

2023

COMPUTER SCIENCE (CS)

Q. 1. A series of natural numbers $F_1, F_2, F_3, F_4, F_5, F_6, F_7, \dots$ obeys $F_{n+1} = F_n + F_{n-1}$ for all integers $n \geq 2$.

If $F_6 = 37$, and $F_7 = 60$, then what is F_1 ?

- (a) 4 (b) 5
(c) 8 (d) 9

Q. 2. Looking at the surface of a smooth 3-dimensional object from the outside, which one of the following options is TRUE?

- (a) The surface of the object must be concave everywhere.
(b) The surface of the object must be convex everywhere.
(c) The surface of the object may be concave in some places and convex in other places.
(d) The object can have edges, but no corners.

Q. 3. Consider two functions of time (t),

$$f(t) = 0.01 t^2$$

$$g(t) = 4t$$

where $0 < t < \infty$.

Now consider the following two statements:

- (i) For some $t > 0$, $g(t) > f(t)$
(ii) There exists a T , such that $f(t) > g(t)$ for all $t > T$.

Which one of the following option is TRUE?

- (a) only (i) is correct
(b) only (ii) is correct
(c) both (i) and (ii) are correct
(d) neither (i) nor (ii) is correct

Q. 4. $f(x)$ and $g(y)$ are functions of x and y , respectively, and $f(x) = g(y)$ for all real values of x and y . Which one of the following option is necessarily TRUE for all x and y ?

- (a) $f(x) = 0$ and $g(y) = 0$

(b) $f(x) = g(y) = \text{constant}$

(c) $f(x) \neq \text{constant}$ and $g(y) \neq \text{constant}$

(d) $f(x) + g(y) = f(x) - g(y)$

Q. 5. Which one of the options best describes the transformation of the 2-dimensional figure P to Q , and then to R , as shown?



(a) **Operation 1:** A clockwise rotation by 90° about an axis perpendicular to the plane of the figure
Operation 2: A reflection along a horizontal line

(b) **Operation 1:** A counter clockwise rotation by 90° about an axis perpendicular to the plane of the figure
Operation 2: A reflection along a horizontal line

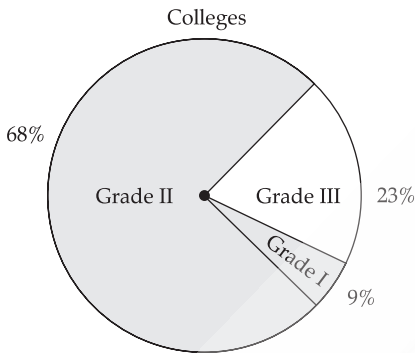
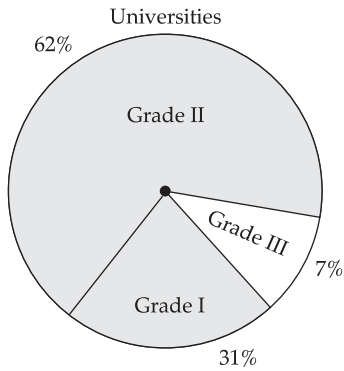
(c) **Operation 1:** A clockwise rotation by 90° about an axis perpendicular to the plane of the figure
Operation 2: A reflection along a vertical line

(d) **Operation 1:** A counter clockwise rotation by 180° about an axis perpendicular to the plane of the figure
Operation 2: A reflection along a vertical line

MECHANICAL ENGINEERING (ME)

Q. 6. A certain country has 504 universities and 25951 colleges. These are categorised into Grades I, II, and III as shown in the given pie charts.

What is the percentage, correct to one decimal place, of higher education institutions (colleges and universities) that fall into Grade III?



- (a) 22.7% (b) 23.7%
 (c) 15.0% (d) 66.8%

- Q. 7. The minute hand and second-hand of a clock cross each other _____ times between 09:15:00 AM and 09:45:00 AM on a day.
 (a) 30 (b) 15
 (c) 29 (d) 31

- Q. 8. The symbols ○, *, △, and □ are to be filled, one in each box, as shown below.

The rules for filling in the four symbols are as follows:

1. Every row and every column must contain each of the four symbols.
2. Every 2 × 2 square delineated by bold lines must contain each of the four symbols. Which symbol will occupy the box marked with '?' in the partially filled figure?

