

**NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY**

(Affiliated to Pokhara University)

**Bachelor of Engineering (Computer/Civil)**

**Entrance Examination**

**FULL MARKS: 100**

**TIME: 2.5 Hrs.**

**INSTRUCTIONS**

1. Check carefully the entrance booklet immediately after you receive it and be ensured that it does not have any unprinted or torn or missing pages or items etc. if so, get it replaced from you invigilator with a complete one.
2. For each question, there are four alternative responses given. Select only one response (even in the cases where you feel that there is more than one correct response)
3. **Choose the correct answer and tick (✓) on the attached Answer Sheet. All questions carry equal marks.**
4. Keep your cellular phone completely switched off during the examination.
5. All rough work to be done only on blank sheet of the back side of question paper
6. Any candidate found violating the instructions and receiving/giving any form of help will be disqualified.

Name of Student:.....

Entrance Roll Number:.....

Program:.....

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Signature of Invigilator

## MATHEMATICS

Put the tick mark (✓) for correct answer.

- The sets  $\overline{(A \cup B)}$  is same as
  - $\overline{A} \cup \overline{B}$
  - $A \cup B$
  - $\overline{A} \cap \overline{B}$
  - $A \cap B$
- A function  $f: \mathbb{N} \rightarrow \mathbb{N}$  defined by  $f(x) = \cos x$ ,  $x \in \mathbb{R}$  will be
  - One to one and onto
  - Into
  - Onto
  - One to one
- The period of the function  $f(x) = \cos 4x$  is
  - $\pi$
  - $\pi/2$
  - $2\pi$
  - $4\pi$
- Two sides of a triangle are  $\sqrt{3}+1$  and  $\sqrt{3}-1$  and the angle between them is  $60^\circ$ , then the 3<sup>rd</sup> side is
  - 1
  - $\sqrt{2}$
  - $\sqrt{3}$
  - $\sqrt{6}$
- If  $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$  then
  - $x+y+z = xyz$
  - $x^2+y^2+z^2 = 1$
  - $xy+yz+zx = 1$
  - $x^2+y^2+2xy = 1$
- The set A has 3 elements and set B has 6 elements then the minimum number of elements in  $A \cup B$  are
  - 3
  - 6
  - 9
  - 0
- The range of the function  $f(x) = \frac{x}{|x|}$  is
  - $\mathbb{R} - \{0\}$
  - $\mathbb{R} - \{-1, 1\}$
  - $\{-1, 1\}$
  - $\{0, 1\}$
- The set of converging vector is known as
  - Co-terminal
  - Co-initial
  - Resolution
  - None
- If A and B are the arbitrary square matrices of the same order, then which of the following is true?
  - $(AB)^T = A^T B^T$
  - $(A^T)^T (B^T)^T = B^T A^T$
  - $A(\text{adj. } A) = A$
  - $(AB)^T = B^T A^T$
- The term free from x in the expansion of  $\left(x + \frac{1}{x}\right)^{2n}$  is
  - n
  - n-1
  - n+2
  - n+1
- The area bounded by the curve  $y^2=8x$  and  $x^2=8y$  is
  - 16/3
  - 64/3
  - 32/5
  - 8/3
- e is
  - an integer
  - a rational number
  - an irrational number
  - a prime number
- The fourth roots of unity are
  - $\pm 1$
  - $\pm i$
  - 1, w, w<sup>2</sup>
  - $\pm 1, \pm i$
- The nature of roots of  $x^2 - 6x + 9 = 0$  are
  - real and unequal
  - imaginary and unequal
  - real, rational and equal
  - irrational
- If  ${}^n P_2 = 336$  and  ${}^n C_r = 36$  then r equals to
  - 2
  - 3
  - 4
  - 5
- $\lim_{x \rightarrow 0} \frac{a^x - b^x}{x}$  equals to
  - $\log(a/b)$
  - $\log(ab)$
  - 1
  - 0
- The differential coefficient of  $\sin x^0$  is
  - $\cos x^0$
  - $\frac{180}{\pi} \cos x^0$
  - $\frac{\pi}{180} \cos x^0$
  - none
- $\int e^x \left(\log x + \frac{1}{x}\right) dx$  equals to
  - $\frac{e^x}{\log x} + c$
  - $\frac{e^x}{x} + c$
  - $e^x \log x + c$
  - $x e^x + c$
- If  $\sin x + \cos x = \sqrt{2}$  then the general solution is
  - $2n\pi + \pi/4$
  - $2n\pi - \pi/4$
  - $n\pi + \pi/4$
  - $n\pi - \pi/4$
- If  $y = \frac{1}{\sec x - \tan x}$  then  $dy/dx$  is equal to
  - $\sec x + \sec x \tan x$
  - $\sec^2 x \tan x$
  - $\sec x (\sec x + \tan x)$
  - $\sec x (\sec x - \tan x)$
- $\int_0^{\pi/4} \cos^3 \theta \sin^2 \theta d\theta =$ 
  - $\frac{7}{60\sqrt{2}}$
  - $\frac{7}{120}$
  - $\frac{1}{2}$
  - $\frac{\pi}{2}$
- A function f is said to have a stationary value at  $x = c$  if
  - $f(c) = 0$
  - $f'(a) = 0$
  - $f''(c) = 0$
  - $f'(c) = 0$

