TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
B.E. Model Entrance Examination-2024
2081-4-12

Attempt all Questions

Choose the correct answer and blacken the appropriate bubble using gel pen on answer sheet.

Full Marks: 140 **Time:** 2 hour

Select the best alternatives:

Section - I **(60 × 1 = 60)**

1. The logically equivalent statement of ~(p∨q) is
   a. ~p ⇒ ~q b. ~q ⇒ ~p c. ~p∧~q d. ~p∨~q
2. The function f(x) = |x| is
   a. an even function b. an odd function
   c. neither even nor odd d. both even and odd
3. If $Z = \cos\theta + i\sin\theta$ then $Z^n + \frac{1}{Z^n} =$
   a. 2sinnθ b. 2cosnθ c. 2i sinnθ d. 2i cosnθ
4. The number of distinct terms in the expansion of $(1 + 2x + x^2)^{15}$ is
   a. 31 b. 30 c. 16 d. 15
5. If $S_n = n^3 - 100$ then $t_{10} =$
   a. 900 b. 271 c. 100 d. 1000
6. The minimum value of $\sec^2\theta + \text{cosec}^2\theta$ is
   a. 8 b. 4 c. 2 d. 1
7. The value of $\sec^2(\tan^{-1}2) + \text{cosec}^2(\cot^{-1}3)$ is
   a. 5 b. 10 c. 15 d. 20
8. If $a\vec{i} + \vec{j} + \vec{k}$, $\vec{i} + b\vec{j} + \vec{k}$ and $\vec{i} + \vec{j} + c\vec{k}$ are coplanar then
   a. a + b + c = 0 b. abc = 1 c. a + b + c = abc + 2 d. a + b + c = 2abc
9. The area of parallelogram with diagonals $\vec{a}$ and $\vec{b}$ is
   a. $|\vec{a} \times \vec{b}|$ b. $2|\vec{a} \times \vec{b}|$ c. $\frac{1}{2}|\vec{a} \times \vec{b}|$ d. $\vec{a}.\vec{b}$
10. A function f(x) is said to be infinitesimal as $x \to a$ if $\lim_{x \to a} f(x) =$
    a. 0 b. 1 c. ∞ d. a
11. The function $f(x) = \frac{1}{x-3} - 5x$ is continuous at
    a. all x except at x = –3 b. all x except at x = 5
    c. all x except at x = 3 d. x = 3 only

12. If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots$ then $\frac{dy}{dx} =$

    a. y b. y – 1 c. y + 1 d. 0

13. The distance s meter covered by a body in t seconds is given by $s = 3t^2 - 8t + 5$, then the body will stop after

    a. $\frac{4}{3}$ sec b. $\frac{3}{4}$ sec c. 1 sec d. 4 sec

14. $\int x \cos x^2 dx =$

    a. $-\frac{1}{2}\sin x^2 + c$ b. $\frac{1}{2}\sin x^2 + c$ c. $-\frac{1}{2}\sin^2 x + c$ d. $\frac{1}{2}\sin^2 x + c$

15. The order of the differential equation whose general solution is given by
    $y = (C_1 + C_2)\sin(x + C_3) - C_4 e^{x + C_5}$ is

    a. 2 b. 3 c. 4 d. 5

16. If the sum of the slopes of the lines given by $x^2 - 2cxy - 7y^2 = 0$ is four times their product then c =

    a. –2 b. –1 c. 1 d. 2

17. The length of intercept, the circle $x^2 + y^2 + 10x - 6y + 9 = 0$ makes on the x-axis, is

    a. 2 b. 4 c. 6 d. 8

18. If A and B are two fixed points and P is a variable point such that PA + PB = 4, then the locus of P is

    a. a circle b. a parabola c. an ellipse d. a hyperbola

19. The perpendicular distance of the point (3, 4, 5) from y-axis is

    a. 3 b. 4 c. 5 d. $\sqrt{34}$

20. The chance that A can solve the problem is $\frac{2}{3}$ and the chance that B can solve the problem is $\frac{1}{3}$. The probability that the problem is solved by both A and B is

    a. 0 b. 1 c. $\frac{2}{9}$ d. $\frac{7}{9}$

21. When $\vec{A}.\vec{B} = |\vec{A} \times \vec{B}|$ then resultant of $\vec{A}$ and $\vec{B}$ is

    a. A + B b. A – B c. $(A^2 + B^2 + 2AB)^{1/2}$ d. $(A^2 + B^2 + \sqrt{2}\,AB)^{1/2}$

