ASSISTANT ENGINEER IN COMMUNITY & RURAL DEVELOPMENT(C&RD) YEAR OF ADVT: 2020 DATE OF EXAM: 18-MAR-2023

# DO NOT BREAK THE SEAL OF THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

# **QUESTION BOOKLET**

**SERIES III** 

Subjects : General English, General Knowledge & Aptitude, Civil Engineering

**BOOKLET SERIAL NO.** 

30739

Marks : 350Time :  $2^{1}/_{2}$  hours

Read the following instructions carefully before you

begin to answer the questions.

# **INSTRUCTIONS TO CANDIDATES**

1. This booklet contains 175 questions to be answered in a separate OMR Answer Sheet using Black Ball Pen in following three parts:

Part-A-General English : 25 questions, Part-B-General Knowledge & Aptitude : 50 questions,

## Part-C-Civil Engineering : 100 questions

2. All Questions are compulsory.

- 3. You will be supplied the Answer sheet separately by the invigilator. You must complete the details of particulars asked for.
- Answers must be shown by completely blackening the corresponding circles in the Answer Sheet against the relevant question number by Black Ball Pen. OMR Answer Sheet without marking series/ double series marking shall not be evaluated.

### Example :

Supposing the following question is asked :-

## The Capital of Meghalaya is-

- A. Guwahati
- B. Kohima
- C. Shillong
- D. Delhi

You will have four alternatives in the Answer Sheet for your response corresponding to each question of the Question Booklet as below :-



In the above illustration, if your chosen response is alternative C i.e. Shillong, then the same should be marked on the Answer Sheet by blackening the relevant circle with a Black Ball Point Pen only as below :-



# WHICH IS THE ONLY CORRECT METHOD OF ANSWERING

5. Answer the questions as quickly and as carefully as you can. Some questions may be difficult and others easy. Do not spend too much time on any one question.

6. There will NOT be any negative marking for wrong answers.

7. The Answer Sheet must be handed over to the invigilator before you leave the Examination Hall.

8. No rough work is to be done on the Answer Sheet. Space for rough work has been provided in the question booklet.

#### PART - A - GENERAL ENGLISH

#### Marks :50

Each question carries 2 marks :

Directions : (Q.NO.1-4), In these questions fill in the blanks by choosing the correct answer from the options given.

1. As the decade \_\_\_\_\_ to wind down, Mark Morris \_\_\_\_\_ as our century's youngest great choreographer.

a) As begun / had stood

b) Will begin / is standing

c) Was beginning / has stood

d) Begins / stands

2. In the past few months, our company director \_\_\_\_\_ more mettle than most industrialists

in an entire career.

a) Had shown / have done

b) Showed / would do

c) Has shown / do

d) Was showing / may have done

3. \_\_\_\_\_ the terms of the forthcoming trade agreement, Japan wins parity \_\_\_\_\_ the United States.

a) Through / above	b) By / of
c) From / from	d) Under / with

4. An acorn, left to itself becomes an oak, and a geneticist \_\_\_\_\_ its DNA to make it grow into an elm may justly be said \_\_\_\_\_ with its natural course.

a) Altering / to have interfered

b) Having altered / to interfere

c) To alter / having interfered

d) Being altered / interfered

Directions : (Q.NO.5-9), Fill in the blanks by choosing the correct phrase or idiom from the options given.

5. I'm sure the situation will improve. It will \_\_\_\_\_.

a) Work out for the better

b) Work in to the best

c) Work out for the best

d) Work out of the best

6. My boss \_\_\_\_\_ at work because it was my first week.

a) Played me the ropesb) Told me the ropesc) Asked me the ropes

d) Showed me the ropes

7. I'll be back in the twinkling of

a) An eye b) A lightning bolt

c) A star d) A smile

8. Jack has egg \_\_\_\_ because he couldn't remember how to spell "fragile"!

a) On his shirt b) On his face

c) On his head d) On his mouth

9. The chairman pulled a long \_\_\_\_\_ when the house did not accept the suggestions put forth by him.

a) Look	b) Cry
c) Sigh	d) Face

Directions : (Q.NO.10-13), In these questions, choose the correct verb to complete the sentence.

10. The boy	the show last night.
a) Steal	b) Stole
c) Steals	d) Stealing

11. The woman \_\_\_\_\_ a magazine when he entered the office.
a) Reads b) Was reading
c) Is reading d) Read

12. He \_\_\_\_\_\_ from a stomach ache for two days.a) Suffersb) Is sufferingc) Sufferedd) Was suffered

13. He wanted to	her name.
a) Ask	b) Asked
c) Asking	d) Asks

Directions : (Q.NO.14-17), In these questions, choose the correct prepositions to complete the sentence.

