



GATE-2019
Full Length Test
Civil Engineering

Name:

Test ID: **CE-FLT- 2019**

Duration: 3 hours

Maximum marks : 100

Please read the following instructions carefully

General Instructions

1. Total duration of examination is 180 minutes (3 hours).
2. The clock will be set at the server. The countdown timer in the top right corner of screen will display the remaining time available for you to complete the examination. When the timer reaches zero, the examination will end by itself. You will not be required to end or submit your examination.
3. The Question Palette displayed on the right side of screen will show the status of each question using one of the following:
 - a. You have not visited the question yet.
 - b. You have not answered the question.
 - c. You have answered the question.
 - d. You have NOT answered the question, but have marked the question for review.
 - e. You have answered the question, but marked it for review.

The **Marked for Review** status for a question simply indicates that you would like to look at that question again. If a question is answered and **Marked for Review**, your answer for that question will be considered in the evaluation.

Navigating to a Question

4. To answer a question, do the following:
 - a. Click on the question number in the Question Palette to go to that question directly.
 - b. Select an answer for a multiple choice type question by clicking on the bubble placed before the 4 choices namely A, B, C, D. Use the virtual numeric keypad to enter a number as answer for a numerical type question.
 - c. Click on **Save and Next** to save your answer for the current question and then go to the next question.
 - d. Click on **Mark for Review and Next** to save your answer for the current question, and also mark it for review, and then go to the next question.
 - e. **Caution:** Note that your answer for the current question will not be saved, if you navigate to another question directly by clicking on its question number without saving the answer to the previous questions.
 - f. You can view all the questions by clicking on the **Question Paper** button. This feature is provided, so that if you want you can just see the entire question paper at a glance.

Answering a Question

5. Procedure for answering a multiple choice (MCQ) type question:
 - a. To select your answer, click on the bubble button of one of the options
 - b. To deselect your chosen answer, click on the bubble button of the chosen option again or click on the clear response button
 - c. To change your chosen answer, click on the bubble button of another option
 - d. To save your answer, you **MUST** click on the **Save and Next button**.
 - e. To mark the question for review, click on the **Mark for Review and Next** button. If an answer is selected for a question that is Marked for Review, that answer will be considered in the evaluation.

6. Procedure for answering a numerical answer type question:

- a. To enter a number as your answer, use the virtual numerical keypad
 - b. A fraction (eg. -0.3 or $-.3$) can be entered as an answer with or without '0' before the decimal point. As many as four decimal points, e.g. 12.5435 or 0.003 or -932.6711 or 12.82 can be entered.
 - c. To clear your answer, click on the Clear Response button
 - d. To save your answer, you MUST click on the **Save and Next** button
 - e. To mark a question for review, click on the **Mark for Review and Next** button. If an answer is selected (for MCQ) or entered (for numerical answer type) for a question that is Marked for Review, that answer will be considered in the evaluation.
7. To change your answer to a question that has already been answered, first select that question for answering and then follow the procedure for answering that type of question.
8. Note that ONLY Questions for which answers are saved or marked for review after answering will be considered for evaluation.

Paper Specific Instructions:

9. There are a total of 65 questions carrying 100 marks. Questions are of multiple choice type or numerical answer type. A multiple choice type question will have four choices for the answer with only one correct choice. For numerical answer type questions, the answer is a number and no choices will be given. A number as the answer should be entered using the virtual keyboard on the monitor.
10. Questions Q.1 – Q.25 carry 1mark each. Questions Q.26 – Q.55 carry 2marks each.
11. Questions Q.56 – Q.65 belong to General Aptitude (GA) section and carry a total of 15 marks. Questions Q.56 – Q.60 carry 1mark each, and questions Q.61 – Q.65 carry 2marks each.
12. Questions not attempted will result in zero mark. Wrong answers for multiple choice type questions will result in NEGATIVE marks. For all 1 mark questions, $\frac{1}{3}$ mark will be deducted for each wrong answer. For all 2 marks questions, $\frac{2}{3}$ mark will be deducted for each wrong answer. There is no negative marking for questions of numerical answer type.
13. Physical calculator is NOT allowed. All candidates will be provided with an online scientific calculator which has to be used to answer the questions.

