

## GATE 2020 Civil Engineering

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Date of Exam: 09/02/2020 (Afternoon)

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#### Detailed Solutions of GATE 2020 : CIVIL ENGINEERING Date of Test : 09-02-2020 (Afternoon)

Total LED bulb sold by X and Y 35% this value = 50000 So, LED bulb sold by Y (April to June)

$$\frac{50000}{35} \times 19.5 = 27857.142$$
  
[As 35% of total = 5000

Total = 
$$\frac{50000}{0.35}$$
 = 142857.142

Y (April- June) = 19.5% of total 0.195 × 1442857.14 = 2785.142]

No option is matching.

Mistake in paper was that examiner intended to give total as 50000 and the options were place accordingly as 19.5% of 50000 = 9750 which is (d).

But this will be wrong as total is NOT 50000 as per language. So correct answer is 27857.142.

Which matches with none of options.

End of Solution

Q.3 After the inauguration of the new building, the head of department (HOD) collated faculty preferences for office space. P wanted a room adjacent to the lab. Q wanted to be close to the lift. R wanted a view of the playground and S wanted a corner office. Assuming that everyone was satisfied, which among the following shows a possible allocation?



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Q.4	In a schoo If 50 stude	ol of 1000 students, 300 stu ents play both chess and f	dents play chess and 600 students play footb potball, the number of students who play neith	all. her		
	is	·				
	(a) 150		(b) 50			
	(c) 100		(d) 200			
Ans.	(a)		<i>T</i> = 1000			
		300 Ches 250	s 600 Football 50 550			
	Total num Total num	ber of students playing sp ber of students not playing	orts = 850 g sports = 1000 - 850 = 150 <i>End of Soluti</i>	on		
Q.5	Select the	most appropriate word that	can replace the underlined word without changi	ing		
	the meani	ng of the sentence:				
	Now-a-day	ys, most children have a ter	ndency to belittle the legitimate concerns of th	ieir		
	parents.					
	(a) Appiai		(b) Begrudge (d) Beduce			
Ano		age				
A115.	Belittle me most appr	eans to undervalue/ underes opriate manner.	timate some as unimportant. Disparage fits in t	the		
Q.6	For the ye	ear 2019, which of the prev	ious year's calendar can be used?	on		
	(a) 2011		(b) 2013			
	(c) 2012		(d) 2014			
Ans.	(b)	Voor	Number of odd dave			
		2013	1			
		2014	1			
		2015	2			
		2017	1			
		2018	1			
		Total	7			
	Number o	f odd days in 2019 = 1, s	o 2013 calendar is same as 2019.			
			End of Soluti	on		
			Page	л		