22. A ball of mass 0.1 kg is thrown against a wall. It strikes the wall normally with velocity of 30 m/s and rebound with velocity of 20 m/s. The impulse exerted by ball on wall is

    a. 0.5 NS b. 50 NS c. 1 N d. 5 NS

23. A ring and a disc have the same mass and radius. The ratio of their moment of inertia about an axis is

    a. 1 : 1 b. 2 : 1 c. 4 : 1 d. 1 : 2

24. The internal energy of an ideal gas depends on

    a. Pressure b. Volume c. Temperature d. Size of molecule

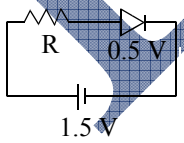
25. A gas perform minimum work when it expands

    a. Adiabatically b. isothermally c. Isobarically d. Isochorically

26. Ultrasonic, infrasonic and audible waves travel through a medium with speed v_u, v_i and v_a respectively then

    a. $v_i = v_a = v_u$ b. $v_u > v_a > v_i$ c. $v_u < v_a < v_i$ d. $v_a \le v_u = v_i$

27. When 100 J of work is performed in carrying a charge –5C from infinity to particular point in electric field. The potential of this point is
    a. 100 V b. 5 V c. –20 V d. 20 V
28. The internal resistance of a cell of emf 2V is 0.1 Ω. It is connected to a resistance of 3.9 Ω then voltage across cell will be
    a. 0.5 V b. 1.9 V c. 1.95 V d. 2 V
29. At a certain place the horizontal component of earths magnetic field is B_0 and angle of dip is 45° then total field intensity at that place will be
    a. B_0 b. $\sqrt{2}\,B_0$ c. $2B_0$ d. $\frac{B_0}{\sqrt{2}}$
30. In LCR circuit the inductance of solenoid changed from L to $\frac{L}{2}$. To keep same resonating frequency, capacitance should change from C to
    a. 2 C b. $\frac{C}{2}$ c. 4 C d. $\frac{C}{4}$
31. In Young's double slit experiment, the separation between the slits is halved and the distance between the slits and screen is doubled. The fringe width will be
    a. Unchanged b. Halved c. Doubled d. Quadrupled
32. When light passed through a prism then the colour which deviate least is
    a. Red b. Violet c. Blue d. Green
33. Double ionized helium atom and hydrogen ion are accelerated from rest through the same potential difference. The ratio of final velocities of helium and hydrogen ions is
    a. 2 : 1 b. $\sqrt{2}$: 1 c. 1 : 2 d. 1 : $\sqrt{2}$
34. When voltage of 0.5 V drop across diode in circuit and maximum power rating is 100 mw. The value of R in circuit will be



    a. 2 Ω b. 5 Ω c. 10 Ω d. 20 Ω
35. The bond present in N_2O_5 are
    a. only covalent b. covalent & co-ordinate
    c. covalent & ionic d. only ionic
36. Hydrogen behave as oxidizing agent when it reacts with
    a. Oxygen to form water b. Sulphur to form Hydrogen sulphide
    c. Nitrogen to form Ammonia d. Calcium to form calcium hydride
37. The correct set of four quantum numbers of 4d electron is
    a. 4, 2, 1, $-\frac{1}{2}$ b. 4, 3, –2, $+\frac{1}{2}$ c. 4, 3, 2, $+\frac{1}{2}$ d. 4, 3, 1, $+\frac{1}{2}$
38. 0.53 gm of anhydrous Na_2CO_3 is added to 100 ml 0.1 M HCl, the resulting solution will be
    a. Acidic b. Neutral c. Alkaline d. Acidic or Alkaline
39. Reduction of nitrobenzene in neutral medium yields
    a. Aniline b. Azobenzene
    c. Phenyl hydroxyl amine d. Hydrazobenzene

