

## POST GRADUATE COMMON ENTRANCE TEST-2018

<b>DATE and TIME</b>	<b>COURSE</b>		<b>SUBJECT</b>
14-07-2018 2.30 p.m. to 4.30 p.m.	ME/M.Tech/M.Arch/ courses offered by VTU/UVCE/UBDTCE		CIVIL ENGINEERING
<b>MAXIMUM MARKS</b>	<b>TOTAL DURATION</b>	<b>MAXIMUM TIME FOR ANSWERING</b>	
100	150 Minutes	120 Minutes	
<b>MENTION YOUR PGCET NO.</b>		<b>QUESTION BOOKLET DETAILS</b>	
		<b>VERSION CODE</b>	<b>SERIAL NUMBER</b>
		<b>A</b>	<b>101921</b>

### DOs:

1. Candidate must verify that the PGCET number & Name printed on the OMR Answer Sheet is tallying with the PGCET number and Name printed on the Admission Ticket. Discrepancy if any, report to invigilator.
2. This question booklet is issued to you by the invigilator after the 2<sup>nd</sup> bell i.e., after 2.25 p.m.
3. The Version Code of this Question Booklet should be entered on the OMR Answer Sheet and the respective circle should also be shaded completely.
4. The Version Code and Serial Number of this question booklet should be entered on the Nominal Roll without any mistakes.
5. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

### DON'Ts:

1. The timing and marks printed on the OMR answer sheet should not be damaged / mutilated / spoiled.
2. The 3<sup>rd</sup> Bell rings at 2.30 p.m., till then;
  - Do not remove the paper seal / polythene bag present on the right hand side of this question booklet.
  - Do not look inside this question booklet.
  - Do not start answering on the OMR answer sheet.

### IMPORTANT INSTRUCTIONS TO CANDIDATES

1. This question booklet contains 75 (items) questions and each question will have one statement and four answers. (Four different options / responses.)
2. After the 3<sup>rd</sup> Bell is rung at 2.30 p.m., remove the paper seal / polythene bag on the right hand side of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start answering on the OMR answer sheet.
3. During the subsequent 120 minutes:
  - Read each question (item) carefully.
  - Choose one correct answer from out of the four available responses (options / choices) given under each question / item. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **only one response** for each item.
  - **Completely darken / shade the relevant circle with a BLUE OR BLACK INK BALL POINT PEN against the question number on the OMR answer sheet.**

ಸರಿಯಾದ ಕ್ರಮ CORRECT METHOD	ತಪ್ಪು ಕ್ರಮಗಳು WRONG METHODS
(A) ● (C) (D)	(A) (B) (C) (D) (A) (B) (C) (D) (A) ● ● (D)

4. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
5. After the last Bell is rung at 4.30 p.m., stop marking on the OMR answer sheet and affix your left hand thumb impression on the OMR answer sheet as per the instructions.
6. Handover the OMR ANSWER SHEET to the room invigilator as it is.
7. After separating the top sheet (KEA copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
8. Preserve the replica of the OMR answer sheet for a minimum period of ONE year.
9. Only Non-programmable calculators are allowed.

#### Marks Distribution

PART-1 : 50 QUESTIONS CARRY ONE MARK EACH (1 TO 50)  
PART-2 : 25 QUESTIONS CARRY TWO MARKS EACH (51 TO 75)

CE - A









# CIVIL ENGINEERING

## PART - I

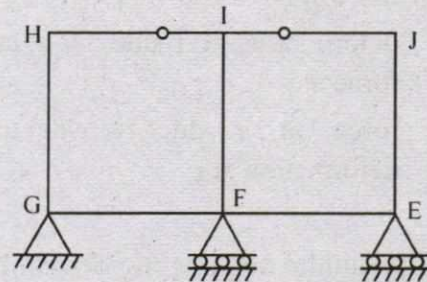
Each question carries one mark.