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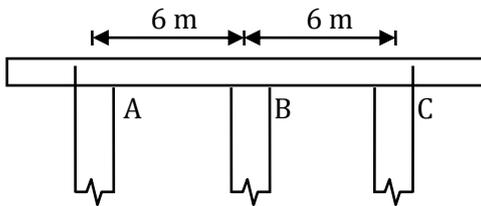
Full Length Test Civil Engineering

Q.1 - Q.25 Carry One Mark each.

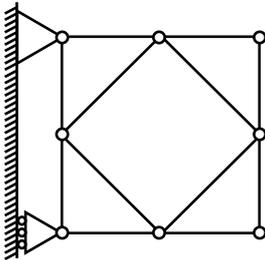
- Green's theorem is used to convert
 - Line integral to surface integral
 - Surface integral to volume integral
 - Line integral to volume integral
 - None of these
- Let P, Q, R, S be $m \times m$ matrices each with non-zero determinant
If PQRS = I, then R^{-1} is
 - SPQ
 - $Q^{-1}P^{-1}S^{-1}$
 - PQS
 - $S^{-1}P^{-1}Q^{-1}$
- Find the 2nd approximation using Newton-Raphson method to the root $\sqrt{18}$ if $x_0 = 4$
 - 4.25
 - 4.243
 - 4.23
 - 4.526
- The particular solution for a given differential equation $(D^2 + 5D + 6)y = \sin 2x$ is
 - $\frac{5\sin 2x - \cos 2x}{104}$
 - $\frac{5\cos 2x - \sin 2x}{104}$
 - $\frac{10\sin 2x - 2\cos 2x}{-104}$
 - $\frac{10\cos 2x - 2\sin 2x}{-104}$
- Consider the function $y = x^2 - 6x + 9$. The maximum value of y obtained when x varies over the interval 2 to 5 will be at _____
- Loss of pre - stress due to shrinkage of concrete is product of
 - Modular ratio and % of steel
 - Modulus of elasticity of concrete and shrinkage of concrete
 - Modulus of elasticity of steel and shrinkage of concrete
 - Modular ratio and modulus of elasticity of steel
- Workability of concrete can be measured by
 - Rebound hammer test
 - Vicat's apparatus
 - Vee-bee test
 - Le- Chatelier test
- The state of plane stress at a point is given as σ_x, σ_y where $\sigma_x = 2\sigma_y$ and $\tau_{xy} = 100\text{MPa}$. The Radius of the Mohr's circle representing the given state of stress in MPa is 110. The magnitude of σ_x is _____ MPa [upto 1 decimal]
- A steel wire of 15mm diameter is bent into circular shape of 10m radius. If the modulus of elasticity of steel is $2.1 \times 10^5 \text{ N/m}^2$, the maximum stress induced in the wire is _____ N/m^2 .

10. The loads on the floor beam of a building area as below
 Dead load = 5 kN/m^2
 Live load = 3 kN/m^2
 Roof load = 1 kN/m^2
 The design load for limit state of serviceability as per IS 456:2000 is _____ kN/m^2 .

11. As per IS 456:2000, the minimum effective depth required for slab portion AB to satisfy deflection criteria is _____ [Assuming modification factor to be unity]



12. The degree of Static and Kinematic Indeterminacy of the structure shown below are:



- (A) 1 and 13
 (B) -1 and 13
 (C) 3 and 1
 (D) 1 and 1
13. Consider the following statements:
 1. A conspicuous break in continuity of grain size distribution curve indicates mixture of soil from two different layers
 2. A steep grain size distribution curve indicates prevalence of nearly uniform grain size
 3. A flat size distribution curve indicates certain range of missing grain size
 4. The correct statements are
 (A) 1, 2 and 3
 (B) 1 and 2 only
 (C) 2 and 3 only
 (D) 1 and 3 only
14. Which of the following test is used to determine strength of undisturbed sample of clay for studying immediate effect of construction on strata?
 (A) Consolidated Undrained Test (CU)
 (B) Unconsolidated Undrained Test (UU)
 (C) Consolidated Drained Test (CD)
 (D) Both (B) and (C)