40. Aldehyde can be prepared from acid chloride by
    a. Rosenmund reduction
    b. Wolf-Kishner red^{n}
    c. Clemmensen's reduction
    d. Catalytic hydrogenation in presence of Raney nickel
41. Sodium nitroprusside solution is added to sodium extract of an organic compound in alkaline medium. If violet colour is obtained, it is due to the formation of
    a. $K_3[Fe(CN)_5NS]$ b. $Na_4[Fe(CN)_6]$ c. $K_3[Fe(CN)_6]_2$ d. $Na_4[Fe(CN)_5NOS]$
42. Which of the following shows electrophilic substitution reaction most strongly
    a. Benzene b. Phenol c. Nitrobenzene d. Dinitrobenzene
43. CF_3COOH is stronger acid than acetic acid because of
    a. inductive effect b. electromeric effect c. mesomeric effect d. resonance
44. When 2-propanone is treated with Iodine in presence of sodium hydroxide gives
    a. 1-iodopropane b. 1, 2-diiodopropane
    c. 2-iodopropanone d. Iodoform
45. The catalyst used in the manufacture of sulphuric acid by contact process is
    a. MnO_2 b. ZnO c. V_2O_5 d. CuO
46. In the blast furnace iron oxide is reduced by
    a. Carbon b. Br_2 c. CO d. $CaCO_3$
47. On heating KBr with conc. H_2SO_4 for sometime the gases evolved are
    a. HBr b. $Br_2 + SO_2$ c. $HBr + Br_2$ d. $SO_2 + HBr$
48. Conc. HNO_3 reacts with phosphorous to form
    a. H_3PO_4 b. H_3PO_3 c. P_2O_5 d. $H_2P_2O_7$
49. We are accustomed ... doing hard work.
    a. in b. of c. to d. with
50. If you were to buy a car, it ... you a lot of money.
    a. would cost b. cost c. had cost d. will cost
51. He said to her, "Are you coming to the party?"
    a. He asked her whether she had been coming to the party.
    b. He told her if she was coming to the party.
    c. He asked her if she was coming to the party.
    d. He asked her if she will be coming to the party.
52. You must look into this matter.
    a. This matter has been looked into by you. b. This matter may be looked into by you.
    c. This matter should be looked into by you. d. This matter into looked by you.
53. Choose the correct synonym of **Stern**.
    a. lenient b. Yong c. stem d. strict
54. Choose the correct antonym of MISANTHROPIST.
    a. pedant b. pragmatist c. zealot d. philanthropist
55. I dare to talk to him, ...?
    a. does he b. don't I c. aren't I d. did I

56. Choose the correct punctuation mark.

She is rich ( ) he is poor

a. : b. ; c. _ d. .

57. Rabin insisted on ... the letter.

a. read b. reading c. to read d. have read

58. Please don't make so much noise. I ...

a. work b. will work c. will be working d. am working

59. The correct phonemic transcription of the word 'cat' is

a. /Kæt/ b. /Kʌt/ c. /Ket/ d. /Kət/

60. The word 'vegetation' has its stress on its ... syllable.

a. 1st b. 2nd c. 3rd d. none

Section - II **(40 × 2 = 80)**

61. The domain of the function $y = \sin^{-1}\left[\log_3\left(\frac{x}{3}\right)\right]$ is

a. [–1, 9] b. [1, 9] c. [–9, 1] d. [–9, –1]

62. In ΔABC, if (a + b + c) (b + c – a) = 3bc then A =

a. 30° b. 45° c. 60° d. 90°

63. If $\vec{a}$ and $\vec{b}$ are unit vectors such that $|\vec{a} + \vec{b}| = 1$ then the value of $|\vec{a} - \vec{b}|$ =

a. 2 b. $\sqrt{2}$ c. 1 d. $\sqrt{3}$

64. $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix}$ =

a. 0 b. 1 c. $a^2 + b^2 + c^2$ d. $4a^2b^2c^2$

65. The number of 4 digit even numbers that can be formed using the digits 0, 1, 2, 3, 4, 5, 6 without repetition is

a. 120 b. 300 c. 420 d. 480

66. If the ratio of the roots of $x^2 + px + q = 0$ be equal to the ratio of the roots of $x^2 + lx + m = 0$ then

a. $pq^2 = l^2m$ b. $p^2m = l^2q$ c. $pq = lm$ d. $pq = -lm$

67. $1 + \frac{1+2}{2!} + \frac{1+2+2^2}{3!} + \frac{1+2+2^2+2^3}{3!} + \ldots$ to ∞ =

a. 2e b. e + 1 c. $\frac{1}{3}(e^3 - e)$ d. $e^2 - e$

68. The coordinates of the foot of the perpendicular drawn from the point (2, 4) to the line x + y = 1 is

a. $\left(-\frac{1}{2}, \frac{3}{2}\right)$ b. $\left(\frac{2}{3}, \frac{1}{4}\right)$ c. (1, –4) d. (–2, 3)

