RESEARCH METHODOLOGY FOR ENGINEERING

1. A pot is fully filled (upto brims) with water. A cube of ice floating in it is partially submerged and partially seen above the water level. As the ice cube fully melts, what will happen to the level of water ?

(A) The water spills over

(B) The water level decreases

(C) The water level remains the same

(D) The water level increases

2. Suppose a 2-dimensional graph is to be plotted, with '*s*' as independent variable, '*p*' as dependent variable and also showing the impact of a 3rd variable, '*q*', on the '*p*' variable, then :

(A) independent variable, '*s*', is plotted along the *x*-axis; dependent variable, '*p*', is plotted along *y*-axis holding '*q*' constant, then other plots of '*s*' *vs.* '*p*' are done, each for a different value of '*q*' held constant.

(B) '*p*' is plotted along *x*-axis; '*s*' is plotted along *y*-axis holding '*q*' constant, then other plots of '*s*' *vs.* '*p*' are done, each for a different value of '*q*' held constant.

(C) '*s*' is plotted along *x*-axis; '*q*' is plotted along *y*-axis holding '*p*' constant, then other plots of '*q*' *vs.* '*s*' are done, each for a different value of '*p*' held constant.

(D) '*p*' is plotted along the *x*-axis; '*q*' is plotted along the *y*-axis holding '*s*' constant, then other plots of '*q*' *vs.* '*p*' are done, each for a different value of '*s*' held constant.

3. In a laboratory experiment, while plotting a graph,

(A) generally, 10 readings are taken, and a graph is plotted by connecting all the points plotted, even if it results in a zig-zag line.

(B) generally, 25 readings are taken, and a graph is plotted by connecting all the points plotted, even if it results in a zig-zag line.

(C) generally, 6 to 8 readings are taken, and a graph is plotted by connecting all the points plotted, even if it results in a zig-zag line.

(D) generally, 6 to 8 readings are taken, and a graph is plotted by drawing a smooth curve passing close to all points but may not touch all/several points.

4. The distinction between parameter and variable is :

(A) Parameter is an intrinsic property of the system and exists even if no input is applied to a system, while variable shows up only in response to applied input(s).

(B) Parameter is a fixed property of the system and exists even if no input is applied to a system, while variable is a variable quantity that shows up only in response to applied input(s).

(C) Parameter is a variable property of the system, while variable is a fixed property of the system.

(D) Parameter is a fixed property of the system and exists only if input is applied to a system, while variable is a variable property that shows up even if no input(s) is (are) applied.

5. In a class, the ratio of number of boys to girls is 5 : 3. What percentage of the students in the class are girls ?

(A) 37.5 %

(B) 50 %

(C) 60 %

(D) 62.5 %

6. If 25% of 260 equals 6.5% of P, what is P ?

(A) 65 (B) 100

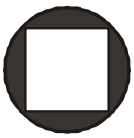
(C) 130 (D) 1000

7. How many different arrangements are there of the letters A, B, C and D ?

(A) 6 (B) 12

(C) 24 (D) 18

8. In the figure below, a square of perimeter 24 is inscribed in a circle. What is the area of shaded region ?



(A) $18\pi - 24$ (B) $18\pi - 36$

(C) $12\pi - 36$ (D) $9\pi - 36$

9. MULTAN : OUOTEN :: PURIFY: _____

(A) RUUIJY (B) OQTVQS

(C) QVSJEZ (D) None of these

10. If word PLAYER is coded as AELPRY, then word MANAGER is coded as :

(A) AEAGMNR (B) AAGEMNR

(C) AAEGMNR (D) AAEGNMR

11. In the sequence below, some letters are missing. From the choices, select the choice that gives the letters that can fill the blanks in the sequence :

a _ b _ _ _ a a _ b c _.

(A) abcabc (B) abccba

(C) abccbc (D) ababcc

12. The entropy of the universe is :

(A) decreasing

(B) increasing

(C) constant

(D) getting halved every year

13. How many 9's are there in the following sequence which are either immediately followed by 9 or immediately preceded by 9 :

793992896793579975

(A) Four (B) Two

(C) Three (D) One

14. What is the next letter in the series ?

B, D, G, K, P, __

(A) S (B) V

(C) W (D) X

15. True value of a quantity can be practically obtained by :

(A) mean of squares of a number of readings taken under no bias conditions such that positive deviations cancel out negative deviations.