14. A drowning r	nan will clutch	a straw.
a) At	b) For	
c) After	d) about	

15. You must apologize to him \_\_\_\_\_ your rudeness.
a) Of b) For
c) At d) Over

16. What is the time \_\_\_\_\_ your watch ?a) Inb) Atc) Byd) On

17. He felt no qualmsborrowing moneyfrom his friends.a) Tob) Forc) Aboutd) On

Directions : (Q.NO.18-21), In these questions, choose the word/phrase nearest in meaning to the underlined part of the sentences.

**18.** His <u>abbreviation</u> of his famous monograph made an excellent introduction to the volume of collected essays he edited.

a) Inclusion	b) Extension
c) Interpretation	d) Contraction

19. As the Chief Rabbi of the <u>cabalistic</u> city of Safed, he felt he held authority over the city.a) Intrinsicb) Mystic

,		0) 1.1 5000	
c)	Rustic	d) Nepotic	

**20.** Often people do not make a will because they are confused by the extensive legal jargon.

a)	Documents	b) Meetings
c)	Agreements	d) Vernacular

**21.** The youth are too busy having fun to join in the political <u>machinations</u> of their elders.

a) Stratagemsb) Interestc) Discussionsd) Involvement

Directions : (Q.NO.22-25), In these questions, choose the word/phrase which is closest to the opposite meaning of the underlined part of the sentences.

22. It would be a serious <u>abnegation</u> of leadership if he were to do nothing.
a) Acceptance b) Renouncement
c) Crime d) Abuse

23. It was a fatue	ous comment.
a) Silly	b) Rude
c) Intelligent	d) Controversial

24. He was a placid man and with an even <u>phlegmatic</u> temperament.
a) Excited b) Calm
c) Simple d) Quick witted

25. It surprised the Minister that the officer should show herself recalcitrant to his orders.
a) Compliant
b) Iconoclastic
c) Resistant
d) Confused

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#### PART - B - GENERAL KNOWLEDGE & APTITUDE

#### Marks : 100

#### Each question carries 2 marks :

26. Who among the following had started the Public Works Department in India in AD 1848?
a) Lord William Bentinck
b) Lord Dalhousie
c) Lord Wellesley
d) Lord Cornwallis

27. Who among the following was the founder of the Muslim League ?a) Muhammad Ali Jinnah b) Shaukat Alic) Nawab Salimullah d) Aga Khan

28. In which of the following years the Fundamental Duties have been added to the existent Fundamental Rights in the Constitution of India?

a) 1965	b) 1976
c) 1979	d) 1982

**29.** Which one of the following, when dissolved in  $H_2O$ , gives hissing sound ?

a) Limestone	b) Slacked lime
c) Soda lime	d) Quicklime

**30.** 'Prince of Wales Cup' is associated with the game of

a) Polo	b) Basketball
c) Golf	d) Volley ball

**31.** Who won the French presidential elections of 2022 ?

a) Marine Le Penb) Emmanuel Macronc) Francois Hollanded) Nicolas Sarkozy

32. Who has been crowned 70<sup>th</sup> Miss World ?
a) Harnaaz Sandhu
b) Andrea Meza
c) Karolina Biewlaska
d) Shree Saini

**33.** Who has been appointed new ISRO chief in 2022 ?

a)	К.	Sivan	b) A.S. Kıran Kumar
c)	K.	Radhakrishnan	d) S. Somanath

**34.** Look at this series : 3,4,7,8,11,12..... What number should come next ? a) 7 b) 10 c) 14 d) 15 **35.** Look at the series : 31,29,24,22,17,.... What number should come next ?

a) 15	b) 14
c) 13	d) 12

36. Three of the following four are alike in certain way and form a group. Find the odd one
a) 17
b) 119
c) 162
d) 289

**37.** Sachin walked 40 metres towards west and took a left turn and walked 50 metres. He again took a left turn and walked 60 metres. Towards which direction is he from his starting point ?

a)	South-east	b) North-east
c)	South-west	d) South

**38.** How many pairs of letters are there in the word IMMATURE each of which has as many letters between them in the word as in alphabet?

a) One	b) Two
c) Four	d) Three

39. If '+' means divided by, '-' means added to, 'x' means subtraction and '/' means multiplication by, then what is the value of 32/9-42+7 ?
a) 288 b) 294
c) 394 d) 188

**40.** Introducing a women, a woman said, 'she is the only daughter of my mother's mother'. How is the woman related to the woman ?

a) Mother	b) Niece
c) Aunt	d) Sister

**41.** In a certain code language 35796 is written as 44887. How is 46823 written in the code ? a) 57714 b) 35712

a) 57714	b) 35712
c) 55914	d) 55732

**42.** What is the length of the bridge which a man, riding at a speed of 15km an hour can cross in 5 minutes ?

a)	1.75 km	b) 1.25	km
c)	1 km	d) 0.75	km

43. If 17 men can earn Rs. 1190 in 2 days, how

many men will earn Rs 560 in 4 days at same rate ?

a) 7	b) 6
c) 5	d) 4

**44.** If the sequence of the English alphabets is reversed which of the following would be the 14<sup>th</sup> letter from your left ?

