

**DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO**

## TEST BOOKLET

**AE(C)MPP-PPCL/2015**

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. Write your Roll Number only in the box provided alongside.   
Do not write anything else on the Test Booklet.
3. 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.
4. 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 :  

A
B
C
D
5. 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.
6. 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.
7. 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.
8. 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.
9. After you have completed the test, hand over the Answer Sheet to the Invigilator.

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**A.E.(C)MPP-PPCL/2015**

Time Allowed : 2 Hours]

[Maximum Marks : 100

1. A weight of  $500 \pi$  Newton hangs from a cable of length of 10 m, diameter 2 cm and  $E = 200$  GPa, then the elongation of the cable is :  

(A) 0.05 cm	(B) 0.025 cm
(C) $1/\pi$	(D) 1 cm
2. The Bending Moment Diagram for a cantilever beam subjected to moment at free end of beam will be :  

(A) Triangle	(B) Rectangle
(C) Parabola	(D) Elliptical
3. What will be the torsional stiffness of a shaft of length  $L$  and shear modulus  $G$  if it is subjected to a twisting moment  $M_t$  and an angle of twist  $\phi$  ?  

(A) $\frac{M_t L}{G}$	(B) $\frac{\phi}{M_t}$
(C) $\frac{M_t}{\phi}$	(D) $\frac{M_t L}{\phi}$

4. In a plane stress case, if the principal stresses are 130 MPa and 30 MPa, then the magnitude of the maximum shear stress will be :
- (A) 40 MPa (B) 50 MPa  
(C) 60 MPa (D) 95 MPa
5. Two bars of different materials are of same size and are subjected to same tensile forces. If the bars have unit elongations in the ratio of 4 : 7, then the ratio of moduli of elasticity of these two materials is :
- (A) 16 : 49 (B) 4 : 7  
(C) 4 : 17 (D) 7 : 4
6. Which one of the following is the *correct* relationship between the maximum shear stress and average shear stress over the cross-section of a thin circular tube ?
- (A) top edge of the section  
(B) C.G. of the section  
(C) mid-point of the depth of section  
(D) bottom edge of the section

7. If the length of a cantilever beam carrying uniformly distributed load throughout the span is doubled, the deflection at the free end will become :
- (A) two times (B) four times  
(C) eight times (D) sixteen times
8. A cube having each side of length  $a$ , is constrained in all directions and is heated uniformly so that the temperature is raised to  $T^\circ\text{C}$ . If  $\alpha$  is the thermal coefficient of expansion of the cube material and  $E$  the modulus of elasticity, the stress developed in the cube would be :
- (A)  $\frac{\alpha TE}{\mu}$  (B)  $\frac{\alpha TE}{2\mu}$   
(C)  $\frac{\alpha TE}{(1 - 2\mu)}$  (D)  $\frac{\alpha TE}{(1 + 2\mu)}$
9. Which one of the following relationships is correct if one of the principal stress is zero at a point in two-dimensional stress system and the normal stress on two mutually perpendicular planes are  $\sigma_x$  and  $\sigma_y$  (both like) and the shear stress is  $\tau_{xy}$  ?
- (A)  $\tau_{xy}^2 = \sigma_x \sigma_y$  (B)  $\tau_{xy} = \sqrt[3]{\sigma_x \sigma_y}$   
(C)  $\tau_{xy}^2 = 2\sigma_x \sigma_y$  (D)  $\tau_{xy} = \frac{\sigma_x + \sigma_y}{\sigma_x - \sigma_y}$



10. Match List-I (property) with List-II (characteristics) and select the *correct* answer using the codes given below the lists :

**List I**

**List II**

(a) Fatigue

(1) Material continues to deform with time under sustained loading

(b) Creep

(2) Decreased resistance of material to repeated reversals of stress

(c) Plasticity

(3) Material has a high probability of not failing under reversals of stress of magnitude below this level

