PURBANCHAL UNIVERSITY
FACULTY OF ENGINEERING
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ENTRANCE EXAMINATION Model Question

BE (Civil/Computer/Electrical/Electronics Communication & Automation/Geomatic/Biomedical)/B.Arch.

Time: 2 hours | Total Full Marks: 100

Choose the most appropriate answer and **DARKEN** the circle on the attached **ANSWER SHEET**. Answer **ALL** questions. **ALL** questions carry **Equal Marks**.

1. If A = {1, 2, 3, 4} and B = {a, b, c, d, e}, then number of elements in the set A × B is equal to:
   (A) 16 (B) 9 (C) 20 (D) 18
2. If $f : R \to R$ is defined by $f(x) = -3x + 4$, then $f^{-1}(x)$ is equal to:
   (A) $\frac{4-x}{3}$ (B) $\frac{x-4}{3}$ (C) $3x - 4$ (D) $\frac{4-3x}{3}$
3. If z is any complex number with its conjugate $\bar{z}$, then the value of $z + \bar{z}$ is:
   (A) 2 Re(z) (B) 2 Im(z) (C) 2i Im(z) (D) Re (z)
4. If the matrix $\begin{bmatrix} 2 & 1 & 3 \\ 4 & k & 6 \\ -1 & 2 & 1 \end{bmatrix}$ is not invertible, then the value of k is equal to:
   (A) -2 (B) 0 (C) −1 (D) 2
5. If two numbers (a -2) and (a + 1) have their geometric mean (a -1), then value of a is:
   (A) 8 (B) 3 (C) 1 (D) 4
6. If C(x, 2) = 36, then the value of x is equal to:
   (A) 7 (B) 8 (C) 9 (D) 10
7. If $\tan^{-1}\alpha + \tan^{-1}\beta = \tan^{-1} x$, then x is equal to:
   (A) $\alpha + \beta$ (B) $\frac{\alpha+\beta}{\alpha\beta-1}$ (C) $\frac{\alpha\beta-1}{\alpha+\beta}$ (D) $\frac{\alpha+\beta}{1-\alpha\beta}$
8. The angle θ between the lines represented by the equation $6x^2 - xy - y^2 = 0$ is:
   (A) $\frac{\pi}{2}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) π
9. The eccentricity of the ellipse $\frac{x^2}{16} + \frac{y^2}{4} = 1$ is:
   (A) $\frac{\sqrt{3}}{4}$ (B) $\frac{\sqrt{5}}{2}$ (C) $\frac{\sqrt{5}}{4}$ (D) $\frac{\sqrt{3}}{2}$
10. The distance between the parallel planes $x-2y+3z+7=0$ and $-2x+4y-6z+5=0$ is:
    (A) $\frac{9}{2\sqrt{14}}$ (B) $\frac{19}{2\sqrt{14}}$ (C) $\frac{2}{\sqrt{14}}$ (D) $\frac{1}{\sqrt{14}}$
11. If $y = \sin^{-1} x + \cos^{-1}\sqrt{1-x^2}$, then $\frac{dy}{dx}$ is equal to:
    (A) $-\frac{1}{\sqrt{1-x^2}}$ (B) $\frac{2}{\sqrt{1-x^2}}$ (C) $\frac{-2}{\sqrt{1-x^2}}$ (D) $\frac{1}{\sqrt{1-x^2}}$
12. $\int(\tan^4\theta + \sec^2\theta - 1)d\theta$ is equal to:
    (A) $\tan^3\theta + C$ (B) $\frac{\sec^3\theta}{3} + C$ (C) $\frac{\tan^3\theta}{3} + C$ (D) $3\tan^3\theta + C$
13. The value of the definite integral $\int_0^1 x(1-x)^7\,dx$ is equal to:
    (A) $\frac{1}{7}$ (B) $\frac{1}{72}$ (C) $\frac{1}{56}$ (D) $\frac{1}{8}$
14. The integrating factor of the differential equation $\cos x\frac{dy}{dx} + y\sin x = 1$ is:
    (A) $-\sec x$ (B) $\sec x$ (C) $\tan x$ (D) $-\cos x$