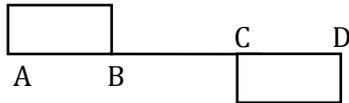
15. Consider the following statements and select the correct statements using given codes:
1. Placement water content is always greater than optimum water content
 2. Cohesive sub-grade under pavements are compacted wet of optimum
 3. Highway embankments on cohesive soil are compacted dry of optimum
 4. Impermeable core of earth dams are compacted dry of optimum
- The correct statements are
- (A) 1 and 4 only (C) 1, 2 and 3 only
(B) 1,2 and 4 only (D) 2 and 3 only
16. Vibro-expanded piles are used where
- (A) Desired driving resistance is not obtained at reasonable depth due to low bearing capacity of soil
(B) End bearing of pile is low as compared to skin friction
(C) When ground is soft and offers less frictional resistance to concrete
(D) Both (A) and (C)
17. While analyzing a control volume problem the governing laws are
- (A) Conservation of Mass (C) Conservation of Energy and Mass
(B) Conservation of Momentum (D) Both B and C
18. What is the work done in blowing a soap bubble of diameter 15 cm, where the surface tension of soap solution is 0.05 N/m?
- (A) 0.768×10^{-4} Nm (C) 70.68×10^{-4} Nm
(B) 7.068×10^{-4} Nm (D) 706.8×10^{-4} Nm
19. In recent, flash flood of 'Uttarakhand' the precipitation for month of June were recorded as 75 mm above normal.
Here, the term normal means
- (A) Rainfall in same month previous year
(B) Rainfall statistically expected from analysis of previous data
(C) Average rainfall computed from past 12 months record
(D) Average monthly rainfall for September computed from 30 years of record
20. A Salt concentration of 3000 ppm in sample of water is equivalent to the electrical conductivity (EC) in millimho/cm of value
- (A) 4.69 (C) 5.34
(B) 5.12 (D) 6.23
21. Which of the following unit work in anaerobic conditions?
- (A) Sludge digestion tank (C) Activated sludge treatment
(B) Sedimentation tank (D) Trickling filters

22. Following data pertain to sewage sample :
Initial D.O = 12 mg/l
Final D.O = 4 mg/l
Dilution to 2 %
The B.O.D of given sample is _____mg/l
23. With increase in % of bitumen in Marshall Test, the variation of stability with % bitumen is
(A) Monotonically increasing (C) First increases, then decreases
(B) Monotonically decreasing (D) First decrease, then increases
24. Los angles abrasion test is used to ascertain which of the following property of aggregate ?
(A) Toughness (C) Strength
(B) Hardness (D) Durability
25. In an instrument, the bubble tube with division of 1 mm and a radius of 0.8 m has the sensitivity of: _____ [upto 5 decimals]

Q.26 - Q.55 Carry Two Mark each.

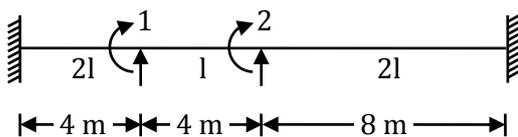
26. The number of solution of the equation $a^{f(x)} + g(x) = 0$ Where $a > 0, g(x) \neq 0$ has minimum value $\frac{1}{2}$, is
(A) Infinitely many (C) Two
(B) Only One (D) Zero
27. The stopping sight distance on a highway at a descending gradient of 3% for a design speed of 80 kmph is _____m. [Assume $g = 9.81 \text{ m/s}^2, t = 2.5 \text{ sec}, f = 0.35$]
(A) 154.5 (C) 122.00
(B) 134.5 (D) 145.5
28. 'x' is the matrix $x = \begin{bmatrix} b^2 & 1 \\ (b^2 + b - 1) & (1 - b) \end{bmatrix}$ and $x^2 - x + I = 0$
I: Identity matrix
0: Zero matrix
Then, which of the following denotes the inverse of x?
(A) $\begin{bmatrix} -b & (b^2 - 1) \\ (b - 1) & 1 \end{bmatrix}$ (C) $\begin{bmatrix} (b - 1) & b^2 \\ b^2 & (-b^2 + b - 1) \end{bmatrix}$
(B) $\begin{bmatrix} (1 - b) & (b^2 - 1) \\ b^2 & b \end{bmatrix}$ (D) $\begin{bmatrix} (1 - b^2) & -1 \\ (1 - b - b^2) & b \end{bmatrix}$
29. Due to rise in temperature, the viscosity and unit weight of percolating fluid are reduced to 75% and 97% respectively other things being constant, percentage change in coefficient of permeability is _____ %.