	?		△
	○	*	
		□	*
*		△	○

- (a) ○ (b) *
 (c) △ (d) □

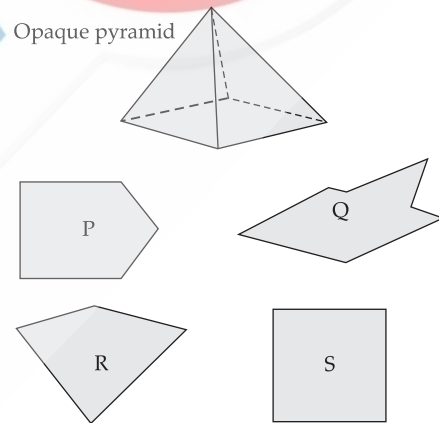
- Q. 9. Consider the following inequalities
 $p^2 - 4q < 4$
 $3p + 2q < 6$
 where p and q are positive integers.
 The value of $(p + q)$ is

- (a) 2 (b) 1
 (c) 3 (d) 4

- Q. 10. How many pairs of sets (S,T) are possible among the subsets of {1, 2, 3, 4, 5, 6} that satisfy the condition that S is a subset of T?

- (a) 729 (b) 728
 (c) 665 (d) 664

- Q. 11. An opaque pyramid (shown below), with a square base and isosceles faces, is suspended in the path of a parallel beam of light, such that its shadow is cast on a screen oriented perpendicular to the direction of the light beam. The pyramid can be reoriented in any direction within the light beam. Under these conditions, which one of the shadows P, Q, R and S is NOT possible?



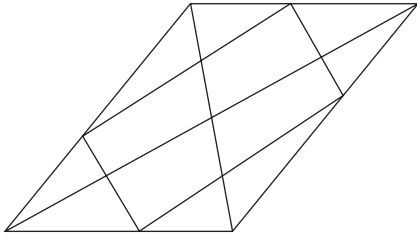
- (a) P (b) Q
 (c) R (d) S

ELECTRICAL ENGINEERING (EE)

- Q. 12. Given a fair six-faced dice where the faces are labelled '1', '2', '3', '4', '5' and '6', what is the probability of getting a '1' on the first roll of the dice and a '4' on the second roll?

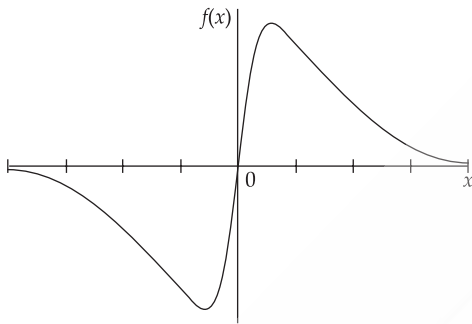
- (a) $\frac{1}{36}$ (b) $\frac{1}{6}$
 (c) $\frac{5}{6}$ (d) $\frac{1}{3}$

- Q. 13. How many triangles are present in the given figure?



- (a) 12 (b) 16
(c) 20 (d) 24

Q. 14. Which one of the following options represents the given graph?



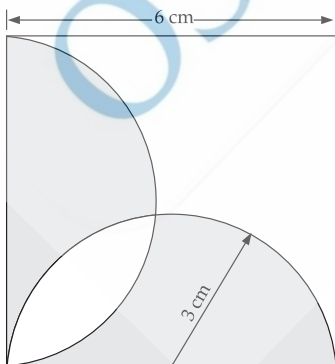
- (a) $f(x) = x^2 2^{-|x|}$ (b) $f(x) = x 2^{-|x|}$
(c) $f(x) = |x| 2^{-x}$ (d) $f(x) = x 2^{-x}$

Q. 15. The digit in the unit's place of the product $3^{999} \times 7^{1000}$ is _____.

- (a) 7 (b) 1
(c) 3 (d) 9

Q. 16. A square with sides of length 6 cm is given. The boundary of the shaded region is defined by two semi-circles whose diameters are the sides of the square, as shown.

The area of the shaded region is _____ cm^2 .



- (a) 6π (b) 18
(c) 20 (d) 9π

ELECTRONICS COMMUNICATION (EC)

Q. 17. What is the smallest number with distinct digits whose digits add up to 45?

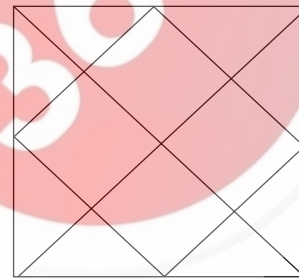
- (a) 123555789 (b) 123457869
(c) 123456789 (d) 99999

Q. 18. In a class of 100 students,
(i) there are 30 students who neither like romantic movies nor comedy movies,
(ii) the number of students who like romantic movies is twice the number of students who like comedy movies, and
(iii) the number of students who like both romantic movies and comedy movies is 20.

How many students in the class like romantic movies?

