Tribhuvan University
Institute of Science and Technology
4 Years Bachelor in Computer Science and Information Technology (B.Sc.CSIT)
Entrance Examination
Model Question

Full Marks: 200
Time: 2 hrs.

Attempt all question:

Mathematics

(50 × 2 = 100)

1. If $A = \{ x \mid x^2 - 5x + 6 = 0\}$ and $B = \{2, 4\}$, $C = \{4, 5\}$ then $A \times (B \cap C)$ is
   (a) {(2, 4), (3, 4)}
   (b) {(4, 2), (4, 3)}
   (c) {4}
   (d) empty set.

2. The range of $y = \sqrt{4 - x^2}$ is
   (a) [-2, 2] (b) [-2, 0]
   (c) [0, 2] d) $(-\infty, \infty)$

3. The polar co-ordinates of the point $x = -\sqrt{3}$ and $y = 1$ are
   (a) $r = 1, \theta = 30°$
   (b) $r = 2, \theta = 150°$
   (c) $r = 1, \theta = 150°$
   (d) $r = 2, \theta = 30°$

4. The equation of the bisectors of the angle between the lines represented by $2x^2 - 6xy - y^2 = 0$ is
   (a) $x^2 - xy - y^2 = 0$ (b) $x^2 + xy + y^2 = 0$
   (c) $y^2 + xy - x^2 = 0$ (d) $x^2 + yx - y^2 = 0$

5. If M^T denotes the transpose of matrix M, then $(cAB)^T$ equals
   (a) $c A^T B^T$ (b) $c B^T A^T$
   (c) cAB (d) cBA

6. Any point in the feasible region of a linear programming problem is called a
   (a) feasible solution (b) optimal solution
   (c) infeasible solution (d) none of the above

7. If $\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = 0$, $\begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix} = 0$, $\begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix} = 0$, then the system of equations $a_1 x + b_1 y = c_1$ and $a_2 x + b_2 y + c_2 = 0$ has
   (a) no solution
   (b) infinite number of solutions
   (c) unique solution
   (d) none of the above.

8. The remainder when $f(x) = x^3 + 6x^2 - x - 30$ is divided by $x + 1$ is
   (a) -1 (b) -30 (c) -24 (d) 24

9. If $\alpha = -3$, $\beta = 2$ be two roots of an equation $a x^2 + bx + c = 0$. Then the equation is
   (a) $x^2 + x + 6 = 0$ (b) $x^2 + x - 6 = 0$
   (c) $x^2 - x - 6 = 0$ (d) $x^2 - x + 6 = 0$

10. The sum of three cube roots of unity is
(a) zero (b) one (c) i (d) – i

11. If α, β, γ be the angles which a line makes with the coordinate axes, then the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ is equal to

(a) 0 (b) 1 (c) 2 (d) none of the above.

12. In any triangle, the value of
$a^2 + b^2 + c^2 - 2$ (bc cos A + ca cos B + ab cos C) is

(a) Δ (b) 0 (c) 4R (d) 1

13. The logarithmic function is defined as the inverse function of the function
(a) exponential (b) trigonometric
(c) algebraic (d) none

14. $\frac{d}{dx}(\cot x)$ equals
(a) cosc^2x (b) cotx cosecx
(c) – cotx cosecx (d) $-\text{cosec}^2\text{x}$

15. The value of $\int_0^2 \frac{xdx}{\sqrt{x^2+4}}$ is

(a) $2\sqrt{2}$ (b) 2
(c) $2\sqrt{2} - 2$ (d) $2\sqrt{2} + 2$

16. The value of $\int^{e} \frac{\sin(\log t)}{t} dt$ is

(a) 1 – cos (log 2) (b) cos log 2
(c) log 2 (d) 1

17. The value of the integral $\int \log x \, dx$ is
(a) x log x + c (b) x + c
(c) x log x – x + c (d) log x + c

18. If $x = t + \frac{1}{t}$ and $y = t - \frac{1}{t}$ then $\frac{dy}{dx}$ equals

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

19. The value of $\lim_{x\to 0} \frac{\text{cosec}x - \cot x}{x}$ is
(a) 1 (b) 2
(c) -2 (d) $\frac{1}{2}$

20. If a, b, c in a triangle are in A, P, then $\frac{1}{r_1}, \frac{1}{r_2}, \frac{1}{r_3}$ are in
(a) AP (b) GP
(c) HP (d) none of the above

21. If f.g: R → R defined by
f(x) = $x^2 + 1$, f(x) = x^5, then (f o g) (x) is
(a) $(x^2 + 1)^5$ (b) $x^{10} + 1$
(c) $(x^{10} + 1)^5$ (d) none

