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India's Best Institute for IES, GATE & PSUs

Revision Through Questions

for **GATE 2022**

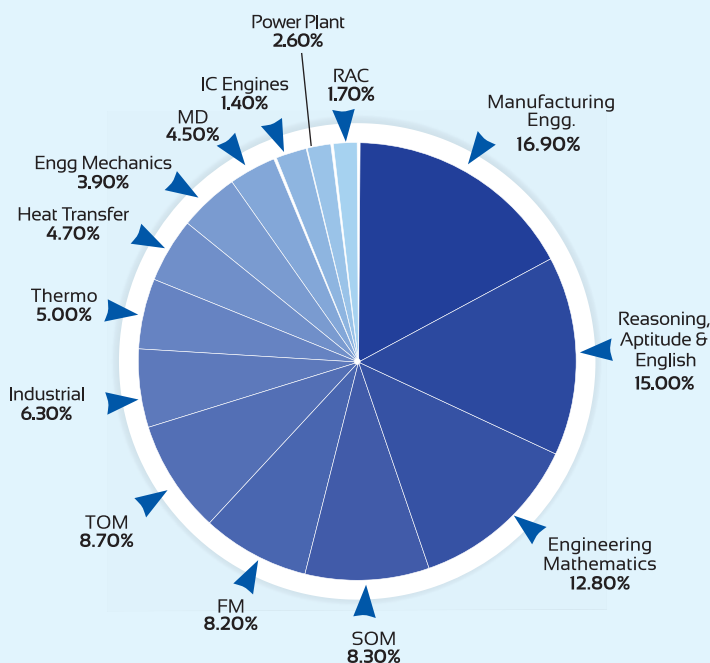
**MECHANICAL
ENGINEERING**

Day 1 of 8

Q.1 - Q.25 (Out of 200 Questions)

**General
Aptitude**

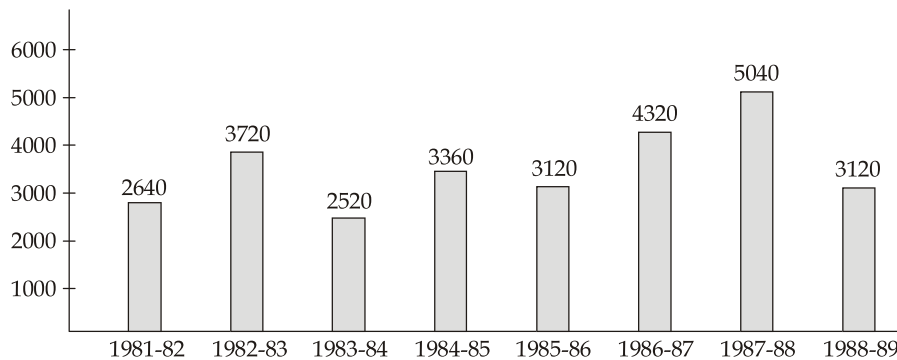
SUBJECT-WISE WEIGHTAGE ANALYSIS OF GATE SYLLABUS



Subject	Average % (last 5 yrs)
Manufacturing Engineering	16.90%
Reasoning, Aptitude & English	15.00%
Engineering Mathematics	12.80%
Strength of Materials	8.30%
Theory of Machines	8.70%
Fluid Mechanics & Hydraulic Machines	8.20%
Industrial Engineering	6.30%
Thermodynamics	5.00%
Heat Transfer	4.70%
Engineering Mechanics	3.90%
Machine Design	4.50%
Internal Combustion Engines	1.40%
Power Plant Engineering	2.60%
Refrigeration & Air Conditioning	1.70%
Total	100%

General Aptitude

- Q.1** The difference of the squares of two consecutive even integers is divisible by which of the following integers?
 (a) 7 (b) 6
 (c) 5 (d) 4
- Q.2** A tank is emptied by three taps with uniform flow. The first two taps operating together empty the tank in the same time during which the tank is emptied by the third tap alone. The second tap empties the tank 5 hours faster than the first tap and 4 hours slower than the third tap. The time required by the first tap is
 (a) 8 hours (b) 10 hours
 (c) 15 hours (d) 20 hours
- Q.3** In how many different ways can the letters of the word "WORKSPACE" be arranged so that the vowels always come together.
 (a) 28420 (b) 30240
 (c) 32420 (d) 34820
- Q.4** The angle of elevation of the moon, when the length of the shadow of a pole on a full moon night is $\sqrt{3}$ times the height of a pole is _____ degree.
- Q.5** The gold reserves of India (in million USD) from 1981-82 to 1988-1989 are shown below