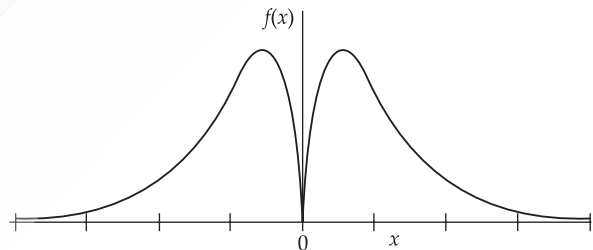
- (a) 40 (b) 20
(c) 00 (d) 30

Q. 19. How many rectangles are present in the given figure?



- (a) 8 (b) 9
(c) 10 (d) 12

Q. 20. Which one of the following options represents the given graph?



- (a) $f(x) = x^2 2^{-|x|}$
(b) $f(x) = x 2^{-|x|}$
(c) $f(x) = |x| 2^{-x}$
(d) $f(x) = x 2^{-x}$

Q. 21. Out of 1000 individuals in a town, 100 unidentified individuals are covid positive. Due to lack of adequate covid-testing kits, the health authorities of the town devised a strategy to identify these covid-positive individuals. The strategy is to:

- (i) Collect saliva samples from all 1000 individuals and randomly group them into sets of 5.
(ii) Mix the samples within each set and test the mixed sample for covid.

INSTRUMENTATION ENGINEERING (IN)

(iii) If the test done in (ii) gives a negative result, then declare all the 5 individuals to be covid negative.

(iv) If the test done in (ii) gives a positive result, then all the 5 individuals are separately tested for covid.

Given this strategy, no more than testing kits will be required to identify all the 100 covid positive individuals irrespective of how they are grouped?

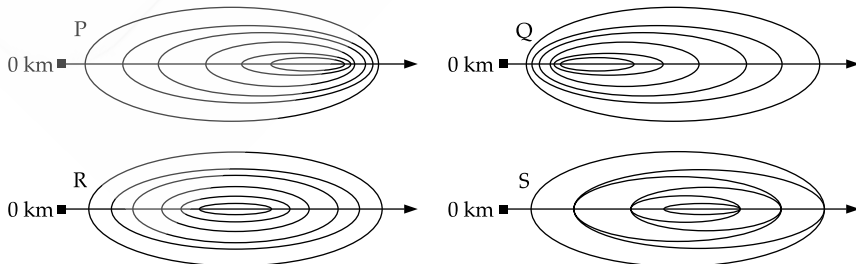
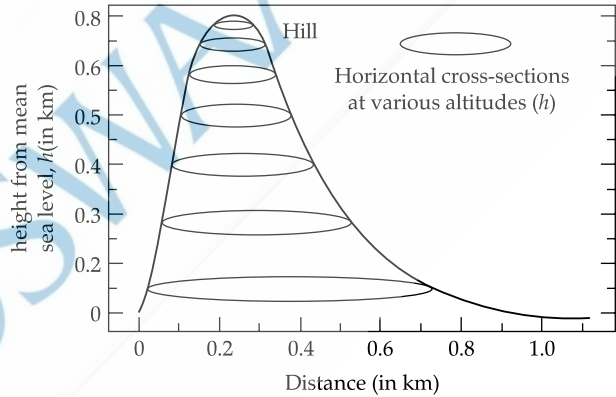
- (a) 700
- (b) 600
- (c) 800
- (d) 1000

Q. 22. 100 cm x 32 cm rectangular sheet is folded 5 times. Each time the sheet is folded, the long edge aligns with its opposite side. Eventually, the folded sheet is a rectangle of dimensions 100 cm x 1 cm.

The total number of creases visible when the sheet is unfolded is _____.

- (a) 32
- (b) 5
- (c) 31
- (d) 63

Q. 25. In the given diagram, ovals are marked at different heights (h) of a hill. Which one of the following options P, Q, R, and S depicts the top view of the hill?



- (a) P
- (b) Q
- (c) R
- (d) S

Q. 23. A 'frabjous' number is defined as a 3 digit number with all digits odd, and no two adjacent digits being the same. For example, 137 is a frabjous number, while 133 is not. How many such frabjous numbers exist?

- (a) 125
- (b) 720
- (c) 60
- (d) 80

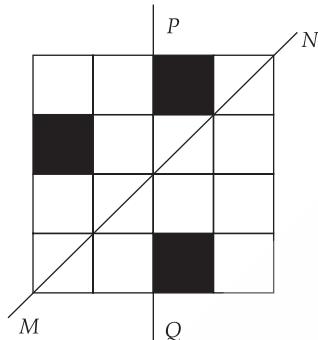
Q. 24. Which one among the following statements must be TRUE about the mean and the median of the scores of all candidates appearing for GATE 2023?

