

ENGINEERING APTITUDE

(QUANTITATIVE APTITUDE & ANALYTICAL ABILITY)



Revised and Updated

**AS PER ENGINEERING
SERVICE EXAM NEW PATTERN**
1270+ Objective Questions

ENGINEERING APTITUDE

QUANTITATIVE APTITUDE & ANALYTICAL ABILITY

New Pattern
for
UPSC ESE Exam



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PREFACE

Engineering Aptitude, as a subject, has been growing in significance across competitive examinations in India. Now, Union Public Service Commission (UPSC) has introduced this topic in Engineering Service Examination (ESE). We have immense pleasure in introducing this book “**Engineering Aptitude covering Quantitative Aptitude and Analytical ability**” for the aspirants of various competitive examinations, mainly Civil Services, ESE and GATE aspirants.

In writing this book, under the guidance of **Mr. Kanchan Kumar Thakur (Ex. IES)**, we have had in mind the needs and interests of students appearing for Competitive Examinations like UPSC exams and GATE exam.

The discussion points focus on points of topical interest or on particular concept. Questions typical of those asked in the examinations have been included for practice and to discover the extent of knowledge of the aspirants. Keywords are printed in bold type to assist the student further in assimilating the information.

IES Master Publication is thankful to **Mr. Satendra Dubey** for his extensive contribution in generating, shaping, editing and production of this work. We also thanks the staff of IES Master and all those who have assisted with information and advice in the production of this book.

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EXERCISE (LEVEL-I)

Previous Year Questions from UPSC, CDS, CAPF and NDA

- E1.1:** A person has to completely put each of three liquids: 403 litres of petrol, 465 litres of diesel and 496 litres of mobil oil in bottles of equal size without mixing any of the above three types of liquids such that each bottle is completely filled. What is the least possible number of bottles required?
(a) 34 (b) 44
(c) 46 (d) None of the above
(UPSC 2007)
- E1.2:** Three bells toll at intervals of 9, 12 and 15 minutes respectively. All the three begin to toll at 8am. At what time will they first toll together again?
(a) 08:45 am (b) 10:30 am
(c) 11:00 am (d) 01:30 pm
(UPSC 2013)
- E1.3:** There are five hobby clubs in a college viz, photography, yachting, chess, electronics and gardening. The gardening group meets every second day, the electronics group meets every third day, the chess group meets every fourth day, the yachting group meets every fifth day and the photography group meets every sixth day. How many times do all the five groups meet on the same day within 180 days?
(a) 3 (b) 5
(c) 10 (d) 18 **(UPSC 2013)**
- E1.4:** A gardener has 1000 plants. He wants to plan them in such a way that the number of rows and the number of columns remains the same. What is the minimum number of plants that he needs more for this purpose?
(a) 14 (b) 24
(c) 32 (d) 34 **(UPSC 2013)**
- E1.5:** Five persons fire bullets at a target at an interval of 6, 7, 8, 9 and 12 sec. respectively. The number of times they would fire the bullets together at the target in an hour is.
(a) 6 (b) 7
(c) 8 (d) 9 **(UPSC 2014)**
- E1.6:** A bell rings every 18 min. A second bell rings every 24 min. A third bell rings every 32 min. If all the three bells ring at the same time at 8 O'clock in the morning, at what other time will they all ring together?
(a) 12:40 hrs. (b) 12:48 hrs.
(c) 12:56 hrs. (d) 13:04 hrs.
(UPSC-2014)
- E1.7:** For what value of k is $(x + 1)$ a factor of $x^3 + kx^2 - x + 2$?
(a) 4 (b) 3
(c) 1 (d) -2 **(CDS-2016)**
- E1.8:** The largest natural number which divides every natural number of the form $(n^3 - n)(n - 2)$, where n is a natural number greater than 2, is
(a) 6 (b) 12
(c) 24 (d) 48 **(CDS-2015)**
- E1.9:** What is the sum of digits of the least multiple of 13, which when divided by 6, 8 and 12 leaves 5, 7 and 11, respectively, as the remainders?
(a) 5 (b) 6
(c) 7 (d) 8 **(CDS-2015)**
- E1.10:** The number of pairs (x, y) , where x, y are integers satisfying the equation $21x + 48y = 5$, is
(a) Zero (b) One
(c) Two (d) Infinity
(CDS-2015)
- E1.11:** A number when divided by 7 leaves a remainder 3 and the resulting quotient, when divided by 11 leaves a remainder 6. If the same number when divided by 11 leaves a remainder m and the resulting quotient when divided by 7 leaves a remainder n. What are the values of m and n, respectively?
(a) 1 and 4 (b) 4 and 1
(c) 3 and 6 (d) 6 and 3
(CDS-2015)