a) N	b) L
c) O	d) M

45. When a number is divided n succession by the factors 2,3 and 7 of the divisor, then the remainders are 1, 1 and 6 respectively. What is the complete remainder if it be divided by 42 ?
a) 27 b) 45
c) 32 d) 39

46. Which number is wrong in the following series ?

1236, 2346	, 3456, 450	66, 5686
a) 5686		b) 1236
c) 3456		d) 4566

47. If from twice the greater the greater number of the two numbers, 20 is subtracted, then the result is the other number. If from twice the smaller number, 5 is subtracted, then the result is the first number. What are the number?

a) 20 and	15	b)	25	and	10
c) 15 and	10	d)	12	and	15

**48.** A dealer sold a Wall clock for Rs.250 and made a profit of 20%. At what rate must the buyer sell it, if he also wants to make a profit of 20%?

a) Rs.310	b) Rs.305
c) Rs.295	d) Rs.300

**49.** A sum of money worth Rs.130 consists of an equal number of coins worth 50 paise, 10 paise and 5 paise. How many of each kind of coins are there ?

a) 150	b) 175
c) 200	d) 220

**50.** Four bells toll at the intervals of 12, 18, 24 and 30 seconds respectively, beginning to toll together. After what interval will they next toll together ?

a) 8 minutes	b) 10 minutes
c) 24 minutes	d) 6 minutes

**51.** In a certain code, PEAK is written as '3512' and DINE is written as '6895'. How is KIND written in that code ? a) 2396 b) 2986

a) 2396	D) 2980
c) 2896	d) 2596

52. A is sister of B. C is brother of D. D is sister of A. How is B related to D?
a) Brother b) Brother or sister
c) Sister d) Data inadequate

53. 'Day' is related to 'Night' in the same way as 'White' is related toa) Black b) Colour

c) F	Ray	d) Red			

54. 'Mango' is related to 'Fruit' in the same way as 'Potato' is related to

a) Fruit	b) Stem
c) Flower	d) Root

**55.** Mohan is thirteenth from the left end in a row of children. Prabir is twelfth from the right end and eighteenth from the left end. How many children are towards the right of Mohan in that row ?

a)	12			b)	18
c)	17			d)	16

**56.** Navin walked 20 metres towards the East, took a left turn and walked 10 metres and again took a left turn and walked 20 metres. How far is he from his starting position ?

a)	10	metres	b) 50 metres
c)	40	metres	d) 30 metres

57. If 'Apple' is called 'Orange', 'Orange' is called 'Peach', 'Peach' is called 'Potato', 'Potato' is called 'Banana', 'Banana' is called 'Guava', which of the following grows underground ?

a) Potato	b) Guava
c) Apple	d) Banana

**58.** If each of the odd digits in the number 54638 is decreased by '1' and each of the even digits is increased by '1', then which of the following will be '1', then which of the following will be the sum of the digits of the new number ?

a) 27	b) 29
c) 25	d) 28

59. Who formulated Laws of motoin and the Law

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of Universal Gravitation ? a) Isaac Newton b) Albert Einstein c) David Gregory d) Stephen Hawking

60. Which is the smallest and innermost planet in our solar system ?

a) Venus	b) Mars
c) Mercury	d) Neptune

 61. What is period of Indus Valley Civilisation ?

 a) 1500-1000 B.C.
 b) 3000-1500 B.C

 c) 5000-1000 B.C
 d) 2000-1000 B.C

62. Who composed India's national song ?a) Rabindranath Tagore

b) Subhas Chandra Bose

c) Bankim Chandra Chatterjee

d) Lala Lajpat Rai

63. Who was the British Governor General of Free India ?

- a) Lord Louis Mountbatten
- b) Lord T.B. Macaulay

c) Lord Wavell

d) Lord Lithgow

64. The term Lubb and Dubb relate to which one of the following ?

a) Heart	b) Eyes
c) Teeth	d) Lungs

65. Green Revolution in India is also known as
a) Seed, fertilizer and irrigation revolution
b) Food-security revolution
c) Agricultural revolution

d) Multi-crop revolution

66. The first Secretary-General of the United Nations was

a) Dag Hammarskjoldb) Trygve Liec) U. Thantd) Dr. Kurt Waldheim

67. Citizens and foreigners both enjoy
a) Political Right
b) Fundamental Rights
c) Civil Rights
d) Legal Rights

68. The Khalji Sultans of Delhi werea) Mongolsb) Afghansc) Turksd) A jat tribe

69. The rulers of Vijayanagar promoteda) Hindi, Marathi and Sanskritb) Malayalam, Tamil and Sanskrit

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c) Tamil, Telugu and Sanskritd) Telugu, Urdu and Sanskrit