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Q.7	If $f(x) = x^2$ for each $x \in (-\infty, \infty)$ , then (a) $f(x)$ (c) $(f(x))^2$ (d)	$\frac{f(f(f(x)))}{f(x)} \text{ is equal to } \$ (b) $(f(x))^4$ (d) $(f(x))^3$
	$f(x) = x^{2}$ $f(f(f(x))) = f(f(x^{2})) = f(x^{2})$	$(x^4) = (x^4)^2 = x^8$
	So, $\frac{f(f(f(x)))}{f(x)} = \frac{x^8}{x^2} = x^6 = 0$	$(x^2)^3 = (f(x))^3$
Q.8	Rescue teams deployed disate to save the people.	End of Solution aster hit areas combata lot of difficulties (b) to, to
Ans.	(c) with, with (d)	(d) in, with
Q.9	Nominal interest rate is defined as the using the borrowed amount for a spec on the basis of actual value (inflation-ac between nominal rate and expected r Which of the following assertions is b (a) Under low inflation, real interest ra (b) Under high inflation, real interest ra (c) Under low inflation, real interest ra (d) Under high inflation, real interest (b)	e amount paid by the borrower to the lender for cific period of time. Real interest rate calculated djusted), is approximately equal to the difference ate of inflation in the economy. est supported by the above information? ate is low and borrowers get benefited. rate is low and borrowers get benefited. ate is high and borrowers get benefited. rate is low and lenders get benefited.
Ans.	(0)	End of Solution
Q.10	The ratio of 'the sum of the odd positiv positive integers from 150 to 200' is (a) 50 : 91 (c) 1 : 2	re integers from 1 to 100' to 'the sum of the even (b) 1 : 1 (d) 45 : 95
Ans.	(a)	
	Sum of old numbers from 1 to 100 Sum of even numbers from 150 to 200 Ratio = 50 : 91 From 1 to 100 = 50 odd nu From 150 to 200 = 26 even nu	$\frac{50^2}{175 \times 26} = \frac{50 \times 50}{175 \times 26} = \frac{2500}{4550}$ mber umber
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	Detailed Solutions of GATE 2020 : CIVIL ENGINEERING Date of Test : 09-02-2020 (Afternoon)
	SECTION B : TECHNICAL
Q.1	For an axle load of 15 tonne on a road, the Vehicle Damage Factor (round off to two decimal places), in terms of the standard axle load of 8 tonne, is
Ans.	(12.35) Axle load = 15 T Standard axle load = 8 T $VDF = \left[\frac{15}{8}\right]^4 = 12.35$
	End of Solution
Q.2	Muskingum method is used in(a) hydrologic channel routing(b) hydraulic channel routing(c) hydrologic reservoir routing(d) hydraulic reservoir routing
Ans.	(a) End of Solution
Q.3 Ans.	The traffic starts discharging from an approach at an intersection with the signal turning green. The constant headway considered from the fourth or fifth headway position is referred to as <ul> <li>(a) saturation headway</li> <li>(b) effective headway</li> <li>(c) discharge headway</li> <li>(d) intersection headway</li> </ul>
Q.4 Ans.	Soil deposit formed due to transportation by wind is termed as (a) lacustrine deposit (b) alluvial deposit (c) estuarine deposit (d) aeolian deposit (d) Soil deposited by wind is Aeolian soil.
Q.5	The relationship between oxygen consumption and equivalent biodegradable organic removal (i.e. BOD) in a closed container with respect to time is shown in the figure.
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## ESE 2020 Main Exam Streams: CE ME EE E&T



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	Description       Description         Description       Description         GATE 2020 : CIVIL ENGINEERING         Date of Test : 09-02-2020 (Afternoon)
Ans.	(1023)
	$T_{24} = 1000 \text{ veh (Tuesday)}$
	DAF = 1.121
	AADT = ?
	MAF = 0.913
	$T_{\text{week}} = T_{24} \times \text{DAF}$
	$= 1000 \times 1.121 = 1121$
	AADT = $MAF \times ADT = (0.913 \times 1121)$
	= 1023.473
	= 1023 VPD
	End of Solution
Q.10	Velocity distribution in a boundary layer is given by $\frac{u}{U_{\infty}} = \sin\left(\frac{\pi}{2}\frac{y}{\delta}\right)$ , where <i>u</i> is the velocity at vertical coordinate <i>y</i> , $U_{\infty}$ is the free stream velocity and $\delta$ is the boundary layer thickness. The values of $U_{\infty}$ and $\delta$ are 0.3 m/s and 1.0 m, respectively. The velocity gradient $\left(\frac{\partial u}{\partial y}\right)$ (in s <sup>-1</sup> , round off to two decimal places) at <i>y</i> = 0, is
Ans.	(0.47)
	Given : $\frac{u}{u_{\infty}} = \sin\left(\frac{\pi}{2} \cdot \frac{y}{\delta}\right)$
	$u_{\infty} = 0.3 \text{ m/s}$ $\delta = 1 \text{ m}$
	$\frac{du}{dy} = \frac{d}{dy}u_{\infty} \cdot \sin\left(\frac{\pi}{2} \cdot \frac{y}{\delta}\right)$
	$= \frac{U_{\infty} \cdot \pi}{2\delta} \cos\left(\frac{\pi}{2} \cdot \frac{y}{\delta}\right)$
	At $y = 0$ and $\delta = 1$
	$\frac{du}{dy}\Big _{y=0} = \frac{0.3\pi}{2(1)}\cos\left(\frac{\pi}{2}\cdot\frac{0}{1}\right)$
	$= 0.47 \text{ s}^{-1}$
	End of Solution
Q.11	A weightless cantilever beam of span <i>L</i> is loaded as shown in the figure. For the entire span of the beam, the material properties are identical and the cross-section is rectangular with constant width