22. The value of the determinant $\begin{vmatrix} a+x & b & c \\ a & b+y & c \\ a & b & c+z \end{vmatrix}$ is

(a) xyz (b) $1+\frac{a}{x}+\frac{b}{y}+\frac{c}{z}$

(c) $xyz\left(1+\frac{a}{x}+\frac{b}{y}+\frac{c}{z}\right)$ (d) none

23. If $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$, then A^{-1} is

(a) $\frac{-1}{19}A$ (b) A (c) –A (d) $\frac{1}{19}A$

24. Minimum value of G = x + 7y subject to
$-x + 2y \le 8$, $x - y \le 4$, x, y, ≥ 0 is

(a) – 16 (b) 12 (c) 0 (d) none

25. The value of $\frac{2(\cos 70^\circ + i\sin 70^\circ)}{\cos 10^\circ + i\sin 10^\circ}$ is

(a) $1 - i\sqrt{3}$ (b) $1 + i\sqrt{3}$ (c) $i\sqrt{3}$ (d) 1

26. If the roots of $ax^2 + cx + c = 0$ be in the ratio m:n, then

(a) $\sqrt{\frac{m}{n}}+\sqrt{\frac{n}{m}}+\sqrt{\frac{c}{a}}=0$ (b) $\sqrt{\frac{m}{n}}+\sqrt{\frac{n}{m}}+\sqrt{\frac{a}{c}}=0$

(c) both of the above (d) none of the above.

27. The direction cosines of the line equally inclined to the area are
(a) $(\pm\sqrt{3}, \pm\sqrt{3}, \pm\sqrt{3})$ (b) $(\pm 3, \pm 3, \pm 3)$
(c) $\left(\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}\right)$ (d) $\left(\pm\frac{1}{3}, \pm\frac{1}{3}, \pm\frac{1}{3}\right)$

28. If cot x + tan x = 2, then x equals
(a) $n\pi + \frac{\pi}{4}$ for any n (b) $n\pi + \frac{\pi}{4}$ for any integral x
(c) both (d) none

29. If $\cos^{-1}x + \cos^{-1}y = \pi/2$ then
(a) $x^2 + y^2 = 1$ (b) $x^2 + y^2 = -1$
(c) $x^2 - y^2 = 1$ (d) none

30. If the pair of lines $x^2 - 2p\,xy - y^2 = 0$ and $x^2 - 2q\,xy - y^2 = 0$ be such that each pair bisects the angle between the other pair then
(a) $p\,q = 1$ (b) $pq = -2$
(c) $pq = 2$ (d) $pq = -1$

31. for any subsets A and B of the universal set U, it holds
(a) $A - B \subseteq A \cap \overline{B}$ (b) $A \cap \overline{B} \subseteq A - B$
(c) both (d) none

32. The vertices of the bounded region of the system $x + 2y \leq 8, -x + 2y \leq 6$ and $y \geq 0$
(a) $(-1, 7/2), (6, 0), (8, 0)$ (b) $(i, 7/2), (6, 0), (8, 0)$
(c) $(1, 7/2), (-6, 0), (-8, 0)$ (d) $(1, 7/2), (-6, 0), (8, 0)$

33. If ω be a complete cube root of unity, then $(1 + \omega - \omega^2)^3$ equals
(a) 1 (b) ω
(c) 0 (d) -1

34. The polar form of $2 + 2\sqrt{3}\,i$ is
(a) $4(\cos 60^0 + i \sin 60^0)$ (b) $\cos 60^0 + i \sin 60^0$
(c) $\cos 60^0$ (d) $i \sin 60^0$

35. The remainder when $f(x) = x^3 + 6x^2 - x - 30$ is divided by $(x + 1)$ is
(a) -30 (b) 0
(c) -24 (d) -1

36. The quadratic equation whose roots are the square of the roots of $4x^2 + 8x - 5 = 0$ is
(a) $x^2 - 104x + 25 = 0$ (b) $16x^2 - 104x + 25 = 0$
(c) $16x^2 - x + 25 = 0$ (d) $x = 0$

37. The value of $\tan^{-1}2 + \cot^{-1}2$ is
(a) 0 (b) 1 (c) $\pi/2$ (d) non existence

38. Inverse of the matrix $\begin{pmatrix} 3 & 2 \\ -1 & 6 \end{pmatrix}$ is
(a) $\begin{pmatrix} 3 & 2 \\ -1 & 6 \end{pmatrix}$ (b) $\begin{pmatrix} 6 & -1 \\ 2 & 3 \end{pmatrix}$
(c) $\begin{pmatrix} 6 & -2 \\ 1 & 3 \end{pmatrix}$ (d) $\frac{1}{20}\begin{pmatrix} 6 & -2 \\ 1 & 3 \end{pmatrix}$

