

NG 24 (GROUP B)

PART I — ENGINEERING MATHEMATICS

(Common to all Candidates)

(Answer ALL questions)

1. If A is a 3×3 matrix and determinant of A is 6, then find the value of the determinant of the matrix $(2A)^{-1}$
 - a. $\frac{1}{12}$
 - b. $\frac{1}{24}$
 - c. $\frac{1}{36}$
 - d. $\frac{1}{48}$

2. If $3x + 2y + z = 0$, $x + 4y + z = 0$, $2x + y + 4z = 0$, be a system of equations, then
 - a. it is inconsistent
 - b. it has only the trivial solution $x = 0, y = 0, z = 0$
 - c. it can be reduced to a single equation and so a solution does not exist
 - d. the determinant of the matrix of coefficients is zero

3. Let $M = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}$. The maximum number of linearly independent eigen vectors of M is
 - a. 0
 - b. 1
 - c. 2
 - d. 3

4. The shortest and longest distance from the point $(1, 2, -1)$ to the sphere $x^2 + y^2 + z^2 = 24$ is
 - a. $(\sqrt{14}, \sqrt{46})$
 - b. $(14, 46)$
 - c. $(\sqrt{24}, \sqrt{56})$
 - d. $(24, 56)$

5. The solution of the given ordinary differential equation $x \frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ is
 - a. $y = A \log x + B$
 - b. $y = Ae^{\log x} + Bx + C$
 - c. $y = Ae^x + B \log x + C$
 - d. $y = Ae^x + Bx^2 + C$

6. The complete integral of the partial differential equation $pz^2 \sin^2 x + qz^2 \cos^2 y = 1$ is
 - a. $z = 3a \cot x + (1 - a) \tan y + b$
 - b. $z^2 = 3a^2 \cot x + 3(1 + a) \tan y + b$
 - c. $z^3 = -3a \cot x + 3(1 - a) \tan y + b$
 - d. $z^4 = 2a^2 \cot x + (1 + a)(1 - a) \tan y + b$

7. The area between the parabolas $y^2 = 4 - x$ and $y^2 = x$ is given by
- $\frac{3\sqrt{2}}{16}$
 - $\frac{16\sqrt{3}}{5}$
 - $\frac{5\sqrt{3}}{16}$
 - $\frac{16\sqrt{2}}{3}$
8. The value of the integral $\int_0^a \int_0^b \int_0^c e^{x+y+z} dz dy dx$ is
- e^{a+b+c}
 - $e^a + e^b + e^c$
 - $(e^a - 1)(e^b - 1)(e^c - 1)$
 - e^{abc}
9. If $\nabla\phi = 2xyz^3 \vec{i} + x^2z^3 \vec{j} + 3x^2yz^2 \vec{k}$, then $\phi(x, y, z) =$
- $\phi = xyz^2 + c$
 - $\phi = x^3yz^2 + c$
 - $\phi = x^2yz^3 + c$
 - $\phi = x^3yz + c$
10. The only function from the following that is analytic is
- $F(z) = \operatorname{Re}(z)$
 - $F(z) = \operatorname{Im}(z)$
 - $F(z) = z$
 - $F(z) = \sin z$
11. The value of m so that $2x - x^2 + my^2$ may be harmonic is
- 0
 - 1
 - 2
 - 3
12. The value of $\int_C \frac{1}{z} dz$, where C is the circle $z = e^{i\theta}$, $0 \leq \theta \leq \pi$ is,
- πi
 - $-\pi i$
 - $2\pi i$
 - 0
13. The Region of convergence of the signal $x(n) = \delta(n - k)$, $k > 0$ is
- $z = \infty$
 - $z = 0$
 - Entire z -plane, except at $z = 0$
 - Entire z -plane, except at $z = \infty$