- For which year, the percent increase of gold reserves over the previous year is the highest?
 (a) 1987-88 (b) 1985-86
 (c) 1984-85 (d) 1982-83
- Q.6** The following table gives the percentage distribution of population of five states Punjab, Haryana, Rajasthan, Bihar and Orissa on the basis of UN poverty line and also on the basis of sex.

State	% of population below UN poverty line	Proportion of Females and Males	
		Below poverty line	Above poverty line
Punjab	35	M : F 5 : 6	M : F 6 : 7
Haryana	25	3 : 5	4 : 5
Rajasthan	24	1 : 2	2 : 3
Bihar	19	3 : 2	4 : 3
Orissa	15	5 : 3	3 : 2

What will be male population above poverty line for Punjab if the female population below poverty line for Punjab is 2.1 million?

- (a) 3.0 million (b) 3.3 million
(c) 3.6 million (d) 2.7 million

Q.7 Find the volume of the largest right circular cone in cm^3 that can be fitted in a cube with edge 20 cm. [Round off the answer to the nearest integer]

Q.8 The value of bitcoin has fallen down from 15000 USD to 6000 USD in a matter of weeks. The bitcoin has

- (a) mushroomed (b) crashed
(c) squeezed (d) skidded

Q.9 Choose the most appropriate alternative from the options given below to complete the following sentence.

The two boosters, _____ were used in previous launches of Falcon rocket, will not be reused again

- (a) who (b) whence
(c) whom (d) which

Q.10 Find the missing sequence in the letter series A, CF, HKN, _____.

- (a) SUVY (b) PRVY
(c) PSVY (d) SVXZ

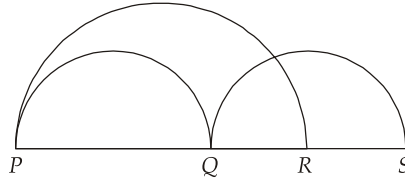
Q.11 A sentence is broken into 5 parts. Join these to make a meaningful sentence. The correct order of parts is the answer.

1. coffee 2. that
3. have 4. before
5. some
(a) 3 1 5 4 2 (b) 4 2 3 1 5
(c) 3 5 1 4 2 (d) 3 5 4 2 1

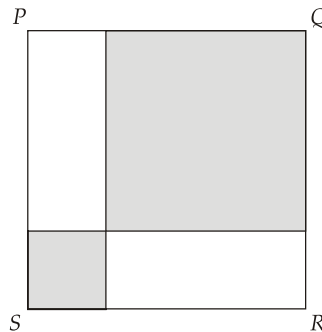
Q.12 How many numbers lie between 300 and 600 in which 4 comes only one time?

- (a) 108 (b) 99
(c) 88 (d) 117

- Q.13** If diameter $PQ =$ diameter QS and $QR = \frac{2}{5}$ of PR , what is the ratio of circumference of larger semicircle to that of the combined circumference of the two equal smaller semicircles?

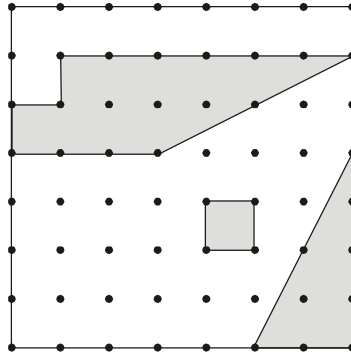


- (a) 6 : 5
(b) 5 : 3
(c) 9 : 25
(d) 5 : 6
- Q.14** If square PQRS has an area of 50 unit², and the area of the larger shaded square is 9 times the area of the smaller shaded square, what is the length of one side of the smaller shaded square?