70. Yellow fever is transmitted by

a) Aedes b) Anopheles c) House-fly d) Culex

71. Who amongst the following has written the book "Sandy Storms"?

a) Harbhajan Singhb) Sachin Tendulkarc) Rahul Dravidd) Sandeep Patil

72. Holding a 'Bandh' was declared illegal for the first time in India by which one of the following High Courts ?
a) Rajasthan High Court
b) Gujarat High Court
c) Kerala High Court
d) Maharashtra High Court

73. The Marine animal called dugong which is vulnerable to extinction is a / an
a) Amphibian
b) Bony Fish
c) Shark
d) Mammal

74. Which one of the following South Asian countries has the highest population density ?
a) India
b) Nepal
c) Pakistan
d) Sri Lanka

75. Indira Gandhi Centre for Atomic Research, Kalpakkam is located in

a)	Karnataka				b)	) Tamil Na		Nadu	
		11	Th	1	1	11	**		

c) Andhra Pradesh d) Kerala

#### PART - C - CIVIL ENGINEERING

#### Marks :200

#### Each question carries 2 marks :

76. The force in the member BC for the truss shown in the Figure below is-



a)	0	kN		b) 2 kN (Tensile)
c)	1	kN	(Tensile)	d) 1 kN (Compressive)

77. The kinematic indeterminacy of the following pin jointed plane frame given below is-



78. Which one the following is the ILD for the bending moment at section C for the given fixed beam ?



**79.** Carryover Moment at end B due to moment M applied at end A for the given beam is-AE(C&RD)-23

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**80.** Which of the following Mohr's Circle represent the condition of pure uniaxial tension ?



**81.** A hollow cylindrical steel shaft given below is 1.5m long and has inner and outer diameters respectively equal to 40 and 60 mm. What is the largest torque that can be applied to the shaft if the shearing stress is not to exceed 120 MPa ?



a)	1.1	kN.m	b) 2.1 kN.m
c)	3.1	kN.m	d) 4.1 kN.m

82. The steel beam AC is simply supported and carries the uniformly distributed load as shown below. The maximum bending moment occurs is-



a)	160	kN.m	b)	140	kN.m	
c)	120	kN.m	d)	100	kN.m	

83. The critical buckling load is expressed by

 $P_{cr} = \frac{n^2 \pi^2 EI}{L^2}$ . The most critical load is when

the value of n takes the value.

a) 1b) 2c) 3d) None of the above

84. The selection of design bending strength under high shear  $M_{dv}$  will be used when V is

a) Greater than  $0.5V_d$  b) Less than  $0.5V_d$ 

c) Greater than  $0.6V_d$  d) Is less than  $0.6V_d$ 

**85.** Torsional constant,  $I_t$ , for equal flange Ibeams is given by

a)	$\sum b_i t_i^3$	b)	$\sum b_i t_i^3/3$
c).	$\sum b_i^3 t_i$	d)	$\sum b_i^3 t_i/3$

86. A lower chord of truss has a vertical member and a tie member ( $f_u=250$  MPa;  $f_u=410$  MPa) at a point "O" in it, as shown in Figure below, along with the factored axial forces. Assume the gusset plate thickness of 8 mm. Use 16 mm diameter bolts of grade 4.6 ( $f_u=400$  MPa) for connection. The number of bolts required against bolt shearing in the vertical member is-



87. The design bending strength of a laterally supported beam is given by  $M_d = \beta Z_p f_y / \gamma_{mo}$ .

For plastic and compact sections  $\beta$  is a)  $Z_e/Z_p$  b) 0.5 c) 1.0 d) 3

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**88.** Anchor bolts are provided in column bases to -

a) Act as reinforcement in the pedestal below the base plate

b) Fix column is correct position during erection

c) Resist tensile forces due to moments

d) All of the above

89. The concept of second-order moments in beam-columns are seen in

a) Non-sway frames b) Sway frames

c) Both (a) and (b) d) None of the above

90. The failure mode of beam-column is by

a) Local buckling

b) Flexural-torsional buckling

c) Flexural yielding

d) All of these

91. Which of these methods is the most appropriate if we want to determine a soil's water content ?

a) Calcium carbide method

b) Sand bath method

c) Oven drying method

d) Pycnometer method

**92.** The soils most susceptible to liquefaction are a) Saturated fine and medium sands of uniform particle size

b) Saturated dense sands

c) Saturated clays of uniform size

d) Saturated gravels and cobbles

93. The soil most susceptible to liquefaction area) 0.425 to 0.075 mmb) 2.00 to 0.425 mmc) 4.75 to 2.00 mmd) 0.075 to 0.002 mm

94. Local shear failure can also be expected in, a) Soils having low compressibility

b) Soils having moisture content between 35% to 70%

c) Sand having relative density lying between 35% to 70%

d) None of the above

**95.** Plate bearing test with 20cm diameter plate on soil subgrade yielded a pressure of  $1.25 \times 10^5$  N/m<sup>2</sup> at 0.5 cm deflection. What is the elastic modulus of subgrade ?

a)  $56.18 \times 10^5 \text{ N/m}^2$  b)  $22.10 \times 10^5 \text{ N/m}^2$ c)  $44.25 \times 10^5 \text{ N/m}^2$  d) None of the above