23. The circumference of the circle  $x^2 + y^2 - 25 = 0$  is  
 a.  $25\pi$                       b.  $2\pi r$                       c.  $10\pi$                       d.  $5\pi$
24. The line  $y = mx + c$  is a normal to the parabola  $y^2 = 4ax$  if  $c$  is equal to  
 a.  $a/m$     b.  $a\sqrt{1+m^2}$   
 c.  $-2am - am^3$     d.  $2am + am^2$
25. The value of  $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ bc & ca & ab \end{vmatrix}$  is  
 a.  $a+b+c$     b.  $4abc$   
 c.  $(a-b)(b-c)(c-a)$     d.  $(a-b)(b-c)(c-a)(a+b+c)$ .
26. If  $\vec{a}$  and  $\vec{b}$  are two vectors such that  $\vec{a} \cdot \vec{b} = 0$  and  $\vec{a} \times \vec{b} = 0$ , then  
 a.  $\vec{a}$  is parallel to  $\vec{b}$     b.  $\vec{a}$  is perpendicular to  $\vec{b}$   
 c. either  $\vec{a}$  or  $\vec{b}$  is a null vector    d.  $\vec{a}$  and  $\vec{b}$  are unit vector
27. The pairs of straight lines joining the origin to the common point of  $x^2 + y^2 = a^2$  and  $y = mx + c$  are perpendicular to each other if  
 a.  $2c^2 = a^2(1+m^2)$     b.  $c^2 = a^2 + m^2$   
 c.  $2c^2(1+m^2) = a^2$     d.  $2a^2 = c^2(1+m^2)$
28. If  $\sin^{-1}x = \frac{\pi}{5}$ , then  $\cos^{-1}x$  is equal to  
 a.  $\frac{\pi}{10}$                       b.  $\frac{3\pi}{10}$                       c.  $\frac{5\pi}{4}$                       d.  $\frac{7\pi}{4}$
29. The equation  $ax^2 + 2hxy + by^2 = 0$  represents  
 a. Circle                      b. Pair of straight lines  
 c. Parabola                      d. plane
30. The complex number  $z$  is purely imaginary if  
 a.  $z\bar{z}$  is real                      b.  $z = \bar{z}$                       c.  $z + \bar{z} = 0$                       d.  $\frac{z}{\bar{z}}$  is real
31. The sum of first ten odd natural number is  
 a. 55                      b. 70                      c. 75                      d. 100
32. The integral value of  $\int_0^{\pi} \cos^3 x dx$  is equal to  
 a. -1                      b. 0                      c. 1                      d.  $\pi$