- (a) $\frac{3}{2\sqrt{2}}$ unit
(b) $\frac{5}{2\sqrt{2}}$ unit
(c) $\frac{6}{2\sqrt{2}}$ unit
(d) $\frac{5}{3}$ unit
- Q.15** The passage below consists of six sentences. The first and sixth sentence are given in the beginning. The middle four sentences have been jumbled up. These are labelled as P, Q, R and S. Find out the proper order for the four sentences.
- S1 : He said on the phone that he would report for duty next day.
S6 : Eventually we reported to the police.
P : We found it locked.
Q : But he did not.
R : We waited for few more days then we decided to go to his place.
S : Even after that we waited for him quite a few days.
- (a) R P S Q
(b) Q R S P
(c) Q R P S
(d) S Q R P

Q.16 The big outside square has an area of 84 unit^2 , and the dots are all equally spaced, forming smaller squares. The sum of the areas of the shaded regions is _____ unit^2 .



Q.17 Consider the set of the numbers $\{1, 7, 7^2, \dots, 7^{100}\}$. The ratio of last number and the sum of remaining numbers is closest to

- (a) 2 (b) 6
(c) 9 (d) 12

Q.18 There is a circular aquarium. A fish is released in the water at the edge of the aquarium. The fish swims north for 5 m before it hits the edge of the aquarium. It then turns East and swims for 12 m before hitting the edge. The area of the aquarium is

- (a) $\frac{169}{4} \pi \text{ m}^2$ (b) 1690 m^2
(c) $169 \pi \text{ m}^2$ (d) Can't be determined

Q.19 Four pipes A, B, C and D can fill the cistern in 10, 15, 20 and 25 hours respectively. The pipe A is opened at 2 : 00 AM, pipe B at 4 : 00 AM, pipe C at 5 : 00 AM and pipe D at 6 : 00 AM. The time at which cistern will be full is

- (a) 6 : 37 AM (b) 7 : 37 AM
(c) 8 : 37 AM (d) 9 : 37 AM

Directions : Read each of the following sentences to find out whether there is an error in any part. No sentence has more than one error. If you feel there is no error in a sentence, signify a 'No error' response.

Q.20 The Municipality has made littering public places a punished offence. No error
(a) (b) (c) (d)

Q.21 Select the pair that best expresses the relation in the original pair.

Callow: Maturity

- (a) Eager : Anxiety (b) Incipient : Fruition
(c) Apathetic : Disinterest (d) Exposure : Weathering

Directions : Each of the following sentences is given with blank space(s) to be filled in with appropriate word(s). Four alternatives are suggested for each sentence. Choose the correct alternative.

Q.22 If we wish to _____ democracy, we must _____ fast to our constitutional norms.

- (a) engage, stick (b) rule, access
(c) absorb, work (d) maintain, hold

Q.23 People tend to estimate the likelihood of an event's occurrence according to its salience; that is, according to how strongly and how often it comes to their attention. By placement and headlines, newspapers emphasize stories about local crime over stories about crime elsewhere and about many other major events.

It can be concluded on the basis of the statements above that, if they are true, which of the following is most probably also true?

- (a) The language used in newspaper headlines about local crime is inflammatory and fails to respect the rights of suspects.
(b) The press is the news medium that focuses people attention most strongly on local crimes.
(c) Readers of local news in newspapers tend to overestimate the amount of crime in their own localities relative to the amount of crime in other places.
(d) None of the events concerning other people that are reported in newspapers is so salient in people's minds as their own personal experiences.

Q.24 The rate of a certain chemical reaction is directly proportional to the square of the concentration of chemical *A* present and inversely proportional to the concentration of chemical *B* present. If the concentration of chemical *B* is increased by 100 percent, which of the following is closest to the percent change in the concentration of chemical *A* required to keep the reaction rate unchanged?

- (a) 40% increase (b) 50% decrease
(c) 40% decrease (d) 100% decrease

Q.25 Mammals cannot digest cellulose and therefore cannot directly obtain glucose from wood. Mushrooms can, however; and some mushrooms use cellulose to make highly branched polymers, the branches of which are a form of glucose called beta-glucans. Beta-glucan extracts from various types of mushrooms slow, reverse, or prevent the growth of cancerous tumors in mammals, and the antitumor activity of beta-glucans increases as the degree of branching increases. These extracts prevent tumor growth not by killing cancer cells directly but by increasing immune-cell activity.

