ENTRANCE EXAMINATION FOR ADMISSION, MAY 2010.

M.Tech. (ENVIRONMENTAL ENGINEERING AND MANAGEMENT)

COURSE CODE : 393

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 393

Time : 2 Hours   Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.

2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.

3. Read each question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.

4. Avoid blind guessing. A wrong answer will fetch you –1 mark and the correct answer will fetch 4 marks.

5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.

6. Do not open the question paper until the start signal is given.

7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.

8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.

9. Use of Calculators, Tables, etc. are prohibited.

1. Of the following quantities, which one has dimensions different from the remaining three?

   (A) Energy per unit volume

   (B) Force per unit area

   (C) Product of voltage and charge per unit volume

   (D) Angular momentum per unit mass

2. If the unit of velocity and force are doubled then the units of Power will be

   (A) doubled

   (B) halved

   (C) quadrupled

   (D) remain unaffected

3. From the top of the building a ball is thrown straight upwards with an initial speed and at the same time another ball is thrown straight downwards with the same initial speed. Neglecting air resistance, which one of the following statements in correct

   (A) Both balls hit lie ground at the same time

   (B) Both the balls in it the ground with same speed

   (C) The ball thrown downwards hits the ground with larger speed

   (D) The ball thrown upwards hits the ground with larger speed

4. Which of the following is not an example of linear motion?

   (A) a hook at rest

   (B) a body in uniform circular motion

   (C) wheel rotating at uniform speed on road

   (D) a body rolling down an inclined plane

5. An insect crawls a distance of 4 m along north in 10 seconds and then distance of 3 m along east in 5 seconds. The average velocity of the insect is

   (A) 7/15 m/sec

   (B) 1/5 m/sec

   (C) 5/15 m/sec

   (D) 12/15 m/sec

6. A man in a lift will weigh more when

   (A) the lift beings to go up

   (B) the lift is going up steadily

   (C) the lift is slowing down while ascending

   (D) the lift is ascending freely

7. A cyclist turns around a cure at 15 miles per hour. If he turns at double the speed, the tendency to overturn is

    (A) doubled   (B) quadrupled   (C) halved   (D) unchanged

8. A point mass m is placed at the origin. The gravitational potential due to the point mass at a point distant x from it is proportional to

    (A) x^0 (B) x^{-1} (C) x^{+1} (D) x^{-2}

9. If you float on your back on water, your weight is

    (A) Zero

    (B) Equal to your normal weight

    (C) Half your normal weight

    (D) Greater than the weight of water you displace

10. A boy carries a fish in one hand and a bucket of water in the other. If he transfers the fish to the bucket of water, the total weight carried by him

    (A) Is less than before   (B) Is more than before

    (C) Is the same as before   (D) Depends on the mode of travel

11. Streamline flow is more likely for liquids with

    (A) High density and low viscosity   (B) Low density and high viscosity

    (C) High density and high viscosity   (D) Low density and low viscosity

12. By increasing the temperature of a liquid its

    (A) Volume and density decrease

    (B) Volume and density increase

    (C) Volume increases and density decreases

    (D) Volume decreases and density increases

13. Which of the following is the smallest temperature?

    (A) 1°F   (B) 1°R   (C) 1°K   (D) 1°C

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14. A cold coke bottle is left open on the pan of a balance and its weight observed from time to time. The weight

   (A) increases

   (B) decreases

   (C) increases, reaches a maximum and then starts decreasing

   (D) remains stationary

15. The saturation vapour pressure of water at 100°C is

   (A) 739 mm of mercury   (B) 750 mm of mercury

   (C) 760 mm of mercury   (D) 772 mm of mercury

16. At normal temperature and pressure water boils at 100°C. Deep down the mine, water boil at a temperature

   (A) 100°C   (B) greater than 100°C

   (C) less than 100°C   (D) will not boil at all

17. When a large bubble rises from the bottom of a lake to the surface; its radius doubles. The atmospheric pressure is equal to that of a column of water of height H, the depth of the lake is

   (A) H   (B) 2H   (C) 7H   (D) 8H

18. In the equation $PV = RT$, V stands for the volume of

   (A) any amount of gas   (B) one gram of gas

   (C) one gram mole of gas   (D) one litre of gas

19. A tube of length L and radius R is joined to another tube of length L/3 and radius R/2. A fluid is flowing through this tube. If the pressure difference across the first tube is P, then the pressure difference across the second tube is