15. The area of the parallelogram whose diagonals are given by the vectors $3\vec{i}+\vec{j}-2\vec{k}$ and $\vec{i}-3\vec{j}+4\vec{k}$ is:
(A) $10\sqrt{3}$ (B) $5\sqrt{3}$ (C) 8 (D) 4

16. If the marks of 7 students are 4, 5, 6, 7, 8, 9, 9, then the median mark is:
(A) 5.5 (B) 6.5 (C) 7 (D) 7.5

17. If $n = 10, \sum x = 120$ and $\sum x^2 = 1530$, then the value of standard deviation σ is:
(A) 2 (B) 3 (C) 4 (D) 9

18. The probability of simultaneous occurrence of two events A and B is given by:
(A) $P(A \cup B)$ (B) $P(A \cap B)$ (C) $P(A - B)$ (D) $P(A + B)$

19. Express $\frac{i}{2+i}$ in the form of x+iy:
(A) 1+i2 (B) 1-i2 (C) $\frac{1}{5}+i\frac{2}{5}$ (D) $\frac{1}{5}-i\frac{2}{5}$

20. The sum of the first ten odd natural number is:
(A) 20 (B) 21 (C) 81 (D) 100

21. The coefficient of x^8 in the expansion of $(1+x^2)10$ is:
(A) 20 (B) 80 (C) 45 (D) 54

22. The equations 9x-2y=4 and x+4y=1 is:
(A) Consistent and dependent (B) Consistent and independent
(C) inconsistent and dependent (D) inconsistent and independent

23. The area of the quadrilateral whose vertices are (2,1) , (-1,3) (-3,-1) and (3,-4) is:
(A) 21 (B) 21.5 (C) 22.5 (D) 21.25

24. The equation of the line making an angle of 135° with positive x-axis and cutting an intercept 3 from the negative y-axis is:
x+y=0 (B) x-y=0 (C) x+y+3=0 (D) x+y-3=0

25. The equation of the ellipse whose latus rectum is 3 and eccentricity is $\frac{1}{\sqrt{2}}$ is:
(A) $2x^2+y^2= 9$ (B) $3x^2+y^2=4$ (C) $x^2+2y^2=9$ (D) None of these.

26. The radius and centre of circle $2x^2+2y^2-12x+4y= 1$ is:
(A) $\frac{41}{2}$, (3,-1) (B) $\sqrt{\frac{41}{2}}$, (-3,1) (C)) $\sqrt{\frac{41}{2}}$, (3,-1) (D)) $\sqrt{\frac{41}{2}}$, (-3,-1)

27. The point of inflection of the function $x^3-6x^2+9x+12$ is:
(A) 4 (B) 6 (C) 8 (D) 2

28. The differential coefficient of sinθ with respect to cosθ is:
(A) cot θ (B) cos θ (C) sinθcosθ (D) –cot θ

29. The area in the first quadrant bounded by $y=4x^2$, x= 0, y=1 and y=4 is:
(A) 2 (B) $\frac{4}{3}$ (C) $\frac{7}{3}$ (D) $\frac{11}{3}$

30. The curve is concave upwards if:
$\frac{dy}{dx} > 0$, $\frac{d^2y}{dx^2} < 0$ (B) $\frac{dy}{dx} > 0$, $\frac{d^2y}{dx^2} > 0$ (C) $\frac{dy}{dx} < 0$, $\frac{d^2y}{dx^2} > 0$ (D)) $\frac{dy}{dx} < 0$, $\frac{d^2y}{dx^2} < 0$

31. If $f(x)= x^3+ \tan x$, the f(x) is:
(A) Even function (B) odd function
(C) power function (D) None of these.

32. The domain of the function $f(x)= \log(1-x)+\sqrt{x^2-1}$ is:
(A) [-1,1] (B) (1,∞) (C) (1, 0) (D) (-∞, -1]

33. If A={x: $x^2 + 4 = 0$ where x is real}, then its elements are:
(a)+ 2 (B) no elements (C) -4 (D) -2

34. The function f: N→N where N is the set of natural numbers defined by f(x) = 2x+3 is:
(A) Surjective (B) injective (C) not surjective (D) None of these.