(50 × 1 = 50)

- Creep strain is
  - caused due to dead load only
  - caused due to live load only
  - caused due to cyclic load only
  - independent of load
- The effective length of a column of length  $L$  fixed against rotation and translation at one end is
  - $0.5 L$
  - $0.7 L$
  - $1.414 L$
  - $2 L$
- The ratio of the theoretical critical buckling load for a column with fixed ends to that of another column with the same dimensions and material, but with pinned ends, is equal to
  - $0.5$
  - $1.0$
  - $2.0$
  - $4.0$
- When the middle pontoon is removed, the deflection at  $H$  will be
  - $0.2 \text{ m}$
  - $0.4 \text{ m}$
  - $0.6 \text{ m}$
  - $0.8 \text{ m}$

- The components of strain tensor at a point in the plane strain case can be obtained by measuring longitudinal strain in following directions :
  - along any two arbitrary directions
  - along any three arbitrary directions
  - along two mutually orthogonal directions
  - along any arbitrary direction

- The degree of static indeterminacy of the rigid frame having two internal hinges as shown in the figure below, is



- 8
- 7
- 6
- 5

Space For Rough Work



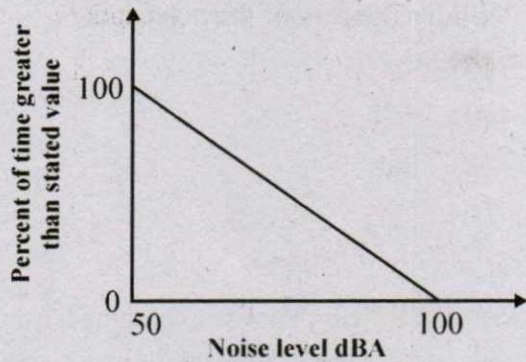
7. Muller Breslau Principle in structural analysis is used for
- (A) drawing influence line diagram for any force function
  - (B) writing virtual work equation
  - (C) super position of load effects
  - (D) None of these
8. For a linear structural system, minimization of potential energy yields
- (A) compatibility conditions
  - (B) constitutive relations
  - (C) equilibrium equations
  - (D) strain-displacement relations
9. The stiffness coefficient  $k_{ij}$  indicates
- (A) force at  $i$  due to a unit deformation at  $j$
  - (B) deformation at  $j$  due to a unit force at  $i$
  - (C) deformation at  $i$  due to a unit force at  $j$
  - (D) force at  $j$  due to a unit deformation at  $i$
10. The maximum hogging moment in the beam anywhere is
- (A) 300 kNm
  - (B) 450 kNm
  - (C) 500 kNm
  - (D) 750 kNm
11. Consider four common air pollutants found in urban environments, NO, SO<sub>2</sub>, Soot and O<sub>3</sub>. Among these, which one is the secondary air pollutant?
- (A) O<sub>3</sub>
  - (B) NO
  - (C) SO<sub>2</sub>
  - (D) Soot
12. A coastal city produces municipal solid waste (MSW) with high moisture content, high organic materials, low calorific value and low inorganic materials. The most effective and sustainable option for MSW management in that city is
- (A) Composting
  - (B) Dumping in sea
  - (C) Incineration
  - (D) Landfill
13. What is the solids content (by weight) of the thickened sludge?
- (A) 3.96%
  - (B) 4.00%
  - (C) 4.04%
  - (D) 4.10%