69. The equation of the plane through (2, –3, 1) and normal to the line joining (3, 4, –1) and (2, –1, 5) is

a. x + 2y + z = 5 b. x + 3y – 2z + 9 = 0 c. 2x + 3y + 4z = 3 d. x + 5y – 6z + 19 = 0

70. If the parabola $y^2 = 4ax$ passes through the point $(1, -2)$ then the equation of tangent at this point is

a. $x + y + 1 = 0$ b. $2x + 3y + 1 = 0$ c. $x - y - 1 = 0$ d. $4x + 3y = 2$

71. The S.D. of a first n natural numbers is

a. $\sqrt{\frac{n^2-1}{3}}$ b. $\sqrt{\frac{n^2+1}{3}}$ c. $\sqrt{\frac{n^2-1}{12}}$ d. $\sqrt{\frac{n^2+1}{2}}$

72. $\lim_{x \to 0} x^x =$

a. 0 b. 1 c. e d. doesn't exist

73. If $y = \tan^{-1}\left(\frac{\cos x + \sin x}{\cos x - \sin x}\right)$ then $\frac{dy}{dx} =$

a. -1 b. 0 c. $\frac{1}{2}$ d. 1

74. The value of $\int_0^{\sqrt{2}} [x^2]\, dx$, where $[\cdot]$ is the greatest integer function is

a. $\sqrt{2} - 1$ b. $\sqrt{2} + 1$ c. $2 - \sqrt{2}$ d. $\frac{2\sqrt{2}}{3}$

75. The area enclosed between the curves $y^2 = x$ and $y = |x|$ is

a. $\frac{2}{3}$ b. 1 c. $\frac{1}{6}$ d. $\frac{1}{3}$

76. After falling from aeroplane parachutist fall 50 m without friction. When parachute opens, it decelerates at 2 m/s^2. Parachute reach the ground with 3 m/s. What is height of aeroplane when parachute fall

a. 182 m b. 98 m c. 248 m d. 298 m

77. A mass of 0.5 kg moving with speed of 1.5 m/s on a horizontal smooth surface collides with spring of spring constant K = 50 N/m. The maximum compression of spring will be

a. 0.5 m b. 0.15 m c. 0.12 m d. 1.5 m

78. A boat of length 3 m and breadth 2 m is floating on lake. Boat sink by 1 cm when a man gets on it. The mass of man is

a. 60 kg b. 62 kg c. 72 kg d. 128 kg

79. 5.6 *l*ts of Helium gas at STP is compressed adiabatically to 0.7 *l*ts. If initial temperature is T_1 then work done in the process is

a. $\frac{9}{8}RT_1$ b. $\frac{3}{2}RT_1$ c. $\frac{15}{8}RT_1$ d. $\frac{9}{2}RT_1$

80. Two identical rods of same material are connected between two containers one of the is at 100°C and another is at 0°C. If rods are placed in parallel then q_1 g/s ice melt and if rods are placed in series then q_2 g/sec ice melt. The value of $\frac{q_2}{q_1}$ is

a. 2 : 1 b. 4 : 1 c. 1 : 2 d. 1 : 4

81. A car is moving towards a high diff. A car driver sound horn of frequency 'f'. The frequency of echo noticed by driver of car is 2f then velocity of car is, if velocity of sound is v m/s

a. $\frac{v}{2}$ b. $\frac{v}{\sqrt{2}}$ c. $\frac{v}{3}$ d. $\frac{v}{4}$

82. If potential in the region is V = (6xy – y + 2yz) then electric field intensity at a point (1, 1, 0) is

a. $-(6\hat{i} + 5\hat{j} + 2\hat{k})$ b. $-(2\hat{i} + 3\hat{j} + \hat{k})$ c. $-(6\hat{i} + 9\hat{j} + \hat{k})$ d. $-(3\hat{i} + 5\hat{j} + 3\hat{k})$

83. The charge flowing through a resistor 'R' varies with time by $Q = at - bt^2$ where a & b are +ve constant. The total heat developed in resistor is

a. $\frac{a^3r}{6b}$ b. $\frac{a^3R}{3b}$ c. $\frac{a^3R}{2b}$ d. $\frac{a^3R}{b}$

