ESE 2025

UPSC ENGINEERING SERVICES EXAMINATION

Preliminary Examination

General Studies & Engineering Aptitude

Objective Solved Papers

- ✓ Topicwise presentation
- ✓ Analysis of previous years papers
- ✓ Detailed solutions with **additional information**
- ✓ Matched and verified with the official keys of UPSC

MADE EASY
PUBLICATIONS

ESE-2025 : Preliminary Examination
General Studies and Engineering Aptitude
Topicwise Objective Solved Papers : (2017-2024)

Preface

To get a thorough knowledge and to succeed in the growing competition in Engineering Services Examination reading just the theory will not suffice. To supersede other competitors, an aspirant needs a thorough practice of variety of questions. With the introduction of 9 Non-Technical subjects and Current Affairs in Paper-I of ESE Prelims, it has become mandatory to get well versed with these subjects by getting acquainted with every possible variety of questions. To help every aspirant to score high marks in the exam, MADE EASY has come up with **General Studies and Engineering Aptitude Previous Year Objective Solved Papers** with subject and topicwise bifurcations. This book contains questions of ESE-2017, ESE-2018, ESE-2019, ESE-2020, ESE-2021, ESE-2022 and ESE-2023.

B. Singh (Ex. IES)

MADE EASY team has put sincere efforts in framing and compilation of questions with accurate explanations, supplemented with relevant theory and illustrations of subjects namely:

- Engineering Aptitude covering Logical Reasoning and Analytical Ability
- Engineering Mathematics and Numerical Analysis
- General Principles of Design, Drawing, Importance of Safety
- Standards and Quality Practices in Production, Construction, Maintenance and Services
- Basics of Energy and Environment
- Basics of Project Management
- Basics of Material Science and Engineering
- Information and Communication Technologies (ICT)
- Ethics and Values in Engineering Profession

Note: For Current Affairs, students are advised to go through the MADE EASY Current Affairs Magazine Annual Edition.

It is impossible to acknowledge all the individuals who helped us, but would like to sincerely thank all authors, editors and reviewers for putting their painstaking efforts to publish this book.

With Best Wishes

B. Singh

CMD, MADE EASY

GENERAL STUDIES AND ENGINEERING APTITUDE

Objective Solved Papers
of UPSC Engineering Services Examination

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Reasoning & Aptitude

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Reasoning & Aptitude

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UNIT I

Reasoning & Aptitude

1. NUMBER SYSTEM

1.1 The sum of squares of successive integers 8 to 16, both inclusive, will be
(a) 1126 (b) 1174
(c) 1292 (d) 1356
[ESE Prelims : 2018]

1.2 A number of friends decided to go on a picnic and planned to spend Rs. 96 on eatables. Four of them, however, did not turn up. As a consequence, the remaining ones had to contribute Rs. 4 each extra. The number of those friends who attended the picnic is
(a) 8 (b) 12
(c) 16 (d) 20
[ESE Prelims : 2020]

1.3 The sum of all the natural numbers between 1 and 101 which are divisible by 5 is
(a) 1000 (b) 1050
(c) 1500 (d) 2550
[ESE Prelims : 2020]

1.4 Sum of the series $2^2 + 4^2 + 6^2 + ... + 20^2$ is
(a) 1040 (b) 1540
(c) 2540 (d) 3080
[ESE Prelims : 2021]

1.5 21 mango trees, 42 apple trees and 56 orange trees have to be planted in rows such that each row contains the same number of trees of one variety only. Minimum number of rows in which the above trees may be planted is
(a) 9 (b) 12
(c) 14 (d) 17
[ESE Prelims : 2022]

1.6 A general wishes to draw up his 36562 soldiers in the form of a solid square. After arranging them, he found that some of them are left over. How many are left?

(a) 81 (b) 75
(c) 61 (d) 52
[ESE Prelims : 2022]

1.7 Two boys begin together to write out a booklet containing 817 lines. The first boy starts with first line, writing at the rate of 200 lines an hour and the second boy starts with the last line. He writes line 817 and so on backwards proceeding at the rate of 150 lines an hour. At what line will they meet?
(a) 469th (b) 467th
(c) 465th (d) 463th
[ESE Prelims : 2022]

1.8 Anuhya picks a number. She doubles the number, squares the result, divides the square by 3, subtracts 30 from the quotient, and gets 18. What are the possible numbers that Anuhya could have picked?
(a) 6 or –6 (b) 16 or –16
(c) 26 or –26 (d) 36 or –36
[ESE Prelims : 2024]

1.9 Nothing is known about the personal life of the ancient Green Mathematician Diophantus except for the information in the following:

"Diophantus passed $\frac{1}{6}$ of his life in childhood, $\frac{1}{12}$ in youth, and $\frac{1}{7}$ more as a bechelor. Five years after his marriage was born a son who died four years before his father, at $\frac{1}{2}$ his father's (final) age." How old was Diophantus when he died?
(a) 64 (b) 54
(c) 74 (d) 84
[ESE Prelims : 2024]

1.10 Select a two-digit number between 50 and 100. Add 83 to your number. From this number form a new number by adding the digit in the hundreds place to the number formed by the other two digits (the digits in the tens place and the ones place). Now subtract this newly formed number from your original number, to arrive at the final result. What is the final result?
(a) 16
(b) 26
(c) 36
(d) 46

[ESE Prelims : 2024]

1.11 The members of a club are going to elect a president from four nominees. In each first-place vote receives 4 points, each second-place vote receives 3 points, each third-place vote receives 2 points, and each last place vote receives 1 point. If the 100 members of the club mark their ballots as shown in the table below, who will be elected president?

