Booklet Serial No. : 378

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TEST BOOKLET SERIES

TEST BOOKLET

LECT (CIVIL ENGINEERING) T.E. 2016

B

Time Allowed : 2 Hours] [Maximum Marks : 100

All questions carry equal marks.

INSTRUCTIONS

1. Immediately after the commencement of the examination, you should check that test booklet does not have any unprinted or torn or missing pages or items, etc. If so, get it replaced by a complete test booklet.
2. **Encode clearly the test booklet series A, B, C or D as the case may be in the appropriate place in the answer sheet.**
3. Write your Roll Number only in the box provided alongside. Do not write anything else on the Test Booklet.
4. This Test Booklet contains **100** items (questions). Each item comprises four responses (answers). Choose only one response for each item which you consider the best.
5. After the candidate has read each item in the Test Booklet and decided which of the given responses is correct or the best, he has to mark the circle containing the letter of the selected response by blackening it completely with Black or Blue ball pen. In the following example, response "C" is so marked :

   Ⓐ Ⓑ ● Ⓓ

6. Do the encoding carefully as given in the illustrations. While encoding your particulars or marking the answers on answer sheet, you should blacken the circle corresponding to the choice in full and no part of the circle should be left unfilled. After the response has been marked in the ANSWER SHEET, no erasing/fluid is allowed.
7. You have to mark all your responses ONLY on the ANSWER SHEET separately given according to 'INSTRUCTIONS FOR CANDIDATES' already supplied to you. *Responses marked on the Test Booklet or in any paper other than the answer sheet shall not be examined.*
8. All items carry equal marks. Attempt all items. Your total marks will depend only on the number of correct responses marked by you in the Answer Sheet. There will be no negative marking.
9. Before you proceed to mark responses in the Answer Sheet fill in the particulars in the front portion of the Answer Sheet as per the instructions sent to you.
10. If a candidate give more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct.
11. After you have completed the test, hand over the Answer Sheet only, to the Invigilator.

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P.T.O.

Time Allowed : 2 Hours] [Maximum Marks : 100

1. Partial safety factors considered for concrete and steel in the limit state design methods are :

   (A) 1.5, 1.15 (B) 1.15, 1.5

   (C) 1.5, 1.5 (D) 3.0, 1.5

2. The permissible load for columns with helical reinforcement shall be ..... times the permissible load for similar member with lateral ties or rings.

   (A) 1.5 (B) 1.05

   (C) 0.7 (D) 1.25

3. The maximum diameter of reinforcing bars used in slabs shall not exceed ..... of the total thickness of the slab.

   (A) 1/8th (B) 1/10th

   (C) 1/12th (D) 1/15th

4. As per IS : 456-2000, the basic span to effective depth ratio for cantilever beam is :

   (A) 20 (B) 26

   (C) 7 (D) 35

5. As per IS : 456-2000, the beam is considered a deep beam when the effective span to overall depth ratio is less than ..... for simply supported beam.

   (A) 2.5 (B) 2.0

   (C) 3.0 (D) 4.0

6. In order to ensure the lateral stability of simply supported beams, the beam shall be so proportioned that the clear distance between the lateral restraints does not exceed ..... whichever is less.

(A) $60b$ or $\frac{250b^2}{d}$

(B) $60b$ or $\frac{100b^2}{d}$

(C) $25b$ or $\frac{250b^2}{d}$

(D) $25b$ or $\frac{250d^2}{b}$

7. In the case of concrete where mineral admixtures or blended cements are used, it is recommended to cure the concrete for the minimum period of .....

(A) 10 days

(B) 20 days

(C) 14 days

(D) 5 days

8. The moment and shear coefficients mentioned in IS : 456-2000 can be used for the analysis of continuous beams with three or more spans only if the spans do not differ by more than ..... percent with respect to the longest span.

(A) 20

(B) 15

(C) 10

(D) 30

9. Which of the following characterizes the typical failure of an over-reinforced concrete beam that has a reinforcement ratio higher than the balanced ratio ?

(A) The steel yields, and large deflections and tensile cracks will be observed prior to failure

(B) The concrete crushes and large deflections and tensile cracks will be observed prior to failure

(C) The steel yields, and the beam fails suddenly without warning

(D) The concrete crushes, and the beam fails suddenly without warning

10. What is the *correct* sequence of operations involved in concrete production ?

(A) Batching → Mixing → Handling → Transportation

(B) Mixing → Batching → Handling → Transportation

(C) Transportation → Handling → Mixing → Batching

(D) Handling → Transportation → Mixing → Batching

11. An axially laded column is of 300 mm × 300 mm size. If effective length of column is 3.0 m, what is the minimum eccentricity of the axial load for the column ?