30. The given figure shows the shear force diagram for the beam ABCD. Bending moment in the portion BC of the beam



- (A) is a non-zero constant
(B) is zero
(C) varies linearly from B to C
(D) Varies parabolically from B to C.

31. Displacement coordinates for a beam are shown in the given figure. The stiffness matrix is given by

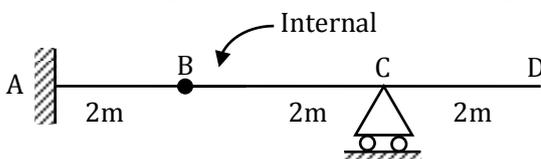


- (A) $\begin{bmatrix} 3EI & EI \\ EI & 2EI \end{bmatrix}$
(B) $\begin{bmatrix} 3EI & -0.5EI \\ -0.5EI & 2EI \end{bmatrix}$
(C) $\begin{bmatrix} 3EI & 0 \\ 0 & 2EI \end{bmatrix}$
(D) $\begin{bmatrix} 3EI & 0.5EI \\ 0.5EI & 2EI \end{bmatrix}$

32. A freely supported beam of span L carries a central load W. The sectional area of beam is so designed that the moment of inertia of the section increased uniformly from I at the ends to 1.5 I at center. Central deflection will be

- (A) $\frac{WL^3}{EI}$
(B) $0.15 \frac{WL^3}{EI}$
(C) $0.015 \frac{WL^3}{EI}$
(D) $\left(1 + \frac{1}{L}\right) \frac{WL^3}{EI}$

33. Two point loads of 20kN and 10kN spaced at 1m (with 20 kN leading and 10 kN trailing) roll on a compound beam from left to right as shown below

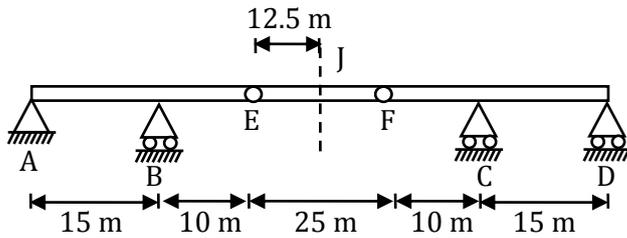


The maximum design moment at 'A' in kN-m is _____

34. A cantilever beam of length L, width b & depth d is loaded with a concentrated vertical load P at the free end. If the plastic Moment capacity of beam is PL, the collapse load for formation of plastic hinge will be

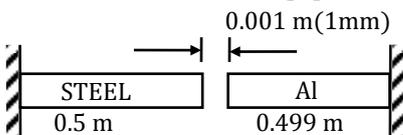
- (A) 2P
(B) 1.5 P
(C) 1.2 P
(D) P

35. Consider the beam shown in figure having internal hinge E and F



The maximum value of Bending moment at point J because of udl of 30kN/m that can be applied anywhere and cover any portion of span is _____ kN-m. [Correct upto 2 place of decimal]

36. Two axial bars have a gap of 1 mm at room temperature.



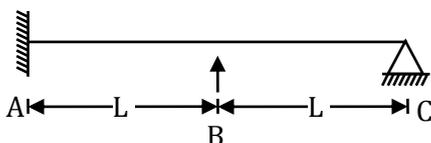
Co-efficient of thermal expansion of steel and Al is 12×10^{-6} m/mk and 24×10^{-6} m/mk. We heat the system uniformly. Assume that parts expand horizontally. If parts just touch each other without any stress, _____ degree is the temperature rise to the nearest integer.