Rankings						
Avalon	2	2	2	2	3	2
Branson	1	4	4	4	2	1
Columbus	3	3	1	3	1	3
Dunkrirk	4	1	3	1	4	4
Number of voters	30	24	18	12	10	6

(a) Avalon
(b) Branson
(c) Columbus
(d) Dunkirk

[ESE Prelims : 2024]

1.12 A man has a certain number of small boxes to pack into parcels. If he packs 3, 4, 5 or 6 in a parcel, he is left one, if he packs 7 in a parcel, none is left over. What is the number of boxes, he may have to pack?
(a) 106
(b) 301
(c) 309
(d) 400

[ESE Prelims : 2024]

2. PERCENTAGE

2.1 Rajiv spends 40% of his salary on food, 20% on house rent, 10% on entertainment and 10% on conveyance. If his savings at the month end are ₹ 2,000, then his monthly salary is:
(a) ₹ 6,000
(b) ₹ 8,000
(c) ₹ 10,000
(d) ₹ 12,000

[ESE Prelims : 2017]

2.2 The population of a village is 5500. If the number of males increases by 11% and the number of females increases by 20% then the population becomes 6330. The population of female in the village is
(a) 2000
(b) 2500
(c) 3000
(d) 3500

[ESE Prelims : 2021]

2.3 Rohith spends 40% of his monthly income on food items and 50% of the remaining on clothes and conveyance. He saves one-third of the remaining amount after spending on food, clothes and conveyance. If he saves ₹19,200 every year, what is his monthly income?
(a) ₹32,000
(b) ₹16,000
(c) ₹12,000
(d) ₹6,000

[ESE Prelims : 2022]

3. PROFIT AND LOSS

3.1 A total of 324 notes comprising of ₹ 20 and ₹ 50 denominations make a sum of ₹ 12,450. The number of ₹ 20 notes is
(a) 200
(b) 144
(c) 125
(d) 110

[ESE Prelims : 2017]

3.2 A man sold a chair and a table together for Rs. 7,600, thereby making a profit of 25% on the chair and 10% on the table. By selling them together for Rs. 7,500 he would make a profit of 10% on the chair and 20% on the table. Then the cost price of chair and table will be
(a) Rs. 3000 and Rs. 4000
(b) Rs. 3500 and Rs. 4000
(c) Rs. 3000 and Rs. 3500
(d) Rs. 3500 and Rs. 3500

[ESE Prelims : 2019]

4. SIMPLE INTEREST & COMPOUND INTEREST

4.1 In how many years will a sum ₹800 at 10% per annum compounded semi-annually become ₹926.10?
(a) $1\frac{1}{3}$ years
(b) $1\frac{1}{2}$ years
(c) $2\frac{1}{3}$ years
(d) $2\frac{1}{2}$ years

[ESE Prelims : 2021]

4.2 The difference between simple interest and compound interest on a sum for 2 years at 8% when the interest is compounded annually is ₹16. If the interest were compounded half yearly the difference in two interests would be nearly

(a) ₹21.35   (b) ₹24.64
(c) ₹27.85   (d) ₹29.94

[ESE Prelims : 2022]

5. RATIO AND PROPORTION

5.1 The present ages of 3 brothers are in the proportion 3 : 4 : 5. After 10 years the sum of their ages will be 78. What are their ages now?

(a) 12, 16 and 20   (b) 15, 20 and 25
(c) 21, 28 and 35   (d) 24, 32 and 40

[ESE Prelims : 2017]

5.2 If $(2x + 3y) : (3x + 5y) = 18 : 29$, then the value of $x : y$ is

(a) 4 : 1   (b) 4 : 5
(c) 3 : 4   (d) 3 : 1

[ESE Prelims : 2021]

6. AVERAGE

6.1 A student purchases some books for Rs. 1600. If he had bought 8 more books for the same amount, each book would cost Rs. 10 less. The number of books he buys is

(a) 30   (b) 32
(c) 34   (d) 36

[ESE Prelims : 2019]

6.2 Ten years ago father was 12 times as old as his son and after 10 years father will be 2 times older than his son. The present ages of father and son respectively are

(a) 32 years and 14 years
(b) 34 years and 14 years
(c) 32 years and 12 years
(d) 34 years and 12 years

[ESE Prelims : 2020]

7. TIME AND WORK

7.1 Five Men can paint a building in 20 days, 8 Women can paint the same building in 25 days and 10 Boys can paint it in 30 days. If a team has 2 Men, 6 Women and 5 Boys, how long will it take to paint the building?

(a) 12 days   (b) 13 days
(c) 14 days   (d) 15 days

[ESE Prelims : 2017]

7.2 A group of workers estimate to finish a work in 10 days, but 5 workers could not join the work. If the rest of them finished the work in 12 days, the number of members present in the team originally is

(a) 50   (b) 45
(c) 35   (d) 30

[ESE Prelims : 2017]

7.3 A small production unit now works 6 days per week with $3\frac{1}{3}$ hours of first shift every one of the 6 days and 3 hours of second shift for each of the first 5 days. Wage negotiations led to an agreement to work on 5 days a week with both shifts together clocking $7\frac{1}{2}$ hours per day with an 8% increase in weekly wages. How much change in the hourly production would mean parity in the agreement for both management and employees?