84. A long solenoid of diameter 0.1 m has 2×10^4 turns per m. At the centre of the solenoid a coil of 100 turns and radius 0.01 m is placed with its axis coinciding with axis of solenoid. The current in the solenoid reduces at constant rate to 0A from 4A in 0.05 sec. The resistance of coil is $10\pi^2$ Ω then charge circulate through it is

a. 16 μc b. 32 μc c. 16 π μc d. 32 πμc

85. In Young's double slit experiment the intensity of light at a point on screen where path difference is λ is K. The intensity at another at which path difference is $\frac{\lambda}{4}$ will be

a. K b. $\frac{K}{4}$ c. $\frac{K}{2}$ d. $\frac{K}{8}$

86. In spectrum of hydrogen atom the ratio of longest wavelength in Lyman series to the longest wavelength in Balmer series is

a. 9 : 4 b. 27 : 5 c. 5 : 27 d. 4 : 9

87. A converging lens of focal length 20 cm in air lens is made by material of refractive index 1.6. If lens is immersed in liquid of refractive index 1.3. The new focal length of lens will be

a. 40 cm concave b. 80 cm convex c. 52 cm convex d. 160 cm convex

88. The half life of radium is 1620 yrs and atomic weight is 226. The activity of 1g of sample will be

a. 3.6×10^6 /s b. 3.6×10^8/s c. 3.6×10^9/s d. 3.6×10^{10}/s

89. ΔH and ΔS values of the reactants X, Y and Z are given below

X : $\Delta H = 10.5$ KJ, $\Delta S = 30$ JK^{-1}

Y : $\Delta H = 1.08$ KJ, $\Delta S = -100$ JK^{-1}

Z : $\Delta H = -11.7$ KJ, $\Delta S = -100$ JK^{-1}

The reaction that will be spontaneous at 300 K is

a. X only b. Z only c. Y only d. None of them

90. A first order reaction is half complete in 40 minutes. The time required for completion of $3/4^{th}$ of reaction is

a. 60 minute b. 10 minute c. 80 minute d. 160 minute

91. An oxide of metal contains 47% by weight of oxygen if the metal has the relative atomic mass of 27. The empirical formula of metal oxide is

a. M_2O b. MO c. M_2O_3 d. MO_2

92. To an acidic solution having pH = 2, sufficient acid is added so that the pH decreases to 1. The increase in hydrogen ion concentration is

a. 2 times b. 100 times c. 10 times d. 3 times

93. 1.2 gm of gas occupies 336 ml at NTP. The molecular weight of the gas is

a. 40 b. 80 c. 60 d. 160

94. The oxidation of ethanol with acidified sodium dichromate gives
    a. Acetone b. Acetic anhydride c. Acetic acid d. Formic acid
95. Benzene on treating with acetyl chloride in presence of Aluminium chloride gives
    a. C_6H_5COOH b. $C_6H_5COCH_3$ c. C_6H_5OH d. $C_6H_5CH_3$
96. The yellow light used to illuminates the high way is of
    a. Murcury vapor lamp b. Sodium vapor lamp
    c. Neon gas lamp d. Halogen lamp

Read the following passage and answer the given questions.

Three fourths of the surface of our planet is covered by the sea, which both separates and unites the various races of mankind. The sea is the great highway along which man may journey at his will, the great road that has no walls or hedges hemming it in, and that nobody has to keep it in good repair with the aid of pickaxes and barrels of tar and steamrollers. The sea appeals to man's love of the perilous and the unknown, to his love of conquest, his love of knowledge and his love of gold. Its green, and grey, and blue, and purple waters call to him and bid him fare forth in quest of fresh fields. Beyond their horizons he has found danger and death, glory and gain.

In some great continents such as America and Australia, there are towns and villages many thousands of miles from the coast, whose children have never seen or heard or felt the waves of the sea. But in the British Isles it is nowhere much more than a hundred miles from the most inland spot. The love of the sea is in the very blood of the British people.

97. How much of our planet is not covered by the sea?
    a. Half of the planet b. One fourth of the planet
    c. More than one can measure d. Three fourths of the planet
98. The sea helps a man
    a. in building great roads
    b. in making journey at his will all around the world
    c. in raising walls on the coast
    d. in clearing hedges hemming the sea water
99. In what way does the sea appeal to man?
    a. It helps man take lessons from the perilous waves and stay at home.
    b. It invites man to amass gold hidden under the sea water.
    c. It makes man wax eloquent about the futility of adventurous deeds.
    d. It bids man to venture out in quest of new places.
100. The children have not responded to the call of the sea
    a. in remote towns and villages of America
    b. in Great Britain
    c. in the Antarctica
    d. in India

...Best of Luck...