35. The diameter of the circumcircle of a triangle with sides 5 cm, 6cm, 7 cm is:
(A) $\frac{3\sqrt{6}}{2}$ cm (B) $2\sqrt{6}$ cm (C) $\frac{35}{48}$cm (D) $\frac{35}{2\sqrt{6}}$cm

36. If $\sin^{-1}x = \frac{\pi}{5}$ then $\cos^{-1}x$ is equal:
(A) $\frac{\pi}{10}$ (b)$\frac{3\pi}{10}$ (C) $\frac{5\pi}{10}$ (D) $\frac{7\pi}{10}$

37. If $\sin 9\theta = \sin \theta$, then general value of θ is:
(A) $n\pi$ (B) $\frac{n\pi}{4}$ (C)) $\frac{n\pi}{2}$ (D) $2n\pi$

38. If $\cos^{-1}(\frac{1}{x})=\alpha$ then $\tan \alpha$ equals:
(a)$\frac{1}{x^2-1}$ (B) $\sqrt{x^2-1}$ (C) $\sqrt{1-x^2}$ (D) $\sqrt{x^2+1}$

39. If $\vec{a} = \vec{i} + \vec{2j} + 3\vec{k}$ and $\vec{b} = 2\vec{i} + 3\vec{j} + 4\vec{k}$ then the projection of $\vec{a}$ on $\vec{b}$ is:
(A) $\frac{29}{\sqrt{20}}$ (B) $\frac{20}{\sqrt{29}}$ (C) $\frac{20}{29}$ (D) $\frac{\sqrt{20}}{29}$

40. The area of parallelogram determined by the vectors $\vec{i} + \vec{2j} + \vec{3k}$ and $-3\vec{i} - \vec{j} + \vec{k}$ is:
(A) $6\sqrt{5}$ sq. units (B) $3\sqrt{5}$ sq. units
(C) $\sqrt{5}$ sq. units (D) None of these.

41. A force F is given by $F = at + bt^2$, where t is time. What are the dimensions of a and b?
(A) MLT^{-1} and MLT^0 (B) MLT^{-3} and ML^2T^4
(C) MLT^{-4} and MLT^1 (D) MLT^{-3} and MLT^{-4}

42. A car moves with zero initial velocity up to a velocity of 5 m/s with an acceleration of 10 m/s^2. The distance covered in meter is:
(A) 0 (B) 1.25 (C) 1.5 (D) 2.5

43. At the height 80 m, an airplane is moving with 150 m/s. A bomb is dropped from it so as to hit a target. At what distance from the target should the bomb be dropped:
(A) 600 m (B) 505.3 m (C) 230 m (D) 80 m

44. Two bodies are rapidly approaching each other. They eventually clash. Which of the following statements regarding the system is correct?
(A) Around the time of collision, the whole momentum is conserved.
(B) During a collision, the overall momentum is conserved.
(C) The overall momentum of the system is not conserved.
(D) The complete momentum is maintained.

45. Which of the following is not true about frictional force?
(A) Rolling friction is much more than sliding friction, the use of ball bearings in a machine considerably reduces friction
(B) Friction in machines wastes energy and also causes wear and tear
(C) The force of friction that acts when a body moving on a surface is called sliding friction
(D) Friction is force which opposes the relative motion of two surfaces in contact

46. A vehicle is moving with a uniform velocity on a smooth horizontal road then power delivered by its engine must be:
(A) zero (B) increasing (C) uniform (D) decreasing

47. A body moves with a constant speed along a circle, then:
(A) no work is done on it (B) there is no acceleration produced in the body
(C) no force acts on the body (D) the body has constant velocity

48. In Hooke's law, F=-kx, the constant k is called the:
(A) velocity (B) speed constant (C) spring constant (D) time

49. The rotational analogue of force is:
(A) moment of inertia (B) angular momentum
(C) aangular acceleration (D) torque

50. The unit of modulus of elasticity is same as those of:
(A) stress, pressure and modulus of rigidity (B) stress, force and modulus of rigidity
(C) stress, strain and pressure (D) strain, force & pressure

