Name.. Roll no................................. ....
Physical Group

Tribhuvan University
Institute of science and Technology
B.Sc. Entrance Examination
2074

Full marks : 100
Time : 2 hrs

Answer all questions

Group A (Mathematics)

1. If $A \cap B = B$ then
   a) $A \subseteq B$
   b) $B \subseteq A$
   c) $A = \emptyset$
   d) $B = \emptyset$

2. Let R be a relation from a set A to a set B, then
   a) $R = A \cup B$
   b) $R = A \cap B$
   c) $R \subseteq A \times B$
   d) $R \subseteq B \times A$

3. If $f(x) = \log\left(\frac{1+x}{1-x}\right)$, then $f\left(\frac{2x}{1+x^2}\right)$ is equal to
   a) $\{f(x)\}^2$
   b) $\{f(x)\}^3$
   c) $2f(x)$
   d) $3f(x)$

4. If $f(x) = 10 - x^2$ is defined in the interval $[-3, 0]$ then the function $f(x)$ is
   a) Increasing function
   b) Decreasing functioin
   c) Neither increasing nor decreasing function
   d) None of above

5. For any statement p and q, $p \rightarrow q$ equals to
   a) $\sim p \vee \sim q$
   b) $p \vee q$
   c) $\sim p \wedge q$
   d) $\sim p \wedge \sim q$

6. The range of the function $f(x) = |x - 1|$ is
   a) $(-\infty, 0)$
   b) $[0, \infty)$
   c) $(0, \infty)$
   d) R

7. The general solution of $\tan x = 0$ is
   a) $n\pi$
   b) $2n\pi$
   c) $2n\pi \pm \pi$
   d) $n\pi + (-1)^n \pi$

8. The value of $\tan^{-1}(3) + \tan^{-1}\left(\frac{1}{3}\right)$ is
   a) 1
   b) 0
   c) $\pi/4$
   d) $\pi/2$

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9. The value of $\cos 1° \ \cos 2° \ \cos 3° \ \dots \dots \dots \dots \dots \dots \dots \cos 179°$ is
   a) $\frac{1}{\sqrt{2}}$
   c) $\frac{1}{2}$
   b) 1
   d) not defined
10. If $a = 1 + i$, then a^2 equals
   a) $1 - i$
   d) $i - 1$
   b) $2i$
   c) $(1 + i)(1 - i)$
11. The number of words that can be formed out of the letters of the word "COMMITTEE" is
   a) $\frac{9!}{(2!)^3}$
   c) $\frac{9!}{2!}$
   b) $\frac{9!}{(2!)^2}$
   d) $9!$
12. If $n_{c_r} + n_{c_{r+1}} = n + 1_{c_x}$, then $x =$
   a) r
   c) n
   b) $r - 1$
   d) $r + 1$
13. If r^{th} term in the expansion of $\left(2x^2 - \frac{1}{x}\right)^{12}$ is without x, then r is equal to
   a) 8
   c) 9
   b) 7
   d) 10
14. $1^2 + 2^2 + 3^2 + \cdots \dots \dots .. + n^2$ is equal to
   a) $\frac{n(n+1)}{2}$
   c) $\frac{n(n+1)(2n+1)}{6}$
   b) $\left\{\frac{(n+1)}{2}\right\}^2$
   d) None of above
15. For any square matrix A, A-A^T is
   a) Upper triangular
   c) Symmetric
   b) Skew Symmetric
   d) Lower triangular
16. The system of equations $a_1 x + b_1 y + c_1 = 0, a_2 x + b_2 y + c_2 = 0$ satisfy $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ then the number of solution are
   a) Unique
   c) Two solution
   b) Infinitely many
   d) No solution
17. The value of $\begin{vmatrix} 11 & 12 & 13 \\ 12 & 13 & 14 \\ 13 & 14 & 15 \end{vmatrix} =$
   a) 1
   c) 0
   b) -1
   d) 76

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18. The maximum value of $5 + 20x - 4x^2$, $x \in R$ is
    a) 30
    c) 5
    b) 25
    d) 1

19. $\frac{a+ib}{c+id}$ is purely real if
    a) $ab = cd$
    c) $bd = ac$
    b) $ad = bc$
    d) $None\ of\ these$

20. The gradient of a line parallel to $y - axis$ is
    a) 1
    c) 0
    b) -1
    d) ∞

21. The angle between the lines $xy = 0$ is
    a) $0°$
    c) $90°$
    b) $60°$
    d) $120°$

22. The centre of the circle $3x^2 + 3y^2 + 5x - 6y + 9 = 0$ is
    a) $\left(\frac{5}{3}, 2\right)$
    c) $\left(\frac{-5}{2}, 3\right)$
    b) $\left(\frac{-5}{6}, 1\right)$
    d) $(5, 6)$