(d) Endurance limit

(4) Material continues to deform without any further increase in stress

**Codes :**

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

11. Which one of the following corresponds to the shear force at a section in the conjugate beam ?
- (A) slope at that section in the real beam
  - (B) slope multiplied by  $EI$  at that section in real beam
  - (C) deflection multiplied by  $EI$  at that section in real beam
  - (D) shear force multiplied by  $EI$  at that section in the real beam
12. What is the stiffness factor at the near end of a beam of length 'L' with far end fixed ?
- (A)  $\frac{EI}{L}$
  - (B)  $\frac{2EI}{L}$
  - (C)  $\frac{3EI}{L}$
  - (D)  $\frac{4EI}{L}$
13. The numbers of plastic hinges that are required to cause the overall total collapse of a structure is :
- (A) one less than the order of static indeterminacy
  - (B) equal to the order of static indeterminacy
  - (C) one more than the order of static indeterminacy
  - (D) not determinable

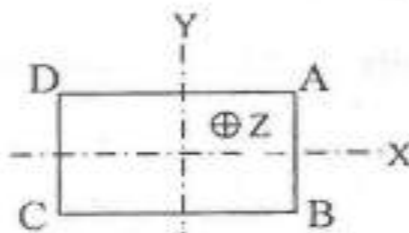
14. If a single concentrated load  $W$  is moving on a symmetrical three hinged parabolic arch of span  $L$ , what is the position of the maximum sagging moment from its ends ?
- (A)  $0.105 L$  (B)  $0.211 L$   
 (C)  $0.250 L$  (D)  $0.500 L$
15. A beam has the same section throughout its length with  $I = I \times 10^8 \text{ mm}^4$ . It is subjected to a uniform B.M.  $= 40 \text{ kNm}$  and  $E = 2 \times 10^5 \text{ N/mm}^2$ . What is the radius of curvature of the circle into which the beam will bend in the form of an arc of a circle ?
- (A)  $1000 \text{ m}$  (B)  $500 \text{ m}$   
 (C)  $400 \text{ m}$  (D)  $350 \text{ m}$
16. If the modular ratio is ' $m$ ', steel ratio is ' $r$ ', what will be the critical neutral axis constant ' $k$ ' ?
- (A)  $\frac{r}{m}$  (B)  $\frac{m - r}{m}$   
 (C)  $\frac{m}{r}$  (D)  $\frac{m}{m + r}$

17. What for high grade concrete is used in pre-stressed concrete ?
- (A) Controlling the pre-stress loss
  - (B) Having concrete of low ductility
  - (C) Having concrete of high Brittleness
  - (D) Having low creep
18. Under which one of the following conditions the doubly reinforced beams are recommended ?
- (A) the depth of the beam is restricted
  - (B) the breadth of the beam is restricted
  - (C) both depth and breadth are restricted
  - (D) the shear is high
19. What will be the position of critical section for computing design shear force in a reinforced concrete beam when the supports exert a compressive reaction ?
- (A) at the centre of support
  - (B) at the face of support
  - (C) at a distance of half of effective depth from the face of support
  - (D) at a distance of effective depth from the face of support



20. What will be the percentage area of the steel required in a singly reinforced beam if the permissible compressive and tensile stresses are  $5 \text{ N/mm}^2$  and  $140 \text{ N/mm}^2$  respectively and the modular ratio is 18.67 ?
- (A) 0.51 (B) 0.71  
(C) 0.81 (D) 0.91
21. At which condition the splicing of the reinforcement bars in R.C.C. beams is required ?
- (A) if shear force is zero  
(B) if bending moment is less than half the maximum B.M. on the beam  
(C) if bending moment is more than half the maximum B.M. on the beam  
(D) if bending moment is zero
22. The plastic modulus of a section is  $5 \times 10^{-4} \text{ m}^3$ . Its shape factor is 1.2 and the plastic moment capacity is 120 kNm, what is the value of the yield stress of the material ?
- (A)  $100 \text{ N/mm}^2$  (B)  $200 \text{ N/mm}^2$   
(C)  $240 \text{ N/mm}^2$  (D)  $288 \text{ N/mm}^2$