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Space For Rough Work



14. The cumulative noise power distribution curve at a certain location is given below :



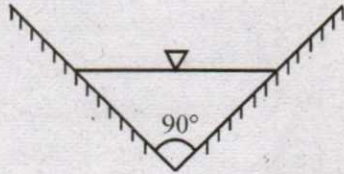
The value of  $L_{40}$  is equal to

- (A) 90 dBA  
 (B) 80 dBA  
 (C) 70 dBA  
 (D) 60 dBA
15. Zero hardness of water is achieved by  
 (A) lime soda process  
 (B) excess lime treatment  
 (C) ion exchange treatment  
 (D) excess alum and lime treatment
16. For subcritical flow in an open channel, the control section for gradually varied flow profile is  
 (A) at the downstream end  
 (B) at the upstream end  
 (C) at both ends  
 (D) at any intermediate section
17. The normal depth in a wide rectangular channel is increased by 10%. The % increase in discharge in the channel is  
 (A) 20.1  
 (B) 15.4  
 (C) 10.5  
 (D) 17.2
18. A rectangular open channel of width 5.0 m is carrying a discharge of  $100 \text{ m}^3/\text{s}$ . The Froude number of the flow is 0.8. The depth of flow (in m) in the channel is  
 (A) 4  
 (B) 5  
 (C) 16  
 (D) 20
19. In the Bernoulli's equation, used in pipe flow, each term represents  
 (A) Energy per unit weight  
 (B) Energy per unit mass  
 (C) Energy per unit volume  
 (D) Energy per unit flow length

Space For Rough Work



20. A hydraulic jump takes place in a triangular channel of vertex angle  $90^\circ$ , as shown in figure. The discharge is  $1 \text{ m}^3/\text{s}$  and the pre-jump is  $0.5 \text{ m}$ . What will be the post-jump depth? (Take  $g = 981 \text{ m/s}^2$ )



- (A) 0.57 m  
 (B) 0.91 m  
 (C) 1.02 m  
 (D) 1.57 m
21. Deposit with flocculated structure is formed when
- (A) clay particles settle on sea bed  
 (B) clay particles settle on fresh water lake bed  
 (C) sand particles settle on river bed  
 (D) sand particles settle on sea bed
22. The ratio of saturated unit weight of dry unit weight of soil is 1.25. If the specific gravity of solids ( $G_s$ ) is 2.65, the void ratio of the soil is
- (A) 0.625  
 (B) 0.663  
 (C) 0.944  
 (D) 1.325

23. The void ratios at the densest, loosest and the natural states of a sand deposit are 0.2, 0.6 and 0.4 respectively. The relative density of the deposit is
- (A) 100%  
 (B) 75%  
 (C) 50%  
 (D) 25%

24. The following data was obtained from a liquid test conducted on a soil sample :

<b>Number of blows</b>	17	22	25	28	34
<b>Water content (%)</b>	63.8	63.1	61.9	60.6	60.5

The liquid limit of the soil is

- (A) 63.1%  
 (B) 62.8%  
 (C) 61.9%  
 (D) 60.6%
25. A 25 kN point load acts on the surface of an infinite elastic medium. The vertical pressure intensity in  $\text{kN/m}^2$  at a point 6.0 m below and 4.0 m away from the load will be
- (A) 132  
 (B) 13.2  
 (C) 1.32  
 (D) 0.132

Space For Rough Work



26. Camber on highway pavement is provided to take care of
- (A) Centrifugal force
  - (B) Drainage
  - (C) Sight Distance
  - (D) Off-tracking
27. The minimum value of CBR(%) required for granular sub-base as per Ministry of Surface Transport (MOST) specification is
- (A) 5
  - (B) 10
  - (C) 15
  - (D) 20
28. The design value of lateral friction coefficient of highway is
- (A) 1.5
  - (B) 0.50
  - (C) 0.35
  - (D) 0.15
29. Bitumen is derived from
- (A) destructive distillation of coaltar
  - (B) destructive distillation of petroleum
  - (C) fractional distillation of petroleum
  - (D) naturally occurring ores
30. The speed and delay studies on a defined section of highway are conducted by
- (A) radar gun
  - (B) traffic counters
  - (C) moving car method
  - (D) enoscope
31. Road roughness is measured using
- (A) Benkelman beam
  - (B) Bump integrator
  - (C) Dynamic cone penetrometer
  - (D) Falling weight deflectometer
32. Curvature correction to a staff reading in a differential leveling survey is
- (A) always subtractive
  - (B) always zero
  - (C) always additive
  - (D) dependent on latitude