(a) 3.68%   (b) 2.15%
(c) 1.82%   (d) 1.33%

[ESE Prelims : 2018]

7.4 A clock strikes once at 1 o'clock, twice at 2 o'clock, thrice at 3 o'clock and so on. The number of times it strikes in 24 hours will be

(a) 116   (b) 136
(c) 156   (d) 196

[ESE Prelims : 2020]

7.5 A is twice as good a workman as B and together, they finish a piece of work in 18 days. In how many days will A alone finish the work?

(a) 28 days   (b) 30 days
(c) 27 days   (d) 29 days

[ESE Prelims : 2021]

7.6 A tank can be filled by 20 buckets each of capacity 13.5 litres. If the capacity of each bucket be 9 litres, how many buckets will fill the same tank?

(a) 30   (b) 25
(c) 20   (d) 15

[ESE Prelims : 2022]

8. TIME, SPEED AND DISTANCE

8.1 Which of the following conditions hold good for a train which crosses the bridge of length l in time t_1 and crosses another bridge of length $\dfrac{l}{2}$ in time t_2?

1. $t_2 = \dfrac{t_1}{2}$ 2. $2t_2 > t_1$

3. $t_2 < \dfrac{t_1}{2}$

4. Speed of train is $\dfrac{l}{10}$ if $t_1 - t_2 = 5$

Select the correct answer using the codes given below:
(a) 1 and 4 only   (b) 2 and 4 only
(c) 1 and 3 only   (d) 2 and 3 only

[ESE Prelims : 2019]

8.2 A tourist covers half of his journey by train at 60 km/h, half of the remainder by bus at 30 km/h and the rest by cycle at 10 km/h. Average speed of the tourist during the journey is
(a) 36 km/h   (b) 33 km/h
(c) 24 km/h   (d) 18 km/h

[ESE Prelims : 2019]

8.3 What is the angle between the hour hand and minute hand of a clock at 3 : 30?
(a) 105°   (b) 180°
(c) 75°   (d) 90°

[ESE Prelims : 2021]

9. PROGRESSION

9.1 Let the sum of the squares of successive integers 0, 1, 2, ..., $n-1$, n be denoted by S. Let the sum of the cubes of the same integers be denoted by C. It is desirable that $\dfrac{C}{S}$, as n increases in steps of 'unity' from 'zero', is given by the series:

$\dfrac{0}{1}, \dfrac{3}{3}, \dfrac{9}{5}, \dfrac{18}{7}, \dfrac{30}{9}, \cdots$ (for n = 0, 1, 2, 3, 4 ....). What will this ratio be for $n = 8$?

(a) $\dfrac{108}{17}$ (b) $\dfrac{103}{17}$

(c) $\dfrac{103}{15}$ (d) $\dfrac{100}{15}$

[ESE Prelims : 2018]

10. PROBABILITY

10.1 Four persons are chosen at random from a group of 3 men, 2 women and 4 children. The chance that exactly 2 of them are children, is

(a) $\dfrac{2}{9}$ (b) $\dfrac{4}{5}$

(c) $\dfrac{7}{12}$ (d) $\dfrac{10}{21}$

[ESE Prelims : 2021]

10.2 A library has two books each having three copies and three other books each having two copies. In how many ways can all these books be arranged in a shelf so that copies of the same book are not separated?
(a) 80   (b) 100
(c) 120   (d) 140

[ESE Prelims : 2022]

10.3 If six people greet each other at a meeting by shaking hands with one another, how many handshakes will take place?
(a) 14   (b) 16
(c) 15   (d) 18

[ESE Prelims : 2024]

11. SET THEORY

11.1 In a group of 1000 people, 750 speak Hindi and 400 speak English. The number of only Hindi speaking people is
(a) 150   (b) 350
(c) 600   (d) 750

[ESE Prelims : 2020]

11.2 An activities director for a cruise ship has surveyed 240 passengers. Of the 240 passengers, 135 like swimming, 80 like swimming and dancing, 150 like dancing, 40 like swimming and games, 65 like games, 25 like dancing and games, 15 like all three activities. How many passengers like exactly two of the three types of activities?
(a) 220   (b) 20
(c) 30   (d) 100

[ESE Prelims : 2024]

12. BLOOD RELATIONSHIP

12.1 Mary introduces Jack as the son of the only daughter of my father's wife. How is Jack related to Mary?
(a) Brother   (b) Son
(c) Husband   (d) Father
[ESE Prelims : 2021]

13. DIRECTIONS

13.1 A man walked 3 km towards East, then 5 km towards North-East, then 8 km towards South and finally 5 km towards North-East direction. The distance of his present location from the starting point will be
(a) 9 km   (b) 11 km
(c) 15 km   (d) 21 km
[ESE Prelims : 2020]

13.2 A man walks 1 km to East and then he turns to South and walks 5 km. Again, he turns to East and walks 2 km. After, he turns to North and walks 9 km. Now, how far he is from his station point?
(a) 3 km   (b) 4 km
(c) 5 km   (d) 7 km
[ESE Prelims : 2021]

