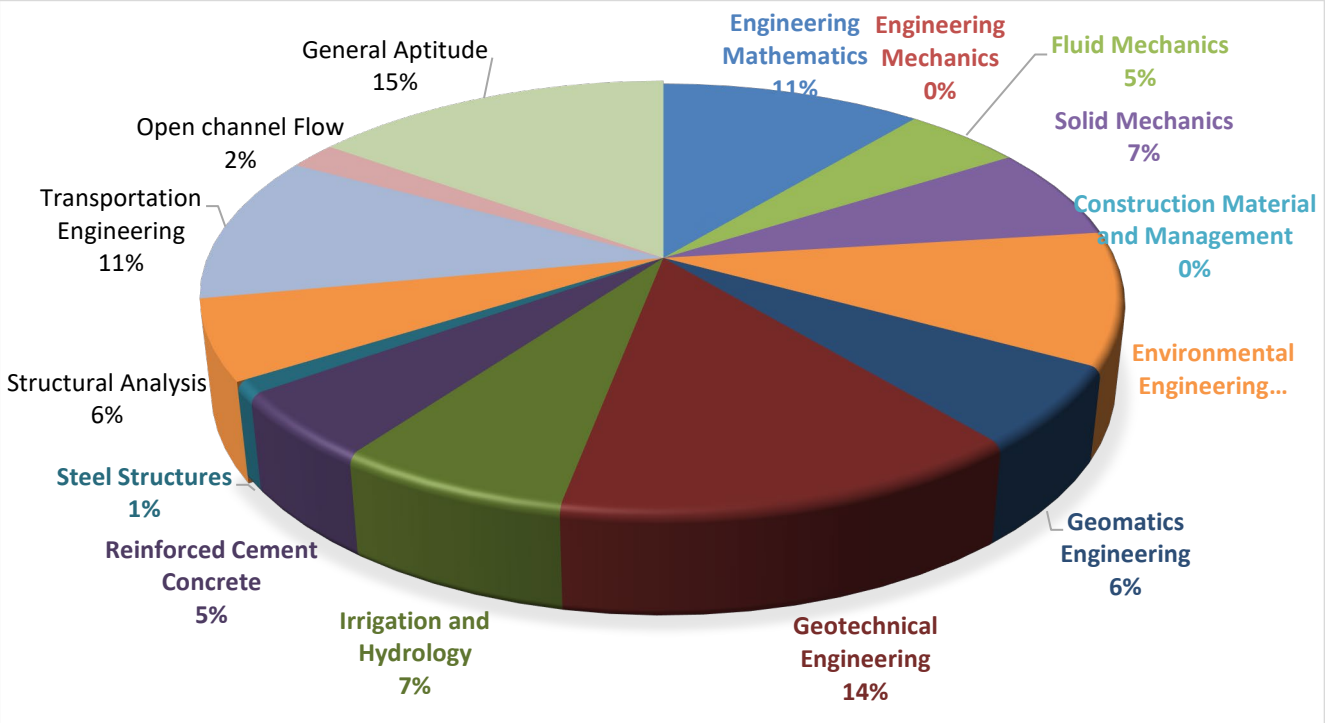
ANALYSIS OF GATE 2020

Memory Based

Civil Engineering



CE ANALYSIS-2020_Feb-09_Afternoon

SUBJECT	No. of Ques.	Topics Asked in Paper(Memory Based)	Level of Ques.	Total Marks
Engineering Mathematics	1 Marks: 5 2 Marks: 3	Differential equation, Fourier series, Eigen values, Numerical method, Limits	Easy	11
Engineering Mechanics	1 Marks: 0 2 Marks: 0	-	-	0
Fluid Mechanics	1 Marks: 1 2 Marks: 2	Velocity component for stream lines, Boundary layer, Pipe flow	Easy	5
Solid Mechanics	1 Marks: 3 2 Marks: 2	Tensile strength, Deflection	Average	7
Construction Material and Management	1 Marks: 2 Marks:	-	-	0
Environmental Engineering	1 Marks: 4 2 Marks: 3	Sedimentation and BOD, Solid waste management, Theoretical O_2 demand, pH, Hardness	Average	10
Geomatics Engineering	1 Marks: 0 2 Marks: 3	Levelling	Average	6
Geotechnical Engineering	1 Marks: 4 2 Marks: 5	Consolidation	Average	14
Hydrology and Irrigation Engineering	1 Marks: 3 2 Marks: 2	Hydrograph, Gravity dam, Filled capacity, Water requirement of crops, Gravity dams, Drainage structure	Easy	7
Reinforced Cement Concrete	1 Marks: 1 2 Marks: 2	Prestress		5
Steel Structures	1 Marks: 1 2 Marks: 0	Shape factor	Easy	1
Structural Analysis	1 Marks: 0 2 Marks: 3	Truss		6
Transportation Engineering	1 Marks: 3 2 Marks: 4	Airport , Railway, Pavement materials design, High geometric design, Traffic	Average	11
Open channel Flow	1 Marks: 0 2 Marks: 1	Hydraulic jump	Average	2
General Aptitude	1 Marks: 5 2 Marks: 5	Number systems, Venn diagram, Calendar, Vocabulary	Easy	15
Total	**65**			**100**
Faculty Feedback	Overall paper was average level.			