Which one of the following is most strongly supported by the information above?

- (a) Mammals obtain no beneficial health effects from eating cellulose.
(b) If extracts from a type of mushroom slow, reverse, or prevent the growth of cancerous tumors in mammals, then the mushroom is capable of using cellulose to make beta-glucans.
(c) The greater the degree of branching of beta-glucans, the greater the degree of immune-cell activity it triggers in mammals.
(d) Immune-cell activity in mammals does not prevent tumor growth by killing cancer cells.



Detailed Explanations

1. (d)

Let the two consecutive even integers be $2n$ and $(2n + 2)$.

$$\begin{aligned}(2n + 2)^2 - 2n^2 &= (2n + 2 + 2n)(2n + 2 - 2n) \\ &= 2(4n + 2) \\ &= 4(2n + 1)\end{aligned}$$

$4(2n + 1)$ is divisible by 4.

The answer is (d).

2. (c)

Suppose first tap alone takes x hours to empty the tank. Then, second and third taps will take $(x - 5)$ and $(x - 9)$ hours respectively to empty the tank.

$$\therefore \frac{1}{x} + \frac{1}{(x-5)} = \frac{1}{(x-9)}$$

$$\Rightarrow \frac{x-5+x}{x(x-5)} = \frac{1}{(x-9)}$$

$$\Rightarrow (2x-5)(x-9) = x(x-5)$$

$$\Rightarrow x^2 - 18x + 45 = 0$$

$$\Rightarrow (x-15)(x-3) = 0$$

$$\Rightarrow x = 15, 3$$

For $x = 3$, $(x - 5)$ and $(x - 9)$ will be negative. \therefore Answer is 15 hours.

3. (b)

The word WORKSPACE contains 9 different letters.

When the vowels (OAE) are always together. They can be supposed to form one letter.

Then, we have to arrange the letters WRKSPC (OAE).

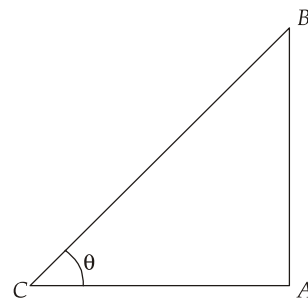
Now, 7 letters can be arranged in $7! = 5040$ ways.

The vowels (OAE) can be arranged among themselves in $3! = 6$ ways.

\therefore Required no. of ways = $(5040 \times 6) = 30240$

4. (30)

Let AB be the pole and AC be its shadow on the full moon night



Let $\angle ACB = \theta$

Then $\frac{AC}{AB} = \sqrt{3}$

$\Rightarrow \cot \theta = \sqrt{3}$

$\therefore \theta = 30^\circ$

5. (d)

There is an increase in gold reserves during the years 1982-1983, 1984-1985, 1986-1987, 1987-1988 as compared to previous year as shown by bar-graph.

The percentage increase in reserves during these years compared to previous year are:

$$\text{For 1982-1983} = \left[\frac{(3720 - 2640)}{2640} \times 100 \right] \% = 40.91\%$$

$$\text{For 1984-1985} = \left[\frac{(3360 - 2520)}{2520} \times 100 \right] \% = 33.33\%$$

$$\text{For 1986-1987} = \left[\frac{(4320 - 3120)}{3120} \times 100 \right] \% = 38.46\%$$

$$\text{For 1987-1988} = \left[\frac{(5040 - 4320)}{4320} \times 100 \right] \% = 16.67\%$$

Clearly, the percentage increase over previous year is highest for 1982-1983.

The answer is (d).

6. (b)

Female population below poverty line for Punjab = 2.1 million

Let the male population below poverty line for Punjab be x million

Then $5 : 6 = x : 2.1$

$$\Rightarrow x = \frac{2.1 \times 5}{6} = 1.75 \text{ million}$$

\therefore Population between poverty line for Punjab = (2.1 + 1.75) million = 3.85 million

Let the population above poverty line for Punjab be y million.

Since, 35% of population of Punjab is below poverty line, therefore, 65% of the total population of Punjab is above poverty line i.e. the ratio of population below poverty line to that above poverty line for Punjab is 35 : 65.

$$\therefore 35 : 65 = 3.85 : y$$

$$\Rightarrow y = \frac{65 \times 3.85}{35} = 7.15$$

\therefore Population above poverty line for Punjab = 7.15 million.