   (A) 16 P/3   (B) 4 P/3   (C) P   (D) 3 P/16

20. A fluid of density 'r' and viscosity η is flowing through a pipe of diameter 'd' with a velocity 'v'. Reynold number R is

   (A) $R = 2rdv/\eta$ (B) $R = rdv/\eta$ (C) $R = rdv/\eta^2$ (D) $R = 2\eta rv/d$

21. The viscous force between two liquid layers is

    (A) Radial

    (B) Normal to the liquid surface

    (C) Tangential to the liquid surface

    (D) Neither purely tangential nor purely normal

22. There is a hole of area A at the bottom of a cylindrical vessel. Water is filled upto a height h and water flows out in t sec. If water is filled to a height $4h$, it will flow out in time

    (A) t   (B) 4t   (C) 2t   (D) t/4

23. Water is flowing through a tube of non-uniform cross-section. If the radius of the tube at the entrance and exit is in the ratio 3 : 2 then the ratio velocity of liquid entering and leaving the tube is

    (A) 8 : 27   (B) 4 : 9   (C) 1 : 1   (D) 9 : 4

24. According to the kinetic theory of gases, which of the following statements is wrong?

    (A) All molecules of a gas are identical

    (B) Collisions between the molecules of a gas and that of the molecules with the walls of the containers are perfectly elastic

    (C) The molecules do not exert appreciable force on one another except during collision

    (D) The pressure exerted by a gas is due to the collisions between the molecules of the gas

25. A ball and a highly stretched spring are made of the same metal and have the same mass. They are heated so that the melt. The latent heat required

    (A) Is the same for both

    (B) Is greater for the ball

    (C) Is greater for the spring

    (D) May or may not he same depending on the metal

26. To what extent must a given solution containing 40 mg $AgNO_3$ per ml be diluted to yield a solution containing 16 mg $AgNO_3$ per mL?

    (A) To 1 mL solution add 1.5 mL of water

    (B) To 1 mL of solution 2.5 mL of water should be added

    (C) To 1.5 mL of solution 2 mL of water should be added

    (D) To 1.5 mL of solution 1.5 mL of water should be added

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27. According to Raoult's law the relative lowering of vapour pressure of a solution of non-volatile substance is equal to?

    (A) Mole fraction of solute
    (B) Mole fraction of solvent
    (C) Weight percent of solute
    (D) Weight percent of solvent

28. Which of the following is not a colligative property?

    (A) Lowering of vapour pressure
    (B) Freezing point
    (C) Osmotic pressure
    (D) Elevation of poiling point

29. The vant Hoff factor i for a 0.1 M Molal aqueous solution of an ideal solute is?

    (A) 0.1
    (B) 1
    (C) 0
    (D) 0.2

30. In a 0.1 M solution of NaCl in water, which one of the following will be closest to 0.1?

    (A) Mole-fraction of NaCl
    (B) Mole-fraction of water
    (C) Percent wt. of NaCl
    (D) Molality

31. The concentrations of two HCl solutions are 0.5 N and 0.1 N. The volumes of A and B required to prepare 2 liters of 0.2 N HCl will be [KCET 1993]

    (A) 0.5 L of A + 1.5 L of B
    (B) 1.5 L of A + 0.5 L of B
    (C) 1.0 L of A + 1.0 L of B
    (D) 0.75 L of A + 1.25 L of B

32. The pressure under which liquid and vapour can co-exist in equilibrium is known as?

    (A) Normal vapour pressure
    (B) Saturated vapour pressure
    (C) Real vapour pressure
    (D) Limiting vapour pressure

33. The formula weight of $Al_2(SO_4)_3$ is 342. A solution containing 342 of $Al_2(SO_4)_3$ is

    (A) One litre of solution of one molar
    (B) One litre of solution of 2 molar
    (C) 1000 gm of water in 3 normal
    (D) 2 litre of solution in 3 molar

34. That colloidal particles carry charge is demonstrated by

    (A) Tyndall effect
    (B) Cataphoresis
    (C) Brownian Movement
    (D) Dialysis

35. In the coagulation of positively charged colloidal solution which of the following has maximum coagulating power?

    (A) SO_4^{2-}
    (B) Cl^-
    (C) PO_4^{3-}
    (D) $[Fe(CN)_6]^{4-}$

36. Lyophilic sols are more stable than lyophobic colloids because?

   (A) Colloidal particles have positive charge

   (B) Colloidal particles have negative charge

   (C) Colloidal particles are solvated

   (D) There are strong electrostatic repulsions between the negatively charged particles

37. The extent of adsorption of a gas on a solid depends on?

   (A) Nature of gas   (B) Pressure of gas

   (C) Temperature of the system   (D) All are correct

38. When a reversible reaction is in equilibrium, opposing forces?

   (A) Stop acting   (B) Are shifted to the right

   (C) Are in constant operation   (D) Go to one end

39. The Kc for the reaction $A + B \leftrightarrow C + D$ is 9. If one mole of each of A and B are mixed and there is no change in volume the number of moles of C formed is?