EXERCISE (LEVEL-II)

Previous Year Questions from GATE, CAT and ESE

E1.23: If $q^{-a} = \frac{1}{r}$ and $r^{-b} = \frac{1}{s}$ and $s^{-c} = \frac{1}{q}$, the value of abc is.....

- (a) $(rqs)^{-1}$ (b) 0
(c) 1 (d) $r + q + s$

(GATE-2016)

E1.24: If $(1.001)^{1259} = 3.52$, $(1.001)^{2062} = 7.85$, then $(1.001)^{3321}$

- (a) 2.23 (b) 4.33
(c) 11.37 (d) 27.64

(GATE-2012)

E1.25: The numeral in the units position of $211^{870} + 146^{127} \times 3^{424}$ is _____.

(GATE-2016)

E1.26: The binary operation \square is defined as $a \square b = ab + (a + b)$, where a and b are any two real numbers. The value of the identity element of this operation, defined as the number x such that $a \square x = a$, for any a , is _____.

- (a) 0 (b) 1
(c) 2 (d) 10

(GATE-2016)

E1.27: If $\text{Log}(P) = (1/2) \text{Log}(Q) = (1/3) \text{Log}(R)$, then which of the following option is TRUE?

- (a) $P^2 = Q^3R^2$
(b) $Q^2 = PR$
(c) $Q^2 = R^3P$
(d) $R = P^2Q^2$

(GATE-2011)

E1.28: Given $(9 \text{ inches})^{1/2} = (0.25 \text{ yards})^{1/2}$, which one of the following statements is TRUE?

- (a) 3 inches = 0.5 yards
(b) 9 inches = 1.5 yards
(c) 9 inches = 0.25 yards
(d) 81 inches = 0.0625 yards

(GATE-2016)

E1.29: Operators \square , \diamond and \rightarrow are defined by;

$$a \square b = \frac{a-b}{a+b}; a \diamond b = \frac{a+b}{a-b}; a \rightarrow b = ab,$$

Find the value of $(66 \square 6) \rightarrow (66 \diamond 6)$.

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

(GATE-2015)

E1.30: Consider the equation : $(7526)_8 - (Y)_8 = (4364)_8$, where $(X)_N$ stands for X to the base N . Find Y .

- (a) 1634 (b) 1737
(c) 3142 (d) 3162

(GATE-2014)

E1.31: If $137 + 276 = 435$ how much is $731 + 672$?

- (a) 534 (b) 1408
(c) 1623 (d) 1513

(GATE-2010)

E1.32: A number is as much greater than 75 as it is smaller than 117. The number is:

- (a) 91 (b) 93
(c) 89 (d) 96

(GATE-2013)

E1.33: If $x = -0.5$, then which of the following has the smallest value?

- (a) $\frac{1}{2^x}$ (b) $\frac{1}{x}$
(c) 2^x (d) $\frac{1}{\sqrt{-x}}$

(CAT-2006)

E1.34: If $\frac{a}{b} = \frac{1}{3}$, $\frac{b}{c} = 2$, $\frac{c}{d} = \frac{1}{2}$, $\frac{d}{e} = 3$ and $\frac{e}{f} = \frac{1}{4}$, then

what is the value of $\frac{abc}{def}$?