23. The tangent $y = mx + \frac{a}{m}$ will touch the parabola $y^2 = 4ax$ at
    a) $(am^2, -2am)$
    c) $\left(\frac{a}{m^2}, \frac{-2a}{m}\right)$
    b) $\left(\frac{a}{m^2}, \frac{2a}{m}\right)$
    d) $(am^2, 2am)$

24. The eccentricity of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ is
    a) $^3/_5$
    c) $^5/_3$
    b) $^4/_5$
    d) 3

25. If $k, -2k, 3k$ denotes dc's of a line then k is
    a) $\frac{1}{\sqrt{14}}$
    c) $\pm\sqrt{14}$
    b) $\pm\frac{1}{\sqrt{14}}$
    d) $\pm\sqrt{41}$

26. The value of $\lim_{x \to 0} \frac{\sin\left(^1/_x\right)}{^1/_x}$ is equal to
    a) 1
    d) Doesn't exists
    b) 0
    c) i

27. Which of the following is incorrect ?
    a) $\lim_{x \to 0} \frac{\sin(x)}{x} = 1$
    c) $\lim_{n \to \infty} \left(1 + \frac{1}{x}\right)^x = 1$
    b) $\lim_{x \to 0} \frac{\log(1+X)}{x} = 1$
    d) $\lim_{x \to 0} \frac{\tan x}{x} = 1$

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28. The derivative of x^x is
   a) x^x
   b) $x^x \log x$
   c) $\dfrac{x^x}{\log x}$
   d) $x^x(1 + \log x)$

29. If $e^{\sin x} + e^{\sin y} = 1$ then $\dfrac{dy}{dx} =$
   a) $\dfrac{\cos x}{\cos y}$
   b) $\dfrac{e^{\sin x}}{e^{\sin y}}$
   c) $\dfrac{e^{\sin x} \cos x}{e^{\sin y}}$
   d) $-\dfrac{e^{\sin x} \cos x}{e^{\sin y} \cos y}$

30. $\int e^{e^x} e^x \, dx$ is equal to
   a) $e^{e^x} + k$
   b) $\dfrac{1}{2} e^x + k$
   c) $\left(e^{e^x}\right)^2 + k$
   d) $\dfrac{1}{2} e^{x^x} + k$

31. $\int_0^{1/2} \dfrac{dx}{\sqrt{1-x^2}} =$
   a) 0
   b) 1
   c) $\dfrac{\pi}{6}$
   d) $\sin^{-1} \sqrt{1 - \left(\dfrac{\pi}{2}\right)^2}$

32. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ then $\vec{a}$ and $\vec{b}$ are
   a) Null
   b) Collinear
   c) Like Parallel
   d) Perpendicular

33. The solution of differential equation $\dfrac{dy}{dx} = \dfrac{x}{y}$ is
   a) $x^2 - y^2 = c$
   b) $x^2 + y^2 = c$
   c) $x = yc$
   d) None of these

Group B (Physics)

34. Dimensional formula for elasticity is
a) MLT^{-1}
b) MLT^{-1}
c) $ML^{-1}T^{-2}$
d) M^2LT^{-2}

35. The displacement of a body is zero. The distance covered
   a) is zero
   b) is not zero
   c) may or may not be zero
   d) depends on acceleration

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36. The displacement time graph of a partice moving with uniform velocity is
    a) a point
    b) a parabola
    c) a circle
    d) a straight line
37. Newton's first law of motion gives the definition of
    a) momentum
    b) acceleration
    c) energy
    d) force
38. In case of a fan suspended from ceiling
    a) a fan applies action force
    b) fan applies reaction force
    c) ceiling applies action force
    d) there is no way of finding about the energy the agency applying action force.
39. If v and g have their usual meaning then the maximum horizontal range of a projection is
    a) $\dfrac{v^2}{g^2}$
    b) $\dfrac{v^2}{g}$
    c) $\dfrac{g}{v}$
    d) $\sqrt{2gv}$
40. a device in which chemical energy is converted into electrical energy
    a) Photo cell
    b) Electric cell
    c) Dynamo
    d) G.M. counter
41. A body of mass 1 gm is raised vertically through a height of 1 cm. The work done is
    a) 1 erg
    b) 1 Joule
    c) 1 gm cm
    d) Zero
42. Aeroplanes, Jets etc are streamlined to reduce
    a) dynamic friction
    b) sliding friction
    c) rolling friction
    d) fluid friction
43. a body executing uniform circular motion in a horizontal plane has a constant
    a) velocity
    b) momentum
    c) kinetic energy
    d) acceleration
44. Want will be the duration of day and night if the earth shrinks to half the present radius ?
    a) 24 hour
    b) 12 hour
    c) 3 hour
    d) 6 hour