13.3 Rohith went 15 km to the west from his house, then he turned left and walked 20 km. He then turned east and walked 25 km and finally turning left covered 20 km. How far is he from his house?
(a) 5 km   (b) 10 km
(c) 40 km   (d) 80 km
[ESE Prelims : 2023]

13.4 The following map shows the 10 bridges and 3 islands between the suburbs of North Bay and South Bay. During your morning workout, you decide to jog over each bridge exactly once. Which one of the following statements is correct?
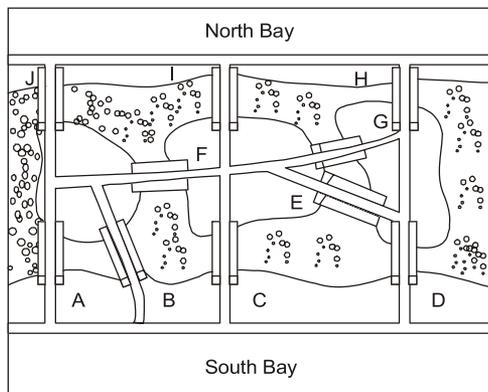
(a) You want to start from North Bay and that your workout concludes after you jog over the 'D' bridge.
(b) You want to start from North Bay and that your workout concludes after you jog over the 'E' bridge.
(c) You want to start from North Bay and that your workout concludes after you jog over the 'H' bridge.
(d) You want to start from North Bay and that your workout concludes after you jog over the 'G' bridge.
[ESE Prelims : 2024]

14. ANALYTICAL REASONING

14.1 The 12 digits on the face of a clock are to be represented employing contributions of only the number 9 as either 9 or $\sqrt{9}$. The other prescribed conditions are (i) the least number of uses alone are permitted; and (ii) when alternates are possible, use of 9 will be preferred over use of $\sqrt{9}$, which should be used minimally. How many times would $\sqrt{9}$ have to be used?
(a) 6   (b) 5
(c) 4   (d) 3
[ESE Prelims : 2018]

14.2 In a particular test, the marks scored by 4 candidates – *A*, *B*, C and *D* are as follows:
• Marks obtained by *A* and *B* add to 100;
• Marks obtained by C and *D* add up to those scored by *A*;
• B scores 4 times of *D*;
• D scores 10 marks less than *C*.
The marks obtained by C will be
(a) 30   (b) 15
(c) 20   (d) 25
[ESE Prelims : 2018]

14.3 Consider the following gold articles P, Q, R, S and T with different weights:
• P weighs twice as much as Q
• Q weighs four and a half times as much as R
• R weighs half as much as S
• S weighs half as much as T
• T weighs less than P but more than R
Article T will be lighter in weight than

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

[ESE Prelims : 2020]

14.4 Consider the following students in an examination:
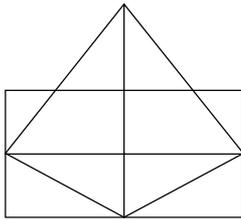- A scored more than B
- C scored as much as D
- E scored less than F
- B scored more than C
- F scored less than D

Who scored the lowest?
(a) E   (b) C
(c) D   (d) F

[ESE Prelims : 2020]

14.5 The number of triangles in the given figure is

(a) 11   (b) 13
(c) 15   (d) 17

[ESE Prelims : 2021]

14.6 Statement 1 : A has more coins than B.
Statement 2 : B has fewer coins than C.
Statement 3 : C has fewer coins than A.
If the statement 1 is true and statement 2 is false, then the statement 3 is
(a) True   (b) False
(c) Uncertain   (d) Insufficient data

[ESE Prelims : 2021]

14.7 A, B, C, D and E are five different integers. When written in the ascending order of values, the difference between any two adjacent integers is 4. D is the greatest and A is the least. B is greater than E but less than C. The sum of the integers is equal to E. What is the positive difference between the lowest and the highest integers?
(a) 8   (b) 6
(c) 16   (d) 18

[ESE Prelims : 2021]

14.8 Some environmentalists question the prudence of exploiting features of the environment, arguing that there are no economic benefits to be gained from forests, mountains, or wetlands that no longer exist. Many environmentalists claim that because nature has intrinsic value it would be wrong to destroy such features of the environment, even if the economic costs of doing so were outweighed by the economic costs of not doing so.
Which one of the following can be logically inferred from the passage?
(a) It is economically imprudent to exploit features of the environment.
(b) Some environmentalists appeal to a noneconomic justification in questioning the defensibility of exploiting features of the environment.
(c) Most environmentalists appeal to economic reasons in questioning the defensibility of exploiting features of the environment.
(d) Many environmentalists provide only a noneconomic justification in questioning the defensibility of exploiting features of the environment.