(B) mean of a large number of readings taken under no bias conditions such that positive deviations cancel out negative deviations.

(C) whatever is measured by a laboratory or industrial meter.

(D) the actual value obtained after removing parallax error.

16. The sum, s, of probabilities of all outcomes of an event or a statistical experiment is :

(A) zero (B) $0 < s < 1$

(C) $0 \leq s \leq 1$ (D) 1

17. If '+' stands for '–', '–' stands for '×', '×' stands for '÷', and '÷' stands for '+', then evaluate :

$56 \times 7 \div 13 - 11 + 15 - 8 \div 2 - 7$

(A) 30 (B) 45

(C) 60 (D) 90

18. An engineer starts from home and travels 10 m towards West, then turns right and travels 40 m. He then travels 25 m East followed by 50 m towards the South to reach his factory. What is the approximate distance between his home and factory ?

(A) 18 m (B) 125 m

(C) 25 m (D) 105 m

19. A compass was damaged and its needle twisted / turned in such a manner that the pointer which was showing East, now showed North. A man went towards West as per the above mentioned compass. In which direction did he actually go ?

(A) South-West (B) South

(C) North-East (D) North

20. One evening, a person was facing a pole. The shadow of the pole fell to his right. Which direction he was facing ?

(A) East (B) West

(C) North (D) South

21. When a watch shows 3 : 45, the minute hand points towards East. When the watch shows 6 O'clock, in what direction will the hour hand point ?

(A) North (B) South

(C) East (D) West

22. A is the husband of B. E is the daughter of C. A is the father of C. How is B related to E ?

(A) Mother (B) Grandmother

(C) Aunt (D) Cousin

23. If we take the union and intersection respectively of a crisp/classical set with its compliment, what is the resultant in each case ?

(A) 1 and 0 respectively.

(B) 0 and 1 respectively.

(C) Universal set, X, and Null set, ø, respectively.

(D) Null set, ø, and Universal set, X, respectively.

24. If P, Q and R are matrices, and if PQ = PR, then it :

(A) does not imply that Q = R, except if P is non-singular.

(B) always implies that Q = R.

(C) never implies that Q = R.

(D) implies that Q and R are commutative under multiplication.

25. If P and Q are matrices, then :

(A) order of PQ is always the same as that of QP

(B) PQ = QP provided that matrices are conformable for multiplication in both cases

(C) in general, PQ may or may not be equal to QP

(D) both "A" and "B"

26. How many negative integers satisfy $|x+4|+|x-7|<13$?

(A) 2 (B) 3

(C) 4 (D) 5

27. If $x \in R$, the greatest value that $x^4 / (1 + x^8)$ attains is :

(A) 2/5 (B) 1/3

(C) 3/4 (D) 1/2

28. Researcher S's teaching experience (in years) is twice that of researcher M. But 2 years back, S's teaching experience was thrice that of M. How many years S has been teaching ?

(A) 8 years (B) 10 years

(C) 12 years (D) 16 years

29. If you add three quarters of the number of Labs I have, to three quarters of a Lab., you will get the number of Labs I have. How many labs do I have ?

(A) 3 (B) 4

(C) 6 (D) 9

30. A Ph.D. entrance test had 60 questions. A student scores 1 mark for a correct answer, –1/2 for a wrong answer and –1/4 for not attempting a question. A candidate attempted 48 questions and got a net score of 33 marks. How many questions did he attempt wrongly ?

(A) 8 (B) 12

(C) 14 (D) 10

31. Among the visitors to a Lab., the ratio of the number of Professors to B.Tech. students was the same as that of B.Tech. students to Research Scholars. Greater number of visitors were Research Scholars who were attracted by research facilities in the Lab. One day, 7 B.Tech. students visited the said Lab. How many Research Scholars visited the Lab. that day ?

(A) 44 (B) 49

(C) 52 (D) 57

32. A dealer bought an equipment at 30% discount on the list price. He then sold it at a price which is 160% of the list price, thereby making a profit of Rs. 81. What is the list price of the equipment ?

(A) 100 (B) 90

(C) 80 (D) 240

33. A researcher found that for the 1007 pages of his thesis, there were on an average 2 mistakes per page, while in the first 612 pages, there were only 434 mistakes, they seemed to increase for the latter pages. Find the average number of mistakes per page for the remaining pages :

(A) 6 (B) 4

(C) 2 (D) 3

34. After enjoying a feast at my college canteen with 12 friends, I paid Rs. 145 but my each friend paid an equal amount, say X. Later we found that the average sum paid by all of us was Rs. 5 more than what was originally paid by each of my friends. What amount did each friend pay ?