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45. The mass of a flywheel is concentrated at its rim so as to have

   a) large moment of inertia   c) a stable equilibrium
   b) a small moment of inertia   d) an unstable equilibrium

46. Heat is closely related to
   a) friction   c) momentum
   b) temperature   d) energy

47. When the temperature of a liquid is increased then its surface tension
   a) increases   c) remains unchanged
   b) decreases   d) completely disappears

48. Cold syrup flows sluggishly from a container. However, it flows more freely when heated on account of
   a) increased viscosity   c) increased Pressure
   b) decreased viscosity   d) decreased pressure

49. A proton of mass 'm' moves with velocity 'v' paralled to the magnetic field B. The force experienced by the proton is
   a) Zero   c) Bv
   b) 'B'   d) Bmv

50. The equation of transverse wave is given by
$$y = 10 \sin \pi \ (0.01x - 2t)$$
   when distance are in cm & t in second. The frequency of the wave is
   a) 10 HZ   c) -2 HZ
   b) 0.01 HZ   d) 1 HZ

51. Which of the following remains unchanged when the wave propagates from air to water ?
   a) Frequency   c) Wavelengths
   b) Speed   d) Intensity

52. A virtual image, layer than the object, can be produced by

   a) convex mirror   c) plane mirror
   b) concave mirror   d) concave lens

53. An air bubble inside water behaves like a
   a) glass plate   c) convex lens
   b) plano - concave lens   d) concave lens

54. current in a circuit is wattles if
    a. inductance in circuit is zero
    b. resistance in the circuit is zero
    c. current is alternating
    d. both resistance & inductance are zero

55. Which of the following wavelengths falls in the X-ray region ?
    a. $10,000 \, A^0$
    b. $1000 \, A^0$
    c. $1 \, A^0$
    d. $1 \, A^0$ to $100 \, A^0$

56. de- broglie wavelength of 2 kg mass whose velocity is 25 m/s is
    a) $1.33 \times 10^{-25} A°$
    b) $1.33 \times 10^{-25} m$
    c) $1.33 \, m$
    d) $1.33 A°$

57. The fact that the photon carries momentum was demonstrated through
    a) the famous Bosr's theory of action
    b) the wonderful thomsn's e/m experiment
    c) the amazing compton effect
    d) the interesting Duppler's effect.

58. A block of wood and block of metal steel equally cold or equally hot when touched them, their common temperature is
    a) the same as that of the human body
    b) 0 K
    c) 0°F
    d) 0°C

59. Absolute zero may be regarded as the temperature at which
    a) water freezes
    b) gases liquefy
    c) all substances are solid
    d) molecular motion in gas becomes zero

60. Diode can be used as a
    a) rectifier
    b) amplifier
    c) oscillator
    d) switch

61. The net charge on n-type semiconductor is
    a) zero
    b) positive
    c) negative
    d) maximum

62. Earth is taken as zero electric poental, though it has net negative charge, because of
    a) its layer radius
    b) its smaller radius
    c) heavy mass
    d) its large permittivity

63. Nichrome and copper wines, having same length and same area of cross-section are connected across a battery in turn, In which case the role of production of heat will be higher ?
   a) Copper
   b) Nichrome
   c) Both
   d) Does not depend on wires

64. The SI unit of See beck coefficient is
   a) $V/°C$
   b) $V/°C^2$
   c) $V/°C$
   d) Ampere per meter (Am^{-1})

65. The capacitive reactance is a.c circuit is
   a) $2\pi f c$
   b) $\dfrac{1}{2\pi f c}$
   c) $\sqrt{R^2 + C^2 + L^2}$
   d) C

66. A lens has a power of -2.5D, its focal length will be
   a) convex lens of 40cm
   b) concave lens of 40cm
   c) concave lens of 100cm
   d) convex lens of 10cm

Group C (Chemistry)

67. The number of molecule in 4.25 g of ammonia is approximately:
   a) 1×10^{23}
   b) 1.5×10^{23}
   c) 2.0×10^{23}
   d) 2.5×10^{23}

68. The rate of diffusion of methane at given temperature is twice that of gas X. The molecular mass of X is :
   a) 64.0
   b) 32.0
   c) 4.0
   d) 8.0

69. The correct set of quantum numbers for the unpaired electron of chlorine atom is (in the order as n, l, mj:
   a) 2, 1, 0
   b) 2, 1, 1
   c) 3, 1, 1
   d) 3, 0, 0

70. Which one of the following has the lowest electronegativity?
   a) Be
   b) Na
   c) Ba
   d) Cs

71. The species in which the central atom uses sp^2 hybrid orbital's in its bonding is:
   a) PH_3
   b) NH_3
   c) CH^+_3
   d) SbH_3