   (A) 0.50   (B) 0.75   (C) 0.90   (D) 1.5

40. In the reaction $A + B \leftrightarrow AB$, if the concentration of A is doubled, the rate of reaction will be?

   (A) Doubled   (B) Decreased to one half

   (C) Remains unaffected   (D) Increased to 4 times

41. The rate law for a reaction $A + B \rightarrow$ Product is rate $= K[A]^1[B]^2$. Then which one of the following statements is false?

   (A) If [B] is held constant while [A] is doubled, the reaction will proceed twice as fast

   (B) If [A] is held constant while [B] is reduced to one quarter, the rate will be halved

   (C) If [A] and [B] are both doubled, the reaction will proceed 8 times as fast

   (D) This is a third order reaction

42. The reaction proceeds in three stages. The first stage is a slow second order reaction. The third stage is fast and is a third order reaction. The overall order of the reaction is

   (A) First order   (B) Second order

   (C) Third order   (D) Zero order

43. For a reaction, $2A + B \leftrightarrow C + D$, $\dfrac{-d[A]}{dt} = k[A]^2[B]$. The expression for $\dfrac{-d[B]}{dt}$ will be?

(A) $k[A]^2[B]$

(B) $1/2\ k[A^2][B]$

(C) $k[A]^2[2B]$

(D) $k[2A]^2[B]$

44. The rate of a reaction is doubled for every 10°C rise in temperature. The increase in rate as a result of increase in temperature from 10°C to 100°C is?

(A) 112

(B) 512

(C) 400

(D) 256

45. Efficiency of a catalyst depends on its

(A) Particle size

(B) Solubility

(C) Molecular weight

(D) None

46. The rate of a certain biochemical reaction when enzyme catalysed in the human body is 10^4 times faster than when it carried out in the laboratory. The activation energy of this reaction

(A) Is zero

(B) Is different in two eases

(C) Is the same in both the cases

(D) Can only he determined if temperature of the reaction is known

47. For a spontaneous process

(A) G increases

(B) G decreases

(C) S decreases

(D) S = 0

48. In a galvanic cell

(A) Chemical energy is converted into electricity

(B) Chemical energy is converted into heat

(C) Electrical energy is converted into chemical energy

(D) Electrical energy is converted into heat

49. The pH of a solution is 5.0. To this solution sufficient acid is added to decrease the pH to 2.0. The H^+ ion concentration?

(A) Increases 1000 times

(B) Decreases 1000 times

(C) Increases 100 times

(D) Decreases 100 times

50. If the solubility of $Ca(OH_2)$ is $\sqrt{3}$, what will be the solubility product?

(A) 3   (B) 27   (C) $\sqrt{3}$ (D) $12\sqrt{3}$

51. If the heat conduction vessels of the following shapes, of identical volume, are filled with a liquid heated to 80 C which vessel will loose heat the fastest

(A) The spherical vessel   (B) The cylindrical vessel

(C) The rectangular vessel   (D) The ellipsoidal vessel

52. The indefinite integral of $x \cdot dx$ is

(A) x (B) x^2 (C) $\dfrac{x^2}{2}$ (D) $\dfrac{x^2}{2} + c$

53. A tree is broken by wind, its upper part touches the ground at appoint 10 m from the foot of the tree and makes all angles of 45° with the ground. The entire length of the tree is

(A) 15 metres   (B) 20 metres

(C) $10(1 + \sqrt{2})$ metres   (D) $10(1 + \sqrt{3}/2)$ metres

54. The value of $\dfrac{i^{592} + i^{590} + i^{588} + i^{586} + i^{584}}{i^{582} + i^{580} + i^{578} + i^{576} + i^{574}} - 1 =$