- (a) $3/8$ (b) $27/8$
(c) $3/4$ (d) $27/4$

(CAT-2006)

PRACTICE PROBLEMS KEY

P1.1 (d)	P1.4 (a)	P1.7 (c)	P1.10 (a)	P1.13 (b)
P1.2 (a)	P1.5 (a)	P1.8 (b)	P1.11 (b)	P1.14 (d)
P1.3 (b)	P1.6 (d)	P1.9 (a)	P1.12 (a)	

EXERCISE (LEVEL-I) KEY

E1.1 (b)	E1.6 (b)	E1.11 (a)	E1.16 (c)	E1.21 (a)
E1.2 (c)	E1.7 (d)	E1.12 (d)	E1.17 (b)	E1.22 (d)
E1.3 (a)	E1.8 (c)	E1.13 (a)	E1.18 (c)	
E1.4 (b)	E1.9 (a)	E1.14 (a)	E1.19 (b)	
E1.5 (b)	E1.10 (a)	E1.15 (c)	E1.20 (d)	

EXERCISE (LEVEL-II) KEY

E1.23 (c)	E1.29 (c)	E1.35 (d)	E1.41 (a)	E1.47 (b)
E1.24 (d)	E1.30 (c)	E1.36 (b)	E1.42 (d)	E1.48 (b)
E1.25 (7)	E1.31 (c)	E1.37 (d)	E1.43 (a)	
E1.26 (a)	E1.32 (d)	E1.38 (b)	E1.44 (d)	
E1.27 (b)	E1.33 (b)	E1.39 (d)	E1.45 (d)	
E1.28 (c)	E1.34 (a)	E1.40 (c)	E1.46 (b)	

EXERCISE EXPLANATIONS (LEVEL-I)

E1.1: (b)

The size of bottle required to be filled
 = HCF of (403, 465 and 1496 litres)
 = 31 litres

The minimum possible number of bottles required

$$= \frac{403}{31} + \frac{465}{31} + \frac{496}{31}$$

$$= 13 + 15 + 16 = 44$$

E1.2: (c)

The time direction after which each bell toll
 = LCM of (9, 12 and 15 min.)
 = 180 min.
 = 3 hrs

∴ If all the three begin to toll at 8:00 AM then the next toll together again
 = 8 + 3 = 11:00 AM

E1.3: (a)

The number of days after which all the five groups meet same day
 = LCM of (2, 3, 4, 5 and 6 days)
 = 60 days

∴ The number of times all the groups meet on the same day within 180 days

$$= \frac{180}{60} = 3 \text{ times}$$

E1.4: (b)

As the number of columns and rows are same so, the number of plants will be a perfect square (i.e. n^2).

The perfect square just greater than 1000 is 1024

so, the number of plants needed
 = 1024 – 1000
 = 24 plants

E1.5: (b)

The time after which the persons firing the bullet together = LCM of (6, 7, 8, 9 and 12 sec.)

$$6 = 2 \times 3$$

$$7 = 1 \times 7$$

$$8 = 2 \times 2 \times 2$$

$$9 = 3 \times 3$$

$$12 = 2 \times 2 \times 3$$

$$\therefore \text{LCM} = 2 \times 3 \times 7 \times 2 \times 2 \times 3$$

$$= 36 \times 14 \text{ sec.}$$

So, the number of times they firing bullets together in a hour

$$= \frac{3600}{36 \times 14} = \frac{50}{7} = 7 \frac{1}{7}$$

Hence, it will be 7.

E1.6: (b)

The time after which all the bell rings at the same time

$$= \text{LCM of (18, 24 and 32 min.)}$$

$$= 288 \text{ min.}$$

$$= 4 \text{ hrs } 48 \text{ min.}$$

∴ The required time

$$= 08:00 \text{ hrs} + 04:48 \text{ hrs}$$

$$= 12:40 \text{ hrs}$$

E1.7: (d)

As $(x + 1)$ is a factor of $f(x) = x^3 + kx^2 - x + 2$ so, $f(-1)$ will result of zero remainder.

$$\therefore f(-1) = 0 = (-3)^3 + k(-1)^2 - (-1) + 2$$

$$\text{or } -1 + k + 1 + 2 = 0$$

$$\text{or } k = -2$$

E1.8: (c)

Let $f(n) = (n^3 - n)(n - 2)$ for $n > 2$; where n is natural number.

$$f(3) = (3^3 - 3)(3 - 2) = 24 = 1 \times 24$$

$$f(4) = (4^3 - 4)(4 - 2) = 120 = 5 \times 24$$

$$f(5) = (5^3 - 5)(5 - 2) = 360 = 15 \times 24$$

As we see the pattern above, all the natural numbers are divisible by 24 (largest).

E1.9: (a)

This is a LCM based type-3 problem.

