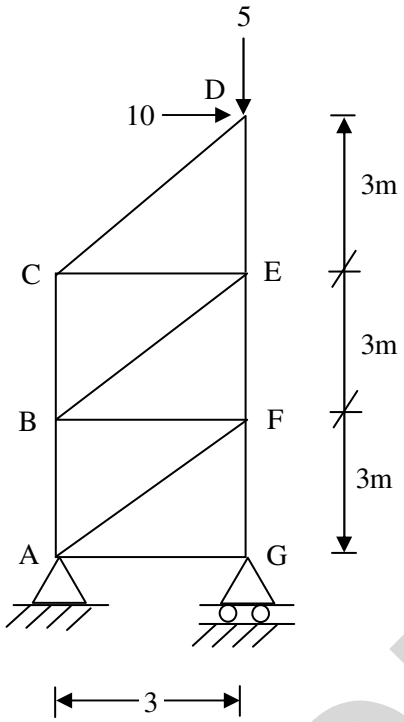
$F_iq = 0.444$ $F_{ir} = 0.2$

$FOS = 3$

$\gamma = 18\ kN/m^3$

Find maximum eccentric load at net safe criteria.

55. Find strain energy in



56. Excavation is to be obtained either from x,y or z,
5000 m^3 sand. Unit weight 17.6. Cost of trKeyportation per km is double of cost of excavation per m^3. Find economical option.