So, male population above poverty line for Punjab = $\left(\frac{6}{13} \times 7.15 \right)$ million = 3.3 million

The answer is (b).

7. 2094.39 (2090 to 2097)

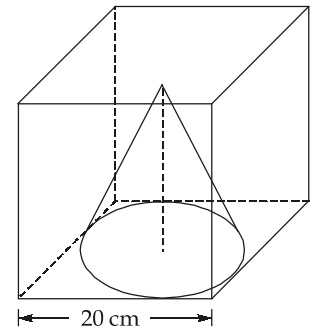
For the largest right circular cone to be fitted in a cube, the base of the cone will touch all the vertical faces of the cube.

∴ The diameter of base of cone = Side of cube = 20 cm

∴ Radius = 10 cm

Height = 20 cm

$$\begin{aligned} \text{Volume} &= \frac{\pi r^2 h}{3} = \frac{1}{3} \times \pi \times 10^2 \times 20 \\ &= 2094.39 \text{ cm}^3 \end{aligned}$$



8. (b)

There is a steep drop in value of bitcoin as mentioned.

Option (b) crashed is used when there is a sudden and sharp drop in value of shares or a business.

Option (a) mushroomed means to spread or grow rapidly.

Option (d) skidded also means to decline or deteriorate when talking about value of shares or a business. But "crashed" is more appropriate in this context.

The answer is (b).

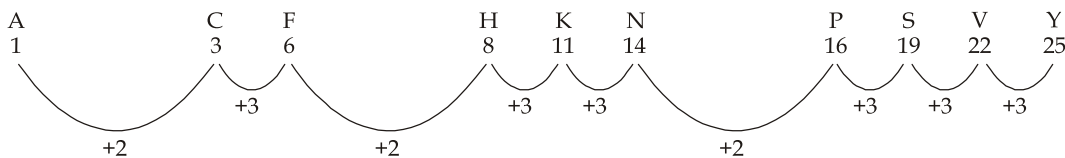
9. (d)

"Which" is used in relative clauses to refer to animals and to things.

Also, in this question the other three options can be easily eliminated.

The correct answer is (d).

10. (c)



So the required alphabets have to start with P and the common difference in terms is 3.

Hence, PSVY is the answer.

The answer is option (c).

11. (c)

"Have some coffee before that"

12. (d)

- 304, 314 394 (except 344) = 9 numbers
- 340, 341 349 (except 344) = 9 numbers
- 400, 401 409 (except 404) = 9 numbers
- 410, 411 419 (except 414) = 9 numbers
- 420, 421 429 (except 424) = 9 numbers
- 430, 431 439 (except 434) = 9 members
- 440, 441 449 (all excepted) = 0 numbers
- 450, 451 459 (except 454) = 9 numbers
- 460, 461 469 (except 464) = 9 numbers

470, 471 479 (except 474) = 9 numbers
 480, 481 489 (except 484) = 9 numbers
 490, 491 499 (except 494) = 9 numbers
 504, 514 594 (except 544) = 9 numbers
 540, 541 549 (except 544) = 9 numbers
 Total = 117 numbers

13. (d)

QR : PR = 2 : 5 i.e. PQ : PR = 3 : 5

or we can simply say PQ = 3 and PR = 5

then QS = PQ = 3

The diameter of the larger semicircle PR = 5

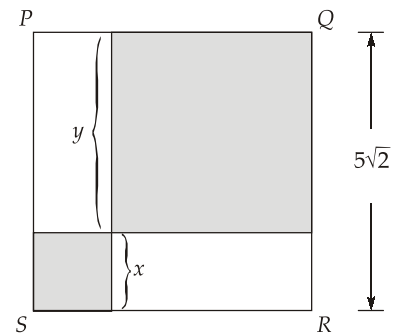
The sum of the diameters of two smaller semicircles PQ + QS = 3 + 3 = 6

Ratio of diameters = 5 : 6

This will be the same as the ratio of circumferences i.e 5 : 6.