23. What will be the maximum bending moment on a square footing of side 'b' corresponding to a net upward pressure 'p' if A square column of side 'a' is founded on the square footing ?
- (A)  $\frac{pb(b-a)^2}{8}$  (B)  $\frac{pb(b+a)^2}{8}$   
 (C)  $\frac{pb(b-a)}{8}$  (D)  $\frac{pb(b+a)}{8}$
24. In the limit state design as per IS 456 : 2000, the shape of the compressive stress block of concrete is :
- (A) Rectangular  
 (B) Parabolic  
 (C) Combination of Rectangular and Parabola  
 (D) Triangular
25. The column ABCD is subjected to an eccentric compressive load at point Z as shown in figure. If the stresses at point A are as follows :
- due to direct compression =  $400 \text{ N/mm}^2$   
 due to bending about x-axis =  $1200 \text{ N/mm}^2$   
 due to bending about y-axis =  $800 \text{ N/mm}^2$
- Then the compressive stress at point will be



- (A)  $2400 \text{ N/mm}^2$  (B)  $2000 \text{ N/mm}^2$   
 (C)  $1200 \text{ N/mm}^2$  (D)  $800 \text{ N/mm}^2$

26. As per the Unwin's formula, if  $t$  is the thickness of plate in mm, what will be the nominal diameter of the rivet ?
- (A)  $d = 1.91 \sqrt{t}$  (B)  $d = 1.91 t^2$   
(C)  $d = 1.91 t^{2/3}$  (D)  $d = 1.91 t^{1/4}$
27. The limit of proportionality of a certain steel sample is 300 MPa in simple tension. It is subjected to principal stresses of 150 MPa (tensile), 60 MPa (tensile) and 30 MPa (tensile). According to the maximum principal stress theory, what will be the factor of safety in this case ?
- (A) 10 (B) 5  
(C) 4 (D) 2
28. What will be the live load for a sloping roof with slope  $15^\circ$  if access is not provided to roof ?
- (A)  $0.65 \text{ kN/m}^2$  (B)  $0.85 \text{ kN/m}^2$   
(C)  $1.05 \text{ kN/m}^2$  (D)  $1.25 \text{ kN/m}^2$

29. What is the most critical consideration in the design of rolled steel columns carrying axial loads ?
- (A) percent elongation at yield and the net cross-sectional area
  - (B) critical bending strength and axial yield strength of the material
  - (C) buckling strength based on the net area of the section and per cent elongation at ultimate load
  - (D) compressive strength based on slenderness ratio and gross cross-sectional area of the member
30. A steel column in a multi-storied building carries an axial load of 125 N. It is built up of 2 ISMC 350 channels connected by lacing. What will be the load carried by the lacing ?
- (A) 12.500 N
  - (B) 12.250 N
  - (C) 3.125 N
  - (D) Zero

31. Match List I with List II and select the *correct* answer using the codes given below lists :

(Assume  $y_n$  = Normal depth;  $y_c$  = critical depth and  $y$  = depth of gradually varied flow)

**List I**

(Flow regimes for gradually varied flow)

- (a)  $y_c > y_n > y$
- (b)  $y_c < y_n < y$
- (c)  $y_n > y > y_c$
- (d)  $y > y_c > y_n$

**List II**

(Type of Gradually varied flow profile)

- (1)  $C_1$
- (2)  $M_1$
- (3)  $S_2$
- (4)  $M_2$
- (5)  $S_1$

**Codes :**

- |     |     |     |     |     |
|-----|-----|-----|-----|-----|
|     | (a) | (b) | (c) | (d) |
| (A) | (1) | (2) | (3) | (4) |
| (B) | (3) | (4) | (5) | (2) |
| (C) | (3) | (2) | (4) | (5) |
| (D) | (5) | (4) | (3) | (2) |