EXERCISE EXPLANATIONS (LEVEL-II)

E1.23: (c)

$$\text{Given, } q^{-a} = \frac{1}{r}, r^{-b} = \frac{1}{s}, s^{-c} = \frac{1}{q}$$

By using the Rules of indices, the above equations can be written as

$$q^a = r, r^b = s, s^c = q$$

$$\text{Now, } q^{abc} = (q^a)^{bc} = (r)^{bc} = (r^b)^c = (s)^c = q$$

$$\therefore q^{abc} = q \Rightarrow abc = 1$$

E1.24: (d)

$$(1.001)^{1259} = 3.52, (1.001)^{2062} = 7.85$$

Multiplying both the equations

$$(1.001)^{1259} \times (1.001)^{2069} = 3.52 \times 7.85$$

$$\text{As } 1259 + 2062 = 3321$$

$$\therefore (1.001)^{3321} = 27.632$$

E1.25: (7)

The number $(211)^{870}$ can be written as $(210 + 1)^{870}$

As the cyclicity of number 11 is 1 so,

$$\text{Numeral at the unit position in } (211)^{870} = 1$$

Similarly, the number $(146)^{127}$ can be written as $(140 + 6)^{127}$.

As the cyclicity of number 6 is 1 so, the last numeral of $(146)^{127}$ will be 6.

Similarly, 3^{424} can be written as

$$(9)^{212} = (10 - 1)^{212}.$$

So, at unit place it will be 1.

Hence, the numeral at the unit position of

$$211^{870} + 146^{127} \times 3^{424} = 1 + 6 \times 7 = 7.$$

E1.26: (a)

$$\text{Given, } a \square b = ab + a + b$$

$$\text{The equation, } a \square x = a \text{ or } ax + a + x = a$$

$$\text{or } (a + 1)x = 0 \Rightarrow x = 0$$

E1.27: (b)

$$\text{Let } \log P = \frac{1}{2} \log Q = \frac{1}{3} \log R = k$$

$$P = 10^k, Q = 10^{2k} \text{ and } R = 10^{3k}$$

$$\frac{Q}{P} = \frac{10^{2k}}{10^k} = 10^k \quad \dots (i)$$

$$\text{and } \frac{R}{Q} = \frac{10^{3k}}{10^{2k}} = 10^k \quad \dots (ii)$$

\therefore From equation (i) and (ii),

$$Q^2 = PR$$

E1.28: (c)

$$\text{Given, } (9 \text{ inches})^{1/2} = (0.25 \text{ yards})^{1/2}$$

By squaring both the sides of above equation

$$9 \text{ inches} = 0.25 \text{ yards}$$

E1.29: (c)

From the given data :

$$(66 \square 6) = \frac{66 - 6}{66 + 6} = \frac{60}{72}$$

$$\text{and } (66 \diamond 6) = \frac{66 + 6}{66 - 6} = \frac{72}{60}$$

$$\text{then, } (66 \square 6) \rightarrow (66 \diamond 6) = \frac{60}{72} \times \frac{72}{60} = 1$$

E1.30: (c)

$$(7526)_8 - (Y)_8 = (4364)_8$$

$$\text{or } (Y)_8 = (7526 - 4364)_8 = (3142)_8$$

E1.31: (c)

The given addition is an octal addition as,

$$137 + 276 = 435$$

$$7 + 6 = 8 + 5$$

$$3 + 7 = 8 + 2$$

$$1 + 2 = 0 + 3$$

$$\therefore (731)_8 + (672)_8 = (1623)_8$$

E1.32: (d)

Let the number, say N, is x greater than 75 and it is x less than 117 then,

$$N = 75 + x = 117 - x$$

$$\Rightarrow 2x = 117 - 75 = 42$$

$$\Rightarrow x = 21$$

$$\therefore N = 75 + 21 = 96$$

E1.33: (b)

In the given options, for negative value of x, all are positive except $\frac{1}{x}$ which will be negative.

Hence, $\frac{1}{x}$ is smallest among all options for $x = -0.5$.

ENGINEERING APTITUDE

(QUANTITATIVE APTITUDE & ANALYTICAL ABILITY)



Revised and Updated

**AS PER ENGINEERING
SERVICE EXAM NEW PATTERN**
1270+ Objective Questions