96. The value of bearing capacity factor for cohesion,  $N_c$ , for piles as per Meyerhof, is taken as

a) 6.2	b) 12.0
<b>c)</b> 9.0	d) 5.14

**97.** If the plasticity index of a soil is 45%, then the soil will be

a) Non-plastic	b) Very highly plastic
c) Low plastic	d) Medium plastic

**98.** A fine-grained soil has 60% (by weight) silt content. The soil behaves as semi-solid when water content is between 15% and 28%. The soil behaves fluid-like when the water content is more than 40%. The "Activity" of the soil is a) 3.33 b) 0.42 c) 0.30 d) 0.20

**99.** For a particular loading condition unsaturated clay layer undergoes 30% consolidation in a period of 180 days. What would be the additional time required for further 20% consolidation to occur.

a) 320 days	b) 220 days
c) 280 days	d) 160 days

**100.** According to Coulomb, the relationship between shear strength and normal stress could be represented by

a) Linear curve	b) Parabolic curve
c) Straight line	d) None of the above

101. For cohesion-less soil, the angle of internal friction is  $45^{\circ}$ , then the value of K<sub>o</sub> is

a) 0.429	b) 0.784
c) 0.293	d) 0.334

**102.** A backfill of a retaining wall consists of  $\gamma = 19 \text{ kN/m}^3$  which is 6 m high. Find the total earth pressure per metre length. Given coefficient of earth pressure at rest is 0.5.

a)	165	kN/m	b)	150	kN/m
c)	141	kN/m	d)	171	kN/m

103. Which of the following cases for cohesion less backfill in Rankine's theory is considered?a) Submerged backfill

b) Moist backfill with no surcharge

c) Backfill with sloping surface

d) All of the above

**104.** For 6.0m deep excavation in soft clay  $\gamma = 18$  AE(C&RD)-23

kN/m<sup>3</sup>, c = 26 kN/m<sup>2</sup>, Taylor's stability number, S<sub>n</sub> = 0.172, factor of safety ( $F_c$ ) against sliding will be

a) 1.2	0,1.5
c) 1.4	d) 1.5

**105.** The maximum superelevation on hill roads should not exceed

a) 10%	b) 5%
c) 4%	d) 7%

**106.** The shape of "Give Way" sign in the traffic signal is

a)	Kectangle	b) Octagonal
c)	Circle	d) Inverted triangle

**107.** Abrasion test is conducted to find aggregates

a) St	rength	b) Toughness	5
c) Ha	ardness	d) Durability	

108. In a vertical curve, an upgrade of 2.0% is followed by a downgrade of 2.0%. The rate of change of grade is 0.05% per 20-meter chain. The length of vertical curve will be

a)	1000 m	b) 1600 m
c)	1200 m	d) 800 m

**109.** What will be the theoretical maximum capacity (to the nearest 10 units) for a single lane of highways given that the speed of the traffic stream is 40 km/hr ?

a) 3000 vehicle/hr	b) 2860 vehicle/hr
c) 2510 vehicle/hr	d) 2010 vehicle/hr

**110.** Calculate the lag distance for design speed of 47 km/hr for two-way traffic on a single-lane road (assume coefficient of friction as 0.38 and reaction time of driver as 2.5 seconds)

		-	 1.00			100		1.101		
a) 32.64	m			b	)	11	1.	04	m	
c) 55.52	m			d	) (	55	.2	8	m	

111. In India, Green & White colour on a milestone indicates

a) National Highwayb) Rural roadsc) State Highwayd) Major district road

112. Which of the following is the CORRECT order for increasing width of a railway gauge : (where, BG-Broad Gauge, LG-Light Gauge, MG-Metre Gauge, NG-Narrow Gauge)
a) BG < LG < NG < MG</li>
b) BG < MG < LG < NG</li>

c) LG < NG < MG < BG d) NG < LG < BG < MG

113. The sleeper density of a Broad Gauge track is (n+6) in metre units. The number of sleepers per 1.024 km of track is

a) 1520	b) 1630
c) 1720	d) 1800

114. The maximum limit of super elevation on Broad Gauge track in India is

a) 83.2 mm	b) 165.1 mm
c) 101.6 mm	d) 76.2 mm

115. Ballast if used in Railway section to serve as

a) An elastic bed

b) Foundation of rail track

c) Both (a) and (b)

d) None of the above

**116.** A volume of  $3.0 \times 10^6 \text{ m}^3$  of ground water was pumped out from an unconfined aquifer, uniformly from an area of 5 km<sup>2</sup>. The pumping lowered the water table from initial level of 102 m to 99 m. The specific yield of the aquifer is a) 0.2 b) 0.3 b) 0.5

c) 0.4	d) 0.5		

117. The downstream end of a long prismatic channel of mild slope, ends in a pool created by a dam. The resulting non-uniform water surface profile can be described as one of the following a)  $M_3$  profile ending in a hydraulic jump

b) M, profile that lies above normal depth line

c)  $M_2$  profile that lies between critical and normal depth lines

d)  $M_3$  profile that lies between critical and normal depth lines

118. The equation 
$$gz + \frac{v^2}{2} + \int \frac{dp}{p} = \text{constant}$$

along a streamline holds true fora) Steady, frictionless, compressible fluidb) Steady, uniform, incompressible fluidc) Steady, frictionless, incompressible fluidd) Unsteady incompressible fluid