32. Which of the following statements is *false* regarding the relation for Specific-

$$\text{speed, } N_s = \frac{N\sqrt{O}}{H^{5.4}} ?$$

- (A) The relation is valid for both impulse as well as reaction turbines
- (B) The value of specific speed depends on the system of units
- (C) The value of specific speed will be lower than that for Kaplan turbine for any system of units
- (D) The dimensions of specific speed are  $[FLT^{-1}]$

33. Which one of the following equations represents the free surface profile of a liquid, partially filled in a cylindrical container when it is subjected to uniform rotation ? Assume that the coordinate axes  $(z, r)$  have their origin at the centre of the bottom of container with ' $h_0$ ' as the central depth of liquid and ' $\omega$ ' be the angular velocity ?

$$(A) \quad Z = \frac{r\omega^2}{2g} + h_0$$

$$(B) \quad Z = \frac{r^2\omega^2}{2g} + h_0$$

$$(C) \quad Z = \frac{r^2\omega}{2g} + h_0$$

$$(D) \quad Z = \frac{r^2\omega^2}{g} + h_0$$

34. If the point at which local velocity  $v$  is equal to mean velocity  $V$  is at a distance  $kR$  from the centre of circular pipe having radius  $R$ , what will be the value of  $K$  ?
- (A) 0.707 (B) 0.5  
(C) 1.414 (D) zero
35. If a nozzle is so shaped that the velocity of flow along centre line changes from 1.5 m/sec to 15 m/sec in a distance of 0.375 m, what will be the magnitude of convective acceleration at the beginning ?
- (A) 24 m/s<sup>2</sup> (B) 42 m/s<sup>2</sup>  
(C) 54 m/s<sup>2</sup> (D) 74 m/s<sup>2</sup>
36. A laminar flow is taking place in a pipe of diameter 20 cm. If the mean velocity of flow in the pipe is 0.75 m/sec, what will be the velocity at 4 cm from the wall of the pipe ?
- (A) 0.96 m/s (B) 1.12 m/s  
(C) 1.96 m/s (D) 2.12 m/s

37. If a sphere of diameter 0.5 cm falls in castor oil of kinematic viscosity 10 stokes, with a terminal velocity of 1.0 cm/sec, what will be the coefficient of drag on the sphere ?
- (A) less than 5 (B) 240  
(C) 480 (D) 500
38. What will be the local drag coefficient for laminar boundary layer as per Blacius exact analytical solution ?
- (A)  $\frac{0.059}{(R_{e_x})^{\frac{1}{2}}}$  (B)  $\frac{0.074}{(R_{e_x})^{\frac{1}{4}}}$   
(C)  $\frac{0.664}{(R_{e_x})^{\frac{1}{2}}}$  (D)  $\frac{1.328}{(R_{e_x})^{\frac{1}{2}}}$
39. The head loss in a pipe of diameter 'D' carrying oil at a flow rate 'Q' over a distance 'L' is 'h<sub>L</sub>'. If the pipe is replaced by another pipe with half the diameter, all other things remaining the same, what will be the head loss in this case ?
- (A) 2h<sub>L</sub> (B) 4h<sub>L</sub>  
(C) 6h<sub>L</sub> (D) 8h<sub>L</sub>

40. A long prismatic channel ends in an abrupt drop in bed. Which one of the following statements explains the water surface profile on the upstream of the drop for an initially sub-critical flow ?
- (A) water surface profile lies completely below the critical depth line
  - (B) water surface profile lies between critical and normal depth lines
  - (C) water surface profile starts from critical depth lines and joins the normal depth line asymptotically
  - (D) water surface profile lies completely above the normal depth line
41. Under the same conditions, which one of the following is most suitable for using Isohyetal method to evaluate mean aerial depth of rainfall ?
- (A) Plain country
  - (B) gently sloping basin
  - (C) undulating country
  - (D) a place where the precipitation includes snow-melt

42. If the normal annual precipitation at station X, A, B and C are 700 mm, 1000 mm, 900 mm and 800 mm respectively and the storm precipitation at three stations A, B and C were 100 mm, 90 mm and 80 mm respectively, what will be the storm precipitation for station X ?