GATE 2020 Examination* (Memory Based)

Civil Engineering

Test Date: 9th Feb-2020

Test Time: 2.30 pm to 5.30 pm

Stream Name: Civil Engineering

General Aptitude

Q.1 - Q.5 Carry One Mark each.

1. Ratio of sum of odd positive integers from 1 to 100 to the sum of even positive integers from 150 to 200 will be _____
   (A) 45:95
   (B) 50:91
   (C) 1:1
   (D) 1:2
   [Ans. B]

2. Select the word that fits the analogy
   Partial : Impartial :: Popular : _____
   (A) Impopular
   (B) Mispopular
   (C) Dispopular
   (D) Unpopular
   [Ans. D]

3. Rescue teams deployed _____disaster hit areas combat _____ a lot of difficulties to save the save the people
   (A) in, with
   (B) with, with
   (C) with, of
   (D) to, to
   [Ans. A]

4. If $f(x) = x^2$ for all x in the range $(-\infty, +\infty)$, then $\left(\frac{f(f(f(x)))}{f(x)}\right)$ will be
   (A) $[f(x)]^4$
   (B) $[f(x)]^3$
   (C) $f(x)$
   (D) $[f(x)]^2$
   [Ans. B]

Q.6 - Q.10 Carry Two Mark each.

6. If there are 1000 students in the class 600 play chess 300 play hockey and 50 play both the games. Number students neither play chess not hockey is?

7. For the year 2019 the calendar will be same as the following years?
(A) 2011
(B) 2012
(C) 2013
(D) 2014
[Ans. C]

8. Nominal interest rate is defined as the amount paid by the borrower to the lender for using the borrowed amount for a specific period of time. Real interest rate is calculated on the basis of actual rate (inflation-adjusted) is approximately equal to the difference between nominal rate and expected rate of inflation in the economy.
(A) Under low inflation, real interest rate is low and borrowers get benefitted
(B) Under high inflation, real interest rate is low and lender gets benefitted
(C) Under low inflation, real interest rate is high and borrowers benefitted
(D) Under high inflation, real interest rate is low and borrowers benefitted
[Ans. D]

9. Percentage LED bulbs sold by two firms X and Y from January to June is given below.

January	15%
February	20%
March	30%
April	15%
May	10%
June	10%

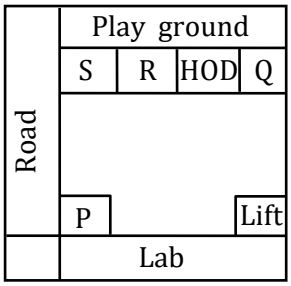
Ratio of LED bulbs sold by X and Y are as shown below.

	X:Y
January	7:8
February	2:3
March	2:1
April	3:2
May	1:4
June	9:11

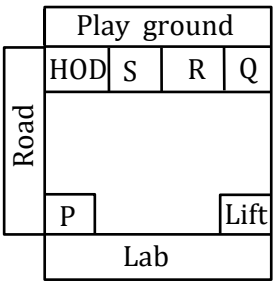
If total bulbs sold by X and Y is 50,000 then the number of bulbs sold by firm Y during April to June is _____.
(A) 8250
(B) 8750
(C) 9750
(D) 11250
[Ans. C]

10. HOD of a college wants to rearrange four faculty rooms based on their requirements. P needs room near to lab. Q needs room near to lift. R needs visibility to the playground, and S need a corner room. Which of the following arrangement will be satisfying the requirements?