119. An outlet irrigates an area of 20 ha. The discharge (I/s) required at this outlet to meet the evapotranspiration requirement of 20 mm occurring uniformly in 20 days neglecting other field losses is

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a) 2.52	- 14 i	b) 2.31
c) 2.01		d) 1.52

120. A stable channel is to be designed for a discharge of Q m<sup>3</sup>/s with silt factor f as per Lacey's method. The mean flow velocity (m/s) in the channel is obtained by



**121.** Which of the following conditions is used to determine the stable equilibrium of all partially submerged floating bodies ?

a) Centre of buoyancy must be above the centre of gravity

b) Centre of buoyancy must be below the centre of gravity

c) Metacentre must be at higher level that the centre of gravity

d) Metacentre must be at lower level that the centre of gravity

**122.** A piece of metal of specific gravity 7.0 floats in mercury of specific gravity 13.6. What fraction of its volume is under mercury ?

a) 0.5	b) 0.414
c) 0.2	d) 0.515

**123.** In a streamline steady flow, two points A and B on a streamline are 1.0 m apart and the flow velocity varies uniformly from 2.0 m/s to 5.0 m/s. What is the acceleration of fluid at B? a) 6 m/s<sup>2</sup> b) 3 m/s<sup>2</sup>

,	/
c) $15 \text{ m/s}^2$	d) 9 m/s <sup>2</sup>

124. A vortex flow is	
a) Rotational flow	b) Irrotational flow
c) Both (a) and (b)	d) Free shear flow

**125.** A soil has a discharge velocity of  $6 \ge 10^{-7}$  m/s and a void ratio of 0.5. What is it seepage velocity ?

a) 18 x 10° m/s	b) $3 \times 10^{-7}$ m/s
c) 6 x 10 <sup>-7</sup> m/s	d) 12 x 10 <sup>-7</sup> m/s

**126.** The discharge in  $m^3/s$  for laminar flow through a pipe of diameter 0.04 m having a cen-

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tre line velocity of 1.5 m/s is



127. Laminar flow developed at an average velocity of 5 m/s in a pipe of 10 cm radius. The velocity at 5 cm radius is

a) 7.5 m/s	b) 10 m/s
c) 2.5 m/s	d) 5 m/s

**128.** A piping system consists of three pipes arranged in series, the lengths of the pipes are 1200 m, 750 m and 600 m and diameters of 750 mm, 600 mm, and 450 mm, respectively. Transforming the system to an equivalent 450 mm diameter pipe will result in equivalent length of

a) 671.3 m	b) 771.3 m
c) 871.3 m	d) 971.3 m

**129.** A pipeline of 300 mm diameter carrying water at an average velocity of 5 m/s branches into two pipes of 150 mm and 200 mm diameter. The total flow rate of discharge of water in the system is

a)	58 litres/sec	b) 132 litres/sec
c)	832 litres/sec	d) 353 litres/sec

**130.** Which one of the following is the purpose of providing a surge tank is a pipeline carrying water ?

a) To store water

b) To increase pressure throughout the pipeline

c) To store overflowing water

d) To protect the pipeline against water hammer

131. Centrifugal pumps	transfer energy from
a) Rotor to fluid	b) Fluid to rotor
c) Draft to rotor	d) Rotor to draft

132. The momentum correction factor ( $\beta$ ) is used to account for

a) Change if direction of flow

b) Change in total energy

c) Non-uniform distribution of velocities at inlet and outlet sections

d) Change in mass rate of flow

133. In a laminar flow through very long straight

round pipe, the velocity profile through a crosssection area of the pipe is parabolic with the axial velocity component given as

$$P = 2V_{avg}\left(1 - \frac{r^2}{R^2}\right)$$
. Find the momentum cor-

rection factor through a cross-section of the pipe for the case in which the pipe flow represents an outlet of the control volume as shown in Figure below:



a) 5/3	b) 3/2
c) 4/3	d) 3/4

**134.** Statement 1 : For a fluid particle having a uniform flow, the acceleration is zero.

Statement 2 : Acceleration is both function of space and time.

a) Both Statement 1 and Statement 2 are individually true, and Statement 2 is the correct explanation of Statement 1.

b) Both Statement 1 and Statement 2 are individually true, and Statement 2 is not the correct explanation of Statement 1.

c) Statement 1 is true, but Statement 2 is false d) Statement 1 is false, but Statement 2 is true