14. The Laplace transform of a signal $X(t)$ is $\frac{4s+1}{s^2+6s+3}$. The initial value $X(0)$ is
- 0
 - 4
 - 1/6
 - 4/3
15. Given the inverse Fourier transform of $f(s) = \begin{cases} a-|s|, & |s| \leq a \\ 0, & |s| > a \end{cases}$ is $\frac{a^2}{2\pi} \left[\frac{\sin \frac{ax}{2}}{\frac{ax}{2}} \right]^2$. The value of $\int_0^{\infty} \left[\frac{\sin x}{2} \right]^2 dx$ is
- π
 - $\frac{2\pi}{3}$
 - $\frac{\pi}{2}$
 - $\frac{\pi}{4}$
16. If $A = [a_{ij}]$ is the coefficient matrix for a system of algebraic equations, then a sufficient condition for convergence of Gauss-Seidel iteration method is
- A is strictly diagonally dominant
 - $|a_{ii}| = 1$
 - $\det(A) \neq 0$
 - $\det(A) > 0$
17. Which of the following formula is used to fit a polynomial for interpolation with equally spaced data?
- Newton's divided difference interpolation formula
 - Lagrange's interpolation formula
 - Newton's forward interpolation formula
 - Least-square formula
18. For applying Simpson's $\frac{1}{3}$ rule, the given interval must be divided into how many number of sub-intervals?
- odd
 - two
 - even
 - three
19. A discrete random variable X has the probability mass function given by $p(x) = cx$, $x = 1, 2, 3, 4, 5$. The value of the constant 'c' is
- 1/5
 - 1/10
 - 1/15
 - 1/20
20. For a Binomial distribution with mean 4 and variance 2, the value of 'n' is
- 2
 - 4
 - 6
 - 8

PART II — BASIC ENGINEERING AND SCIENCES

(Common to all candidates)

(Answer ALL questions)

21. Speed of the processor chip is measured in
- Mbps
 - GHz
 - Bits per second
 - Bytes per second
22. A program that converts Source Code into machine code is called
- Assembler
 - Loader
 - Compiler
 - Converter
23. What is the full form of URL?
- Uniform Resource Locator
 - Unicode Random Locator
 - Unified Real Locator
 - Uniform Read Locator
24. Which of the following can adsorb larger volume of hydrogen gas?
- Finely divided platinum
 - Colloidal solution of palladium
 - Small pieces of palladium
 - A single metal surface of platinum
25. What are the factors that determine an effective collision?
- Collision frequency, threshold energy and proper orientation
 - Translational collision and energy of activation
 - Proper orientation and steric bulk of the molecule
 - Threshold energy and proper orientation
26. Which one of the following flows in the internal circuit of a galvanic cell?
- atoms
 - electrons
 - electricity
 - ions
27. Which one of the following is not a primary fuel?
- petroleum
 - natural gas
 - kerosene
 - coal
28. Which of the following molecules will not display an infrared spectrum?
- CO₂
 - N₂
 - Benzene
 - HCCH
29. Which one of the following behaves like an intrinsic semiconductor, at the absolute zero temperature?
- Superconductor
 - Insulator
 - n-type semiconductor
 - p-type semiconductor
30. The energy gap (eV) at 300K of the material GaAs is
- 0.36
 - 0.85
 - 1.20
 - 1.42

31. Which of the following ceramic materials will be used for spark plug insulator?
- SnO_2
 - $\alpha\text{-Al}_2\text{O}_3$
 - TiN
 - YBaCuO_7
32. In unconventional super-conductivity, the pairing interaction is
- non-phononic
 - phononic
 - photonic
 - non-excitonic
33. What is the magnetic susceptibility of an ideal super conductor?
- 1
 - 1
 - 0
 - infinite
34. The Rayleigh scattering loss, which varies as _____ in a silica fiber.
- λ^0
 - λ^{-2}
 - λ^{-4}
 - λ^{-6}
35. What is the near field length N that can be calculated from the relation (if D is the diameter of the transducer and λ is the wavelength of sound in the material)?
- $D^2 / 2\lambda$
 - $D^2 / 4\lambda$
 - $2D^2 / \lambda$
 - $4D^2 / \lambda$
36. Which one of the following represents open thermodynamic system?
- Manual ice cream freezer
 - Centrifugal pump
 - Pressure cooker
 - Bomb calorimeter
37. In a new temperature scale say $^\circ\rho$, the boiling and freezing points of water at one atmosphere are $100^\circ\rho$ and $300^\circ\rho$ respectively. Correlate this scale with the Centigrade scale. The reading of $0^\circ\rho$ on the Centigrade scale is:
- 0°C
 - 50°C
 - 100°C
 - 150°C
38. Which of the cross-section of the beam subjected to bending moment is more economical?
- Rectangular cross-section
 - I - cross-section
 - Circular cross-section
 - Triangular cross-section
39. The velocity of a particle is given by $V = 4t^3 - 5t^2$. When does the acceleration of the particle becomes zero?
- 8.33 s
 - 0.833 s
 - 0.0833 s
 - 1 s
40. What will happen if the frequency of power supply in a pure capacitor is doubled?
- The current will also be doubled
 - The current will reduce to half
 - The current will remain the same
 - The current will increase to four-fold