33. In how many ways can the letter of the word DAUGHTER be arranged so that the vowels always come together?  
 a. 4320                      b. 4560                      c. 5020                      d. 4030
34. The value of  $\lim_{x \rightarrow 0} \frac{\sin 5x}{\sin 3x}$  is  
 a.  $5/3$                       b.  $3/5$                       c. 1                      d. 0
35. If one root of the equation  $3x^2 + px + 3 = 0$  is twice of the other, then the value of  $p$  is  
 a.  $1/3$                       b.  $\pm 9/\sqrt{2}$                       c. 3                      d.  $\pm 1/\sqrt{2}$
36. The parametric equation  $x = at^2$  and  $y = 4at$  is  
 a. Circle                      b. hyperbola                      c. ellipse                      d. parabola
37. The value of  $x$  for which the matrix  $A = \begin{pmatrix} 6 & x-2 \\ 3 & x \end{pmatrix}$  has no inverse is  
 a. 3                      b. 0                      c. 2                      d. -2
38. Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  and  $g: \mathbb{R} \rightarrow \mathbb{R}$  be functions defined by  $f(x) = 2x$  and  $g(x) = x^2 + 2$ . Then  
 a.  $(f \circ g)(2) = 12$     b.  $(g \circ f)(2) = 18$   
 c.  $(g \circ g)(1) = 11$     d.  $(f \circ f)(1) = 5$
39. If  $\int x \sin x dx = -x \cos x + k$ , then  $k$  is  
 a.  $\sin x + C$                       b.  $\cos x + C$                       c.  $C$                       d.  $x + C$
40. If a coin is tossed three times, then the probability that either all of them are head or all of them are tail is  
 a.  $1/2$                       b.  $1/4$                       c.  $1/8$                       d.  $2/3$

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### CHEMISTRY

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41. The charge required to liberate 11.5 gram of sodium is  
 a) 0.5 F    b) 1.5 F    c) 1 F    d) 965000 C
42. The number of  $H^+$  ion present in 500ml of 0.2M  $H_2SO_4$  solution is  
 a)  $1.2 \times 10^{23}$     b)  $6.02 \times 10^{22}$   
 c)  $1.2 \times 10^{22}$     d)  $6.023 \times 10^{23}$
43. Which of following are isoelectronic and isostructural  
 a)  $NO_3^-$ ,  $CO_3^{2-}$     b)  $SO_3$ ,  $NO_3^-$     c)  $ClO_3^-$ ,  $CO_3^{2-}$     d)  $CO_3$ ,  $SO_3$

44. When  $\text{CH}_3\text{Cl}$  and  $\text{AlCl}_3$  are used in Friedel-Crafts reaction, the electrophile is  
 a)  $\text{Cl}^-$       b)  $\text{AlCl}_4^-$       c)  $\text{CH}_3^+$       d)  $\text{AlCl}_2^+$
45. Both polar and non-polar bonds are present in  
 a)  $\text{NH}_4\text{Cl}$       b)  $\text{HCN}$       c)  $\text{CH}_4$       d)  $\text{H}_2\text{O}_2$
46. Which of these have O-O bond linkage  
 a)  $\text{SO}_4$       b)  $\text{S}_2\text{O}_2$       c)  $\text{S}_2\text{O}_7$       d)  $\text{S}_2\text{O}_8$
47. Which of these can dissolve gas  
 a)  $\text{HF}$       b)  $\text{HCl}$       c)  $\text{HBr}$       d)  $\text{HI}$
48. Which does not give Benedict's test?  
 a) Benzaldehyde      b) Acetaldehyde  
 c) Methane      d) None
49. For an elementary reaction  $2\text{A} + \text{B} \rightleftharpoons \text{C} + \text{D}$ , the molecularity is  
 a) 1      b) 2      c) 3      d) 4
50. Which of the following equations is not correct  
 a)  $\Delta G = \Delta H + T\Delta S$       b)  $\Delta G = \Delta E + P\Delta V$   
 c)  $Q = \Delta E + W$       d)  $\Delta S = \frac{q}{\Delta T}$
51. When a lead storage battery is discharged  
 a)  $\text{SO}_2$  is evolved      b) lead sulphate is consumed  
 c) lead is formed      d)  $\text{H}_2\text{SO}_4$  is consumed
52. The pH of  $10^{-12}$  M  $\text{HCl}$  is  
 a) 12      b) 2      c) 7      d) -12
53. When  $\text{NO}_2$  reacts with water then  
 a)  $\text{HNO}_3 + \text{HNO}_2$       b)  $\text{HNO}_3$   
 c)  $\text{HNO}_2$       d)  $\text{N}_2\text{O}_5 + \text{NH}_3$
54. Fermentation is a  
 a) Reversible process      b) Exothermic process  
 c) Endothermic process      d) Poikilothermic process
55. 0.1M of acid  $\alpha = 1\%$  then what is the value of  $K_a$   
 a)  $10^{-3}$       b)  $10^{-4}$       c)  $10^{-5}$       d)  $10^{-6}$
56. How many tetrahedral angles are present in a methane molecule  
 a) 1      b) 3      c) 4      d) 6
57. Which of the following is not a meta-directing group?  
 a)  $-\text{SO}_3\text{H}$       b)  $-\text{NO}_2$       c)  $-\text{CN}$       d)  $-\text{NH}_2$
58. How many isomers are possible for  $\text{C}_4\text{H}_8\text{O}$   
 a) 3      b) 4      c) 5      d) 6