[ESE Prelims : 2022]

14.9 Fact 1 : Jessica has four children.
Fact 2 : Two of the children have blue eyes and two of the children have brown eyes.
Fact 3 : Half of the children are girls.
If the first three statements are facts, which of the following statements must also be a fact?
I. At least one girl has blue eyes.
II. Two of the children are boys.
III. The boys have brown eyes.
Select the correct answer using the code given below:
(a) II only
(b) I and III only
(c) II and III only
(d) None of the statements is a known fact

[ESE Prelims : 2022]

14.10 Children are in pursuit of a dog whose leash has broken. James is directly behind the dog. Ruby is behind James. Rachel is behind Ruby. Max is ahead of the dog walking down the street in the opposite direction. As the children and dog pass, Max turns around and joins the pursuit. He runs in behind Ruby. James runs faster and is alongside the dog on the left. Ruby runs faster

and is alongside the dog on the right. Which child is directly behind the dog?
(a) James   (b) Ruby
(c) Rachel   (d) Max

                             [ESE Prelims : 2022]

14.11 At the baseball game, Henry was sitting in seat 253. Marla was sitting to the right of Henry in seat 254. In the seat to the left of Henry was George. Inez was sitting to the left of George. Which seat is Inez sitting in?
(a) 251   (b) 254
(c) 255   (d) 256

                             [ESE Prelims : 2022]

14.12 Most serious students are happy students, and most serious students go to graduate school. Furthermore, all students who go to graduate school are overworked.
Which one of the following can be properly inferred from the statements above?
(a) Most overworked students are happy students
(b) Some happy students are overworked
(c) All overworked students are serious students
(d) Some unhappy students go to graduate school

                             [ESE Prelims : 2022]

14.13 Of the five boys A, B, C, D and E two are good, one is poor and two are average in studies. Two of them study in post-graduate classes and three in under graduate classes. One comes from a rich family two from middle class families and two from poor families. One of them is interested in music, two in acting and one in sports. Of those studying in under graduate classes, two are average and one is poor in studies. Of the two boys interested in acting, one is a post-graduate student. The one who is interested in music comes from a middle class family. Both of the boys interested in acting are not industrious, good in studies come from middle class families, are average in studies and one of them is interested in acting. The boy interested in sports comes from a poor family, while the one interested in music in industrious. E is industrious, good in studies comes from a poor family and is not interested in acting, music or sports. C is poor in studies in spite of being industrious. A comes from a rich family, is not

industrious but good in studies. B is industrious and comes from a middle class family. Name the boy who is not industrious and is average in studies.
(a) A   (b) B
(c) C   (d) D

                             [ESE Prelims : 2023]

14.14 At an electric Data Processing Unit five out of the eight program sets, P, Q, R, S, T, U, V and W are to be operated daily. On any one day except for the first day of the month only three of the program sets must be the ones that were operated on the previous day. The program operating must also satisfy the following conditions:
1. If program P is to be operated on a day, V cannot be operated on that day.
2. If Q is to be operated on a day, T must be one of the programs to be operated after Q.
3. If R is to be operated on a day, V must be one of the programs to be operated after R.
4. The last program to be operated on any day must be either S or U.
If the program sets R and W are to be operated on the first day which of the following could be the other programs on that day?
(a) Q, V, S   (b) Q, T, V
(c) T, S, U   (d) T, S, V

                             [ESE Prelims : 2023]

14.15 Read the following information carefully and answer the question give below it:
1. Eight doctors *P, Q, R, S, T, U, V* and *W* visit charitable dispensary every day except on a holiday i.e., Monday.
2. Each doctor visits for one hour from Tuesday to Sunday except Saturday. The timings are 9 A.M. to 1 P.M. and 2 P.M. to 6 P.M., 1 P.M. to 2 P.M. is lunch break.
3. On Saturday it is opened only in the morning i.e. 9 A.M. to 1 P.M. and each doctor visits for only half an hour.
4. No other doctor visits the dispensary, before doctor *Q* and after *U*.
5. Doctor *W* comes immediately after the lunch break is followed by *R*.
6. *S* comes in the same order as *P* in the afternoon session.
If the lunch break and subsequent visiting hours are reduced by 15 minutes at what time doctor *U* is expected to attend the dispensary?

(a) 3.15 P.M.   (b) 4 P.M.

(c) 4.15 P.M.   (d) 4.45 P.M.

                           [ESE Prelims : 2023]

14.16 Study the following information carefully and answer the question given below it:

1. *P, Q, R, S, T* and *U* are six members in a family in which there are two married couples.

2. *T*, a teacher, is married to the doctor who is mother or *R* and *U*.

3. *Q*, the lawyer, is married to *P*.

4. *P* has one son and one grandson.

5. Of the two married ladies on is housewife.

6. There is one student and one male engineer in the family.

How is *R* related to *U*?

(a) Brother only   (b) Sister only

(c) Brother or Sister   (d) Mother

                           [ESE Prelims : 2023]

14.17 Read the following information carefully and answer the question that follow:

1. Madhu and Shobha are good in Dramatics and Computer Science.

2. Anjali and Madhu are good in Computer Science and Physics.

3. Anjali, Poonam and Nisha are good in physics and History.

4. Nisha and Anjali are good in Physics and Mathematics.

5. Poonam and Shobha are good in History and Dramatics.

Who is good in History, Physics, Computer Science and Mathematics?

(a) Poonam   (b) Nisha

(c) Madhu   (d) Anjali

                           [ESE Prelims : 2023]

14.18 The question given below the three statements followed by three conclusions numbered I, II and III. You have to take the given statements to be true even if they seem to be at variance from commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.