- (a) The median is at least as large as the mean.
- (b) The mean is at least as large as the median.
- (c) At most half the candidates have a score that is larger than the median.
- (d) At most half the candidates have a score that is larger than the mean.

CIVIL ENGINEERING (CE) P1

Q. 30. A line of symmetry is defined as a line that divides a figure into two parts in a way such that each part is a mirror image of the other part about that line.

The given figure consists of 16 unit squares arranged as shown. In addition to the three black squares, what is the minimum number of squares that must be coloured black, such that both PQ and MN form lines of symmetry? (The figure is representative.)



- (a) 3
- (b) 4
- (c) 5
- (d) 6

Q. 31. To construct a wall, sand and cement are mixed in the ratio of 3:1. The cost of sand and that of cement are in the ratio of 1:2.

If the total cost of sand and cement to construct the wall is 1000 rupees, then what is the cost (in rupees) of cement used?

- (a) 400
- (b) 600
- (c) 800
- (d) 200

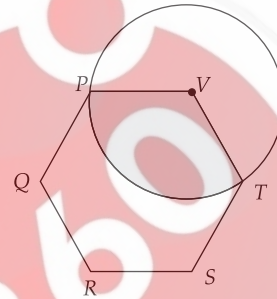
Q. 32. The coefficient of x^4 in the polynomial $(x - 1)^3 (x - 2)^3$ is equal to _____

- (a) 33
- (b) -3
- (c) 30
- (d) 21

Q. 33. Which one of the following shapes can be used to tile (completely cover by repeating) a flat plane, extending to infinity in all directions, without leaving any empty spaces in between them? The copies of the shape used to tile are identical and are not allowed to overlap.

- (a) circle
- (b) regular octagon
- (c) regular pentagon
- (d) rhombus

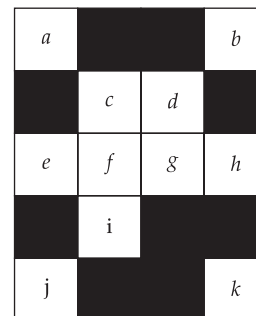
Q. 34. In the given figure, PQRSTV is a regular hexagon with each side of length 5 cm. A circle is drawn with its centre at V such that it passes through P. What is the area (in cm^2) of the shaded region? (The diagram is representative)



- (a) $\frac{20\pi}{3}$
- (b) $\frac{25\pi}{2}$
- (c) 6π
- (d) 7π

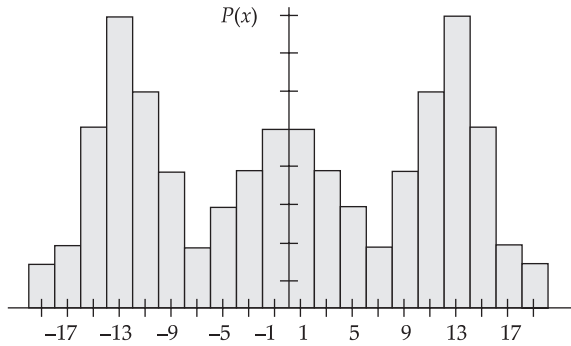
Q. 35. A line of symmetry is defined as a line that divides a figure into two parts in a way such that each part is a mirror image of the other part about that line.

The figure below consists of 20 unit squares arranged as shown. In addition to the given black squares, upto 5 more may be coloured black. Which one among the following options depicts the minimum number of boxes that must be coloured black to achieve two lines of symmetry? (The figure is representative.)



- (a) d
- (b) c, d, i
- (c) c, i
- (d) c, d, i, f, g

Q. 36. Which one of the options can be inferred about the mean, median, and mode for the given probability distribution (i.e. probability mass function), $P(x)$, of a variable x ?



- (a) mean = median \neq mode
- (b) mean = median = mode
- (c) mean \neq median = mode
- (d) mean \neq mode = median

Q. 37. Let $a = 30!$, $b = 50!$, and $c = 100!$. Consider the following numbers:

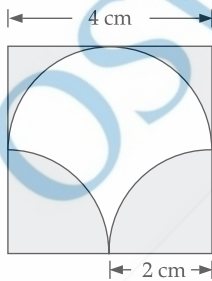
$$\log_a c, \log_c a, \log_b a, \log_a b$$

Which one of the following inequalities is CORRECT?

- (a) $\log_c a < \log_b a < \log_a c < \log_a b$
- (b) $\log_c a < \log_a b < \log_b a < \log_b c$
- (c) $\log_c a < \log_b a < \log_a c < \log_a b$
- (d) $\log_b a < \log_c a < \log_a b < \log_a c$

Q. 38. A square of side length 4 cm is given. The boundary of the shaded region is defined by one semi-circle on the top and two circular arcs at the bottom, each of radius 2 cm, as shown.