(A) No eccentricity (B) 15 mm

(C) 20 mm (D) 25 mm

12. IS : 1343–1980 limits the minimum characteristic strength of pre-stressed concrete for post tensioned works and pretension work as :

(A) 25 MPa, 30 MPa respectively

(B) 25 MPa, 35 MPa respectively

(C) 30 MPa, 35 MPa respectively

(D) 30 MPa, 40 MPa respectively

13. In the case of bolted, riveted or welded trusses and braced frames, the effective length of the compression members shall be taken as ..... times the distance between centers of connections.

(A) 0.7 to 1.0 (B) 0.7 to 0.85

(C) 1.0 to 2.0 (D) 0.5 to 0.7

14. Lacing bars shall be inclined at an angle not less than ..... and nor more than .....to the axis of the built-up member.

(A) 70°, 40° respectively

(B) 40°, 70° respectively

(C) 45°, 45° respectively

(D) 30°, 40° respectively

15. For the compression members, the distance between the centers of two adjacent fasteners (pitch) in a line lying in the direction of stress shall not exceed ..... or ..... whichever is less. Take t as the thickness of thinner plate.

(A) 16 t, 200 mm

(B) 16 t, 450 mm

(C) 12 t, 200 mm

(D) 12 t, 450 mm

16. The size of fillet welds shall not be less than ..... and not more than ..... respectively. Take t is the thickness of the thinner plate of elements being welded.

(A) 3 mm, 1 t

(B) 7 mm, 0.5 t

(C) 10 mm, 1 t

(D) 15 mm, 0.5 t

17. For a simply supported span supporting brittle cladding in industrial building, the maximum vertical deflection as per IS : 800-2007 is restricted to .....

(A) span/150 (B) span/300

(C) span/120 (D) span/240

18. A steel section is subject to a combination of shear and bending actions. The applied shear force is V and the shear capacity of the section is Vs. For such as section, high shear force (as per IS : 800-2007) is defined as :

(A) $V > 0.6Vs$ (B) $V > 0.7Vs$

(C) $V > 0.8Vs$ (D) $V > 0.9Vs$

19. Friction factor f in laminar and turbulent flow in a pipe varies as Re^{-1} and $Re^{-0.25}$ respectively. If V is the average velocity, the pressure drop in a horizontal pipe for laminar and turbulent flow respectively will be proportional to :

(A) V and $V^{0.75}$ (B) $V^{0.5}$ and V^2

(C) $V^{0.5}$ and $V^{1.75}$ (D) V and $V^{1.75}$

20. Two pipes are identical in diameter and carry the same fluid. One of the pipes is rough and the other has a very smooth inside surface. If both the pipes have the same friction factor, when carrying the same discharge, then :

(A) the flow is rough-turbulent regime

(B) the roughness magnitudes are much smaller than the laminar sublayer

(C) the flow must be laminar

(D) the flow is in transitional regime from smooth to rough flow

21. How the shear stress variation is taking place in the case of a turbulent flow in a pipe ?

(A) Maximum at the centre and decreases linearly towards the wall

(B) Maximum at the centre and decreases logarithmically towards the wall

(C) Maximum midway between the centerline and the wall

(D) Maximum at the wall and decreases linearly to a zero value at the centre

22. An inert tracer is injected continuously from a point in an unsteady flow field. The locus of locations of all the tracer particles at an instance of time represents :

(A) streamline
(B) pathline
(C) steamtube
(D) streakline

23. A sqaure wooden (SG = 0.6) rod, 5 cm by 5 cm by 10 cm long, floats vertically in water at 20°C when 6 kg of steel (SG = 7.84) are attached to the lower end. How high above the water surface does the wooden end of the rod protrude ?

(A) 0.6 m
(B) 1.6 m
(C) 1.9 m
(D) 2.4 m

24. Consider the conservation of mass equation $\frac{\partial}{\partial t}\int_{CV} \rho dV + \int_{CS} \rho \vec{v}.d\vec{A} = 0.$ In words, this equation reads as :

(A) the rate of change of the amount of mass in the control volume is balanced by the net rate at which mass is flowing through the control surface

(B) the fixed amount of mass in the control volume is balanced by the mass that leaves or enters the control volume

(C) the mass flow into the control volume is equal to the mass flow out of the control volume

(D) the relation between energy and work

25. The Froude number at the end of the hydraulic jump in a rectangular channel is 0.25. The sequent depth ratio of this hydraulic jump is :

(A) 9.8 (B) 8.9

(C) 5.2 (D) 2.5

26. **Assertion (A) :** Total drag is reduced if the boundary layer on the surface of a cylinder separates further down-stream of the leading point.