39. $\lim\limits_{x \to 0} \frac{1 - \cos 3x}{3x^2}$ equals
(a) 2/3 (b) 1/3 (c) 3/2 (d) 0

40. The sum of n terms of the series $a + ar + ar^2 + ar^3 + \ldots$ is
(a) ar^{n-1} (b) $\frac{a(r^n - 1)}{r - 1}$
(c) $\frac{ar^n - 1}{r - 1}$ (d) $\frac{ar^{n-1} - 1}{r - 1}$

41. The equation $z = c$ in 3-diemnsional space represents
(a) plane parallel to yz-plane (b) plane parallel to zx-plane
(c) plane parallel to xy-plane (d) line parallel to $z = 0$

42. The value of $\int_0^{\sqrt{3/2}} \frac{dx}{\sqrt{1-x^2}}$ is
(a) 0 (b) $\pi/3$
(c) $\pi/2$ (d) π

43. If $x = t + \frac{1}{t}$ and $y = t - \frac{1}{t}$ then $\frac{dy}{dx}$ is
(a) $\frac{t^2-1}{t^2+1}$ (b) $\frac{t^2+1}{t^2-1}$
(c) $t^2 + 1$ (d) $t^2 - 1$

44. The angle between the line pair $2x^2 + 7xy + 3y^2 = 0$ is
(a) 45^0 (b) 135^0
(c) 45^0 or 135^0 (d) 30^0

45. For f: $R \to R$ and g: $R \to R$ be defined by $f(x) = 4x^2 - 1$, $g(x) = 3x^2 - x$. Then $(3f + 4g)(x)$ equals
(a) $3x^2 - x$ (b) $4x^2 - 1$
(c) $7x^2 - x - 1$ (d) $24x^2 - 4x - 3$

46. If in a triangle $r_1 = r + r_2 + r_3$, then the triangle is
(a) right angled (b) isosceles
(c) equilateral (d) none

47. If A is a square matrix, then $A - A^T$ is following matrix
(a) symmetric (b) 0
(c) skew-symmetric (d) identity

48. If two linear equations in two variables represent parallel lines, then the equations are
(a) consistent and dependent
(b) consistent and independent
(c) inconsistent and independent
(d) none

49. Value of the determinant $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}$ is
(a) 0 (b) $(y - z)z - x(y - x)$
(c) $(y - z)(z - x)(y - x)$ (d) 1

50. If $f(x) = \begin{cases} 2x + 3 & \text{for } x < 1 \\ 4 & \text{for } x = 1 \\ 6x - 1 & \text{for } x > 1 \end{cases}$
Then the function is
(a) discontinuous at $x = 1$
(b) continuous at $x = 1$
(c) the limit does not exist
(d) all are false statement

English

(50×1=50)

I. Fill in the blanks with the word(s) which best fit(s) with the following sentences:

51. I have ..... to do
(a) many work (b) much work
(c) many works (d) much works

52. Both of them have lived here ..... twenty years
(a) for (b) during (c) since (d) while

53. ..... they are widely perceived as gentle creatures, rhinos are responsible for more human deaths than any other animal
(a) despite (b) even though
(c) in spite of (d) nonetheless

54. During the early period of ocean navigation, ... any need for sophisticated instruments and techniques
(a) so that hardly
(b) where these hardly was
(c) hardly was
(d) there was hardly

55. Throughout the animal kingdom ..... bigger than the elephant
(a) whale is only the (b) only the whale is
(c) is the whale only (d) only whale is the

56. The girl .....long hair is my sister.
(a) in (b) on
(c) with (d) by

57. Each of them ..... guilty of doing wrong things.
(a) am (b) is
(c) are (d) were

58. 'They are building a bridge'. In other words the bridge.....
(a) is built (b) are built
(c) is being built (d) was being built.