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Space For Rough Work



33. The plan of a survey plotted to a scale of 10 m to 1 cm is reduced in such a way that a line originally 10 cm long now measures 9 cm. The area of the reduced plan is measured as 81 cm<sup>2</sup>. The actual area (m<sup>2</sup>) of the survey is
- (A) 10000
  - (B) 6561
  - (C) 1000
  - (D) 656
34. The type of surveying in which the curvature of the earth is taken into account is called
- (A) Geodetic surveying
  - (B) Plane surveying
  - (C) Preliminary surveying
  - (D) Topographical surveying
35. The plan of a map was photo copied to a reduced size such that a line originally 100 mm, measures 90 mm. The original scale of the plan was 1 : 1000. The revised scale is
- (A) 1 : 900
  - (B) 1 : 1111
  - (C) 1 : 1121
  - (D) 1 : 1221
36. Maximum possible value of compaction factor for fresh (green) concrete is
- (A) 0.5
  - (B) 1.0
  - (C) 1.5
  - (D) 2.0
37. Which one the following is categorised as a long-term loss of prestresses in a prestressed concrete member ?
- (A) Loss due to elastic shortening
  - (B) Loss due to friction
  - (C) Loss due to relaxation of strands
  - (D) Loss due to anchorage slip
38. The cross-section of a thermo-mechanically treated (TMT) reinforcing bar has
- (A) soft ferrite-pearlite throughout
  - (B) hard martensite throughout
  - (C) a soft ferrite-pearlite core with a hard martensitic rim.
  - (D) a hard martensitic core with a soft pearlite-bainitic rim.

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Space For Rough Work



39. As per Indian standard code of practice for prestressed concrete (IS : 1343-1980) the minimum grades of concrete to be used for post-tensioned and pre-tensioned structural elements are respectively
- (A) M20 for both
  - (B) M40 and M30
  - (C) M15 and M20
  - (D) M30 and M40
40. The partial factor of safety for concrete as per IS:456-2000 is
- (A) 1.50
  - (B) 1.15
  - (C) 0.87
  - (D) 0.446
41. Bernoulli's equation is applicable for
- (A) viscous and compressible fluid flow
  - (B) inviscid and compressible fluid flow
  - (C) inviscid and incompressible fluid flow
  - (D) viscous and incompressible fluid flow
42. The Le Chatelier apparatus is used to determine
- (A) compressive strength of cement
  - (B) fineness of cement
  - (C) setting time of cement
  - (D) soundness of cement
43. The deformation in concrete due to sustained loading is
- (A) creep
  - (B) hydration
  - (C) segregation
  - (D) shrinkage
44. The width of a square footing and the diameter of a circular footing are equal. If both the footings are placed on the surface of sandy soil, the ratio of the ultimate bearing capacity of circular footing to that of square footing will be
- (A)  $4/3$
  - (B) 1
  - (C)  $3/4$
  - (D)  $2/3$

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**Space For Rough Work**



45. There are 20,000 vehicles operating in a city with an average annual travel of 12,000 km per vehicle. The  $\text{NO}_x$  emission rate is 2.0 g/km per vehicle. The total annual release of  $\text{NO}_x$  will be
- (A) 4,80,000 kg
  - (B) 4,800 kg
  - (C) 480 kg
  - (D) 48 kg
46. The setting time of cement is determined using
- (A) Le Chatelier apparatus
  - (B) Briquette testing apparatus
  - (C) Vicat apparatus
  - (D) Casagrande's apparatus
47. The clay mineral, whose structural units are held together by potassium bond is
- (A) Halloysite
  - (B) Illite
  - (C) Kaolinite
  - (D) Smectite
48. Dupuit's assumptions are valid for
- (A) artesian aquifer
  - (B) confined aquifer
  - (C) leaky aquifer
  - (D) unconfined aquifer
49. A flownet below a dam consists of 24 equipotential drops and 7 flow channels. The difference between the upstream and downstream water levels is 6 m. The length of the flow line adjacent to the toe of the dam at exit is 1 m. The specific gravity and void ratio of the soil below the dam are 2.70 and 0.70, respectively. The factor of safety against piping is
- (A) 1.67
  - (B) 2.5
  - (C) 3.4
  - (D) 4
50. For a given discharge in an open channel, there are two depths which have the same specific energy. These two depths are known as
- (A) alternate depths
  - (B) critical depths
  - (C) normal depths
  - (D) sequent depths