Reason (R) : As the separation point moves further downstream, form drag is reduced and the skin drag is only marginally increased

Select the *correct* answer from the codes given below :

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is not a correct explanation of A

(C) A is true but R is false

(D) A is false but R is true

27. The lift formula is given by Lift = $\rho V_0 \Gamma$, where ρ is the density of the fluid, V_0, the free stream velocity and Γ, the circulation. Given the following conditions :

(1) two-dimensional steady flow

(2) compressible flow,

(3) incompressible flow,

(4) body of any shape

The lift formula would be valid for condition(s) :

(A) (1) and (3)

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

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

(D) (4) alone

28. If U is the main stream velocity of a fluid flow, the momentum integral equation $\left(\text{for } \frac{\partial p}{\partial x} = 0\right)$ is given by :

(A) $\frac{\tau_0}{\rho} = U_0 \frac{d\delta^*}{dx}$

(B) $\frac{\tau_0}{\rho} = U_0^2 \frac{d\theta}{dx}$

(C) $\frac{\tau_0}{\rho} = U_0 \frac{d\theta}{dx}$

(D) $\frac{\tau_0}{\rho} = \frac{1}{U_0^2} \frac{d\theta}{U_0^2 dx}$

29. In the Moody diagram, the values of friction factor, f for the turbulent flow are based on :

(A) Nikuradse's uniform sand grain data

(B) Data on non-uniform sand grains coated to a pipe

(C) Colebrook-white data on commercial pipes

(D) Hazen-William pipe flow formula

30. A sphere is moving in water with a velocity of 1.2 m/s. Another sphere of thrice the diameter is placed in a wind tunnel and tested with air which is 750 times less dense and 60 times less viscous (dynamically) than water. The velocity of air that will model dynamically similar conditions is :

(A) 5 m/s

(B) 20 m/s

(C) 10 m/s

(D) 40 m/s

31. The Hydraulic grade line is :

(A) always above the energy grade line

(B) the velocity head below the energy grade line

(C) always above the closed conduit

(D) always sloping downward in the direction of flow

32. A conventional flow duration curve is a plot between :

(A) Flow and percentage time flow is exceeded

(B) Duration of flooding and ground level elevation

(C) Duration of water supply in a city and proportion of area receiving supply exceeding this duration

(D) Flow rate and duration of time taken to empty a reservoir at that flow rate

33. The minimum value of 15 minute peak hour factor on a section of a road is :

(A) 0.10 (B) 0.20

(C) 0.25 (D) 0.33

34. Under the same conditions, which of the following shapes of water surface will give the highest rate of evaporation :

(A) flat water surface

(B) convex water surface

(C) concave water surface

(D) independent of shape of water surface

35. A 1 hour rainfall of 10 cm has return period of 50 years. The probability that 1 hour of rainfall 10 cm or more will occur in each of two successive years is :

(A) 0.04 (B) 0.2

(C) 0.02 (D) 0.0004

36. A town is required to treat 4.2 m^3/min of raw water for daily domestic supply. Flocculating particles are to be produced by chemical coagulation. A column analysis indicated that an overflow rate of 0.2 mm/sec will produce satisfactory particle removal in a settling basin at a depth of 3.5 m. The required surface area (in m^2) for settling is :

(A) 200 (B) 350

(C) 420 (D) 840

37. In a setting chamber, what is the minimum dimension of particle which can be completely removed, if rate of overflow is 30 $m^3/d/m^2$. Take specific gravity of particle G = 2.65 and viscosity $\mu = 1 \times 10^{-5}$ $Ns/m^2 \times$ .....

(A) 0.001 mm (B) 0.002 mm

(C) 0.003 mm (D) 0.004 mm

38. A sample of domestic sewage is digested with silver sulphate, sulphuric acid, potassium dichromate and mercuric sulphate in chemical oxygen demand (COD) test. The digested sample is then titrated with standard ferrous ammonium sulphate to determine the un-reacted amount of :

(A) Mercuric sulphate
(B) Potassium dichromate
(C) Silver sulphate
(D) Sulphuric acid

39. Consider the following statements regarding valves in a pipe line :

(1) In long pipe lines, air will accumulate in the low point of the line and will interface with flow

(2) Pressure relief valves are used in pipe lines where pressure may increase beyond the maximum permissible pressure

(3) Non-return valves prevent water flowing back, i.e., in the opposite direction

Which of the above statements are *correct* ?