(A) -1 (B) -2 (C) -3 (D) -4

55. The triangle joining the points $(2, 7)$, $(4, -10)$, $(-2, 6)$ is

(A) equilateral   (B) right angled

(C) isosceles   (D) none of these

56. The distance between the lines $3x + 4y = 9$, and $6x + 8y = 15$ is

(A) 3/2   (B) 3/10

(C) 6   (D) None of these

57. Locus of a point such that the ratio of its distances from two fixed points is constant is

(A) a circle   (B) a straight line

(C) an ellipse   (D) none of these

58. $\lim_{x \to 0}\{(1 - \cos 2x)/x\}$ is

(A) 0   (B) 1   (C) 2   (D) 4

59. Let $f(x) = \dfrac{x(1+a\cos x) - b\sin x}{x^3}$, $x \neq 0$, $f(0) = 1$. If $f(x)$ is continuous at $x = 0$, then a and b are

(A) 5/2, 3/2

(B) −5, −3

(C) −5/2, −3/2

(D) None of these

60. The value of $\dfrac{d}{dx}(x^x)$ is

(A) $x x^{x-1}$

(B) $x^x \log ex$

(C) $x^x \log x$

(D) None of these

61. If $x = \sin\theta\sqrt{(\cos 2\theta)}$, $y = \cos\theta\sqrt{(\sin 2\theta)}$, then dy/dx at $\theta = \pi/4$ is

(A) 1

(B) −1

(C) 0

(D) Not exist

62. If $\Delta_1 = \begin{vmatrix} x & a & a \\ b & x & a \\ b & b & x \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} x & a \\ b & x \end{vmatrix}$, then

(A) $\dfrac{d}{dx}\Delta_1 = \Delta_2$

(B) $\dfrac{d}{dx}\Delta_1 = 3\Delta_2$

(C) $\dfrac{d}{dx}\Delta_2 = \Delta_1 - \Delta_2$

(D) None of these

63. The derivative of $\sin^{-1} x$ w.r.t. $\cos^{-1}\sqrt{(1-x^2)}$ is

(A) $1/\sqrt{[(1-x^2)]}$

(B) $\cos^{-1} x$

(C) 1

(D) None of these

64. If $u = f(y-z, z-x, x-y)$ then $\partial u/\partial x + \partial u/\partial y + \partial u/\partial z =$

(A) 3

(B) 0

(C) $\dfrac{\partial f}{\partial x} + \dfrac{\partial f}{\partial y} + \dfrac{\partial f}{\partial z}$

(D) None of these

65. If $u = (x^{1/4} + y^{1/4})/(x^{1/6} + y^{1/6})$ and $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = ku$, then $k =$

(A) 1/4

(B) 1/12

(C) 1/24

(D) 1/6

66. The maximum possible area that can be enclosed by a wire of length 20 cm by bending it into the form of a sector in square cm is

(A) 10

(B) 25

(C) 30

(D) None of these

67. A particle is moving on a line, where its position s in metres is a function of time t in seconds given by $s = t^3 + at^2 + bt + c$, where a, b, c are constants. It is known that at $t = 1$ seconds, the position of the particle is given by $s = 7$ m, velocity is 7 m/s and acceleration is 12 m/s². The value of a, b, c are

(A) −3, 2, 7

(B) 3, −2, 5

(C) 3, 2, 1

(D) None of these

68. $\int x^2 e^{2x} \, dx =$

(A) $e^{2x}[2x^2 - 2x + 1] + c$

(B) $\frac{1}{2}e^{2x}[2x^2 - 2x + 1] + c$

(C) $\frac{1}{4}e^{2x}[2x^2 + 2x - 1] + c$

(D) None of these,

69. The area enclosed by the curve $y^2 = 4x$ and the line $y = x$ is

(A) 2/3

(B) 4/3

(C) 1/2

(D) 8/3

70. Solution of the diff. eqⁿ. $\dfrac{dy}{dx} + \dfrac{3x + 2y - 5}{2x + 3y - 5} = 0$ is

(A) $3x^2 + 4xy + 3y^2 - 10x - 10y = c$

(B) $x^2 + 4xy - y^2 - 4x + 6y = c$

(C) $(x + 2y)^2 + 3y = c$

(D) none of these

71. The vector $ax(bxa)$ is

(A) perpendicular to a

(B) perpendicular to b

(C) null vector

(D) perpendicular to both a and b

72. If the angle between a and b is $\pi/6$, then angle between $2a$ and $3b$ is

(A) $\pi/3$

(B) $\pi/2$

(C) $\pi/6$

(D) None of these

73. Two points A and B are given on the curve $y = 2^{(x+2)}$ being such that $\overrightarrow{OA} \cdot i = -1$ and $\overrightarrow{OB} \cdot i = 2$ then $\left|\overrightarrow{OB} - 4\overrightarrow{OA}\right|$