59. Ethylene readily undergoes  
 a) Addition      b) substitution      c) Elimination      d) Rearrangement
60. Which of the following is the strongest acid  
 a)  $\text{H}_3\text{AsO}_4$       b)  $\text{H}_3\text{AsO}_3$       c)  $\text{H}_2\text{AsO}_3$       d)  $\text{H}_2\text{AsO}_4$

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## PHYSICS

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61. The dimension of impulse is  
 a)  $[\text{M}^1\text{L}^{-2}\text{T}^{-3}]$       b)  $[\text{M}^1\text{L}^1\text{T}^1]$   
 c)  $[\text{M}^1\text{L}^2\text{T}^{-1}]$       d)  $[\text{M}^0\text{L}^1\text{T}^2]$
62. A ball is dropped from a height of 1m. Its coefficient of restitution is 0.6 then the height it rebounds is  
 a) 0.4m      b) 0.36m      c) 0.6m      d) 0.8m
63. Huygen's principle cannot explain  
 a) Interference      b) Polarization  
 c) Diffraction      d) photoelectric effect
64. A silicon is doped with indium, the resultant is  
 a) N-type conductor      b) P-type conductor  
 c) Non-conductor      d) Superconductor
65. Pressure amplitude of a wave is tripled, then the effect on intensity is  
 a)  $I_0$       b)  $\sqrt{2} I_0$       c)  $9 I_0$       d)  $8 I_0$
66. A wave equation is represented by  $Y = 25 \cos(2\pi nt - \pi x)$ . Then, the amplitude and frequency are  
 a) 25, 100      b) 25, 1      c) 1, 100      d) 1, 25
67. A distant object is seen through a telescope of length 100 cm & magnification 19. Then, focal length of objective piece & eyepiece are respectively.  
 a) 88, 12 cm      b) 85, 15 cm      c) 95, 5 cm      d) 72, 28 cm
68. The equations of two sound waves are  $y = 4\sin(320\pi)t$  and  $Y = 4\sin 326\pi t$ , then the number of beats per second is?  
 a) Zero      b) 5      c) 10      d) 15
69. A substance provides a man of 40kg with 5kg cat. He then climbs up a ladder if the efficiency is 20% then how high does he can climb  
 a) 1m      b) 2m      c) 10m      d) 100m
70. The radius of Bohr's 1<sup>st</sup> orbit is  $r_0$ , then the radius of 3<sup>rd</sup> Bohr's orbit is  
 a)  $8r_0$       b)  $9r_0$       c)  $27r_0$       d)  $36r_0$

71. The ratio of amplitudes of two coherent sources is 1:2 then the ratio of maximum & minimum interference fringes is  
 a) 6:1      b) 8:1      c) 9:1      d) 27:1
72. Thermocouple thermometer is based on principle of  
 a) Seebeck effect      b) peltier effect  
 c) Joule's effect      d) Jhomsons effect
73. Work function of a metal is 2eV then the threshold wavelength is  
 a) 920nm      b) 620nm      c) 1220 nm      d) 420nm
74. A gas is initially at 27°C. It is compressed adiabatically from 27 litres to 8 litres. The rise in temperature is  
 a) 420°C      b) 375°C      c) 675°C      d) None
75. A solid sphere is rolling without sliding on an inclined. The ratio of rotational and translational kinetic energy  
 a) 1/7      b) 2/5      c) 3/7      d) 3/5
76. A tuning fork of frequency 256Hz is resonated with open end organ pipe, the 1<sup>st</sup> and 2<sup>nd</sup> resonating lengths being 35cm and 105.4 cm respectively. Then the velocity of the sound is  
 a) 340 m/s      b) 350 m/s      c) 360 m/s      d) 330 m/s
77. One source and one observer are moving away from each other by equal speed of 10m/s the apparent frequency is 1950Hz. Then the actual frequency of the source is  
 a) 2188Hz      b) 2068 Hz      c) 2346 Hz      d) 2769 Hz
78. The weight of a body at the centre of the earth is  
 a) Zero      b) increases      c) Half      d) Infinity
79. Water has the following types of modulus of elasticity  
 a) Young's      b) bulk      c) shear      d) all of above
80. A Prism of refractive angle 60° produces a minimum Deviation of 30°. Then the angle of incidence is  
 a) 30°      b) 60°      c) 45°      d) 90°
81. Two bodies of mass  $m_1$  and  $m_2$  have equal kinetic energy. Their momenta shall in the ratio of  
 a)  $m_1:m_2$       b)  $m_2:m_1$       c)  $\sqrt{m_1}:\sqrt{m_2}$       d)  $\sqrt{m_2}:\sqrt{m_1}$
82. Wavelength of matter wave is independent of  
 a) mass      b) velocity      c) momentum      d) charge