59. Throughout the animal kingdom ..... bigger than the elephant
(a) whale is only the (b) only the whale is
(c) is the whale only (d) only whale is the

60. Nepal is a ..... country.
(a) democracy (b) democratic
(c) democratically (d) democrat

61. She is one of the loveliest
(a) girl (b) girls
(c) boy (d) boys

62. She made me ..... a lot
(a) laughing (b) laugh
(c) to laugh (d) to have laughed

63. I as well as my friends .....joining the show.
(a) am (b) is
(c) are (d) have

64. Somebody loves me, ...?
(a) doesn't somebody (b) don't they
(c) doesn't he/she (d) do they

94. .....is full moon.
(a) Some moon (b) Moon
(c) The moon (d) A moon

95. If you promise .....angry with me, I'll tell you what I broke
(a) get not (b) not get (c) not to get (d) not getting

96. .....he was only an hour late; don't be upset.
(a) All after (b) Always after
(c) Afterward (d) After all

V. Select the word which is closest to the opposite in meaning of the following words.

97. Protein
(a) complex (b) naive
(c) advanced (d) unchanging

98. Potent
(a) vigorous (b) robust (c) fervent (d) weak

99. Impatient
(a) restless (b) fretful
(c) shy (d) calm

100. Prosaic
(a) imaginative (b) new fashioned
(c) complaisant (d) imposing.

Physics

(25×1=25)

101. The viscous force ($\vec{F}$) acting between liquid layers of area A and velocity gradient $\left(d\vec{v}/dx\right)$ is given by, $\vec{F} = -\eta A \, d\vec{v}/dx$ where η is a constant called coefficient of viscosity. The dimensions of η are :

(a) $ML^{-1}T^{-2}$ (b) MLT^{-2}
(c) $ML^{-1}T^{-1}$ (d) $ML^{-2}T^{-2}$

102. The maximum value of magnitude $\left(\vec{A} - \vec{B}\right)$ is
(a) A + B (b) A – B
(c) A (d) B

103. In the normal reaction is doubled, the force of limiting friction becomes;
(a) half (b) double
(c) Four times (d) One fourth

104. A rocket is launched with a speed less than escape speed from earth. The sum of its kinetic and potential energy is
(a) positive
(b) negative
(c) zero
(d) May be positive or negative depending up on its initial speed.

105. After terminal velocity is reached the acceleration of a body falling through a fluid is
(a) equal to g (b) less than g
(c) greater than g (d) zero

106. At what temperature do the Celsius and Fahrenheit scales coincide?
(a) -40° (b) -32° (c) 0° (d) -45°

107. In an ideal gas the molecules possess
(a) only potential
(b) only kinetic energy
(c) kinetic and potential energy both
(d) only gravitational energy.

108. In an adiabatic expansion temperature of the system
(a) remains constant (b) increases
(c) decreases (d) may increase or decrease.

109. A steam engine operates between 300K and 600K, the maximum possible efficiency of this engine is
(a) 100% (b) 75% (c) 50% (d) 25%

110. The field of view is maximum for
(a) cylindrical mirror
(b) plane mirror
(c) concave mirror
(d) convex mirror

111. Total internal reflection of light is possible when light enters from
(a) air to glass (b) water to air
(c) air to water (d) vacuum to air

112. A prism has angle of prism A and critical angle C. The condition for totally reflecting prism is
(a) $A = 2C$ (b) $A < 2C$
(c) $A \leq 2C$ (d) $A > 2C$

113. When a convex lens of flint glass is immersed in water, its focal length
(a) increases
(b) decreases
(c) remains unchanged
(d) May increase or decrease depending upon material of lens.

114. Which of the following is the most important factor that helps to recognize a person by his voice alone?
(a) loudness (b) pitch
(c) intensity (d) quality

115. Velocity of sound is maximum in
(a) oxygen (b) Hydrogen
(c) nitrogen (d) Ammonia

116. Two waves having a phase difference of 60° have a path difference of
(a) 2λ (b) $\lambda/3$ (c) $\lambda/6$ (d) $\lambda/2$

117. A capacitor of capacitance 2 μF is charged to 500V, What is the energy stored?
(a) 0.25 J (b) 0.5 J (c) 0.2 J (d) 2 J

118. Kirchoff's voltage law is based on the principle of conservation of
(a) energy (b) charge
(c) mass (d) momentum

119. Two parallel wires carrying currents in opposite directions;
(a) attract each other (b) cancel each other
(c) repel each other (d) neither attract nor repel

120. In SI system, the unit of magnetic field is
(a) Weber (b) Weber/m^3
(c) Gauss (d) Tesla

121. In Nepal, the voltage of domestic AC supply is 220V. What does this represent?
(a) root mean voltage (b) root mean squared voltage
(c) mean voltage (d) peak voltage

122. The size of an atom is nearly equal to
(a) one millimeter (b) one Pico meter
(c) one Angstrom (d) one micron.

123. The specific charge of an electron is;
(a) 1.75×10^{11} C/Kg (b) 1.2×10^{9} C/Kg
(c) 1.6×10^{-19} C/Kg (d) 9.31×10^{-31} C/Kg