Statements:

All lions are tigers

All tigers are leopards

Some leopards are wolves

Conclusions:

I. No elephant is lion.

II. Some wolves are lions.

III. Some leopards are lions.

(a) Only I follows   (b) Only II follows

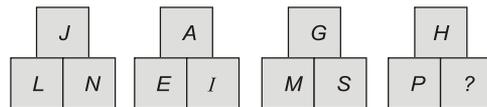(c) Only III follows   (d) Only I and III follows

                           [ESE Prelims : 2023]

14.19 Cryptic language is popular since ages, mostly in the field of espionage and sending classified messages. If 'I LOVE YOU' is coded as 7, then how would you code 'GO TO HELL' in the same language?

(a) 1   (b) 4

(c) 3   (d) 5

                           [ESE Prelims : 2023]

14.20 What letter should replace the question mark?

J		A		G		H	
L	N	E	I	M	S	P	?

(a) Z   (b) Y

(c) X   (d) W

                           [ESE Prelims : 2023]

14.21 In the first two circles, the number inside the circle is written according to a particular relation. What is the number inside the third circle which follows the same relation as that of the first two circles?

Circle 1: 8 / 27 / 125

Circle 2: 10 / 64 / 216

Circle 3: ? / 343 / 216
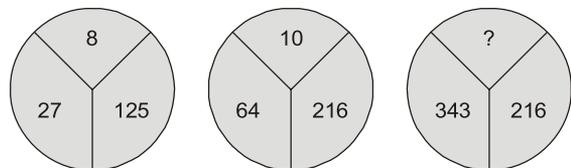
(a) 12   (b) 13

(c) 9   (d) 14

                           [ESE Prelims : 2023]

14.22 Deepthi is playing a treasure hunt game. At the first stage, Deepthi needs to choose a five-digit code to unlock the vault which contains the treasure. She gets the following codes to choose from

15342	26540	35415
23105	15320	13402
35047	71024	28305

The following clues are given to her to help her to find the code

P. The code number is not an even number.

Q. The product of the first two digits is odd.

R. The sum of the first four digits is 12.

S. The code number is not a multiple of 5.

If Deepthi had the option of selecting only one clue, which of the four clues will give her the best chance of finding out the five digit code?

(a) S   (b) R

(c) Q   (d) P

[ESE Prelims : 2023]

14.23 A number series is given with one term missing. Choose the correct alternative from options.

0.5, 0.55, 0.65, 0.8, ?

(a) 0.9   (b) 0.95

(c) 0.82   (d) 1

[ESE Prelims : 2023]

14.24 The soccer club is putting together a mural using lightly colored transparent paper. This paper then is cut into squares of different sizes that are placed next to each other to make the designs for the mural. Of course, the club wants to save money, so its members are trying to buy the minimum number of sheets of colored paper. Below is one of the designs they are going to use. What is the minimum number of squares they will need to make this design?
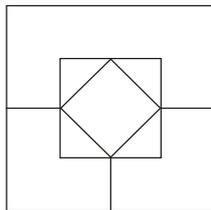
(a) 4   (b) 5

(c) 6   (d) 7

[ESE Prelims : 2023]

14.25 What is the correct alternative for the question mark?

2, 3, 8, 63, ?

(a) 1038   (b) 1998

(c) 3008   (d) 3968

[ESE Prelims : 2023]

14.26 Brianna, Ryan, Tyler, and Ashley were recently elected as the new class officers (president, vice president, secretary, treasurer) of the sophomore class at Summit College. From the following clues, determine which position each holds.

1. Ashley is younger than the president but older than the treasurer.

2. Brianna and the secretary are both the same age, and they are the youngest members of the group.

3. Tyler and the secretary are next door neighbors.

(a) Tyler is the president, Ashley is the vice president, Ryan is the secretary, and Brianna is the treasurer.

(b) Tyler is the president, Ashley is the vice president, Brianna is the secretary, and Ryan is the treasurer.

(c) Tyler is the president, Ryan is the vice president, Ashley is the secretary, and Brianna is the treasurer.

(d) Tyler is the president, Ryan is the vice president, Brianna is the secretary, and Ashley is the treasurer.

[ESE Prelims : 2024]

14.27 You need to buy groceries at the supermarket, deposit a cheque at credit union, and purchase a book at the bookstore. You can complete the errands in any order, however, you must start and end at your home. The driving time, in minutes, between each of these locations is given in the following figure.
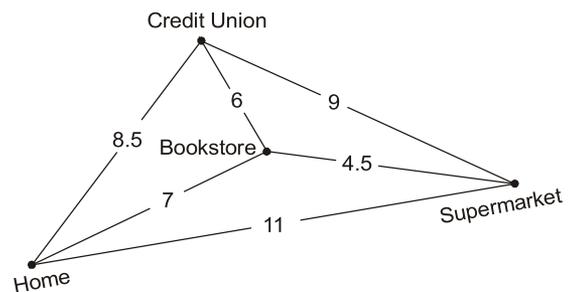
What is the route whose total driving time is less than 30 minutes?