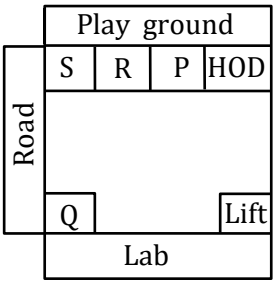
(A)



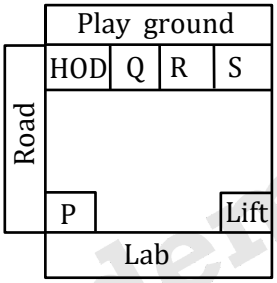
(B)



(C)



(D)



[Ans. A]

Technical

Q.1 - Q.25 Carry One Mark each.

1. Two identically sized primary settling tanks receive water for type-1 settling under laminar flow condition. The SOR in the two tanks are 30 m^3/m^2d and 15 m^3/m^2d. Find $\frac{d_{30}}{d_{15}}$, d_{30} & d_{15} are the lowest dia of particle which will settled out is _____

2. A hydraulic jump occurs in a triangular channel with side slopes 1 : 1 (V : H). The sequent depths are 0.5 m and 1.5 m. The flow rate (in m^3/s) is _____

3. The following partial differential equation is defined for u: u (x, y)

$$\frac{du}{dy} = \frac{\partial^2 u}{\partial x^2};\ y \geq 0; x_1 \leq x \leq x_2$$

The set of auxiliary condition necessary to solve the equation uniquely is

(A) 3 initial condition
(B) 2 initial and 1 boundary
(C) 1 initial and 2 boundary
(D) 3 boundary

[Ans. D]

4. A fair coin is tossed 15 times. The probability of getting exactly 8 heads is _____.

[Ans. 0.1963]

5. The ordinary differential equation $\frac{d^2u}{dx^2} + 2x^2u + \sin x = 0$ is

(A) Linear and homogeneous
(B) Non-linear and homogeneous
(C) Linear and non-homogeneous
(D) Non-linear and non-homogeneous

[Ans. C]

6. The value of $\lim_{x\to\infty}\left(\sqrt{\frac{9x^2+2020}{x+7}}\right)$ is

(A) Indeterminable
(B) 1
(C) 3
(D) 7/9

[Ans. C]

7. For an axle load of 15 Ton, the vehicle damage factor in terms of standard axle load of 8 Ton is _____.
[Ans. *]Range: 12.3 to 12.4

8. The ion product of water is 14. If a rain water has pH of 5.6, the concentration of OH^- in the sample (in 10^{-9}mol/litre)

9. A gas contains two types of suspended particles having average size 2μm and 50μm most suitable strategy
(A) Settling chamber followed by bag filter
(B) Bag filter followed by ESP
(C) ESP followed by cyclonic separator
(D) ESP followed by venturi scrubber

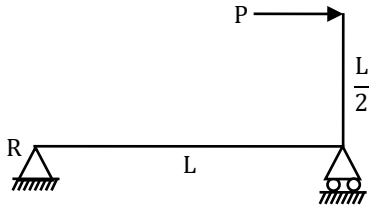
10. Velocity distribution in a boundary layer is $\left(\frac{u}{U_\infty} = \sin\left(\frac{\pi y}{2\delta}\right)\right)$ where u is the velocity at vertical co-ordinate y, u_∞ = free stream velocity = 0.3 m/sec ;
δ = boundary layer thickness = 1 m. Velocity gradient $\left(\frac{\partial u}{\partial y}\right)$ in (Δ^{-1}) at y = 0 is _____.
[Ans. *] Range; 0.471 to 0.471

11. velocity component in x and y direction of incompressible flow are $u = -5 + 6x$, $v = -(9 + 6y)$. Equation of stream line is _____
(A) $\frac{(9+6y)}{-5+6x} = \text{constant}$
(B) $(-5 + 6x) - (9 + 6y) = \text{constant}$
(C) $\frac{-5+6x}{9+6y} = \text{constant}$
(D) $(-5 + 6x)(9 + 6y) = \text{constant}$
[Ans. D]

12. 500 gm dry sand poured into 2 liter container, 86 cc water displaced from the container, take water density 1 g/cc. Then specific gravity of sand is _____

13. Muskingum method used for
(A) Hydraulic river routing
(B) Hydrological Chanel routing
(C) Hydrological river routing
(D) Hydraulic Chanel routing
[Ans. B]

14. Find the rotation at point R.



$\left[\textbf{Ans.}\ \frac{PL^2}{12EI}\right]$

15. The diameter & height of a right cylinder are 3cm & 4 cm, respectively. The absolute error in each of these two measurements is 0.2 cm. the absolute error in the computed volume (in cm^3) is_____.

16. Traffic starts discharging from an approach at an intersection with the signal turning green. The constant head way considered from the fourth or fifth headway position is referred as_____.