- (A) 70 mm (B) 80 mm  
(C) 90 mm (D) 105 mm

43. Match List I with List II and select the *correct* answer using the codes given below in the lists :

**List I**

- (a) Unconfined aquifer  
(b) Confined aquifer  
(c) Aquitard  
(d) Aquiclude

**List II**

- (1) Insignificant yield  
(2) Impermeable of flow of water  
(3) Water table of aquifer  
(4) Artesian aquifer

**Codes :**

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



44. A 6-hour storm has 6 cm of rainfall and the resulting runoff was 3 cm. If  $\phi$  index remains at the same value, which one of the following is the runoff due to 12 cm of rainfall in 9 hours in the catchment ?
- (A) 4.5 cm (B) 6.0 cm  
(C) 7.5 cm (D) 9.0 cm
45. What is the use of Blaney-Criddle equation ?
- (A) to determine the runoff coefficient  
(B) to estimate the evapo-transpiration losses  
(C) to obtain depth of evaporation from a water surface  
(D) to determine the stream-flow from a catchment
46. If a river in alluvial plain has a dominant discharge of  $2025 \text{ m}^3/\text{sec}$ , what should be the waterway for a bridge on the river ?
- (A) 285 m (B) 304 m  
(C) 405 m (D) 215 m

47. Why is it required to provide a cross regulator on a main canal ?

- (A) to let maximum silt be carried into the branch canal
- (B) to minimize the amount of silt entering the branch canal
- (C) to minimize the evaporation losses
- (D) to carry the canal across the drain

48. An irrigation channel is carrying  $3.0 \text{ m}^3/\text{sec}$  of water to a culturable command area of 1500 ha with an intensity of irrigation equal to 50%. If the base period of crop is 140 days, what will be delta for the crop ?

- |             |             |
|-------------|-------------|
| (A) 2.419 m | (B) 1.613 m |
| (C) 0.806 m | (D) 4.838 m |

49. A sample of soil has the following properties :

Liquid limit = 45%, plastic limit = 25%, shrinkage limit = 17%, natural moisture content = 30%.

The consistency index of soil is :

- |           |           |
|-----------|-----------|
| (A) 15/20 | (B) 13/20 |
| (C) 8/20  | (D) 5/20  |

50. A fully saturated clay specimen is placed in a consolidometer and subjected to a loading of  $200 \text{ kN/m}^2$ . After a period of time it was found that the average pore pressure in the specimen was  $70 \text{ kN/m}^2$ . The percentage of consolidation reached by then was :
- (A) 70 (B) 65  
(C) 35 (D) 29
51. According to Terzaghi theory, what is the value of coefficient ( $N_c$ ) for an angle of shear resistance ( $\phi$ ) = 0 ?
- (A) 9.14 (B) 5.70  
(C) 5.14 (D) 5.50
52. For a clay slope of height 20 m, the stability number is 0.05,  $\gamma = 25 \text{ kN/m}^3$ , and  $c = 30 \text{ kN/m}^2$ , the critical height of slope is :
- (A) 30 m (B) 20 m  
(C) 24 m (D) 26 m

53. In a cohesive soil, the settlement of a 30 cm plate in a plate load test is 2 cm, then the settlement of a square footing of 90 cm side under the same load intensity will be :
- (A) 2 cm (B) 4 cm  
(C) 6 cm (D) 4.5 cm
54. A fill having a volume of  $15000 \text{ m}^3$  is to be constructed at a void ratio of 0.5. The borrow pit soil has a void ratio of 1.5. The volume of soil required (in cubic meters) to be excavated from the borrow pit will be :
- (A) 18750 (B) 20000  
(C) 25000 (D) 75000
55. What will be the ratio of passive to active lateral earth pressure for sand having an angle of internal friction of  $30^\circ$  ?
- (A) 1 (B) 3  
(C) 6 (D) 9

56. Consider the following statements :

The Standard Penetration Test (SPT) in soil is the most commonly used field test. SPT is used to determine :

- (1) Consistency of clay.
- (2) Un-drained shear strength of soft sensitive clays.
- (3) Relative density of sands.
- (4) Drained shear strength of fine loose sand.