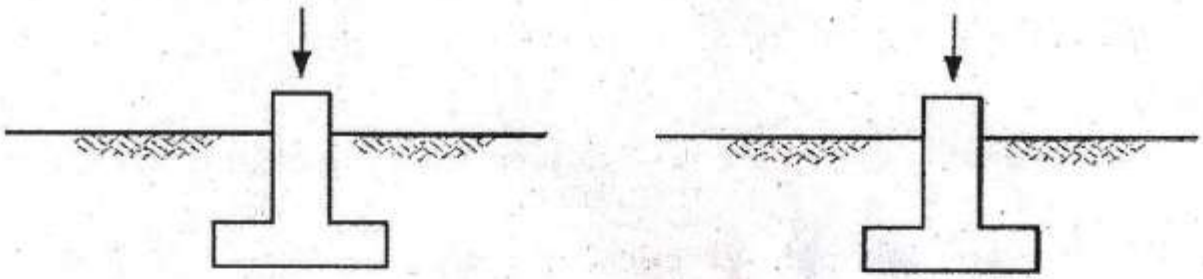
(A) (1) and (2) only
(B) (2) and (3) only
(C) (1) and (3) only
(D) (1), (2) and (3)

40. The foundation soil at the toe of a dam has a void ratio of 0.69. The specific gravity of soil grains is 2.62. For safety against piping the upward gradient must not exceed 29% of the value at which quick condition occurs. The maximum permissible upward gradient is :

(A) 0.287 (B) 0.872

(C) 1.463 (D) 0.278

41. The figure shows two identical building footings with the same load but constructed in two different soil types. Which of the following statements is most *correct* ?



Sand
Medium Dense
Case I

Lean Clay
Lightly Overconsolidated
Case II

(A) The long-term settlement for case I is less than case II

(B) The long-term settlement for case II is less than case I

(C) The long-term settlements are the same for both cases

(D) Settlement is not a concern for either case

42. The Standard Penetration Test (SPT) is widely used as a simple and economic means of obtaining which of the following :

(A) A measurement of soil compressibility expressed in terms of a compression index

(B) A direct measurement of the undrained shear strength

(C) An indirect indication of the relative density of cohesionless soils

(D) A direct measurement of the angle of internal friction

43. A sand has a minimum void ratio of 0.41 and a maximum void ratio of 0.78. Its dry unit weight is 16.5 kN/m^3. If the specific gravity of the solids is 2.65, the relative density of the sand is most nearly :

(A) 0.55

(B) 0.40

(C) 0.65

(D) 0.80

44. Which one of the following statements regarding lateral earth pressure is *correct* ?

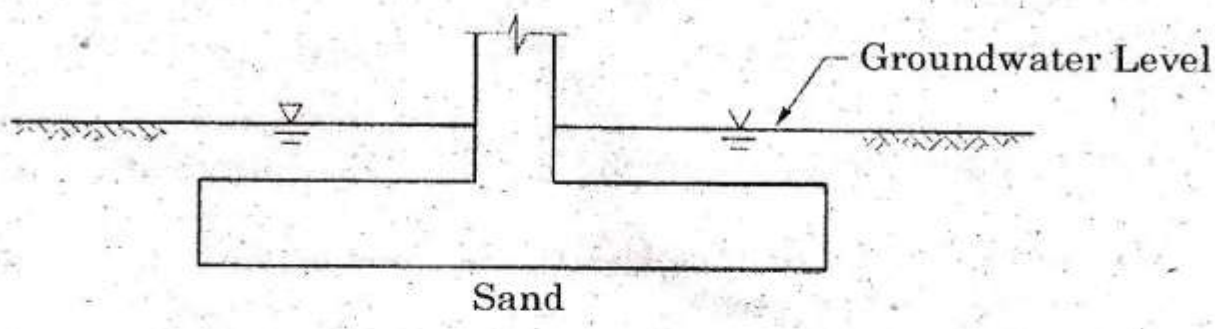
(A) The lateral strain required to fully mobilize the soil passive pressure is considerably smaller than the lateral strain required to fully mobilize the soil active pressure

(B) The lateral strain required to fully mobilize the soil passive pressure is slightly smaller than the lateral strain required to fully mobilize the soil active pressure

(C) The lateral strain required to fully mobilize the soil passive pressure is slightly greater than the lateral strain required to fully mobilize the soil active pressure

(D) The lateral strain required to fully mobilize the soil passive pressure is considerably greater than the lateral strain required to fully mobilize the soil active pressure

45. A bridge footing is to be constructed in sand. The groundwater level is at the ground surface. The ultimate bearing capacity would be based on what type of soil unit weight ?