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72. The relationship between enthalpy (H), internal energy (E), Pressure(P) and volume (V) of a system is:
   a) $E = H + PV$
   b) $H = E + PV$
   c) $PV = H - E$
   d) $H = E + P + V$

73. The compound that is not a Lewis acid is:
   a) $Be\,Cl_1$
   b) $AlCl_3$
   c) BCl_3
   d) $Sn\,Cl_4$

74.. The oxidation number of phosphorus in PCl5 is:
   a) 3
   b) -5
   c) +5
   d) Zero

75. Rate constant of a reaction depends upon:
   a) temperature
   b) initial concentration of the reactants
   c) time of reaction
   d) extent of reaction

76. The oxidation state of oxygen in peroxides is :
   a) -2
   b) -1
   c) - 4
   d) +2

77. Sulphur in readily soluble in :
   a) water
   b) carbon disulphide
   c) hydrochloric acid
   d) sodium hydroxide

78. Ammonia can be dried by :
   a) Conc. H_2SO_4
   b) P_2O_5
   c) $Ca0$
   d) Anhydrous $CaCl_2$

79. Epsom salt is:
   a) $Na_2SO_4 - 7H_20$
   b) $Al_2O_3 - 2H_20$
   c) $MgCO_3 - CaC0_3$
   d) $MgS0_4 - 7H_20$

80. Which of the following would dissolve in hot NaOH solution?
   a) Fe
   b) Zn
   c) Cu
   d) Ag

81. Molecule in which the distance between the two adjacent carbon atoms is largest in:
   a) ethane
   b) ethene
   c) ethyne
   d) benzene

82. Methane is produced by hydrolysis of:
   a) Al_4C_3
   b) CaC_2
   c) $n-C_3H_7MgBr$
   d) Dry ice

83. The compound that is most reactive towards electrophilic nitration is:
   a) toluene
   c) benzoic acid
   b) benzene
   d) nitrobenzene

84. A molecule or group of molecules when repeated to get a polymer is termed as:
   a) monomer
   c) dimer
   b) repeat unit
   d) none

85. Which of the following compound is present in the sodium extract if the organic compound contain nitrogen?
   a) NaCN
   c) Na_2S
   b) NaCNS
   d) NaCl

86. On fermentation, sugars get converted to:
   a) ethanol + CO_2
   c) glucose
   b) carbon dioxide
   d) fructose

87. A 1% solution of phenol is a:
   a) antiseptic
   c) antimalarial drug
   b) disinfectant
   d) antihistamine

88. If 2g of an isotope has a half-life of 7 day, then the half-life of 1g sample is:
   a) 7 day
   c) 35 day
   b) 14 day
   d) 28 day

89. Very dilute solution of zinc sulphate is used as:
   a) fertilizer
   c) eye drops
   b) antiseptic
   d) germicides

90. Which of the following compounds does not react with bromine?
   a) Propene
   c) Phenol
   b) But-2-ene
   d) Chloroform

91. In ethyl alcohol, the bond undergoes heterolytic cleavage most rapidly is:
   a) C - C
   c) C - H
   b) C -O
   d) O - H

92. The most suitable reagent to distinguish an aldehyde from ketone is :
   a) semi-carbazide
   c) DNP
   b) ammoniacal $AgNO_3$
   d) NH_2OH

93. Reduction of nitrobenzene in alkaline medium finally yields :
   a) nitrosobenzene
   c) azoxybenzene
   b) phenyl hydroxyl amine
   d) aniline

94. Carbylamine reaction is give by :
   a) 1^0 amine only
   c) aromatic amines
   b) aliphatic amines
   d) 2^0 amines only
95. Cane sugar on hydrolysis gives:
   a) fructose and lactose
   c) glucose and ribose
   b) glucose and fructose
   d) glucose and lactose
96. Variable valiancy is exhibited by :
   a) alkali metals
   c) transition elements
   b) alkaline earth's metal
   d) non-metals
97. Main contributor of the green house effect is:
   a) CO_2
   c) SO_3
   b) NO_2
   d) OF_2
98. Which of the following pairs of ions cannot be separated by H_2S in dil. HCl?
   a) Ni^{++}, Co^{++}
   c) Cu^{++}, Ni^{++}
   b) Zn^{++}, Fe^{+++}
   d) Al^{+++}, Hg^{++}
99. If 250ml of 0.25 M NaCl solution is diluted with water to a volume of 500 ml, the new concentration of the solution is:
   a) 0.125 M
   c) 0.0833M
   b) 0.167M
   d) 0.0167M
100. The charge on an electron is:
   a) 4.1×10^{-10} coulombs
   c) 4.8×10^{-10} coulombs
   b) 1.6×10^{-19} coulombs
   d) 3.2×10^{-10} coulombs

THE END

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