(a) home, bookstore, credit union, supermarket, home

(b) home, supermarket, bookstore, credit union, home

(c) home, bookstore, supermarket, credit union, home

(d) home, supermarket, credit union, bookstore, home

[ESE Prelims : 2024]

14.28 Each of four siblings (Anita, Tony, Maria and Jose) is given ₹5000 to invest in the stock market. Each chooses a different stock. One chooses a utility stock, another an automotive

16.12 Four metal rods of lengths 78 cm, 104 cm, 117 cm and 169 cm are to be cut into parts of equal length. Each part must be as long as possible. The maximum number of pieces that can be cut will be
(a) 27   (b) 36
(c) 43   (d) 52

[ESE Prelims : 2020]

16.13 The diagonal of a rectangle is $\sqrt{41}$ cm and its area is 20 sq.cm. The perimeter of the rectangle is
(a) 9 cm   (b) 18 cm
(c) 20 cm   (d) 41 cm

[ESE Prelims : 2021]

16.14 One side of a rhombus is 10 cm and one of its diagonals is 12 cm. The area of the rhombus is
(a) 24 sq. cm   (b) 48 sq. cm
(c) 72 sq. cm   (d) 96 sq. cm

[ESE Prelims : 2022]

■■■■

Reasoning & Aptitude : Answer Key

1.1	(d)	**1.2**	(a)	**1.3**	(b)	**1.4**	(b)	**1.5**	(d)	**1.6**	(a)	**1.7**	(b)	**1.8**	(a)
1.9	(d)	**1.10**	(a)	**1.11**	(a)	**1.12**	(b)	**2.1**	(c)	**2.2**	(b)	**2.3**	(b)	**3.1**	(c)
3.2	(c)	**4.1**	(b)	**4.2**	(b)	**5.1**	(a)	**5.2**	(c)	**6.1**	(b)	**6.2**	(d)	**7.1**	(d)
7.2	(d)	**7.3**	(a)	**7.4**	(c)	**7.5**	(c)	**7.6**	(a)	**8.1**	(b)	**8.2**	(c)	**8.3**	(c)
9.1	(a)	**10.1**	(d)	**10.2**	(c)	**10.3**	(c)	**11.1**	(c)	**11.2**	(d)	**12.1**	(b)	**13.1**	(a)
13.2	(c)	**13.3**	(b)	**13.4**	(b)	**14.1**	(b)	**14.2**	(d)	**14.3**	(c)	**14.4**	(a)	**14.5**	(c)
14.6	(a)	**14.7**	(c)	**14.8**	(d)	**14.9**	(a)	**14.10**	(d)	**14.11**	(a)	**14.12**	(b)	**14.13**	(d)
14.14	(d)	**14.15**	(b)	**14.16**	(c)	**14.17**	(d)	**14.18**	(c)	**14.19**	(b)	**14.20**	(c)	**14.21**	(b)
14.22	(b)	**14.23**	(d)	**14.24**	(b)	**14.25**	(d)	**14.26**	(a)	**14.27**	(c)	**14.28**	(a)	**14.29**	(c)
14.30	(a)	**14.31**	(d)	**14.32**	(a)	**15.1**	(d)	**15.2**	(c)	**15.3**	(a)	**15.4**	(a)	**15.5**	(a)
15.6	(c)	**15.7**	(c)	**15.8**	(a)	**15.9**	(*)	**16.1**	(c)	**16.2**	(c)	**16.3**	(b)	**16.4**	(a)
16.5	(a)	**16.6**	(b)	**16.7**	(a)	**16.8**	(a)	**16.9**	(b)	**16.10**	(c)	**16.11**	(d)	**16.12**	(b)
16.13	(b)	**16.14**	(d)												

EXPLANATIONS

1.1   **(d)**

Sum of square of first n natural number

$$\sum n^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\sum_{n=1}^{n=16} n^2 - \sum_{n=1}^{n=7} n^2$$

$$= \frac{16(16+1)(32+1)}{6} - \frac{7(7+1)(14+1)}{6}$$

$$= 1496 - 140 = 1356$$

1.2   **(a)**

$$x \times y = 96 \qquad \qquad ...(i)$$
$$(x-4)(y+4) = 96 \qquad ...(ii)$$

Solving eq. (i) and (ii) we get,

$$x = 12, \ y = 8$$

$$\therefore \qquad 12 - 4 = 8$$

Alternative Solution:

Using option (a)

$$8 \times 12 = 96$$
$$(12-4) \times (8+4) = 8 \times 12 = 96$$

1.3   **(b)**

$$\text{Sum} = 5 + 10 + 15 + ... + 100$$

$$= 5(\Sigma 20) = 5 \times \frac{20 \times 21}{2} = 1050$$

1.4   **(b)**

$$2^2 + 4^2 + 6^2 + ... + 20^2$$
$$\Rightarrow 2^2(1^2 + 2^2 + 3^2 + ... + 10^2)$$

$$\because \sum n^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\Rightarrow 2^2 \times \frac{10 \times 11 \times 21}{6}$$

$$\Rightarrow 4 \times \frac{10 \times 11 \times 21}{6} = 1540$$

1.5   **(d)**

Minimum number of row contain same number of tree of one variety

$$= \frac{\text{Total}}{\text{HCF}(21,42,56)} = \frac{21+42+56}{7}$$

$$= 3 + 6 + 8 = 17$$

1.6   **(a)**

$$(191)^2 + 81 = 36562$$

81 soldiers are left.