(A) Buoyant unit weight

(B) Saturated unit weight

(C) Dry unit weight

(D) Total unit weight

46. A flow net is drawn for a weir, the total head loss is 6 m, number of potential drops is 10 and the length of flow path for the last square is 1.5 m. The exit gradient is :

(A) 0.6

(B) 0.9

(C) 0.4

(D) 1

47. The initial and final void ratios of a clay sample in a consolidation test are 1 and 0.5 respectively. If the initial thickness of the sample is 2.4 cm, then its final thickness will be :

(A) 1.3 cm (B) 1.8 cm

(C) 1.5 cm (D) 2.2 cm

48. A slope of infinite extent is made in dense sand layer at an angle of 30° to horizontal. The factor of safety of the slope against shear failure, if the angle of internal friction of sand is 36° is :

(A) 1.000 (B) 1.258

(C) 1.500 (D) 1.558

49. A continuous wall footing 1.5 m wide supports a load of 596 kN/m. The unit weight of the soil beneath the foundation is 18.6 kN/m^3. The soil has cohesion of 14 kPa and an angel of internal friction of 25° with Terzaghi bearing capacity factors, N_c = 25.1 and N_γ = 9.7. If the footing is placed very near the ground surface, the factor of safety against bearing capacity failure is most nearly :

(A) 0.8 (B) 1.22

(C) 1.82 (D) 2.82

50. Finely-divided Pozzolana reacts with lime producing :

(A) Tricalcium silicate

(B) Dicalcium silicate

(C) Calcium silicate

(D) Calcium chloride

51. Which of the following is *not* an excavation equipment ?

(A) backhoes

(B) power shovels

(C) drag line

(D) grader

52. Integrity and stability of a random-rubble masonry wall is ensured by :

(A) providing parallel bedding layers

(B) providing through stones

(C) reducing the thickness at mortar joints

(D) introducing vertical steel reinforcement

53. Half turn stairs are the stairs which change their direction through :

(A) 90° (B) 180°

(C) 270° (D) 45°

54. The following information is for a proposed horizontal curve in a new subdivision :

PI station	12 + 40.00
Degree of curve	10°
Deflection angle	12°30'

The station of the PT is most nearly equal to :

(A) 12 + 79.80 (B) 12 + 80.10

(C) 13 + 02.25 (D) 13 + 64.75

55. The most essential criteria for proper soil classification using the unified soil classification or the AASHTO soil classification system are :

(A) Water content and soil density

(B) Atterberg limits and specific gravity

(C) Grain-size distribution and water content

(D) Grain-size distribution and Atterberg limits

56. Two major roads with two lanes each are crossing in an urban area to form an uncontrolled intersection. The number of conflict points when both roads are one-way is "X" and when both roads are two-way is "Y". The ratio of X to Y is :

(A) 0.25 (B) 0.33

(C) 0.50 (D) 0.75

57. What are the standards for testing of road macadam in Aggregate Impact Test ?

(A) 14 kg wt, 38 cm drop, 15 blows

(B) 14 kg wt, 35 cm drop, 20 blows

(C) 18 kg wt, 35 cm drop, 25 blows

(D) 18 kg wt, 30 cm drop, 20 blows

58. Two bitumen sample B1 and B2 have softening points 45°C and 60°C respectively. Consider the following statements :

(1) Viscosity of B1 will be higher than that of B2 at the same temperature

(2) Penetration value of B1 will be lesser than that of B2 under standard conditions

The *correct* option evaluating the above statements is :

(A) Both (1) and (2) are true (B) (1) is false and (2) is true

(C) Both (1) and (2) are false (D) (1) is true and (2) is false

59. On a road the free speed was 65 kmph and the space headway at jam density was 6.25 m. What is the maximum flow which could be expected on this road ?