PART III

16 – LEATHER TECHNOLOGY

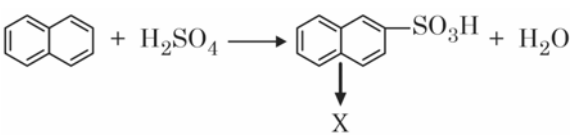
(Answer ALL questions)

41. What is the diameter of the collagen molecule?
- 15 Å
 - 24 Å
 - 14 nm
 - 24 nm
42. Which of these is a post translational modification in collagen biosynthesis?
- mRNA formation
 - Peptide bond formation
 - Glycosylation
 - Transcription
43. Electronegativity is defined as the power of an atom in a molecule to _____
- Repel electrons towards itself
 - Attract electrons towards itself
 - Expand itself
 - All of the above
44. Which of the following is function of Flame or Emission system in Atomic Absorption Spectroscopy?
- To split the beam into two
 - To break the steady light into pulsating light
 - To filter unwanted components
 - To reduce the sample into atomic state
45. What is the Shrinkage temperature of native collagen fibers in skin?
- ~60°C
 - ~37°C
 - ~90°C
 - ~120°C
46. What is the major protein constituent in a hide?
- Collagen
 - Gelatin
 - Mucin
 - Keratin
47. During staining, the smear is heat-fixed in order to _____
- kill the organism so that dyes will penetrate
 - attach the organism firmly to the slide
 - kill the organism and attach the organism firmly to the slide
 - neither kill the organism nor attach the organism firmly to the slide
48. Which of the following constituents present in skin associated with thermo-regulatory function?
- Keratinocytes
 - Sweat glands
 - Nerve cells
 - Fibroblast cells
49. Which enzyme is used for unhairing?
- Protease
 - Amylase
 - Lipase
 - Glycosidase
50. Which of the following is the commonly used to reduce acid swelling during pickling process?
- Sodium chloride
 - Silver chloride
 - Barium chloride
 - Ammonium chloride

51. Bio-deterioration of hides and skin before tanning process, Hair slip occurs due to
- Aspergillus niger
 - Streptococcus sp
 - Aspergillus fumigates
 - Pseudomonas sp
52. Which of the following amino acids has higher percentage in Type I collagen?
- Methionine
 - Proline
 - Glycine
 - Guanosine
53. What is the average molecular weight of Type I collagen molecule?
- 300 KDa
 - 3000 KDa
 - 30 KDa
 - 3 KDa
54. Defective cross-linking of collagen results in
- marfan syndrome
 - lathyrism
 - fibrosis
 - osteogenesis imperfecta
55. Which of the following vitamins require sun light exposure to skin for its synthesis?
- Vitamin A
 - Vitamin B
 - Vitamin C
 - Vitamin D
56. Which of the following is a non-fibrous protein present in skin?
- Collagen
 - Reticulin
 - Keratin
 - Globulin
57. Which of the following raw materials is most suitable for making spongy garment leather?
- Cow hide
 - Sheep skin
 - Buffalo hide
 - Goat skin
58. Which of the following enzymes is involved in the crosslinking of collagen fibrils?
- Prolyl hydroxylase
 - Lysyl hydroxylase
 - Prolyl oxidase
 - Lysyl oxidase
59. The major force, which affects the wetting back of wet blue skins is
- adhesive
 - cohesive
 - hydrogen bonds
 - van der Waals
60. Which of the following enzymes are capable of breaking down native Type I collagen triple helical domain at more than one site?
- Glycosidase
 - Trypsin
 - Chymotrypsin
 - Bacterial Collagenase
61. Pick out the right order which has high fiber density
- Epidermis > Corium minor > Adipose
 - Epidermis > Dermis > Adipose
 - Corium minor > Corium Major > Adipose
 - Adipose > Corium major > Grain
62. What is the functional role of vegetable tannins in plants?
- To resist microbial attack
 - To increase water uptake
 - To act as secondary metabolites
 - To involve in photosynthesis