37. A soil sample has diameter of 38 mm and height of 76 mm. The wet weight is 1.15 N. Upon drying its weight is reduced to 0.5 N, G_s is 2.7. The degree of saturation of soil sample is
 (A) 96% (C) 99%
 (B) 98% (D) 93%

38. A long natural slope in $c - \phi$ soil is inclined at 12° to horizontal. The water table is at surface and seepage is parallel to slope. If a slip plane has depth of 5m, the factor of safety against slip is _____ [Take $c = 8$ kN/m², $\phi = 22^\circ$, $\gamma_{sat} = 19$ kN/m³, $\gamma_{water} = 10$ kN/m³]

39. Efficiency of a uniform pattern pile group with total number of pile is 25, with pile having diameter 45 mm and c/c spacing as 1.5 m using converse labarre formula is
 (A) 86% (C) 93%
 (B) 97% (D) 84%

40. A two span continuous beam ABC is fixed at A and hinged at C. $AB = BC = L$. The beam has a constant flexural rigidity EI. Find the moment required to be applied at B to cause unit rotation at B.



- (A) $\frac{3EI}{L}$ (C) $\frac{5EI}{L}$
 (B) $\frac{4EI}{L}$ (D) $\frac{7EI}{L}$

41. Determine the field capacity of soil using following data:

Depth of root zone = 2.0 m

Existing moisture = 8%

Density of soil = 1450 kg/m^3

Quantity of water applied = 600 m^3

Water lost = 10 %

Area irrigated = 1000 m^2

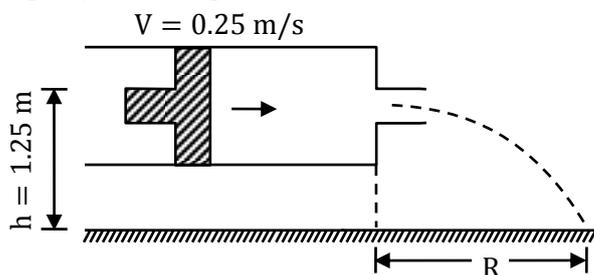
(A) 14.4 %

(C) 32.3 %

(B) 27.0 %

(D) 17.3 %

42. A syringe of diameter $D = 8 \text{ mm}$ and having a nozzle of diameter $d = 2 \text{ mm}$ is placed horizontally at a height of 1.25 m as shown in figure. An incompressible and non-viscous liquid is filled in syringe and the piston is moved at a speed of 0.25 m/s. The range R of the liquid jet on the ground is _____ m



43. A deep reservoir had the following average values of climate parameters during a week

(i) Saturation vapour pressure = 16.42 mm Hg

(ii) Relative humidity = 40%

(iii) Wind velocity at 1.0 m above ground = 15 kmph

An ISI standard pan at the site indicated an evaporation of 77 mm in a week, the percentage difference of Meyer's method relative to the pan evaporation measurements is _____. [Take $k_m = 0.36$, $C_p = 0.7$] (upto 1 decimal)

44. Consider these two statements:

(i) Duty is an expression of the irrigating capacity of a unit volume of water.

(ii) Duty at the head of a distributary will be less than that at the head of a water course and more than that at the head of a canal.

Which of the statement/s is/are correct?

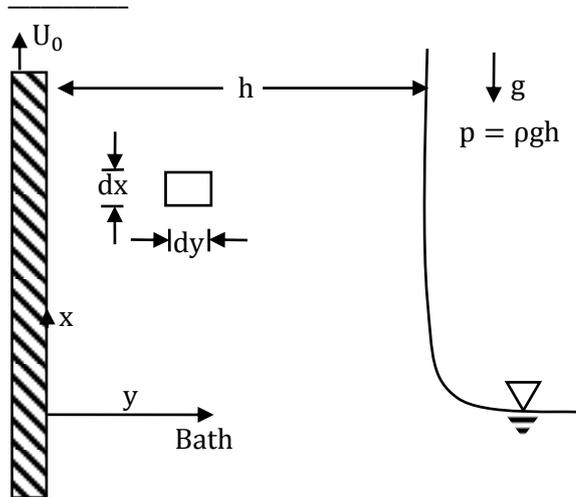
(A) Only i

(C) Both i and ii

(B) Only ii

(D) None of these

45. A continuous belt is shown in figure passing upward through a chemical bath at velocity U_0 picks up a liquid film of thickness h , density ρ and velocity μ . Gravity tends to make the liquid drain down, but the movement of the belt keeps the fluid from running off completely. Assume that the flow is fully developed and that the atmosphere produces no shear at the outer surface of the film. Stated clearly that the boundary conditions to be satisfied by velocity at $y = 0$ and $y = h$. Obtain an expression for the velocity profile is