(A) Rs. 120 (B) Rs. 100

(C) Rs. 95 (D) Rs. 80

35. A tank of 60000 litres capacity has three inlet taps P, Q and R which can individually fill the tank in 20, 15 and 12 hours respectively. It has an outlet pipe S which can supply water to 100 houses. If all the pipes are opened simultaneously, how much water enters the tank every hour ?

(A) 8000 litres (B) 9600 litres

(C) 11400 litres (D) 12000 litres

36. In domestic installations, we get phase to ……. voltage which is about …… V while in industrial installations, we usually get phase to …… voltage which is about ……. V:

(A) neutral, 440, phase, 230 (B) neutral, 230, phase, 440

(C) neutral, 230, phase, 400 (D) phase, 230, neutral, 400

37. P, Q, R and S are motor wiremen. Working alone, wireman P can wire 1 motor in 12 hours. Q is 20% faster P. R is 50% faster than P. S is twice as fast as P. In how much time R alone can do wiring of 90 motors ?

(A) 720 hours (B) 600 hours

(C) 320 hours (D) 480 hours

38. P and Q run a closed circuit race. Besides leading just after start, P overtakes Q twice per round. What is P's speed compared to Q's ?

(A) 4 times (B) 3 times

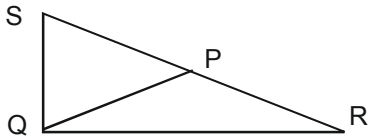
(C) 2 times (D) 5 times

39. An upstream journey of 18 km takes a motor boat 3 hours more than the same distance downstream. If the motor boat speed in still water is twice the speed of the stream, find the speed of the stream :

(A) 7.2 km/hr (B) 6 km/hr

(C) 4.5 km/hr (D) 4 km/hr

40. In the figure below, PQ = PR = PS and angle QRP = 30°. Find angle QSP.



(A) 30° (B) 40°

(C) 45° (D) 60°

41. In the table below, Types of Research are given on left hand side. A few Characteristics are given on the right hand side. Then in the further underneath Table, possible matches are given; select the best choice :

Research Types	**Characteristics**
(a) Fundamental research	(i) Finding out the extent of perceived impact of an intervention.
(b) Applied research	(ii) Developing an effective foundation through theory building.
(c) Action research	(iii) Improving an existing situation through the use of apt interventions.
(d) Evaluative research	(iv) Exploring the possibility of a theory for use in various situations.

	(a)	(b)	(c)	(d)
(A)	(i)	(ii)	(iii)	(iv)
(B)	(ii)	(iii)	(iv)	(i)
(C)	(iii)	(iv)	(i)	(ii)
(D)	(ii)	(iv)	(iii)	(i)

42. A researcher is asked, "What is the probability of finding an apple in the refrigerator ?" The researcher had no idea, neither knowledge nor prior information about an apple having been kept in the refrigerator. Yet he answers, without bias or inclination, as follows; what is his best answer ?

(A) 1.0 (B) 0.75

(C) 0.5 (D) 0

43. While writing a research paper, which one of the following statements is most *true* ?

(A) The 'Abstract' contains a gist of the entire paper but has no citation of references.

(B) The 'Abstract' contains a gist of the entire paper and has citation of references cited in the 'Abstract' part alone.

(C) The 'Future Directions' section must cite the possible offshoots which the authors perceive themselves as well as those perceived by previous researchers.

(D) The 'Materials and Methods' section, if detailed in the paper, must carry out a comprehensive analysis of results.

44. A chain has five links in it, each of which can individually carry a maximum weight of 2.3 Kg, 1.7 Kg, 5.3 Kg, 2.7 Kg and 0.7 Kg. Then which statement is most apt for this chain ?

(A) The strength of this chain is that of the strongest link in it

(B) The strength of this chain is that of the weakest link in it

(C) The strength of this chain is 12.7 Kg

(D) The strength of this chain is the average of the individual link strengths

45. What type of reasoning is used in the following statement ?

"Superiority of intellect depends on its power of concentration on one theme in the same way as a convex lens collects all the rays that strike upon it, into one point" :

(A) Psychological (B) Mathematical

(C) Deductive (D) Analogical

46. In the context of publications, which statement is *true* for SCI ?

(A) Scientific Citation Index is a citation index originally produced by the Institute for Scientific Information and created by Eugene Garfield.