Of these statements :

- (A) (1) and (2) are correct
- (B) (2) and (4) are correct
- (C) (1) and (3) are correct
- (D) (3) and (4) are correct

57. A cylinder of clayey soil fails under an axial vertical stress of  $20 \text{ t/m}^2$  when it is laterally unconfined. The failure plane makes an angle of  $45^\circ$  with the horizontal. The cohesion of the soil sample will be :

- (A)  $10 \text{ t/m}^2$
- (B)  $20 \text{ t/m}^2$
- (C)  $14.14 \text{ t/m}^2$
- (D)  $28.28 \text{ t/m}^2$



58. For a soil void ratio = 0.7 and specific gravity of solids 2.7, the head required to cause quick sand over a column of 5 m high sand will be :
- (A) 3.5 m (B) 4.5 m  
(C) 5.0 m (D) 9.0 m
59. If  $s$  is the shear strength,  $c$  and  $\phi$  are shear strength parameters, and  $\sigma_n$  is the normal stress at failure, then Coulomb's equation for shear strength of the soil can be represented by :
- (A)  $c = s + \sigma_n \tan \phi$  (B)  $c = s - \sigma_n \tan \phi$   
(C)  $s = \sigma_n + c \tan \phi$  (D)  $s = c - \sigma_n \tan \phi$
60. The capacity of a "28 S type" concrete mixer is  $0.8 \text{ m}^3$ . For mixing one cubic meter of concrete, the quantity of cement required is 5.5 bags. In order to avoid fractional usage of cement bags, the volume of concrete (in  $\text{m}^3$ ) to be mixed per batch will nearly be :
- (A) 0.79 (B) 0.55  
(C) 0.73 (D) 0.44

61. The network rules are common to all activity-on-arrow networking systems. The use of computers for making computations may impose certain rules. Which of the following basic rules of network logic are *correct* ?

- (1) Before an activity may begin, all the activities preceding it must be complete.
- (2) Any two events may be directly connected by no more than one activity.
- (3) Event numbers must not be duplicated in a network.

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

**Codes :**

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

62. Consider the following pairs :

- (1) Difference between total float and free float : Interfering float
- (2) Sum of independent float and tail slack : Free float
- (3) Sum of independent float, tail slack and interfering float : Total float

Which of these pairs are *correctly* matched ?

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

63. Match List I with List II and select the *correct* answer using the codes given below in the lists :

<b>List I</b>	<b>List II</b>
<b>(Types of Road)</b>	<b>(Recommended Camber)</b>
(a) Water bound macadam	(1) 1 in 72
(b) Bituminous Concrete	(2) 1 in 60
(c) Earth road (untreated)	(3) 1 in 48
(d) Rigid pavement	(4) 1 in 25

**Codes :**

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

64. To calculate the minimum value of ruling radius of horizontal curves in plains the design speed is increased by :
- (A) 8 kmph (B) 12 kmph  
(C) 16 kmph (D) 20 kmph
65. A vehicle was stopped in two seconds by fully jamming the brakes. The skid marks measured 9.8 meters. The average skid resistance coefficient will be :
- (A) 0.70 (B) 0.50  
(C) 0.40 (D) 0.25
66. For a two-lane rural highway, the (I.R.C.) have recommended that the design volume per day should be :
- (A) 10,000 passenger cars per day with a peak hour volume of 12% of the average daily volume  
(B) 5,000 passenger cars per day with a peak hour volume of 10% of the average daily volume  
(C) 9,000 passenger cars per day with peak hour volume of 8% of the average daily volume  
(D) 1000 passenger cars per day with peak hour volume of 10% of the average daily volume