(A) 2600 vehicles per hour

(B) 1625 vehicles per hour

(C) 1300 vehicles per hour

(D) 406 vehicles per hour

60. A clayey soil has a maximum dry density of 16 kN/m^3 and optimum moisture content of 12%. A contractor during the construction of core of an earth dam obtained the dry density 15.2 kN/m^3 and water content 11%. This construction is acceptable because :

(A) The density is less than the maximum dry density and water content is on dry side of optimum

(B) The compaction density is very low and water content is less than 12%

(C) The compaction is done on the dry side of the optimum

(D) Both the dry density and water content of the compacted soil are within the desirable limits

61. According to 2011 census what is the approximate difference in the literacy percentage of males and females in HP ?

(A) 9.50 (B) 12.86

(C) 14.23 (D) 16.05

62. In which district of HP is Mamleshwar Mahadev Mandir ?

(A) Kullu (B) Kangra

(C) Mandi (D) Bilaspur

63. Under whose subjugation were the Ranas and Thakurs of Lahaul before the tenth century A.D. ?

(A) Kashmir (B) Ladakh

(C) Kangra (D) Jammu

64. When was the Jagirdar of Nurpur conferred the title of raja by the British ?

(A) 1887 (B) 1899

(C) 1909 (D) 1914

65. In which District of H.P. is Nako lake ?

(A) Shimla (B) Chamba

(C) Kullu (D) Kinnaur

66. In which month of Vikram Samvat is the festival of Shivratri celebrated ?

(A) Margshish (B) Pausha

(C) Phalguna (D) Chaitra

67. At which place in Bilaspur District of H.P. is HPMC setting up pack house and cold room for packing and grading of fruit, vegetables, flowers and culinery herbs ?

(A) Behna Jatlan (B) Kalol

(C) Ghumarwin (D) Kuthera

68. How much loan has the H.P. Government received from the World Bank to shift towards green growth and sustainable development during 2014-15 ?

(A) ten million U.S. Dollars

(B) fifty million U.S. Dollars

(C) seventy five million U.S. Dollars

(D) one hundred million Dollars

69. In which river basin is Ghanvi hydel project ?

(A) Ravi (B) Beas

(C) Satluj (D) Yamuna

70. Who was the speaker of first Himachal Pradesh Legislative Assembly (1951-52 to 1956-57) ?

(A) Desraj Mahajan (B) Rana Kultar Chand

(C) Pandit Jaiwant Ram (D) Thakur Sen Negi

71. Which schedule of Indian Constitution deals with anti-Defection Law ?

(A) 9th

(B) 10th

(C) 11th

(D) 12th

72. With which of the following is village Khatkar Kalan associated ?

(A) Madan Lal Dhingra

(B) Lala Lajpat Rai

(C) Shaheed Bhagat Singh

(D) Kartar Singh Sarabha

73. According to Indian census what is the criteria for defining a town ?

(A) minimum 500 population

(B) 75 percent male population working in other than agricultural pursuits

(C) density of population 400 per sq km

(D) all of the above

74. In which district of Maharashtra is Shani Shingnapur temple ?

(A) Amravati

(B) Ahmednagar

(C) Akola

(D) Latur

75. With which game/sport is Heena Sidhu associated ?

(A) Boxing

(B) Swimming

(C) Shooting

(D) Wrestling

76. Which country of the world is the least corrupt according to transparency international's corruption perception index 2015 ?

(A) Denmark

(B) New Zealand

(C) Sweden

(D) Finland

77. What is Zika ?

(A) title of an English novel

(B) Language spoken in Africa

(C) A deadly virus

(D) A copper coin

78. What is the symbol of Democratic Party of the USA ?

(A) Jackal

(B) Donkey

(C) Mule

(D) Fox

79. Which woman tennis player won the 2016 Australian open singles title ?

(A) Steffi Graf

(B) Serena Williams

(C) Angelique Kerber

(D) Martina Hingis

80. Which city is called forbidden city ?

(A) Moscow

(B) Lhasa

(C) Kent

(D) Jerusalem

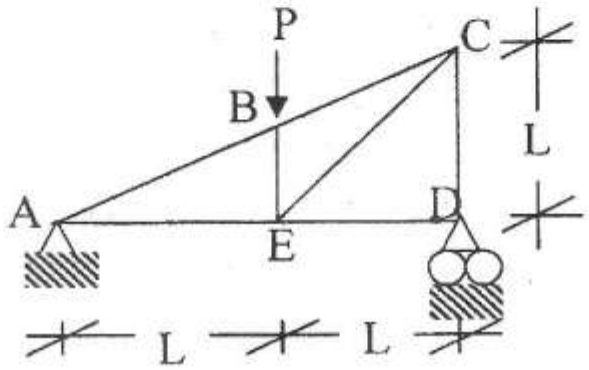
81. Shear strain γ_{yz} is given by :

(A) $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}$ (B) $\frac{\partial w}{\partial y} + \frac{\partial v}{\partial z}$

(C) $\frac{\partial u}{\partial z} + \frac{\partial w}{\partial x}$ (D) $\frac{\partial v}{\partial x} + \frac{\partial u}{\partial y}$

where u, v and w are the displacement vectors along x, y and z axes respectively.