(B) Super Citation Index is a citation index originally produced by the Institute for Scientist's Information and created by Bill Gates.

(C) Science Citation Index is a citation index originally produced by the Institute for Scientific Information and created by Eugene Garfield.

(D) Science Common Index is a citation index originally produced by the Institute for Scientific Information and created by Clarivate Analytics.

47. The term ICT usually refers to :

(A) An acronym that stands for Indian Classical Technologies

(B) Convergence of audio-visual and telephone networks with computer networks through a single cabling or link system

(C) Unified communications and integration of telecommunications, computers, enterprise software, middleware, audio-visual systems and storage

(D) Both "B" and "C"

48. With reference to a fixed frame of reference, your competitor moves forward with a velocity of 9.8 m/second while you too move forward a velocity of 5.2 m/sec with reference to the same frame. What is your velocity vis-à-vis that of your competitor ?

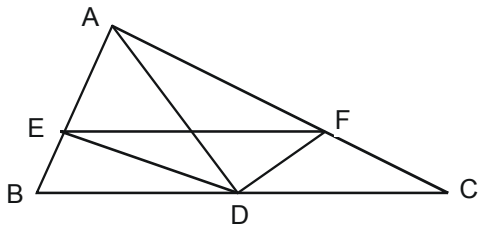
(A) 15 m/sec in forward direction

(B) 4.6 m/sec in forward direction

(C) 7.5 m/sec in forward direction

(D) 4.6 m/sec in backward direction

49. In the following figure (not drawn to scale), angle DEF = 35°. Find the other two angles of triangle DEF if DE and DF are the angle bisectors of angles ADB and ADC respectively :



(A) 30° and 120°

(B) 65° and 80°

(C) 55° and 90°

(D) 70° and 75°

50. A publisher publishes journals in two modes – Subscription mode, and Open access mode. Which choice is most correct in the context of an open access journal :

(A) It is a journal of which the subscription cost is borne by the subscriber.

(B) It is a journal of which the contents are freely accessible by anybody in the world.

(C) It is a journal of which the subscription cost per paper is borne by the respective author.

(D) "B" and "C"

51. The length of the curve $y = \frac{2}{3}x^{3/2}$ between $x = 0$ and $x = 1$ is :

(A) 0.27 (B) 0.6

(C) 1 (D) 1.22

52. A triangle ABC consists of vertex points A (0, 0); B(1,0) and C(0,1). The value of the integral $\iint 2x\,dx\,dy$ over the triangle is :

(A) 1 (B) 1/3

(C) 1/8 (D) 1/9

53. The divergence of the vector field $(x - y)i + (y - x)j + (x + y + z)k$ is :

(A) 0 (B) 1

(C) 2 (D) 3

54. If three coins are tossed simultaneously, the probability of getting at least one head is :

(A) 1/8 (B) 3/8

(C) 1/2 (D) 7/8

55. The maximum superelevation to be provided on a road curve is 1 in 15. If the rate of change of superelevation is specified as 1 in 120 and the road width is 10 m, then the minimum length of the transition curve on each end will be :

(A) 120 m (B) 100 m

(C) 80 m (D) 180 m

56. What will be the theoretical maximum capacity for a single lane of highway given that the speed of the traffic is 40 kmph ?

(A) 3000 veh/hr (B) 2860 veh/hr

(C) 2010 veh/hr (D) 2510 veh/hr

57. A ship has a metacentric height of 0.90 m and its period of rolling is 20 seconds. The relevant radius of gyration is nearly :

(A) 5.5 m (B) 7.5 m

(C) 9.5 m (D) 11.5 m

58. A square gate 1.5m × 1.5m, on one of the vertical sides of a fully filled water tank has one side on the free water surface. It is hinged on the lower horizontal side and is held in position by a force applied on the vertical central line at a depth of 0.75 m below the free surface. The right magnitude of this force is :

(A) 500 × 9.81 N

(B) 600 × 9.81 N

(C) 750 × 9.81 N

(D) 1000 × 9.81 N

59. Basic working principle of operation of a GPS device is :

(A) Trilateration (B) Triangulation

(C) Intersection (D) Resection

60. For fine adjustments of horizontal angles measured using a theodolite, the tangential (slow motion) screw is adjusted after :