67. M40 grade concrete is used for the construction of concrete pavement of thickness 28 cm. Poisson's ratio of the concrete is 0.15. If the modulus of subgrade reaction is  $8 \text{ kg/cm}^3$ , the radius of relative stiffness would be :
- (A) 93.186 cm (B) 52.15 cm  
(C) 98.15 cm (D) 111.186 cm
68. In a two layer system, when  $\frac{E_1}{E_2}$  changes from 1 to 100, the vertical stress will be changing from .....% to.....% of the applied pressure as per Boussinesq's analogy.
- (A) 100, 1 (B) 88, 6  
(C) 6, 88 (D) 68, 8
69. Which of the following are claimed as advantageous in respect of aerobic sludge digestion as compared to anaerobic sludge digestion ?
- (1) Lower BOD concentration in supernatant liquor.
  - (2) Production of a sludge with excellent dewatering propensity.
  - (3) Greater production of methane.
  - (4) Lesser operating cost.
  - (5) Lesser capital cost.

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

- (A) (1), (2) and (4) (B) (2), (3), (4) and (5)  
(C) (3), (4) and (5) (D) (1), (2) and (5)



70. For proper slow mixing in the flocculator of a water treatment plant, the temporal mean velocity gradient  $G$  needs to be of the order of :
- (A) 5 to 10  $s^{-1}$  (B) 20 to 80  $s^{-1}$   
(C) 100 to 200  $s^{-1}$  (D) 250 to 350  $s^{-1}$
71. If the period of incubation at 37°C is 15 days in the relative stability test on sewage, the relative stability is :
- (A) 99% (B) 99.9%  
(C) 99.99% (D) 100%
72. The ratio of flowing through period to detention period in a sedimentation tank is called :
- (A) surface loading (B) settling velocity  
(C) theoretical efficiency (D) displacement efficiency
73. The end product formed, after separation and anaerobic bacterial digestion of organic municipal solid wastes, is called :
- (A) compost (B) humus  
(C) leachate (D) ashes

74. The pipe mains carrying water from the source to the reservoir are designed for the :
- (A) maximum daily draft
  - (B) average daily draft
  - (C) maximum hourly draft of the maximum day
  - (D) maximum weekly draft
75. Match List I with List II and select the *correct* answer using the codes given below in the lists :

**List I**

**(Treatment units)**

- (a) Grit chamber
- (b) Primary sedimentation
- (c) Activated sludge
- (d) Sludge digestion

**List II**

**(Detention time)**

- (1) Six hours
- (2) Two minutes
- (3) Two hours
- (4) Twenty five days

**Codes :**

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

76. Match List I with List II and select the *correct* answer using the codes given below in the lists :

**List I**

- (a) Proportional weir
- (b) Mottled teeth
- (c) Muffle furnace
- (d) Methaemoglobinemia
- (e) Schmutzdecke

**List II**

- (1) Nitrate
- (2) Slow sand filters
- (3) Grit chambers
- (4) Volatile solids
- (5) Fluoride

**Codes :**

- |     | (a) | (b) | (c) | (d) | (e) |
|-----|-----|-----|-----|-----|-----|
| (A) | (2) | (3) | (1) | (4) | (5) |
| (B) | (2) | (1) | (3) | (5) | (4) |
| (C) | (3) | (5) | (4) | (1) | (2) |
| (D) | (1) | (5) | (3) | (4) | (2) |

77. The efficiency of disinfection by chlorine, in water treatment, increases by:
- (A) decrease in time of contact
  - (B) decrease in temperature of water
  - (C) increase in temperature of water
  - (D) none of the above
78. The chlorine demand of a water sample was found to be 0.2 mg/l. The amount of bleaching powder containing 30% available chlorine to be added to treat 1 liter of such a water sample is :
- (A) 0.67 mg
  - (B) 0.06 mg
  - (C) 1.33 mg
  - (D) 0.14 mg