82. The forces in the members BE, CD, ED for the truss shown in are :



(A) P, P/2, 0 (B) P/2, P, 0

(C) P, P, P (D) P/2, P/2, 0

83. The coefficient of friction does not depend on :

(1) area of interface of two mating surfaces

(2) roughness of two mating surfaces

(3) the time of contact

Out of these statements :

(A) (1), (2) and (3) are correct (B) (1) and (2) are correct

(C) (2) and (3) are correct (D) (1) and (3) are correct

84. In a simply supported beam, the shear force is uniform throughout the length of span when it is subjected to :

(A) UDL over the span

(B) a point load at mid-span

(C) a moment couple anywhere within the span

(D) two point loads kept such that these loads divide the beam in three equal parts

85. If the Mohr's circle for stresses reduces to a point, a body is subjected to :

(A) pure shear stress

(B) uniaxial stress only

(C) equal axial stresses on two mutually perpendicular planes and the planes are free of shear stresses

(D) equal and opposite axial stresses on two mutually perpendicular planes and planes are free of shear stresses

86. A simply supported rectangular beam having width '*b*' and depth '*b*' carries a central load W and undergoes deflection δ at the center. If the width and depth are interchanged, the deflection at the center of the beam would attain the value :

(A) $\frac{d}{b}\delta$ (B) $\left(\frac{d}{b}\right)^2\delta$

(C) $\left(\frac{d}{b}\right)^3\delta$ (D) $\left(\frac{d}{b}\right)^{\frac{3}{2}}\delta$

87. A hollow shaft having internal diameter of 8 mm and external diameter of 9 mm and solid shaft having diameter of 6 mm are twisted by same twisting moment M_t. The two shafts are made from same material and have equal lengths. The ratio of torsional stiffness of hollow shaft to solid shaft is :

(A) 0.95 (B) 3.80

(C) 1.90 (D) 1.00

88. A beam of rectangular cross-section of width 200 mm and depth 500 mm is subjected to a bending moment of 6 kN-m. The bending stress at a distance of 250 mm from bottom fiber is :

(A) 50 N/mm^2 (B) 100 N/mm^2

(C) 150 N/mm^2 (D) None of these

89. A plate in plane stress condition at the onset of yielding has stress components as σ_x = 80 MPa, σ_y = (–) 40 MPa and τ_{xy} = 25 MPa. Yield strength in simple tension test as per Mises criterion is :

(A) Y = 65 MPa (B) Y = 73.65 MPa

(C) Y = 81.65 MPa (D) Y = 114.3 MPa

90. The maximum shear stress on an element under plane stress is 10 MPa and the maximum principal stress is 10 MPa. The minimum principal stress is :