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Ans.	(1.41) For type-I setting, Stokes law is app $V_s \propto d^2$ $\frac{d_{30}^2}{d_{15}^2} = \frac{30}{15} = 2$	licable.
	$\frac{d_{30}}{d_{15}} = \sqrt{2} = 1.4$	.1
		End of Solution
Q.13	As per <b>IS 456:2000</b> , the pH value of (a) 6.0 (c) 4.5	water for concrete mix shall NOT be less than (b) 5.0 (d) 5.5
Ans.	(a) 1. Minimum pH value of water for co As per IS code provision no. 5.4.2,	oncrete = 6.0 the pH value of water shall not less than 6.0. End of Solution
Q.14	Superpassage is a canal cross-draina (a) canal water flows under pressure (b) natural stream water flows under (c) canal water flows with free surfac (d) natural stream water flows with fr	age structure in which below a natural stream pressure below a canal ce below a natural stream ee surface below a canal
Ans.	(c)	End of Solution
Q.15	A soil has dry weight of 15.5 kN/m <sup>3</sup> , of 72%. Considering the unit weight o (in %, round off to two decimal place)	specific gravity of 2.65 and degree of saturation f water as 10 kN/m <sup>3</sup> , the water content of the soil es) is
Ans.	(19.28)	
	$\gamma_d = 15.5 \text{ kN/m}$	$B^3$ , $G = 2.65$ , $S = 72\%$
	$\gamma_d = \frac{G\gamma_w}{1+e} = \frac{2}{1+e}$	$\frac{65 \times 10}{1+e} = 15.5$
	<i>e</i> = 0.7096	
	$w = \frac{Se}{G} = \frac{0.72}{2}$	$\frac{2 \times 0.7096}{2.65} = 0.1928$
	<i>w</i> = 19.28%	
		End of Solution







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DELHI Evening :	BATCHES		Indore : 20-02-2020	_
ME : 16 <sup>th</sup> Jan, 2020 25 <sup>th</sup> Feb, 2020			Pune : 10-02-2020	
CE : 30 <sup>th</sup> Jan, 2020 20 <sup>th</sup> Feb, 2020	CE : 1 <sup>°</sup> Feb, 2020 ME : 9 <sup>th</sup> Feb, 2020		Hyderabad : 16-03-2020	
EE, EC : 20 <sup>th</sup> Jan, 2020	EE: 22 <sup>nd</sup> Feb, 2020		Bhubaneswar : 23-01-2020	
<b>Morning :</b> CE, ME : 12 <sup>th</sup> Feb, 2020			Kolkata : 25-01-2020	
(Batch Closed)	CE & ME : 8 <sup>th</sup> Feb, 2020 FC & FE : 18 <sup>th</sup> Jan, 2020		Jaipur : 16-02-2020	_
EC : 6 <sup>th</sup> Apr, 2020 CS : 18 <sup>th</sup> May, 2020	16 <sup>th</sup> Feb, 2020			