$$
\begin{array}{r|l}
1 & \overline{3}\,\overline{6}\,\overline{5}\,\overline{6}\,\overline{2} \\
+1 & 1 \\ \hline
29 & 2\,6\,5 \\
9 & 2\,6\,1 \\ \hline
381 & 4\,6\,2 \\
1 & 3\,8\,1 \\ \hline
& 8\,1
\end{array}
$$

1.7   **(b)**

Total number of lines = 817

Both meet when :

Time when 1st boy complete x number of lines
= Time when 2nd boy complete $(817 - x)$ number of lines

$$\frac{x}{200} = \frac{817 - x}{150}$$

$$150x = 200 \times 817 - 200x$$

$$x = \frac{200 \times 817}{350} = 466.857 \approx 467^{\text{th}} \text{ line}$$

1.8   **(a)**

Assuming anuhya picks the number 'n', we have

$$\frac{(2n)^2}{3} - 30 = 18$$

$$\Rightarrow \qquad \frac{4n^2}{3} = 48$$
$$\Rightarrow \qquad n^2 = 36$$
$$\Rightarrow \qquad n = +6 \text{ or } -6$$

1.9   **(d)**

Let the age at which Diophantus died be 'x'.
From the given information, the age of Diophantus at the time of marriage,

$$y = \frac{x}{6} + \frac{x}{12} + \frac{x}{7}$$

$$= \frac{(14+12+7)x}{84} = \frac{33x}{84} = \frac{11x}{28}$$

We can write,

$$(x-4) - \left(\frac{11x}{25} + 5\right) = \frac{x}{2}$$

$$\Rightarrow \qquad \frac{x}{2} - \frac{11x}{28} = 9$$
$$\Rightarrow \qquad 3x = 28 \times 9$$
$$\Rightarrow \qquad x = 84 \text{ years}$$

1.10   **(a)**

Select a random number between 50 and 100, say 90. Adding 83 to this number, we get

$$83 + 90 = 173$$

Forming a new number by adding the digit in the hundreds place to the number formed by the other two digits, we get

$$1 + 73 = 74$$

Subtracting from the original number, the final result is obtained as:

$$90 - 74 = 16$$

1.11   **(a)**

Total points received by different members:
Avalon: $(5 \times 3) + 2 = 17$ points
Branson: $(2 \times 4) + 3 + (3 \times 1) = 14$ points
Columbus: $(2 \times 4) + (4 \times 2) = 16$ points
Dunkrirk: $(2 \times 4) + 2 + (3 \times 1) = 13$ points
Hence, Avalon will be the elected president.

1.12   **(b)**

The required number should be such that it leads a remainder of 1 when divided by 3, 4, 5 or 6 and no remainder when divided by 7.
LCM (3, 4, 5, 6) = 60
So, number in the form = $60x + 1$
The minimum value of x for which the number leaves no remainder when divided by 7 is 5.
Hence,
Required number = $60 \times 5 + 1 = 301$

2.1   **(c)**

Given that Rajiv spends on
         Food $\rightarrow$ 40%
     House rent $\rightarrow$ 20%
  Entertainment $\rightarrow$ 10%
    Conveyance $\rightarrow$ 10%
$\therefore$ His savings $= 100 - (40 + 20 + 10 + 10)$
               $= 20\%$
The remaining percentage after expenditure 20% which equals Rs. 2000 leading to total monthly income = Rs. 10000.

2.2   **(b)**

Let the number of males $= x$
Then number of females $= (5500 - x)$
$x(1 + 0.11) + (5500 - x) \times 1.2 = 6330$

$1.11x + 6600 - 1.2x = 6330$

$$x = \frac{270}{9} \times 100$$

$$x = 3000$$

So, Number of females = 5500 – 3000 = 2500

2.3   **(b)**

Let Income = $100k$ per month

Spend on food $= \dfrac{40}{100} \times 100k = 40k$

Spend on cloth and conveyance

$= \dfrac{60}{100} \times \dfrac{50}{100} \times 100k = 30k$

Saving $= \left(\dfrac{1}{3}\right) \times (100 - 40k - 30k)$

$= \dfrac{1}{3} \times 30k = 10k$

Monthly saving $= \dfrac{19200}{12} = ₹\ 1600 = 10k$

$\Rightarrow \quad k = 160$

$\therefore$ Monthly income $= 100k = 100 \times 160$
               $= ₹\ 16,000$

3.1   **(c)**

We can form 2 linear equations taking the number of Rs. 20 and Rs. 50 notes as T and F
$\quad\quad\quad\quad T + F = 324 \quad\quad\quad ...(1)$
$\quad\quad\quad 20T + 50\ F = 12450 \quad\quad ...(2)$
Solving the 2 equations, we get $T = 125$

Alt 1: If all the notes are Rs. 50 notes, total amount = 324×50 = Rs. 16200 which is 16200 – 12450 = 3750

3750/(50 – 20) = 125 notes of Rs. 20.

Alt 2: This question can also be solved by putting options.

3.2   **(c)**

Using options
$3000 \times 1.25 + 3500 \times 1.1 = 7600$
$3000 \times 1.10 + 3500 \times 1.20 = 7500$

4.1   **(b)**

Let the number of year is n

Then, $\quad\quad\quad\quad A = P\left(1 + \dfrac{\frac{R}{2}}{100}\right)^{2n}$