135. A fluid flowing in a pipe and the velocities of liquid particles at all sections are the same. The type of flow is

a) Uniform flow (b) Steady flow

c) Compressible flow d) Streamline flow

136. In a rectangular channel, the depth of flow is 1.6 m and the specific energy at that section is 2.7 m, the flow is

a) Sub-critical	b) Super-critical
c) Critical	d) Not possible

137. Hydraulic jump forms in a horizontal rect-

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angular channel carrying a unit discharge of 1.019 m<sup>3</sup>/sec/m at a depth of 101.9 mm. This jump is classified as

a) Weak jump	b) Oscillating jump
c) Steady jump	d) Strong jump

138. For a hydraulically efficient rectangular channel of bed width 5.0 m, the hydraulic radius is equal to

a) 1.25 m	b) 2.0 m
c) 2.25 m	d) 1.75 m

139. For obtaining the most economical trapezoidal channel section with depth of flow

$= 3.0 {\rm m}.$	What is the hydraulic mean radius?
a) 1.0m	b) 2.0m
c) 1.5m	d) 3.0m

140. Specific energy of flowing water through a rectangular channel of width 5.0m when discharge is 10.0 m<sup>3</sup>/s and depth of water is 2.0m is

a) 1.06m	b) 2.05m
c) 1.02m	d) 2.60m

141. What is the purpose of rainwater harvesting?

a) To hold rainwater on the surface of the earth b) To recharge ground water

c) To use water for the irrigation of crops

d) All of the above

142. A saturated geological unit which can yield water to the wells at a sufficient rate to support a well is called ?

a)	Karst	b) Estuary
c)	Reservoir	d) Aquifer

143. Zero hardness of water is achieved by a) Using line soda process

b) Excess lime treatment

c) Ion exchange method

d) Using excess alum dosage

144. For a given discharge, the efficiency of sedimentation tank can be increased by

a) Increasing the depth of the tank

b) Increasing the surface area of the tank

c) Decreasing the depth of the tank

d) Decreasing the surface area of the tank

145. A water treatment plant of capacity, 1 m<sup>3</sup>/sec has a filter boxes of dimensions 6m x

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10m. The loading rate to the filters is  $120 \text{ m}^3/$ day/m<sup>2</sup>. When two of the filters are out of service for the back washing, the loading rate is (in  $m^3/dav/m^2$ )

a)	144			\$10:	b)	122	
c)	133		$[a_i]$		d)	124	

146. Under ideal conditions, the COD/TOC ratio for sewage containing only organic matter is a) 0.375 b) 1.66 c) 2.66 d) 0.5

147. In initial Dissolved Oxygen (DO) and final DO after 5 days incubation at 20° C in 1.0% dilution sample are 5.0 mg/L and 4.0 mg/L, respectively. What is 5-day BOD of the same sample in mg/L?

a) 50	<b>b)</b> 100
c) 150	<b>d)</b> 200

148. The breaking of the biomass from the slime layer in conventional filter is called

a) Sloughing b) Carbonation c) Biological magnification d) Weathering

149. A septic tank is

a) A physical method of water treatment

b) A physicochemical method of water treatment

c) An anaerobic method of on-site treatment

d) An aerobic method of on-site sewage treatment

150. Which of the following statement's is true for trickling filter sludge ?

a) It is more difficult to dewater than activated sludge

b) It is bulky

c) It has a comparatively low concentration of sludge solids

d) It has a comparatively low sludge volume index

151. The purpose of providing a balancing reservoir in a water supply distribution system is to a) Address the frequent fluctuations in the rate of consumption

b) Equalize the pressure heads in the distribution system

c) Store additional water for contingency

d) Store water for mitigation drought

152. What will be the Sludge Volume Index (SVI) if 100 ml of sludge collected in 30 mins on

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drying weight 800 mg ? a) 115 b) 78 c) 125 d) 100

**153.** As per IS 10500:2012, for drinking water in the absence of alternate source of water, the permissible limits for chloride and sulphate, in mg/L, respectively, are

a) 250 and 200	b) 1000 and 400
c) 200 and 250	d) 500 and 1000

**154.** What is the condition for maximum discharge through a circular channel section using Manning's formula ?

a) 0.938D	b) 0.105D
c) 0.5D	d) 0.093D

**155.** A water treatment plant has a flow rate of  $0.6 \text{ m}^3$ /sec. The settling basin at the plant has an effective settling volume dimensions of length 20m, depth of 3.0 m and width of 6.0m. What percentage of the particles having a settling velocity of 0.004 m/sec is removed ?