51. If the temperature of a body is increased by 5°C, then on Fahrenheit scale its temperature will increase by
(A) 9°F (B) 5°F (C) 1.8°F (D) 7.2°F

52. What is the definition of 1 calorie?
(A) It is the heat required to raise temperature of 1g of water by 1°C at 760mm Hg
(B) It is the heat required to raise the temperature of 1g of any substance by 14.5°C to 15.5°C at 760mm Hg
(C) It is the heat required to raise the temperature of 1g of water from 14.5°C to 15.5°C at 760mm Hg
(D) It corresponds to the heat supplied at 760 mm Hg for 1°C raise in temperature

53. An iron ring has to fit over a cylindrical rod. The diameters of the rod and iron ring are 6.445 cm and 6.420 cm at 20°C. The ring can slip over the iron rod only if the diameter of the ring is about 0.008 cm larger than iron rod. To what temperature should the ring be heated so as to fit the cylindrical rod? (Take $\alpha = 1.20 \times 10^{-5} °C^{-1}$)
(A) 2°C (B) 20°C (C) 200°C (D) 450°C

54. The insulation ability of an insulator with the presence of moisture would:
(A) remain unaffected (B) increase (C) decrease
(D) may increase or decrease depending upon the thickness and temperature of insulation

55. Magnification produced by a rear view mirror fitted in vehicles:
(A) is equal to one (B) is more than one (C) is less than one
(D) can be more than or less than one depending upon the position of the object in front of it

56. The focal length of a concave lens is negative. Its power should be:
(A) zero (B) neutral (C) positive (D) negative

57. Which colour in the white light is deviated most if it passes through a prism?
(A) Violet colour (B) Red colour (C) Yellow colour (D) Blue colour

58. In a Young's double slit experiment, 8 fringes are observed in a segment of screen with the light of wavelength 600 nm. On changing the wavelength to 400 nm, the number of fringes observed is:
(A) 6 (B) 8 (C) 9 (D) 12

59. If two unit charges are separated in air by a distance of 1m, the force exerted between them will be:
(A) 9×10^{9} N (B) 9×10^{19} N (C) 9×10^{-19} N (D) 9×10^{-9} N

60. A parallel plate capacitor has the capacitance of 20 μF where the distance between the plates is 16 cm. If the distance between the plates is reduced to 4 cm, its capacitance will be:
(A) 80 μF (B) 60 μF (C) 20 μF (D) 5 μF

61. Resistivity of a wire depends on
(A) length of wire (B) cross section area
(C) material (D) All of these.

62. A pair of two dissimilar metals joined at their ends is called as:
(A) thermo group (B) thermoelectric series
(C) thermopile (D) thermocouple

63. A transformer with a 110 V primary has a 15:1 turns ratio. The load resistance is 120 Ohm. The approximate voltage across the load will become:
(A) 880 V (B) 88 V (C) 73 V (D) 7.3 V

64. If an LCR series circuit is connected to an ac source, then at resonance the voltage across:
(A) R equals to the applied voltage (B) R is zero
(C) C is zero (D) L equals to the applied voltage

65. In photoelectric effect, electrons should be removed from the:
(A) inner shells (B) surface (C) from core (D) the nucleus

66. If the voltage of X ray tube is doubled, the intensity of X rays will become
(A) half (B) double (C) unchanged (D) four times

67. When a pure semiconductor is heated, its resistance:
(A) remains the same (B) increases
(C) decreases (D) cannot be predicted

68. Quick electron emission are called:
(A) Alpha decay (B) Beta decay
(C) Gamma decay (D) Zeta decay

69. What will be the binding energy of $_2He^4$ if its actual mass is 4.0039 amu? (Take the mass of one neutron and one proton as 2.0165 amu and that of an electron as 0.00045 amu).
(A) 70.12 MeV (B) 14.06 MeV (C) 56.24 MeV (D) 27.93 MeV

70. An antiproton is an atomic particle that has:
(A) the mass of a proton and the charge of a neutron
(B) the mass of an electron and the charge of a proton
(C) the mass of a neutron and the charge of a proton
(D) the mass of a proton and the charge of an electron