Space For Rough Work



PART – II

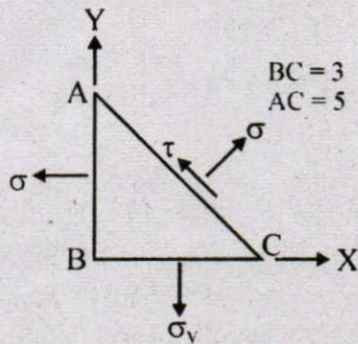
Each question carries two marks.

(25 × 2 = 50)

51. The state of two dimensional stresses acting on a concrete lamina consists of a direct tensile stress,  $s_x = 1.5 \text{ N/mm}^2$ , and shear stress,  $t = 1.20 \text{ N/mm}^2$ , which cause cracking of concrete. Then the tensile strength of the concrete in  $\text{N/mm}^2$  is

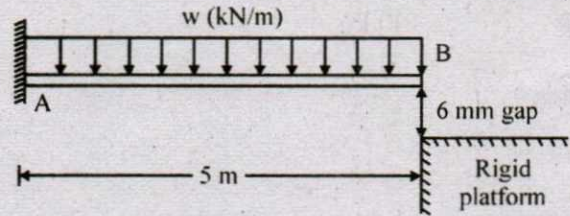
- (A) 1.50
- (B) 2.08
- (C) 2.17
- (D) 2.29

52. In a two dimensional stress analysis, the state of stress at a point is shown below. If  $s = 120 \text{ MPa}$  and  $t = 70 \text{ MPa}$ ,  $s_x$  and  $s_y$ , are respectively,



- (A) 26.7 MPa and 172.5 MPa
- (B) 54 MPa and 128 MPa
- (C) 67.5 MPa and 213.3 MPa
- (D) 16 MPa and 138 MPa

53. For the linear elastic beam shown in the figure, the flexural rigidity,  $EI$  is  $781250 \text{ kNm}^2$ . When  $w = 10 \text{ kN/m}$ , the vertical reaction  $R_A$  at A is 50 kN. The value of  $R_A$  for  $w = 100 \text{ kN/m}$  is



- (A) 500 kN
- (B) 425 kN
- (C) 250 kN
- (D) 75 kN

54. A circular solid shaft of span  $L = 5 \text{ m}$  is fixed at one end and free at other end. A twisting moment  $T = 100 \text{ kNm}$  is applied at the free end. The torsional rigidity  $GH$  is  $50000 \text{ kNm}^2/\text{rad}$ .

Following statements are made for this shaft :

1. The maximum rotation is 0.01 rad.
2. The torsional strain energy is 1 kNm.

With reference to the above statements, which of the following applies ?

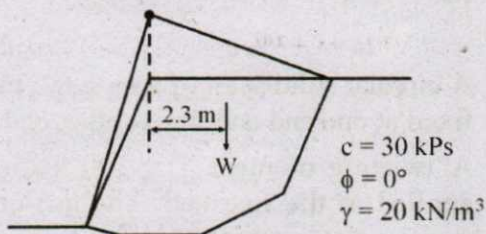
- (A) Both statements are true.
- (B) Statement 1 is true but 2 is false.
- (C) Statement 2 is true but 1 is false.
- (D) Both the statements are false.