(A) Intersection headway
(B) Saturation headway
(C) Effective headway
(D) Discharge headway

17. 24 hour traffic count on a road section was found to be 1000 vehicles on a Tuesday in July. If daily adjustment factor=1.121 and monthly adjustment factor of July =0.913, the annual average daily traffic is _____.

[Ans. *]Range: 1023 to 1024

18. Find excess rainfall, Catchment area = 300 km^2. Triangle shape with 90 hrs duration. Peak discharge = $60m^3/s$

[Ans. *] Range: 6.4 to 6.6

Q.26 - Q.55 Carry Two Mark each.

26. The fourier series to represent $x - x^2$ for $-\pi \leq x \leq \pi$ is given by $x - x^2 = \frac{a_o}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$
The value of a_o is _____
[Ans. −6.58]

27. A 4×4 matrix P is given below
$$P = \begin{bmatrix} 0 & 1 & 3 & 0 \\ -2 & 3 & 0 & 4 \\ 0 & 0 & 6 & 1 \\ 0 & 0 & 1 & 6 \end{bmatrix}$$
The eigen values of [P] is _____
(A) 1, 2, 3, 4
(B) 1, 2, 5, 7
(C) 0, 3, 6, 6
(D) 3, 4, 5, 7
[Ans. B]

28. An ordinary differential equation is given below,
$$6\frac{d^2y}{dx^2} + \frac{dy}{dx} - y = 0$$
The general solution of the above equation is
(A) $y(x) = C_1 e^{-\frac{x}{3}} + C_2 e^{\frac{x}{2}}$
(B) $y(x) = C_1 e^{\frac{x}{3}} + C_2 e^{-\frac{x}{2}}$
(C) $y(x) = C_1 e^{\frac{x}{3}} + C_2 e^{\frac{x}{2}}$
(D) $y(x) = C_1 e^{-\frac{x}{3}} + C_2 e^{-\frac{x}{2}}$
[Ans. B]

29. The integral $\int_0^1 (5x^3 + 4x^2 + 3x + 2)dx$ is estimate numerically using 3 alternative methods, namely the rectangle, trapezoidal and Simpson's rule with a common step size. In this context which one of the following statements is true?
(A) Simpson's rule rectangle rule as well as trapezoidal rule of estimation will give non-zero error
(B) Only Simpson rule will give zero error
(C) Simpson R rectangle give non-zero error
(D) Only rectangle will give zero error
[Ans. B]

30. Match column A to column B

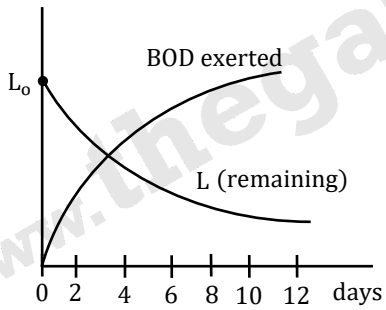
	Test		Purpose
a.	Soundness Test	1.	Strength
b.	Crushing Test	2.	Resistance to weathering
c.	Los angeles abrasion test	3.	Adhesion
d.	Striping value test	4.	hardness

[Ans. a-2, b-1, c-4, d-3]

31. For the hottest month at a proposed site of an airport the monthly mean of average daily temperature and monthly mean of maximum daily temperature are 39°C and 48°C respectively. For this information, the airport reference temperature will be_____?
(A) 42°C
(B) 39°C
(C) 48°C
(D) 36°C
[Ans. A]

32. Design speed of a 2 lane 2way road is 60 KMPH coefficient of longitudinal friction is found to be 0.36. If the reaction time of the driver is 2.5sec, what will be the intermediate sight distance (ISD)? (consider $= 9.81 ms^{-2}$)
[Ans. *]Range: 160 to 164

33. The relationship between oxygen consumption and equivalent biodegradable organic removal (i.e., BOD) in a closed container with respect to time is shown in figure.



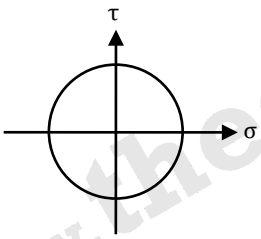
Assume that the rate of oxygen consumption is directly proportional to the amount of degradable organic matter and is expressed as
$\frac{dL_t}{dt} = -kL_t$, where, L_t is the oxygen equivalent of the organics remaining at time 't' and k(in d^{-1}) is the degradation rate constant. $L_o$is the oxygen equivalent of organic matter at time $t = 0$
Correct expression
(A) $L_o = L_t e^{-kt}$
(B) $BOD_5 = L_5$
(C) $L_t = L_o(1 - e^{-kt})$
(D) $BOD_t = L_o - L_t$
[Ans. D]