79. If a sewer drain carrying a discharge of 2 cumecs, outfalls into a river carrying a discharge of 10 cumecs, and having DO equal to 8.4 mg/l, the resultant DO of the mixture will be equal to :
- (A) 5.0 mg/l (B) 7.0 mg/l  
(C) 10.5 mg/l (D) 15.0 mg/l
80. For a colony of 10,000 persons having sewage flow rate of 200 l/c/day, BOD of applied sewage of 300 mg/l and organic loading of 300 kg/day/hectare, the area of an oxidation pond required for treating the sewage of the colony is :
- (A) 0.2 hectare (B) 1 hectare  
(C) 2 hectares (D) 6 hectares
81. In which region of Mandi district of H.P is Shikari Devi temple ?
- (A) Dharampur (B) Joginder Nagar  
(C) Drang (D) Karsog

82. To which god is Nawala festival dedicated ?
- (A) Lord Rama (B) Lord Krishna  
(C) Lord Shiva (D) Lord Vishnu
83. Where are Ski slopes in Himachal Pradesh ?
- (A) Salogra (B) Salooni  
(C) Sultanpur (D) Solang
84. Who is the author of *Antiquities of Chamba State* ?
- (A) J.B. Lyall (B) C.F. Massy  
(C) G.T. Vigne (D) J.Ph. Vogel
85. Which Raja of Mandi handed over the administration of his state to his nephew, Balbir Sen ?
- (A) Ishwari Sen (B) Zalim Sen  
(C) Bijai Sen (D) Bhawani Sen



86. Which princely state witnessed Pajhota agitation around 1942 A.D. ?
- (A) Jubbal (B) Bushahar  
(C) Sirmaur (D) Baghat
87. Besides Chini Tehsil of Mahasu District, how many villages of Rampur Tehsil were transferred to create Kinnaur District ?
- (A) Five (B) Nine  
(C) Fourteen (D) Eighteen
88. When was unique ID Aadhaar Programme started in Himachal Pradesh ?
- (A) January, 2010 (B) April, 2010  
(C) December, 2010 (D) March, 2011
89. Which of the following is *not* included in Integrated Housing and Slum Development Programme in H.P. ?
- (A) Hamirpur (B) Baddi  
(C) Parwanoo (D) Mehatpur

90. In which of the following disciplines P.G. Classes are being run at Govt. P.G.

Ayurvedic College, Paprola (H.P.) ?

(A) Kayachikitsa

(B) Shalakyatantra

(C) Shalyatantra

(D) All of these

91. Who among the following refused the 2014 Padma Awards ?

(A) Sri Sri Ravishankar

(B) Mata Amritanandamayi

(C) Muhammed Burhanud-din

(D) All of these

92. Who is Inderjit Kaur ?

(A) Head of Pingalwara Society

(B) Chairperson, Punjab Women Commission

(C) Member Indian Women Hockey Team

(D) Punjabi Folk Singer

93. Which farm produce did *not* show decline in India in production during 2013-2014 crop year ?
- (A) Sugarcane (B) Pulses  
(C) Wheat (D) Paddy
94. Which is the oldest Harappan site in India ?
- (A) Rakhigarhi (B) Bhirrana  
(C) Dholavira (D) None of these
95. In which state of India is Khajuraho ?
- (A) Chhattisgarh (B) Odisha  
(C) Madhya Pradesh (D) Maharashtra
96. Approximately how many countries were involved in rescue work after the earthquake that hit Nepal in April, 2015 ?
- (A) 17 (B) 23  
(C) 34 (D) 43

97. Gunter Grass was a .....

(A) German writer

(B) French football player

(C) British diplomat

(D) Polish Scientist

98. What is Boko Haram ?

(A) Terrorist outfit

(B) Literary society in Pakistan

(C) Women NGO in Bangladesh

(D) News agency in the middle east

99. How many seats did the Conservative Party get in election to the British Parliament held in May, 2015 ?

(A) 232

(B) 282

(C) 322

(D) 331

100. Who is associated with Wikileaks ?

(A) Mark Zuckerberg

(B) Julian Assange

(C) Pablo Nerude

(D) Mathew Flinders