124. The half life of radium is 1600 years. What is its mean life?
(a) 800 years (b) 1600 years
(c) 4618 years (d) 2309 years

125. An example of n-type semiconductor is
(a) pure Si
(b) Si doped with Phosphorus
(c) pure Ge
(d) Ge doped with boron.

Chemistry

(25×1=25)

126. The alkenes may be represented by a general formula:
(a) $C_n H_{2n+2}$ (b) $C_n H_{2n}$
(c) $C_n H_{2n-2}$ (d) $C_n H_{2n+1}$

127. When alkyl halides are heated with sodium metal in ether, two molecules of the alkyl halide combine to give:
(a) alkene (b) alkyne
(c) alkane (d) alcohol

128. The compound $Fe_4 [Fe(CN)_6]_3$ is known as:
(a) prussian blue
(b) Tollen's reagent
(c) Baeyer's reagent
(d) none of above.

129. The product of the reaction :

$$CH_2 = CH_2 + 40 \xrightarrow{H^+} KMnO_4$$

is

(a) $CH_3\,CH_2\,OH$ (b) 2HCOOH
(c) CH_3COOH (d) $H_2C_2O_4$

130. What is the possible product of the following reaction?

$$C_6H_5OH + NH_3 \xrightarrow[\Delta]{ZnCl_2}$$

(a) nitrobenzene (b) aniline
(c) benzene (d) acetanilide

131. Which of the following reagents is used to detect the aldehyde group?
(a) aq.$CuSO_4$
(b) Ninhydrin reagent
(c) Nessler's reagent
(d) Tollen's reagent

132. What product will be formed when ethylene is passed in cold and alkaline $KMnO_4$ solution?
(a) aniline (b) acetylene
(c) ethylene glycol (d) none of above

133. When benzene and hydrogen are passed over finely divided nickel heated to 150-200°C, the product formed is:
(a) benzoic acid (b) cyclohexane
(c) benzamide (d) nitrobenzene

134. Permanent hardness of water may be caused by:
(a) calcium chloride
(b) magnesium chloride
(c) calcium sulphate and magnesium sulphate
(d) all of above

135. The formula of Calgon is:
(a) $Na_2\,[Na_4\,(PO_3)_6]$ (b) $Na_2\,[Mg_2\,(PO_3)_6]$
(c) $Mg\,(HCO_3)_2$ (d) $Ca\,(HCO_3)_2$

136. Calamine is an ore of the metal:
(a) iron (b) cadmium
(c) zinc (d) magnesium

137. N_2O is a:
(a) basic oxide (b) acidic oxide
(c) neutral oxide (d) amphoteric oxide

138. Amongst the following elements the one having highest ionization energy is
(a) sodium (b) boron
(c) carbon (d) neon

139. Mercuric chloride is also known as:
(a) blue vitriol (b) malachite
(c) calomel (d) corrosive sublimate

140. Nitric oxide is formed, when copper reacts with:
(a) conc. HNO_3 (b) dil. HNO_3
(c) dil. HCl (d) dil H_2SO_4

141. The general electronic configuration of coinage metals is:
(a) ns^1 (b) ns^2
(c) $(n-1)d^{10}\,ns^1$ (d) ns^2np^5

142. How many moles of atoms are contained in 15g of Zn?
(a) 0.272 moles (b) 2 moles
(c) 0.229 moles (d) 0.5 moles

143. What is the normality of a 2% NaOH solution?
(a) 3 N (b) 0.25 N (c) 0.5 N (d) 1 N

144. Potassium permanganate is a:
(a) strong reducing agent
(b) strong oxidizing agent
(c) weak reducing agent
(d) weak oxidizing agent

145. Equivalent weight of H_2SO_4 is equal to:
(a) it's mol.wt (b) mol. wt/2
(c) mol.wt/3 (d) mol.wt/4

146. What volume of 0.5N NaOH is required to neutralize 50 ml of 1.5 N HCl ?
(a) 120 ml (b) 100 ml
(c) 150 ml (d) 50 ml

147. How many grams of calcium are present in 4.25g – atoms of calcium?
(a) 160g (b) 100g (c) 170g (d) 120g

148. In the reaction :
$Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \rightarrow 2Cr^{3+} + 7H_2O + 6Fe^{3+}$ which element is reduced ?
(a) iron (b) chromium
(c) hydrogen (d) oxygen

149. The rate of a reaction generally increases with
(a) decrease in temperature
(b) decrease in concentration
(c) increase in temperature
(d) none of above

150. The number of electrons in d orbitals of an atom having atomic number 29 at ground state is:
(a) 1 (b) 5 (c) 10 (d) 0

*** ***