Space For Rough Work



55. The coefficients of permeability of a soil in horizontal and vertical directions are 3.46 and 1.5 m/day respectively. The base length of a concrete dam resting in this soil is 100 m. When the flow net is developed for this soil with 1 : 25 scale factor in the vertical direction, the reduced base length of the dam will be
- (A) 2.63 m  
 (B) 4.00 m  
 (C) 6.08 m  
 (D) 5.43 m

56. The critical slip circle for a slope is shown below along with the soil properties :



The length of the arc of the slip circle is 15.6 m and the area of soil within the slip circle is  $82 \text{ m}^2$ . The radius of the slip circles is 10.3 m. The factor of safety against the slip circle failure is nearly equal to

- (A) 1.05  
 (B) 1.22  
 (C) 0.78  
 (D) 1.28

57. A plate load test was conducted in sand on a 300 mm diameter plate. If the plate settlement was 5 mm at a pressure of 100 kPa, the settlement (in mm) of a 5 m # 8 m rectangular footing at the same pressure will be
- (A) 9.4  
 (B) 18.6  
 (C) 12.7  
 (D) 17.8

58. If the effective shear stress strength parameters of a soil are  $c' = 10 \text{ kPa}$  and  $f' = 30c$ , the shear strength on a plane within the saturated soil mass at a point where the total normal stress is 300 kPa and pore water pressure is 150 kPa will be
- (A) 90.5 kPa  
 (B) 96.6 kPa  
 (C) 101.5 kPa  
 (D) 105.5 kPa

59. A valley curve has a descending gradient of 1 in 40 followed by an ascending gradient of 1 in 50. The length of the valley curve required for a design speed of 80 km/hour for comfort condition is
- (A) 199 m  
 (B) 116 m  
 (C) 58 m  
 (D) 37 m

Space For Rough Work



60. The radius of relative stiffness for a 20 cm thick slab with  $E = 3 \times 10^5 \text{ kg/cm}^2$  and Poisson's ratio = 0.15, resting on a subgrade having modulus of  $5 \text{ kg/cm}^3$  is
- (A) 10 cm  
(B) 80 cm  
(C) 120 cm  
(D) 320 cm
61. A car is moving at a speed of 72 km/hr on a road having 2% upward gradient. The driver applies brakes when he sees an obstruction. If his reaction time is 1.5 seconds, assuming that the coefficient of friction between the pavement and tyre as 0.15, calculate the distance traversed before the car finally stops.
- (A) 24 m  
(B) 150 m  
(C) 1050 m  
(D) 324 m
62. The design speed for a National Highway is 100 kmph. If the maximum permissible superelevation is 0.10 and the coefficient of lateral friction is 0.15, the ruling minimum radius of horizontal curve on the highway should be
- (A) 260 m  
(B) 315 m  
(C) 380 m  
(D) 410 m
63. A roundabout is provided with an average entry width of 8.4 m, width of weaving section as 14 m, and length of the weaving section between channelizing islands as 35 m. The crossing traffic and total on the weaving section are 1000 and 2000 PCU per hour respectively. The nearest rounded capacity of the roundabout (in PCU per hour) is
- (A) 3300  
(B) 3700  
(C) 4500  
(D) 5200
64. A crest vertical curve joins two gradients of +3% and -2% for a design speed of 80 km/h and the corresponding stopping sight distance of 120 m. The height of driver's eye and the object above the road surface are 1.20 m 0.15 m respectively. The curve length (which is less than stopping sight distance) to be provided is
- (A) 120 m  
(B) 152 m  
(C) 163 m  
(D) 240 m

Space For Rough Work



65. The observations from a closed loop traverse around an obstacle are

Segment	Observation from station	Length (m)	Azimuth (clockwise from magnetic north)
PQ	P	Missing	33.7500c
QR	Q	300.00	86.3847c
RS	R	354.524	169.3819c
ST	S	450.000	243.9003c
TP	T	268.000	317.5000c

What is the value of the missing measurement (rounded off to the nearest 10 mm) ?