- (A) $u = \frac{\rho g}{\mu} \left(\frac{y^2}{4} - hy \right) U_0$
- (B) $u = \frac{\rho g}{\mu} \left(\frac{y^2}{2} - hy \right) U_0$
- (C) $u = \frac{\rho g}{\mu} \left(y^2 - \frac{hy}{4} \right) U_0$
- (D) $u = \frac{\rho g}{\mu} \left(y^2 + \frac{hy}{4} \right) U_0$

46. In a continuous flow settling tank 3.5 m deep and 75 m long , if flow velocity of water is 1.22 cm/s, what size of particles of specific gravity 2.65 shall be removed effectively at temperature of 25°C .[Assume kinematic viscosity of water as 0.01 cm²/s] _____ [in mm upto 3 decimal]

47. Consider the following variation temperature with elevation on a day when air near earth surface is fully saturated with water vapour

Elevation (m)	Temperature (°C)
30m	25°C
1030m	5°C
2030m	-15°C

The type of plume exhibited by flair stack of height 2030m in that region is (assume adiabatic lapse rate as 6°C/km)

- (A) Neutral plume
- (B) Looping plume
- (C) Lofting plume
- (D) Fumigating plume

48. Present population of town is 2,00,000 with average water consumption of 30,000 m³/day. The water treatment system has design capacity of 38,000 m³/ day. It is expected that in next 20 years, population will increase by 50%. Number of years when system will reach its design capacity, assuming arithmetic rate of population growth is
(A) 5.5 years (C) 14.32 years
(B) 8.6 years (D) 10.67 years
49. For a 4% dilution of waste water, D.O. of aerated water used for dilution is 3mg/L and D.O. of diluted sample after 5 days incubation is 0.8mg/L. Initial dissolved oxygen of undiluted sewage sample was 0.6 mg/L. The B.O.D₅ of sample is _____ [in mg/L upto 1 decimal]
50. The theoretical capacity of a traffic lane in vehicle/hour/lane with one way traffic flow at a stream speed of 50 kmph, assuming the average space gap between the vehicles to follow the relation $S_g = 0.278 Vt$ ['t' is average reaction time = 0.75 secs] and average length of vehicle as 6.1 m is _____
(A) 3206 (C) 3620
(B) 3026 (D) 3062
51. If a descending gradient of 1 in 25 meets an ascending gradient of 1 in 40, then the length of valley curve required for a headlight sight distance of 100 m will be
(A) 30 m (C) 310 m
(B) 130 m (D) 630 m
52. The value of resultant retardation in m/s² when longitudinal friction of is 0.22 is allowed for stopping the vehicle on road?
(A) 0.98 ms⁻² (C) 2.15 ms⁻²
(B) 1.95 ms⁻² (D) 3.93 ms⁻²
53. If length of road taken for conducting moving observer experiment is 0.4 Km, time taken by observer to move with traffic is 5 second, number of vehicles moving with test vehicles moving in same direction is 10, flow is 10 vehicle / sec , find the mean speed of traffic stream?
(A) 50 ms⁻¹ (C) 36 ms⁻¹
(B) 100 ms⁻¹ (D) 15 ms⁻¹
54. A traverse is done by three station A, B and C in clockwise order in the form of an equilateral triangle. If bearing of AB is 80°30'. Then bearing of CA is _____ [in degrees upto 1 decimal]

55. Consider the following statements:
1. Rigid pavement transfer load to layers beneath primarily by slab action
 2. Flexible pavements transfer wheel load stresses to lower layers by grain to grain transfer through points of contact in grains
 3. Under identical conditions, flexible pavements offer better traction to a vehicle as compared to rigid pavement.

The correct statements are:

- (A) 2 and 3 only (C) 1, 2, and 3
(B) 1 and 2 only (D) 1 and 3 only

General Aptitude One Marks Question Q. 56 to Q. 60

56. Three bells chime at an interval of 18, 24 and 32 minutes respectively. At a certain time they begin to chime together. What length of time will elapse before they chime together again?