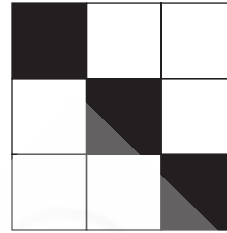
The area of the shaded region is _____ cm^2 .



- (a) 8
- (b) 4
- (c) 12
- (d) 10

CIVIL ENGINEERING (CE) P2

Q. 39. In how many ways can cells in a 3×3 grid be shaded, such that each row and each column have exactly one shaded cell? An example of one valid shading is shown.



- (a) 2
- (b) 9
- (d) 3
- (d) 6

Q. 40. There are 4 red, 5 green, and 6 blue balls inside a box. If N number of balls are picked simultaneously, what is the smallest value of N that guarantees there will be at least two balls of the same colour?

One cannot see the colour of the balls until they are picked.

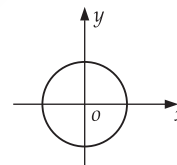
- (a) 4
- (b) 15
- (c) 5
- (d) 2

Q. 41. Consider a circle with its centre at the origin (O) , as shown. Two operations are allowed on the circle.

Operation 1: Scale independently along the x and y axes.

Operation 2: Rotation in any direction about the origin.

Which figure among the options can be achieved through a combination of these two operations on the given circle?



- (a)
- (b)
- (c)
- (d)

Q. 42. Three husband-wife pairs are to be seated at a circular table that has six identical chairs.

Seating arrangements are defined only by the relative position of the people. How many seating arrangements are possible such that every husband sits next to his wife?

- (a) 16 (b) 4
 (c) 120 (d) 720

Q. 43. If x satisfies the equation $4^{8^x} = 256$, then x is equal to _____.

- (a) $\frac{1}{2}$ (b) $\log_{16} 8$
 (c) $\frac{2}{3}$ (d) $\log_4 8$

Q. 44. Consider a spherical globe rotating about an axis passing through its poles. There are three points P , Q and R situated respectively on the equator, the north pole, and midway between the equator and the north pole in the northern hemisphere. Let P , Q and R move with speeds v_P , v_Q , and v_R , respectively. Which one of the following options is CORRECT?

- (a) $v_P < v_R < v_Q$ (b) $v_P < v_Q < v_R$
 (c) $v_P > v_R > v_Q$ (d) $v_P = v_R \neq v_Q$

OSWAAL

360

Answer Key			
Q. No.	Answer	Topic's Name	Chapter's Name
1	(a)	Series	Number System
2	(c)	Analytical Reasoning	Analytical Reasoning
3	(c)	Function	Algebra
4	(b)	Function	Algebra
5	(a)	Direction	Analytical Reasoning
6	(a)	Pie-Chart	Data Interpretation
7	(a)	Clock	Analytical Reasoning
8	(b)	Logic based	Analytical Reasoning
9	(a)	Equations	Algebra
10	(c)	Set theory	Modern Maths
11	(b)	Direction	Analytical Reasoning
12	(a)	Probability	Modern Maths
13	(c)	Triangles	Geometry
14	(b)	Function	Algebra
15	(a)	Unit Place Digit	Number System
16	(b)	Circle	Geometry
17	(c)	Digit	Number System
18	(c)	Set theory	Modern Maths
19	(c)	Triangles	Geometry
20	(a)	Function	Algebra
21	(a)	Puzzle	Analytical Reasoning
22	(c)	Area of the rectangles	Mensuration
23	(d)	Digit	Number System
24	(c)	Statics	Modern Maths
25	(b)	Ovals	Geometry
26	(a)	Function	Algebra
27	(a)	Function	Algebra
28	(d)	Cylinder	Mensuration
29	(b)	Quadrilateral	Geometry
30	(c)	Squares	Geometry
31	(a)	Ratios	Arithmetic
32	(a)	Equations	Algebra
33	(d)	Area	Mensuration
34	(a)	Circle	Geometry
35	(b)	Mirror Image	Analytical Reasoning
36	(a)	Statistics	Modern Maths
37	(a)	Logarithm	Algebra
38	(a)	Square	Mensuration
39	(d)	Logic based	Analytical Reasoning
40	(a)	Permutation and Combination	Modern Maths
41	(a)	Circles	Geometry
42	(a)	Seating Arrangement	Analytical
43	(c)	Equation	Algebra
44	(c)	Time, speed & Distance	Arithmetic