34. Alkalinity of water, in equivalent/litre is given by
$\{HCO_3^-\} + 2\{CO_3^{2-}\} + \{OH^-\} - \{H^+\}$ Where { } represents concentration in mol/litre. For a water sample, the concentration of $HCO_3^- = 2 \times 10^{-3}$mol/litre , $CO_3^{2-} = 3.04 \times 10^{-4}$mol/litre and pH of water = 9.0. The atomic weight are Ca = 40, C = 12 and O = 16. If the concentration of OH^- and H^+ are neglected the alkalinity of water sample (in mg/litre as $CaCO_3$) is _____
(A) 50
(B) 65.2
(C) 100
(D) 130.4
[Ans. D]

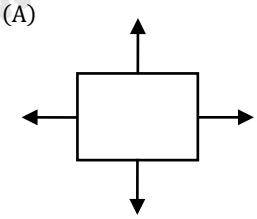
35. A sample of water contains an organic compound $C_8H_{16}O_8$ at a concentration of 10^{-3} mol/ litre. Given that atomic weight of C = 12 g/mol, H = 1 g/mol and O = 16 g/mol, the theoretical oxygen demand of water (in gram of O_2 per litre is _____
[Ans. *]

36. A cast iron pipe of d = 600 mm and l = 400 mm carries water from a tank and discharges freely to the air at a point 4.5 m below the water surface in the tank.
The friction factor = 0.018 and g = 9.81, velocity of flow of pipe is _____m/s
[Ans. 9.34]

37. Mohr's circle for a state of stress is given below



Find the state of stress
(A)



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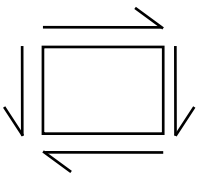

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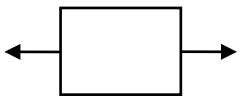
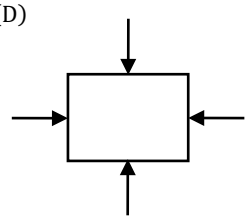
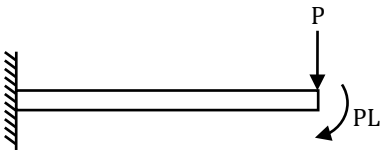


(D)

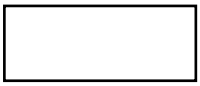


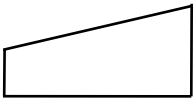
[Ans. B]

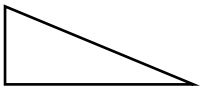
38. A cantilever beam is loaded as shown in figure.



The SFD for the above case is

(A) 

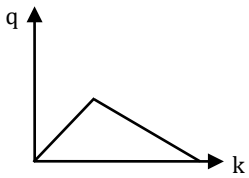
(B) 

(C) 

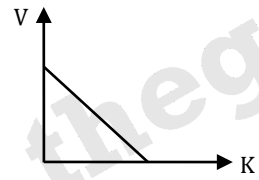
(D) 

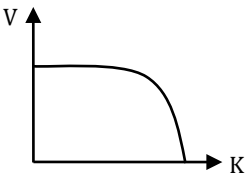
[Ans. A]

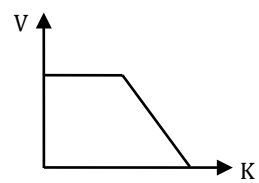
39. The flow(q)-density(K) relationship on a highway section is shown below

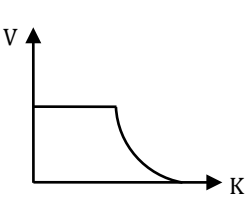


Which of the following options will be correct relationship between speed (V) and density (K)

(A) 

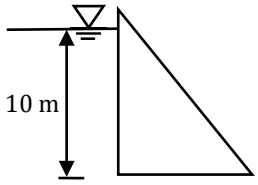
(B) 

(C) 

(D) 

40. Field capacity = 30%, Permanent wilting point= 13%, Moisture content for irrigation = 20%, Density of soil= 1500 kg/m^3, Density of water = 1000 kg/m^3, depth of root zone= 80 cm, consumptive use= 2 mm. Find frequency of irrigation
(A) 11
(B) 12
(C) 10
(D) 7

41. Density of concrete = 24 kN/m^3
Density of water = 9.81 kN/m^3
Coefficient of friction, $\mu = 0.45$
Find minimum base width?



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