14. (b)

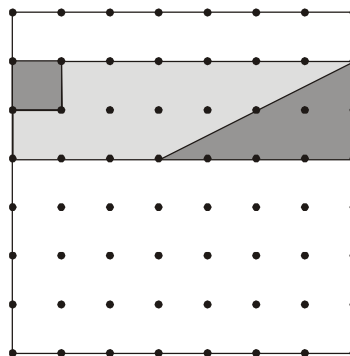
$$\begin{aligned} x + y &= 5\sqrt{2} \\ 9x^2 &= y^2 \\ \Rightarrow 3x &= y \\ x + 3x &= 5\sqrt{2} \\ 4x &= 5\sqrt{2} \\ x &= \frac{5\sqrt{2}}{4} = \frac{5}{2\sqrt{2}} \text{ unit} \end{aligned}$$



15. (c)

16. (24)

We can spend time figuring out the areas of the three individual irregular shapes. Instead, let us rearrange the three to form this :



Here we see that the shaded area is $\frac{2}{7}$ of the whole square.

$$\text{Shaded area} = \frac{84 \times 2}{7} = 24$$

17. (b)

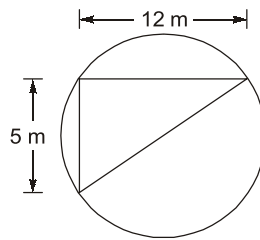
$$\text{Last number} = 7^{100}$$

$$\text{sum, } s = 1 + 7 + 7^2 + \dots + 7^{99}$$

$$= \frac{1(7^{100} - 1)}{7 - 1} = \frac{7^{100} - 1}{6} \approx \frac{7^{100}}{6}$$

$$\text{Ratio} = \frac{7^{100}}{7^{100}/6} = 6$$

18. (a)



$$\text{Diameter} = \sqrt{(5)^2 + (12)^2} = 13 \text{ m}$$

$$\text{Radius} = 6.5 \text{ m}$$

$$\text{Area of pool} = \pi r^2 = \pi \times \left(\frac{13}{2}\right)^2 = \frac{169}{4} \pi \text{ m}^2.$$

19. (b)

Let t hours past 2 AM, the cistern is full.

$$\frac{t}{10} + \frac{t-2}{15} + \frac{t-3}{20} + \frac{t-4}{25} = 1$$

$$t \left[\frac{1}{10} + \frac{1}{15} + \frac{1}{20} + \frac{1}{25} \right] = 1 + \frac{2}{15} + \frac{3}{20} + \frac{4}{25}$$

$$t = \frac{433}{77} = 5 \text{ hours } 37.4 \text{ minutes}$$

The cistern will be full at 7 : 37 AM

20. (c)

Change 'punished' into 'punishable'.

21. (b)

'Callow' is opposite of 'Maturity'. Similarly 'Incipient' is opposite of 'Fruition'.

22. (d)

23. (c)

We know that newspapers' coverage of local crimes is stronger than that of non-local crimes. Nothing is said about frequency of coverage so, we can not assume anything about it. However, all else being equal, we can assume that people tend to think the local crimes outnumber non-local crimes.

24. (a)

Put directly proportional in numerator and inversely proportional in denominator.

$$\text{Rate} = k \frac{A^2}{B}, (k \text{ is a constant})$$

We are told that B increased by 100%, hence in denominator we have $2B$. We want the rate to be the same. As rate is directly proportional to the Square of A , A should also increase (nominator) by x percent and increase of A is square should be 2.

Which means $x^2 = 2 \Rightarrow x \approx 1.41$, which is approximately 40% increase.

$$R = k \frac{A^2}{B} = k \frac{(1.4A)^2}{2B} = k \frac{2A^2}{2B}$$

25. (c)

- Some mushrooms use cellulose to make highly branched polymers, the branches of which are a form of glucose called beta-glucans.
- Beta-glucan extracts from various types of mushrooms slow, reverse, or prevent the growth of cancerous tumors in mammals
- The antitumor activity of beta-glucans increases as the degree of branching increases.
- These extracts prevent tumor growth NOT by killing cancer cells directly BUT BY increasing immune-cell activity.

The premises tell us that the antitumor activity increases as degree of branching increases. They also tell us that antitumour activity is "increasing immune-cell activity". So we can deduce that degree of immune cell activity increases as degree of branching increases.

This is option (c) and is correct.