ANSWERS WITH EXPLANATIONS

COMPUTER SCIENCE (CS)

1. Option (a) is correct.

Given, $F_6 = 37$ and $F_7 = 60$

And $F_{n+1} = F_n + F_{n-1}$ [where $n \geq 2$]

So, $F_{n-1} = F_{n+1} - F_n$

For $n = 6$, $F_5 = F_7 - F_6$

$$F_5 = 60 - 37 = 23$$

For $n = 5$, $F_4 = F_6 - F_5$

$$F_4 = 37 - 23 = 14$$

For $n = 4$, $F_3 = F_5 - F_4$

$$F_3 = 23 - 14 = 9$$

For $n = 3$, $F_2 = F_4 - F_3$

$$F_2 = 14 - 9 = 5$$

For $n = 2$, $F_1 = F_3 - F_2$

$$F_1 = 9 - 5 = 4$$

2. Option (c) is correct.

The surface of a smooth 3-dimensional object may be concave in some place and convex in other places.

3. Option (c) is correct.

Given:

$$f(t) = 0.01 t^2$$

and $g(t) = 4t$

Statement 1: for some $t > 0$, $g(t) > f(t)$ should be true.

i.e., for $t = 1$

$$f(t) = 0.01t^2 = 0.01$$

and $g(t) = 4$

so, $g(t) > f(t)$

Statement 2: There exists $T = 400$ such that

$$f(t) > g(t) \text{ for each } t > 400$$

So, it is also true.

4. Option (b) is correct.

Given:

$f(x) = g(y)$, [for all real values of x and y]

So, it is necessary that image of x using f is same as image of y using g for all real values of x and y .

i.e.,

$$f(x) = g(y) = \text{constant.}$$

5. Option (a) is correct.

For obtaining figure Q, Figure P is rotated by 90° about an axis perpendicular to the plane of figure.

Figure R is obtained by a reflection of Figure Q along a horizontal line.

MECHANICAL ENGINEERING (ME)

6. Option (a) is correct.

Given:

Number of colleges = 25951

Number of universities = 504

According to the question,

Number of colleges in Grade 3

$$= \frac{23}{100} \times 25951 \approx 5968.73$$

Number of universities in Grade 3

$$= \frac{7}{100} \times 504 \approx 35.28$$

So, required percentage

$$= \frac{5968.73 + 35.28}{25951 + 504} \times 100 \approx 22.7\%$$

7. Option (a) is correct.

We know that minute hand and second hand cross each other once in every minute. So, during 30 minutes (from 9:15 am to 9:45 am), they will cross each other 30 times.

8. Option (b) is correct.

The correct figure from given hints will be as shown below.

□	*	○	△
△	○	*	□
○	△	□	*
*	□	△	○

9. Option (a) is correct.

Given:

$$p^2 - 4q < 4 \quad (1)$$

$$3p + 2q < 6 \quad (2)$$

Since p and q both are integers, only possible value which satisfy both the inequalities is $p = q = 1$.

e.g., from (1), $1^2 - 4 \times 1 = 1 - 4 = -3$, which is less than 4.

and from (2), $3 \times 1 + 2 \times 1 = 5$, which is less than 6.

$$\text{So, } p + q = 1 + 1 = 2$$

Hence, option (a) is correct.

10. Option (c) is correct.

If T consists 5 elements from the given set, then number of possible subsets

$$= {}^6C_5 (2^5 - 1) = 6 \times 31 = 186$$

Now, for 4 elements, possible subsets

$$= {}^6C_4 (2^4 - 1) = 15 \times 15 = 225$$

For 3 elements, possible subsets

$$= {}^6C_3 (2^3 - 1) = 20 \times 7 = 140$$

For 2 elements, possible subsets

$$= {}^6C_2 (2^2 - 1) = 15 \times 3 = 45$$

For 1 element, possible subsets

$$= {}^6C_1 (2^1 - 1) = 6 \times 1 = 6$$

So, total number of subsets

$$= 186 + 225 + 140 + 45 + 6 = 665$$

11. Option (b) is correct.

Except shadow given in figure Q, rest shadows in P, R and S are possible shadows of opaque pyramid.

ELECTRICAL ENGINEERING (EE)**12. Option (a) is correct.**

$$\text{Probability of getting 1 on first roll} = \frac{1}{6}$$

$$\text{Probability of getting 4 on first roll} = \frac{1}{6}$$

$$\text{Required probability} = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

13. Option (c) is correct.

Total number of triangles in given figure = 20

14. Option (b) is correct.

Given graph is odd symmetry function.