83. The height from the surface of earth at which value of 'g' becomes one-sixth of that on earth's surface will be  
 a) 2.45R      b) 1.45R      c) 5/12 R      d) 5/6R
84. A cricket ball is hit by a batter for a sixer. The number of degrees of freedom associated with the ball is  
 a) 1      b) 2      c) 3      d) 6
85. The ratio de-Broglie wave-lengths associated with a proton and an alpha particle accelerated through the same potential difference is  
 a) 1:8      b)  $\sqrt{8}:1$       c) 1:2      d) 1:1

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## ENGLISH

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### A. Read the following passage carefully and pick up the correct answer.

[5x1=5]

Broken friendship may be repaired but the break will always show. Friendship is a precious thing – too precious a treasure to be carelessly broken or thrown away. The world handles the word 'friend' lightly; its real, true, deeper meaning is forgotten. Your friend is one who appreciates you – your faults as well as your virtues. He understands and sympathizes with your defeats and victories, your aims and ideals, your joys and temptations, your hopes and disappointments, as no one else does or can. It is your friend to whom you turn for counsel, for comfort, for praise; he may not be as learned as some or as wise as others. Blessed is the man or woman into whose life has come the beauty and power of such a friendship. Prize it well. Do all in your power to keep such a friendship unbroken. Avoid the break, for when it comes which can't be mended and the jarring note mars the harmony.

- 86) In what way will you judge your sincere friend?  
 a) By his appearance  
 b) by the way he appreciates your virtues  
 c) by the way he pinpoints your demerits  
 d) by the way he appreciates your faults and virtues

- 87) A true friend is one who  
 a) shares with another all the joys of life  
 b) encourages you in your hour of trials and tribulations  
 c) shares your defeats and victories, aims and ideals, joys and temptations  
 d) shows lip sympathy
- 88) We owe our blessed life to  
 a) the experience of moments of loneliness  
 b) the power and beauty of friendship  
 c) a friend's constant companionship  
 d) the feeling that there is someone to humor us
- 89) Why do we turn to sincere friends?  
 a) we turn to sincere friends for physical support  
 b) we turn to them for counsel, comfort and words of cheer  
 c) we turn to them for financial assistance.  
 d) we turn to them for their paeans of praise
- 90) Friendship ought not to be broken. Why?  
 a) because broken friendship cannot be mended  
 b) because it will foster discord  
 c) because it will make life troublesome  
 d) because it will rob life of all its vitality and vivacity

**B. Choose the best alternative for the following sentences. [1x10= 10]**

- 91) People rushed.....her rescue and picked her up.  
 a) upon                    b) to                    c) in                    d) for
- 92) Nobody helped the old man,.....?  
 a) did he                    b) didn't they                    c) did they                    d) didn't he
- 93) Today's news.....interesting  
 a) Are                    b) is                    c) has                    d) have
- 94) If I had got the appointment at remote area, I would.....the poor.  
 a) Help                    b) helped                    c) have helped                    d) will help
- 95) The teacher asked us.....  
 a) what he wants    b) what we wanted    c) what did we want    d) what we want
- 96) Someone has stolen my computer. My computer.....  
 a) is stolen                    b) has been stolen                    c) has stolen                    d) was stolen
- 97) Have you seen .....European man.  
 a) a                    b) an                    c) the                    d) nothing

- 98) The antonym of the word mercy is.....  
 a) cruelty                    b) pretend                    c) quiet                    d) glad
- 99) The synonym of the word eager is.....  
 a) Indisputable                    b) fervent                    c) serious                    d) void
- 100) I usually don't like to go shopping. In the sentence *usually* is  
 a.....  
 a) noun                    b) adjective                    c) adverb                    d) verb