71. Which of the following has the smallest size?
(A) Na^+ (B) Mg^{2+} (C) Al^{3+} (D) P^{5+}

72. Ca^{2+} is isoelectronic with
(A) Mg^{2+} (B) Na^- (C) Ar (D) Kr

73. Any p-orbital can accommodate up to:
(A) four electrons (B) two electrons with parallel spin
(C) six electrons (D) two electrons with anti parallel spin

74. 56 grams of carbon monoxide is oxidized with excess of oxygen, how much carbon dioxide will it produce?
(A) 22grams (B) 44grams (C) 66grams (D) 88 grams

75. Non-ideal gases approach ideal behavior under:
(A) high temperature and high pressure (B) high temperature and low pressure
(C) low temperature and high pressure (D) low temperature and low pressure

76. Number of unpaired electrons in N^{2+}:
(A) 3 (B) 1 (C) 2 (D) 0

77. Degree of dissociation does not depend on which of the following factors?
(A) Nature of solute (B) Nature of solvent
(C) Sound (D) Concentration

78. What effect does temperature have on the half-life of a first-order reaction?
(A) It increases (B) It remains the same
(C) It decreases (D) Both increases as well as decrease

79. Loss of hydrogen atoms by an element is called:
(A) Sublimation (B) reduction (C) oxidation (D) hydrogenation

80. Ammonia can be dried by:
(A) Conc H_2SO_4 (B) P_2O_5 (C) Anhydrous $CaCl_2$ (D) CaO

81. Lead pencil contains:
(A) Graphite (B) diamond (C) lead (D) lead sulphate

82. In which compound of Xenon the oxidation state of Xenon is +6?
(A) XeF_4 (B) $XeOF_4$ (C) $XeOF_2$ (D) Na_4XeO_6

83. Malachite is an ore of:
(A) Silver (B) Iron (C) Zinc (D) Copper

84. Alkali metals are characterized by:
(A) Good conductors of heat and electricity (B) High melting point
(C) High ionization potential (D) low oxidation potential

85. Mohr salt is:
(A) Double salt (B) Mixed salt (C) Simple salt (D) Complex salt

86. The IUPAC name of $CH_3 - CH = CH\ COO\ C_2H_5$ is:
(A) Ethyl but-1–enoate (B) Ethyl but-2-enoate
(C) Ethyl prop-2-enoate (D) Ethyl butanoate

87. The hexagonal ring structure of benzene with alternate single and double bond was proposed by:
(A) Baeyer (B) Huckel (C) Berzelius (D) Kekule

88. Compound which decompose at boiling point are distilled by:
(A) Fractional distillation (B) Steam distillation
(C) Under reduced pressure (D) Simple distillation

89. Chlorobenzene reacts with chloral in the presence of Conc.H_2SO_4 to give:
(A) BHC (B) DDT (C) Urotropine (D) Acetophenone

90. Electrolytic reduction of nitro benzene in the presence of H_2SO_4 gives:
(A) Toluene (B) p-aminophenol (C) azoxybenzene (D) Aniline

91. My friends as well as I ..... Joining the army.
(A) is (B) are (C) have (D) am

92. The exam ..... at 9:30 tomorrow.
(A) Starts (B) will start (C) is stating (D) has started

93. He said, " Thank you."
(A) He thanks me. (B) He thanked me.
(C) He said thank you (D) He asked to thank me.

94. Locate the word without/h/ sound .....
(A) Oh ! (B) behold (C) comprehend (D) half

95. I have got ..... cold.
(A) a (B) an (C) the (D) nothing

96. I will tell you all that ..... discussed.
(A) was (B) were (C) are (D) have been

97. The passive voice of 'No one told me about it' is .....
(A) It was not told me about (B) No one was told me about it.
(C) No one had been told about it. (D) I was not told about it.

98. Please fill in the form ..... ink.
(A) with (B) by (C) in (D) on

99. In the sentence, " India is progressing by leaps and bounds", the expression "by leaps and bounds" means .....
(A) slowly (B) rapidly (C) badly (D) cunningly

100. In the sentence "He was fair and square in all his dealings" the expression 'fair and square' represents .....
(A) biased (B) unbiased (C) clever (D) dishonest

Best of Luck