So, from given options $f(x) = x2^{-|x|}$

15. Option (a) is correct.

Unit place digits in multiplication of 3 and 7 will repeat after every 4^{th} power.

$$\text{So, } 3^{999} = 3^{4(249)} \times 3^3$$

$$\text{And } 7^{1000} = 7^{4(250)}$$

$$\text{So, unit digit of } 3^{999} \times 7^{1000} = \text{unit digit of } 3^3 \times 7^0 = 7$$

16. Option (b) is correct.

From given figure,

$$\text{Radius of both semi-circles} = \frac{6}{2} = 3 \text{ cm}$$

$$\text{We have area of semi-circle} = \frac{1}{2} \pi r^2$$

$$\text{Require area} = 2 \left[\left(9 - \frac{9\pi}{4} \right) + \frac{9\pi}{4} \right] = 18 \text{ cm}^2$$

ELECTRONICS COMMUNICATION (EC)**17. Option (c) is correct.**

Sum of digits of 123456789

$$= 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 = 45$$

So, from given options, only option (c) has distinct digits with a sum of 45.

18. Option (c) is correct.

Given:

Total number of students in class = 100

Number of students who neither like romantic movie nor comedy movie = 30

So, number of students who either like romantic movie or comedy movie = $100 - 30 = 70$

Number of students who like both romantic and comedy movies = 20

Let students who like romantic movies $n(R) = R$

And students who like comedy movie $n(C) = C$

A.T.Q., $R = 2C$

We have, $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

So, $n(R \cup C) = n(R) + n(C) - n(R \cap C)$

$$\Rightarrow 70 = 2C + C - 20$$

$$\Rightarrow C = 30$$

$$\text{So, } R = 2 \times 30 = 60$$

Hence, students who like romantic movies $n(R) = 60$

19. Option (c) is correct.

There are total 10 rectangles in the given figure, as the squares are also rectangle.

20. Option (a) is correct.

As the given functions is an even function and $f(x) = x2^{-x}$ is only represent the even function from given options.

21. Option (a) is correct.

$$\text{Total number of groups} = \frac{1000}{5} = 200$$

Given that, total number of covid positives = 100

So, 200 kits are required to perform this test.

Now, according to the question, for maximum condition, these 100 people are in different 100 groups and still 500 kits still required to check the remaining people.

So, the number of testing kits be required = 200 + 500 = 700

22. Option (c) is correct.

Total number of creases will be visible when the sheet is unfolded = $2^0 + 2^1 + 2^2 + 2^3 + 2^4 = 31$

INSTRUMENTATION ENGINEERING (IN)

23. Option (d) is correct.

From 101 to 989, there are only 80 numbers, which are following the given condition.

24. Option (c) is correct.

From given statement, 'At most half the candidates have a score that is larger than the median.' is true.

25. Option (b) is correct.

From given figures, figure Q depicts the top view of the hill.

26. Option (a) is correct.

Given: Number of stairs Ankita has to climb = 5

According to the question,

$$F(5) = 8$$

27. Option (a) is correct.

Given function: $f(x) = ||x + 2| - |x - 1||$

From the given graphs, graph P represents the above function.

28. Option (d) is correct.

From the given answer figures, only shadow S is not possible shadow for an opaque cylinder.

CHEMICAL ENGINEERING (CH)

29. Option (b) is correct.

Given:

$$PS = 7 \text{ cm}$$

$$PT = 4 \text{ cm}$$

$$PV = 5 \text{ cm}$$

Let RS = x cm

We have area of parallelogram = Base × height

So, according to the question,

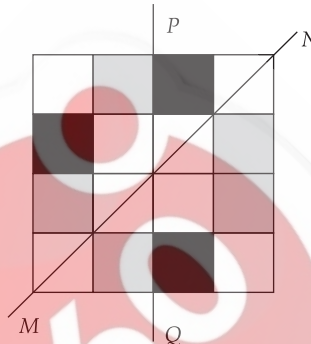
$$\Rightarrow PS \times PT = PV \times x$$

$$\Rightarrow 4 \times 7 = 5 \times x$$

$$\Rightarrow x = \frac{28}{5}$$

$$\text{So, length of RS} = \frac{28}{5} \text{ cm}$$

30. Option (c) is correct.



31. Option (a) is correct.

Given:

The ratio of sand and cement = 3 : 1

Let the quantity of sand = 3x

And the quantity of cement = x

Also given that the ratio of the cost of sand and cement = 1 : 2

Let the cost of sand = Rs. 0

And the cost of cement = Rs. 2y

So, total cost of sand = 3xy

And total cost of cement = 2xy

$$\text{So, total cost of cement} = \frac{2xy}{5xy} \times 1000 = \text{Rs. } 400$$

32. Option (a) is correct.

$$\text{Value of given expression } (x - 1)^3(x - 2)^2 = (x^3 - 1 - 3x^2 + 3x) \times (x^3 - 8 - 6x^2 + 12x)$$

$$\text{So, coefficient of } x^4 \text{ in } 12x^4 + 3x^4 + 18x^4 \text{ is}$$

$$\Rightarrow 12 + 3 + 18 = 33$$

33. Option (d) is correct.

Rhombus can be use to tile, extending to infinite in all the directions, without leaving any empty spaces in between them.