(A) Both the plates are clamped

(B) The lower plate is clamped and the upper plate is unclamped

(C) The upper plate is clamped and the lower plate is unclamped

(D) Both the plates are unclamped

61. How many kg of bleaching powder is needed per day to chlorinate 4 MLD of water so that, after 40 minutes of contact, there remains residual chlorine of 0.25 mg/l ? The input water has a chlorine demand of 1.25 mg/l, and that the bleaching powder has only 25 % available chlorine :

(A) 8 kg (B) 20 kg

(C) 24 kg (D) 6.6 kg

62. A column is effectively held in position and restrained in direction at one end but is free at the other end. If the actual length is L, the effective length is :

(A) 0.67 L (B) L

(C) 1.5 L (D) 2 L

63. Gypsum is added into the raw materials during manufacture of cement so that the final product exhibits :

(A) Retarded initial setting time

(B) Improved mouldability for cornices etc.

(C) Increases compressive strength

(D) Augmented bond strength

64. If one tends to obtain the best workability of concrete, the preferred shape of aggregates is :

(A) Round (B) Angular

(C) Triangular (D) Flinty

65. The age of a log of timber can be estimated by :

(A) Diameter of pith

(B) Thickness of bark

(C) Number of annular rings

(D) Number of medullary rays

66. In the analysis of beams subjected to loads, the point with zero Bending moment can be :

1. Point of contraflexure
2. Point of Maximum Shear force
3. Point of inflection

(A) 1 only (B) 2 only

(C) 3 only (D) 1, 2 and 3

67. In a circular shaft of diameter d, subjected to a torque T, the maximum shear stress induced is :

(A) Proportional to d^3 (B) Proportional to d^4

(C) Inversely proportional to d^3 (D) Inversely proportional to d^4

68. A cement bag comprises of 0.035 m^3 by volume. How many bags will one tonne of cement will comprise ?

(A) 16 (B) 17

(C) 18 (D) 20

69. Consider the following statements which are related to the phenomenon of cavitation in fluid flow :

1. Cavitation occurs when local velocity decreases so that the local pressure increases to a higher degree
2. Cavitation occurs if elevation is high thereby decreasing ambient pressure
3. Cavitation occurs if local velocity is increased so that the local pressure decreases.
4. Cavitation is dependent on vapour pressure of the fluid.

Which of the following are correct ?

(A) 1, 2 and 3 (B) 1, 2 and 4

(C) 1, 3 and 4 (D) 2, 3 and 4

70. The absolute maximum bending moment that a simply supported girder of span 10 m experiences when two concentrated loads 20 kN and 30 kN spaced 2 m apart (30 kN as leading at the right) crosses the girder from left to right, is :

(A) 112.2 kN-m (B) 96.6 kN-m

(C) 136.8 kN-m (D) 105.8 kN-m

71. A bean of symmetrical I-section, made of structural steel has an overall depth of 300 mm. If the flange stresses developed at the top and bottom of the beam are 1200 kg/cm^2 and 300 kg/cm^2 respectively, then the depth of neutral axis from the top of the beam would be :

(A) 250 mm (B) 240 mm

(C) 200 mm (D) 180 mm

72. Which one of the following statements is *correct* ?

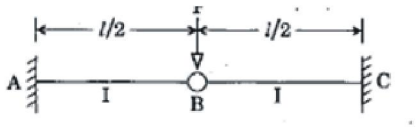
(A) Adding 5% to 6% of moisture by weight increases the volume of dry sand from 18% to 38%

(B) The bulking of fine sand is more than that of coarse sand

(C) Volume of fully saturated sand is equal to that of dry sand

(D) All of the above

73. What is the deflection at the hinge for the beam shown ?



(A) 0 (B) $Pl^3/3$ EL

(C) $Pl^3/24$ EL (D) $Pl^3/48$ EL

74. The total angle of deflection of a transition curve is :

(A) Spiral angle (B) Spiral angle/2

(C) Spiral angle/3 (D) Spiral angle/4

75. What is the most important design parameter used in designing a continuous flow rectangular sedimentation tank for removal of discrete particles ?