(A) 100

(B) 10

(C) $\sqrt{10}$

(D) None of these

74. If $-x^2 + 3x + 4 > 0$, then
   (A) $-1 < x < 4$
   (B) $x < -1$ and $x > 4$
   (C) $-1 \le x \le 4$
   (D) $x \le -1$ or $x \ge 4$

75. An ordinary cube has 4 blank faces, one face marked 2 and another marked 3. Then the probability of obtaining 12 in 5 throws is
   (A) 5/1296
   (B) 5/1944
   (C) 5/2592
   (D) None of these

76. The theory of 'Survival of the fittest' was put forth by
   (A) Lamarck
   (B) Darwin
   (C) De vries
   (D) Roentgen

77. Binominal nomenclature of scientific names was introduced by
   (A) Linnaeus
   (B) Rastogi
   (C) Darwin
   (D) Lamarck

78. The process used to kill bacteria in the milk (to prevent spoiling of the milk) is called
   (A) fermentation
   (B) freezing
   (C) preservation
   (D) pasteurization

79. The December 2004 Tsunami was caused by
   (A) Global warming
   (B) Ozone hole
   (C) Earth quake
   (D) Hurricane

80. Global warming will not cause
   (A) Rise in sea level
   (B) Extinction of some species
   (C) Change in weather
   (D) AIDS

81. In the field of pollution control AS P stands for
   (A) Active scale prevention
   (B) Activated sludge process
   (C) Alternative sludge production
   (D) Ammonia stripping polarimetry

82. In the field of environmental analysis. AAS is the acronym for
   (A) Atomic absorption spectrometry
   (B) Advance atomization system
   (C) Advanced analytical spectroscopy
   (D) Alternative analytical solutions

83. In a relation between two individuals, the individual which receives benefit at the expense of the other individual is called

   (A) host   (B) parasite   (C) predator   (D) prey

84. Of the following, which category of animals face highest possibility of extinction?

   (A) Threatened   (B) Endangered   (C) Vulnerable   (D) Rare

85. Which one is a proven carcinogen?

   (A) DTB   (B) TNT   (C) DDT   (D) NIT

86. Name the gas present in aerated drinks like soda water

   (A) O_2 (B) H_2 (C) CO_2 (D) N_2

87. Among the following which is least damaging to envirnment?

   (A) Nuclear power   (B) Hydroelectricity
   (C) Electricity from coal   (D) Hydrogen energy

88. Among the following which one is not a source of biomass energy

   (A) Municipal waste   (B) Coal
   (C) Biogas   (D) Agricultural residues

89. Anaerobic bacteria are so called because

   (A) They can't survive without free oxygen

   (B) They can't survive with free oxygen

   (C) They can't survive in cold climate

   (D) They can't react with water

90. The settling velocity of a pollutant particle in a liquid medium will depend on

   (A) Its chemical composition   (B) Its density
   (C) Its colour   (D) None of the above

91. Which of the following 'pollutant' can cause eutrophication in a water body

   (A) Mercury   (B) Copper   (C) Iron   (D) Phosphorous

92. Which of the following is not used for disinfection of water?

   (A) Chlorine   (B) Potassium, permanganate
   (C) Sodium chloride   (D) Iodine

93. The substance responsible for the 'Minimata' disaster was

   (A) Copper   (B) Chromium   (C) Mercury   (D) Zinc

94. Which of the following is a free-floating aquatic weed?

   (A) Hydrilla verticillate   (B) Microcystis perifyra

   (C) Salvinia molestsa   (D) Ipomea aquatica

95. BOD level of a water sample is indicative of

   (A) concentration of pathogens

   (B) concentration of organic matter

   (C) concentration of trace elements

   (D) concentration of facultative bacteria

96. Ozone hole is caused by

   (A) CVC   (B) BBC   (C) CDC   (D) CFC

97. Which one of the following gases in implicated with greenhouse effect

   (A) Chlorine   (B) Fluorine

   (C) CFC   (D) Methane

98. Vehicular traffic introduces which of the following pollutant in the environment

   (A) E.Coli   (B) Ozone   (C) Lead   (D) Heptachlor

99. Bhopal gas tragedy as caused by

   (A) CFC   (B) MIC   (C) LIC   (D) PVC

100. Which of the following is a product of anaerobic digest on of biomass?

   (A) HCL   (B) CH_4 (C) N_2 (D) O_2