CIVIL ENGINEERING (CE) P1

34. Option (a) is correct.

Given that the length of each side of hexagon = 5 cm

As shown in the figure, the radius of circle will also be 5 cm.

We have, each angle of regular hexagon = 1200

$$\text{So, the required area} = \frac{120}{360} \times \pi \times 5 \times 5 = \frac{25\pi}{3}$$

CIVIL ENGINEERING (CE) P2

35. Option (b) is correct.

For two lines of symmetry, we required to colour at least 3 boxes named c, d and i.

36. Option (a) is correct.

From the given graph, it is clear that mean and median are equal for given probability distribution.

Mode will not be equal to the both mean and median.

37. Option (a) is correct.

Given: $a = 30!$ $b = 50!$ $c = 100!$

We have,

$$\log_y x = \frac{\log x}{\log y}$$

$$\text{So, } \log_a c = \frac{\log c}{\log a} = \frac{\log 100!}{\log 30!}$$

$$\log_c a = \frac{\log a}{\log c} = \frac{\log 30!}{\log 100!}$$

$$\log_b a = \frac{\log a}{\log b} = \frac{\log 30!}{\log 50!}$$

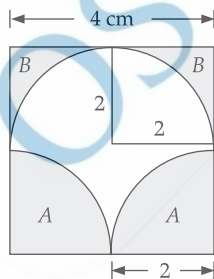
$$\log_a b = \frac{\log b}{\log a} = \frac{\log 50!}{\log 30!}$$

Ascending order of given numbers

$$= \frac{\log 30!}{\log 100!} < \frac{\log 30!}{\log 50!} < \frac{\log 50!}{\log 30!} < \frac{\log 100!}{\log 30!}$$

So, $\log_a c < \log_b a < \log_c a < \log_a b$ is the correct order.

38. Option (a) is correct.



$$\begin{aligned} \text{Area of section P} &= \frac{1}{4} \times \pi \times r^2 \\ &= \frac{1}{4} \times \pi \times 2^2 = \pi \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of section Q} &= \text{Area of square with side } 2 \text{ cm} - \text{Area of quadrant} \\ &= 2 \times 2 - \pi \\ &= 4 - \pi \end{aligned}$$

So, total shaded area

$$\begin{aligned} &= 2P + 2Q = 2\pi + 2(4 - \pi) \\ &= 8 \text{ cm}^2 \end{aligned}$$

39. Option (d) is correct.

Possible number of ways so that only one each cell has only 1 shaded cell = $3 \times 2 \times 1 = 6$

40. Option (a) is correct.

Given:

There are 4 red, 5 green and 6 blue balls inside a box.

For smallest value of N,

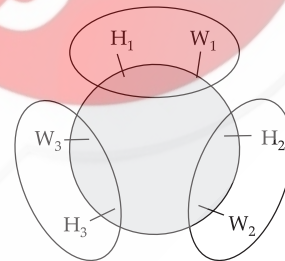
Let we select three balls 1 red, 1 green and 1 blue ball each. Now we select the fourth ball the we found two balls are of same colour.

So, value of N = 4

41. Option (a) is correct.

By using the given operations, only option (a) figure can be achieved.

42. Option (a) is correct.



By circular arrangement,

Three pairs can be arranged in $(3 - 1)!$

or $2!$ number of ways.

And each pair can be arranged in $2!$

number of ways.

$$\begin{aligned} \therefore \text{Total number of ways} &= 2! \times 2! \times 2! \times 2! \\ &= 16 \end{aligned}$$

43. Option (c) is correct.

Given expression:

$$\Rightarrow 4^{8x} = 256$$

$$\Rightarrow 4^{8x} = 4^4$$

On comparing powers

$$\text{So, } 8^x = 4$$

$$\Rightarrow 2^{3x} = 2^2$$

On comparing powers

$$\text{So, } 3x = 2$$

$$\Rightarrow x = \frac{2}{3}$$

44. Option (c) is correct.

Descending order of the speeds of point P, Q and R will be as written below.

$$V_P > V_R > V_Q$$

So, option (c) is correct.