(A) Length of the tank

(B) Surface overflow rate

(C) Depth of the tank

(D) Temperature of the water to be treated

76. Hot bitumen is prayed over freshly constructed bituminous surface followed by spreading of 6.3 mm coarse aggregates and rolled. Which of the following is indicated by this type of construction ?

(A) Surface dressing (B) Gravel-bitumen mix

(C) Liquid seal coat (D) Seal coat

77. It is proposed to increase the discharge by 20% in circular pipe carrying oil in laminar regime. If all other factors remain unchanged, power consumption to maintain the modified flow relative to the original flow would increase by :

(A) 10% (B) 20%

(C) 44% (D) 52%

78. For a bituminous carriageway surface having 2% camber and design speed of 100 kmph, Radius beyond which superelevation is not essential is nearly :

(A) 1100 m (B) 1500 m

(C) 1800 m (D) 2200 m

79. The hydrostatic pressure below the pheratic line within an earthen dam section is :

(A) less than atmospheric pressure

(B) equal to atmospheric pressure

(C) greater than atmospheric pressure

(D) none of the above

80. Among the clay mineral, the one having maximum swelling tendency is :

(A) Kaolinite (B) Illite

(C) Montmorillonite (D) Halloysite

81. For a normally consolidated clay sample, the probable value of pore pressure parameter A at failure is likely to be :

(A) 0.85 (B) 0.35

(C) 0.0 (D) 0.20

82. The maximum permissible settlement raft footing on sandy soil for RCC structure as per IS 1904 is :

(A) 50 mm (B) 60 mm

(C) 75 mm (D) 100 mm

83. The equipment capable of digging the earth at or below its operating level is :

(A) Bulldozer (B) Scraper

(C) Dragline (D) Power shovel

84. Mass diagram are used for :

(A) Calculating mass of excavated earth

(B) Calculating mass of borrowed earth

(C) Balancing earthwork

(D) None of the above

85. Sheep-foot roller can be used for compaction of :

(A) Sandy soil (B) Clayey soil

(C) Silty soil (D) Any type of soil

86. Jumper is a tool used for :

(A) Testing of stones (B) Quarrying of stones

(C) Dressing of stones (D) None of these

87. Spalling hammer is used for :

(A) Driving wooden headed chisels

(B) Rough dressing of stones

(C) Carving of stones

(D) Breaking small projection of stones

88. Gantry girders are designed to resist :

(A) Lateral loads

(B) Longitudinal loads and vertical loads

(C) Lateral, longitudinal and vertical loads

(D) Lateral and longitudinal loads

89. Average rate of water consumption per head per day as per Indian standard is :

(A) 100 liters (B) 135 liters

(C) 165 liters (D) 200 liters

90. Sewerage system is usually designed for :

(A) 10 years (B) 25 years

(C) 50 years (D) 75 years

91. The thickness of bituminous carpet varies from :

(A) 2 to 2.5 cm (B) 5 to 7.5 cm

(C) 7.5 to 10 cm (D) 10 to 12 cm

92. The maximum number of steps in a flight should generally be restricted to :

(A) 10 (B) 12

(C) 15 (D) No limit

93. Weakest section in a fillet weld is :

(A) Throat of the fillet (B) Smaller side

(C) Side parallel to force (D) Side perpendicular

94. Effective length of a weld is equal to :

(A) Overall length – weld size

(B) Overall length – throat thickness

(C) Overall length – 2 × weld size

(D) Overall length – 2 × throat thickness

95. The time with which direct cost does not reduce with the increase in time is known as :

(A) Crash time (B) Normal time

(C) Optimistic time (D) Standard time

96. On a horizontal curve if the pavement is kept horizontal across the alignment, then the pressure on the outer wheels will be :

(A) More than the pressure on inner wheels

(B) Less than the pressure on inner wheels

(C) Equal to the pressure on inner wheels

(D) Zero

97. Loss Angeles testing machine is used to conduct :

(A) Abrasion test (B) Impact test

(C) Attrition test (D) Crushing strength test

98. The ductility value of bitumen for suitability in road construction should not be less than :

(A) 30 cm (B) 40 cm

(C) 50 cm (D) 60 cm

99. Penetration test on bitumen is used for determining its :

(A) Grade (B) Viscosity

(C) Ductility (D) Temperature susceptibility

100. The suitable surfacing material for bridge deck slabs is :

(A) Sheet asphalt (B) Bituminous carpet

(C) Mastic asphalt (D) Rolled asphalt