- (A) 396.86 m  
 (B) 396.79 m  
 (C) 396.05 m  
 (D) 396.94 m
66. The design speed for a two lane road is 80 kmph. When a design vehicle with a wheelbase of 6.6 m is negotiating a horizontal curve on that road, the off-tracking is measured as 0.096 m. The required widening of carriageway of the two-lane road on the curve is approximately
- (A) 0.55 m  
 (B) 0.65 m  
 (C) 0.75 m  
 (D) 0.85 m

67. The  $\text{Ca}^{2+}$  concentration and  $\text{Mg}^{2+}$  concentration of a water sample are 160 mg/lit and 40 mg/lit as their ions respectively. The total hardness of the water sample in terms of  $\text{CaCO}_3$  in mg/lit is approximately equal to

- (A) 120  
 (B) 200  
 (C) 267  
 (D) 567

68. A wastewater sample has an initial BOD of 222 mg/L. The first order BOD decay coefficient is 0.4/day. The BOD consumed (in mg/L) in 5 days is

- (A) 150  
 (B) 192  
 (C) 30  
 (D) 50

69. For a water treatment plant having a flow rate of  $432 \text{ m}^3/\text{hr}$ , what is the required plan area of a Type-I settling tank to remove 90% of the particles having a settling velocity of 0.12 cm/sec is

- (A)  $120 \text{ m}^2$   
 (B)  $111 \text{ m}^2$   
 (C)  $90 \text{ m}^2$   
 (D)  $100 \text{ m}^2$

Space For Rough Work



70. An ideal horizontal flow settling basing is 3 m deep having surface area  $900 \text{ m}^2$ . Water flows at the rate of  $8000 \text{ m}^3/\text{d}$ , at water temperature  $20^\circ\text{C}$  ( $\mu = 10^{-3} \text{ kg/m-s}$  and  $\rho = 1000 \text{ kg/m}^3$ ). Assuming Stoke's law to be valid, the proportion (percentage) of spherical sand particles ( $0.01 \text{ mm}$  in diameter with specific gravity 2.65), that will be removed, is
- (A) 32.5  
(B) 67  
(C) 87.5  
(D) 95.5
71. A 15 cm length of steel rod with relative density of 7.4 is submerged in a two layer fluid. The bottom layer is mercury and the top layer is water. The height of top surface of the rod above the liquid interface in 'cm' is
- (A) 8.24  
(B) 7.82  
(C) 7.64  
(D) 7.38
72. In a 1/50 model of a spillway, the discharge was measured to be  $0.3 \text{ m}^3/\text{sec}$ . The corresponding prototype discharge in  $\text{m}^3/\text{sec}$  is
- (A) 2.0  
(B) 15.0  
(C) 106.0  
(D) 5303.0
73. A solid sphere (diameter 6 mm) is rising through oil (mass density  $900 \text{ kg/m}^3$ , dynamic viscosity  $0.7 \text{ kg/ms}$ ) at a constant velocity of  $1 \text{ cm/s}$ . What is the specific weight of the material from which the sphere is made?  
(Take  $g = 9.81 \text{ m/s}^2$ )
- (A)  $4.3 \text{ kN/m}^3$   
(B)  $5.3 \text{ kN/m}^3$   
(C)  $8.7 \text{ kN/m}^3$   
(D)  $12.3 \text{ kN/m}^3$
74. A velocity field is given as  $V_r = 2yit + 3xjt$  where  $x$  and  $y$  are in metres. The acceleration of a fluid particle at  $(x, y) = (1, 1)$  in the  $x$  direction is
- (A) 0  
(B)  $5.00 \text{ m/s}^2$   
(C)  $6.00 \text{ m/s}^2$   
(D)  $8.48 \text{ m/s}^2$
75. The height of a hydraulic jump in the stilling pool of 1 : 25 scale model was observed to be 10 cm. The corresponding prototype height of the jump is
- (A) not determinable from the data given  
(B) 2.5 m  
(C) 0.5 m  
(D) 0.1 m

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Space For Rough Work



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