- (A) 2 hours 24 minutes (C) 1 hour 36 minutes
(B) 1 hour 12 minutes (D) 4 hours 48 minutes

57. In a one day cricket match, the total runs made by a team were 200. Out of these 160 runs were made by spinners.

Conclusion I: 80% of the team consists of spinners.

Conclusion II: The opening batsmen were spinners.

- (A) Only conclusion I follows (C) Either I or II follows
(B) Only conclusion II follows (D) Neither I nor II follows

58. In a car race of 12km, a participant covers a distance of the first 3 km in 6 minutes. He then increases his speed and covers twice the distance already covered in 6 minutes. He covers the rest of the distance in 12 minutes. Find his average speed.

- (A) 9.23m/s (C) 6.20m/s
(B) 7.44m/s (D) 8.33m/s

Directions for Q. No. 59: Choose the option which is FARTHEST to the word mentioned in Question

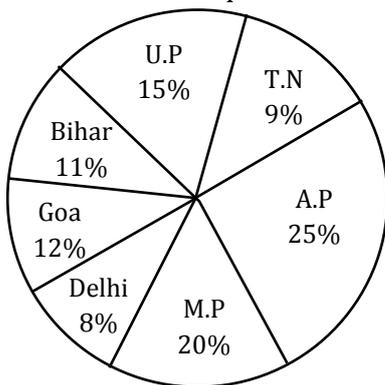
59. **MOROSE**

- (A) Exuberant (C) Mortified
(B) Moron (D) Crestfallen

60. A team of five is to be selected from amongst five boys A, B, C, D and E and four girls P, Q, R and S. Some criteria for selection are as follows
C and P have to be together, Q cannot go with R. E cannot go with S. B and D have to be together. Q cannot go with A. Unless stated otherwise, these criteria apply to all the following questions.
If two of the members have to be boys, the team will consist of
(A) CEPQS (C) ACPRS
(B) AEPQS (D) BDPRS

General Aptitude Two Marks Question Q. 61 to Q. 65

Direction for Q. No 61: Data of different states regarding population of states in the year 1998 is shown in pie chart study the graph and answer the question that follows.



Total population of given states = 32,76,000

Following table shows that sex & literacy wise population ratio

States	Sex		Literacy	
	Male	Female	Literate	Illiterate
Andhra Pradesh	5	3	2	7
Madhya Pradesh	3	1	1	4
Delhi	2	3	2	1
Goa	3	5	3	2
Bihar	3	4	4	1
Uttar Pradesh	3	2	7	2
Tamil Nadu	3	4	9	4

61. What will be the total percentage of total number of males in U.P, M.P & Goa together to the total population of all given states ?
(A) 28.5% (C) 23%
(B) 18.5% (D) 32%
62. A cube is coloured red on one of the face, green on the opposite face, yellow on another face and blue on a face adjacent to the yellow face. The other two faces are left uncolored. It is then cut into 125 smaller cubes of equal size. How many cubes uncolored on the all the faces?
(A) 27 (C) 48
(B) 36 (D) 64

63. NOVICE: SEASONED
- | | |
|------------------------|---------------------------|
| (A) Opulent: Grand | (C) Affluent: Impecunious |
| (B) Nefarious : Wicked | (D) Filthy: Disgusting |

Direction for Q. No 64: Consider the information in the statements to be true. On the basis read the following questions and mark:

64. The Minister said that the teachers are still not familiarised with the need, importance and meaning of population education in the higher education system. They are not even clearly aware about their role and responsibilities in the population education programme.
- I. Population education programme should be included in the college curriculum.
II. Orientation programme should be conducted for teachers on population education
- | | |
|------------------------|---------------------------------|
| (A) If only I follows | (C) If neither I nor II follows |
| (B) If only II follows | (D) If both I and II follow |
65. The question is followed by two statements I and II. Mark the answer.
What is the value of the ratio $(a + c) : c$?
- I. The ratio of $a : b = 1 : 5$.
II. The ratio of $b : c = 3 : 2$.
- (A) If the question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.
(B) If the question can be answered by using either statement alone.
(C) If the question can be answered by using both statements together, but cannot be answered using either statement alone.
(D) If the question cannot be answered even by using both statements together