a) 75%	b) 90%
c) 80%	d) 100%

**156.** Blue baby disease found in infants is due to excessive in drinking water.

a) Colour	b) Sulphates	
c) Carbonates	d) Nitrates	

**157.** What is the percentage of settleable solids in municipal wastewater ?

a) 90%	6) 80%
c) 70%	d) 60%

**158.** The process of converting wet waste to manure is called

a) Incineration	b) Conservation
c) Composting	d) Metabolism

**159.** During the physical treatment process of wastewater, what is the correct order of following operations to be followed ? (A)-Flocculation; (B)-Filtration; (C)-Screening; (D)-Sedimentation

a)	(A)-(D)-(B)-(C)	b)	(C)-(D)-(A)-(B)	
c)	(B)-(D)-(A)-(C)	d)	(B)-(C)-(D)-(A)	

160. While submitting a tender, the contractor is required to deposit some amount to the concerned agency as a guarantee of the tender known as a) Earnest moneyb) Bank guaranteec) Security depositd) Caution money

161. The time by which an activity completion time can be delayed without affecting the early start of the succeeding activities is known as a) Duration b) Total float

c) Free float d) Interfering float

**162.** The Figure below shows the network for a particular project which consists of four activities. The minimum time required for the completion of the project is-



Activity	Normal time (days)	Crash time (days)
1.2	3	2
2-3	4	2
2-4	5	4
3-4	7	5

a) 19 days	b) 13 days
c) 9 days	d) 32 days

163. The technique for establishing and maintaining priorities among the various jobs of a project, is known

a) Event flow scheduling technique

b) Critical ratio scheduling

c) Slotting technique for scheduling

d) Short interval scheduling

164. If D is the duration, ES and EF are the earliest start and finish, LS and LF are latest start and latest finish time, then the following relation holds good-

a) $EF = ES -$	+ D	b) $LS = LF - D$
c) $LF = LS +$	+ D	d) All of the above

165. Bar charts are suitable for-

a) Minor works	b) Major works
c) Large projects	d) All of the above

**166.** The centre of gravity from the origin "0" and second moment on intertia about x-axis for the Figure shown are-

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a) 50, 58.33mm and 5.73 x 10<sup>6</sup> mm<sup>4</sup>
b) 50, 75mm and 5.73 x 10<sup>6</sup> mm<sup>4</sup>
c) 50, 58.33mm and 1.56 x 10<sup>6</sup> mm<sup>4</sup>
d) 50, 75mm and 1.56 x 10<sup>6</sup> mm<sup>4</sup>

167. A framed structure is perfect, if the number of members is \_\_\_\_\_ (2j-3), where, j is the number of joints.a) Less thanb) Equal to

c) Greater than d) None of the above

**168.** Determine the principal normal stress and shear stress for the stress state subjected to

 $σ_x = 240 \text{ MPa}; \sigma_y = -30 \text{ MPa}; \tau_{xy} = 50 \text{ Mpa}.$ a)  $σ_1 = 240 \text{ MPa}, \sigma_2 = -30 \text{ MPa}, \tau_{max} = 50 \text{ MPa}$ b)  $σ_1 = 210 \text{ MPa}, \sigma_2 = 40 \text{ MPa}, \tau_{max} = 40 \text{ MPa}$ c)  $σ_1 = 249 \text{ MPa}, \sigma_2 = -39 \text{ MPa}, \tau_{max} = 141 \text{ MPa}$ d)  $σ_1 = 249 \text{ MPa}, \sigma_2 = -39 \text{ MPa}, \tau_{max} = 50 \text{ MPa}$ 

169. What torque should be applied to the end of the shaft to produce a twist of  $2^{\circ}$  in the Figure shown ? Use the value of G = 77 GPa for the modulus of rigidity of steel.



a) 3.66 kN.m b) 0.92 kN.m c) 2.5 kN.m d) 1.83 kN.m

**170.** The relation between the elastic constant is

a) $E = 2G(1-2\mu)$	b) $E = 2G(1 + \mu)$
c) $E = 2G(1+2\mu)$	d) $E = 2G(1 - \mu)$
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171. The ratio of plastic section modulus to elastic section modulus

a) Is equal to 1.0b) Is less than 1.0c) Is greater than 1.0d) None of the above

172. The cross-section of a beam is shown in Figure below with  $I_{xx} = 3 \times 10^6 \text{ mm}^4$ . It is subjected to a load as shown in the Figure. The maximum tensile stress in the beam would be-



a)	Inc	leterminable	b) 21	$N/m^2$
:)	21	kN/m <sup>2</sup>	d) 21	MN/m <sup>2</sup>

173. The design load used in the deflection limits criteria in floors and roofs is
a) 1.0 L.L
b) 1.0 D.L
c) 1.0 D.L + 1.0 L.L
d) 1.5 D.L + 1.5 L.L

174. For and over-reinforced RC beam

"where;  $\eta$  is the depth of actual neutral axis and  $\eta_c$  is the critical neutral axis depth"

a) η	$=\eta_c$	b) /	η	$>\eta_c$
c) η	$<\eta_c$	d) /	η	= half of beam depth

175. In the design of a reinforced concrete simple isolated footing, the depth of the footing is determined by checking against

a) Only one-way shear

b) Only two-way shear

c) Only Moment

d) All of the above

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