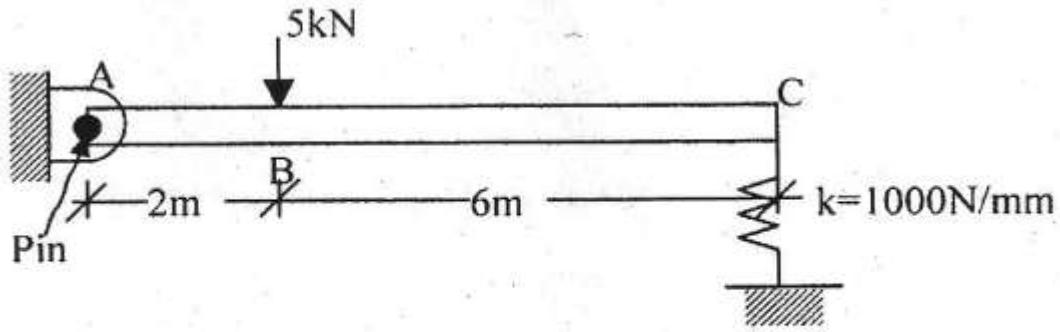
(A) 10 MPa

(B) 20 MPa

(C) –10 MPa

(D) –20 MPa

91. Rigid bar AC shown in figure is supported by spring at C and loaded at B. Deflection of point B will be :



(A) 0.3125 mm

(B) 0.4167 mm

(C) 1.25 mm

(D) 0.625 mm

92. What would be the ratio of bulk modulus to the shear modulus for an isotropic material ?

(A) $\frac{2(1+v)}{3(1-2v)}$

(B) $\frac{3(1+v)}{2(1-2v)}$

(C) $\frac{2(1+v)}{(1-2v)}$

(D) $\frac{(1+v)}{2(1-2v)}$

93. A beam of I-section, is loaded in yz-plane (with y-axis along the length), find which statement is *correct* :

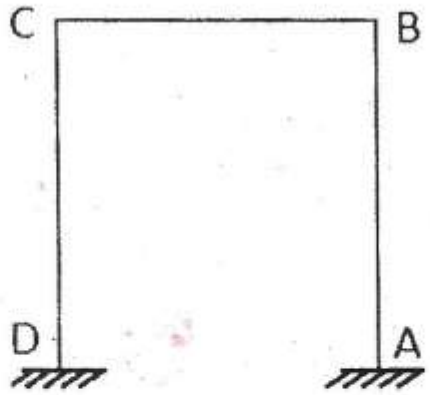
(A) variation of τ_{xz} is linear and that of τ_{xy} is parabolic

(B) variation of τ_{xy} is linear and that of τ_{yz} is parabolic

(C) variation of τ_{xz} is parabolic and that of τ_{xy} is linear

(D) variation of τ_{xy} is parabolic and that of τ_{yz} is linear

94. A portal frame ABCD is fixed at supports A and D as shown in figure. By neglecting axial deformation, determine the kinematic indeterminacy of this frame :



(A) 1

(B) 2

(C) 3

(D) 6

95. Match List I (Collapse load for a) with List II (Values) and select the *correct* answer using the codes given below in the lists if M_p is the fully plastic moment in beam (as specified below) of length L :

List I (Collapse load for a)	**List II (Values)**
(a) Fixed beam with a uniformly distributed load of intensity 'w'	(1) $\frac{4M_p}{L}$
(b) Fixed beam with a central point load	(2) $\frac{6M_p}{L}$
(c) Propped cantilever with a central point load	(3) $\frac{8M_p}{L}$
(d) Simply supported beam with a central point load	(4) $\frac{16M_p}{L^2}$

Codes :

	(a)	(b)	(c)	(d)
(A)	(1)	(2)	(4)	(3)
(B)	(2)	(1)	(3)	(4)
(C)	(4)	(3)	(2)	(1)
(D)	(1)	(2)	(3)	(4)

96. If a cantilever beam of length L is subjected to a point load P acting in the downward direction at its free end and the flexural rigidity (EI) of the beam is constant, the elastic strain energy due to bending would be :

(A) $\frac{PL}{6EI}$ (B) $\frac{P^2L^3}{6EI}$

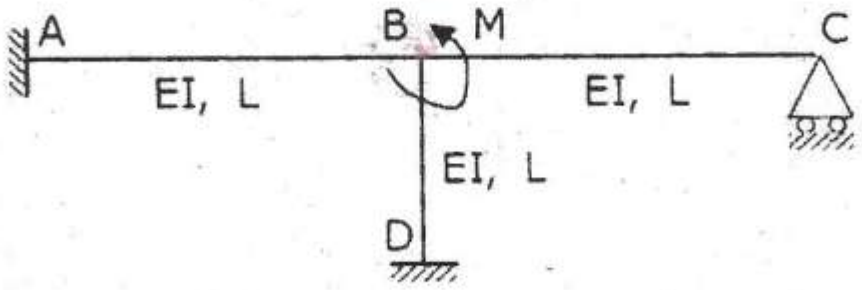
(C) $\frac{P^2L^2}{3EI}$ (D) $\frac{P^2L^3}{3EI}$

97. Two beams with equal cross-sections, made of the same materials, having the same support conditions, and each are loaded with equal uniform load per unit length. One beam is twice as long as the other. The maximum bending stress in the longer beam is larger by a factor of :

(A) 1.25 (B) 2

(C) 3 (D) 4

98. All members of the frame shown below have the same flexural rigidity EI and length L. If a moment M is applied at joint B, the rotation of the joint is :



(A) $\frac{ML}{12EI}$ (B) $\frac{ML}{11EI}$

(C) $\frac{ML}{8EI}$ (D) $\frac{ML}{7EI}$

99. Which one of the following is valid statement in the case of Plastic Analysis ?

(A) Shape factor is the ratio of plastic section modulus to the elastic section modulus

(B) Shape factor is the ratio of elastic section modulus to the plastic section modulus

(C) Shape factor is the ratio of plastic section modulus to the elastic section modulus and its value is always less than 1.0

(D) Shape factor is the ratio of plastic section modulus to the elastic section modulus and its value is always greater than 1.0

100. If the characteristic strength of concrete is 30 MPa, then the short-term static modulus of elasticity in MPa is :

(A) 27386 (B) 16431

(C) 2738 (D) 21908