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Q.21	The ordinary differential equation $\frac{d^2u}{dx^2} - 2x^2u + \sin x = 0$ is
	<ul><li>(a) linear and homogeneous</li><li>(b) nonlinear and homogeneous</li><li>(c) nonlinear and nonhomogeneous</li><li>(d) linear and nonhomogeneous</li></ul>
Ans.	(d) Its solution is of the type $u = f(x)$ , i.e., dependent variable is $u$ . Hence, given equation is Linear & Non-Homogeneous.
Q.22	<ul> <li>A gas contains two types of suspended particle having average sizes of 2 μm and 50 μm. Amongst the options given below, the most suitable pollution control strategy for removal of these particles is</li> <li>(a) electrostatic precipitator followed by cyclonic separator</li> <li>(b) bag filter followed by electrostatic precipitator</li> <li>(c) settling chamber followed by bag filter</li> <li>(d) electrostatic precipitator followed by venturi scrubber</li> </ul>
Ans.	(c)
Q.23	The integral $\int_{0}^{1} (5x^{3} + 4x^{2} + 3x + 2) dx$ is estimated numerically using three alternative methods namely the rectangular, trapezoidal and Simpson's rules with a common step size. In this context, which one of the following statement is TRUE? (a) Simpson's rule as well as rectangular rule of estimation will give non zero error. (b) Only Simpson's rule of estimation will give zero error. (c) Simpson's rule, rectangular rule as well as trapezoidal rule of estimation will give non-zero error. (d) Only the rectangular rule of estimation will given zero error.
Ans.	(b) Because integral is a polynomial of 3rd degree so Simpson's rule will give error free answer.
Q.24	A fair (unbiased) coin is tossed 15 times. The probability of getting exactly 8 Heads (round off to three decimal places), is
Ans.	(0.196)
	$P(H) = \frac{1}{2}$
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$$P = \text{Not given}$$

$$p_0 = \text{Unknown}$$
Change of gradient,  

$$\alpha = \tan \alpha = \frac{8h}{L} = \frac{8 \times 120}{15000} = 0.064$$
% loss of stress in steel due to friction  

$$= \frac{p_0(Kx + \mu\alpha)}{p_0} \times 100$$

$$= (0.0015 \times 15 + 0.35 \times 0.064) \times 100$$

$$= 4.49\%$$
End of Solution  
The Fourier series to represent  $x - x^2$  for  $-\pi \le x \le \pi$  is given by  

$$x - x^2 = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$$
The value of  $a_0$  (round off to two decimal places), is \_\_\_\_\_.  
(-6.58)  

$$a_0 = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) dx = \frac{1}{\pi} \int_{-\pi}^{\pi} (x - x^2) dx = \frac{-1}{\pi} \int_{0}^{\pi} 2x^2 dx$$

$$= -\frac{1}{\pi} \left(\frac{2x^3}{3}\right)_{0}^{\pi} = -\frac{2}{3\pi} [\pi^3] = \frac{-2\pi^2}{3} = -6.58$$

Q.29 The diameter and height of a right circular cylinder are 3 cm and 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<sup>3</sup>, round off to three decimal places), is \_\_\_\_\_.

#### Ans. (5.18)

Q.28

Ans.

Let diameter, x = 3 and height = y = 4 and error =  $\pm 0.2$ 

$$V = \pi \left(\frac{x}{2}\right)^2 y = \frac{\pi x^2 y}{4}$$
$$V = f(x, y)$$

....

So,

 $dV = \left(\frac{\partial V}{\partial x}\right) dx + \left(\frac{\partial V}{\partial y}\right) dy$ 

V

i.e.,

$$dV = \left(\frac{1}{2}\pi xy\right)dx + \left(\frac{\pi x^2}{4}\right)dy$$
$$= \frac{1}{2}\pi \times 3 \times 4 \times (0.2) + \frac{\pi}{4} \times (3)^2 \times (0.2) = 0$$

$$= \frac{1}{2}\pi \times 3 \times 4 \times (0.2) + \frac{\pi}{4} \times (3)^2 \times (0.2) = 1.65\pi$$
  
= 1.65 × 3.14 = 5.18 (approx)

i.e., absolute error = | 5.18 | = 5.18

End of Solution

olution







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Q.43 Joints I, J, K, L, Q and M of the frame shown in the figure (not drawn to the scale) are pins. Continuous members IQ and IJ are connected through a pin at N. Continuous members JM and KQ are connected through a pin at P. The frame has hinge supports at joints R and S. The loads acting at joints I, J and K are along the negative Y direction and the loads acting at joints I, M are along the positive X direction.

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given that corresponding to 0.2% proof stress, the material safety factor is 1.15 and the yield strain of Fe550 steel is 0.0044.





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