63. Which chemical is used to remove hair from the skin?
- Calcium hydroxide
 - Sodium Sulfide
 - Hydrogen sulfide
 - Calcium carbonate
64. Chrome soaps give _____ stains in wet blue skins
- Black
 - Pink
 - Brown
 - Red
65. Permissible limit of total chromium discharge as Cr in treated effluent is
- 1 ppm
 - 2 ppm
 - 3 ppm
 - 4 ppm
66. Mechanism of chrome tanning is based on
- Coordinate covalent cross-linking
 - Hydrogen bonding
 - Covalent crosslinks
 - Unipoint fixation through ionic interactions
67. Which tanning system is more suitable for football leather manufacturing?
- Zirconium tanning
 - Chrome tanning
 - Oil tanning
 - Aldehyde tanning
68. Which the mixed indicator is used for nitrogen estimation?
- bromophenol blue and thymol blue
 - thymol blue and cresol red
 - methyl orange and methyl red
 - methyl red and bromocresol green
69. Which type of crosslinking occurs in collagen stabilization during oil tanning?
- Hydrogen bonding
 - Co-ordinate covalent
 - Covalent
 - Ionic bond
70. Aldehyde pre-treatment is generally carried out for
- Garment leather
 - Chamois leather
 - Sole leather
 - Lining leather
71. Snuffing on grain is called _____ leather
- Nubuck
 - Suede
 - Full grain
 - Oil finish
72. Which chemical is used as an indicator in determining the purity of sodium chloride?
- Potassium chromate
 - Potassium permanganate
 - Silver nitrate
 - Silver chloride

73. How Sulfonation followed by condensation process is called during syntan manufacture?
- Neradol
 - Novolak
 - Sulfone
 - Neutralization
74. Which property is mainly incorporated by melamine syntan?
- Grain Tightness
 - Selective Filling
 - Bleaching
 - Neutralization
75. Which one of the following is the shape of test specimens for tensile strength of leather?
- Rectangle
 - Trapezoidal
 - Dumbbell
 - Square
76. Condensation is an important step in syntan manufacture which contributes towards
- Solubility
 - Crosslinking
 - Dispersion
 - Diffusion
77. Which of the following is used as a reducing agent in the preparation of BCS?
- Hydrogen Peroxide
 - Fluorine
 - Molasses
 - Hydroxide ions
78. Barkometer is used to:
- Determine the shrinkage temperature of leather
 - Determine the concentration of tannin solution
 - Determine the protein content in solution
 - Determine the fat content in solution
79. What is the water solubility properties of a surfactant with HLB range of 1-4?
- Insoluble
 - Soluble
 - Stable
 - Milky dispersion
80. Protein finishing is preferred for which type of leather?
- Glaze leathers
 - Nubuck
 - Laminated
 - Suede
81. Chromophores consists of _____ which are responsible for color.
- Functional groups with localized electrons
 - Functional groups with localized protons
 - Functional groups with delocalized protons
 - Functional groups with delocalized electrons

82. Which deliming agent is ideal for the manufacture of glove leather?
- Ammonium chloride
 - Ammonium sulphate
 - Sodium bicarbonate
 - Sodium sulphate
83. What is the product name (X)?
- 
- Phenol sulfonic acid
 - Naphthalene sulfonic acid
 - Polyhydroxy sulfonic acid
 - Benzesulfonic acid
84. Washing after neutralization is necessary to ensure
- removal of excess alkali
 - removal of chromium hydroxide formed
 - removal of neutral salts
 - effective fixation of dyes and fat liquors
85. For making light and bright colored leathers _____ syntans are preferable.
- Quebracho tannins
 - Sulphone
 - Phenolic
 - Replacement
86. The position of an auxochromic group in a dye molecule influences
- colour characteristics
 - solubility
 - Fastness property
 - Charge
87. What is an ideal cutting direction of leather?
- Parallel to stretch direction
 - Perpendicular to stretch direction
 - Diagonal to stretch direction
 - None of the above
88. Snuffing is an important machinery operation for which type of leathers?
- Suede
 - Nubuck
 - Upper
 - Sole
89. Which technique is used to determine the particle size?
- Dynamic Light scattering
 - Xray Diffraction
 - Vibrational Spectroscopy
 - Nuclear Magnetic Resonance
90. What is the approximate molecular weight of syntan, if the average number of phenolic nuclei per molecule is 5 with mole ratio of 0.8?
- 300-350 dalton
 - 750-900 dalton
 - 1500-2000 dalton
 - 2500-3000 dalton

91. Which base coat is preferred for a low absorbency crust leather?
- Sealing Coat
 - Clearing Coat
 - Impregnation Coat
 - Both (a) and (c)
92. Which type of thread is used in shoe stitching that provides excellent sewing and superior tensile strength?
- Cellulose
 - Polyamide base
 - Cotton
 - Spandex
93. The purpose of skiving machine is to _____ the thickness of a leather component along the edge to the desired thickness
- Increase
 - Maximize
 - Improve
 - Reduce
94. Which theory is based on the assumption that the rigidity of the resin arises from intermolecular friction binding the chains together in a rigid network. On heating, these frictional forces are weakened to allow the plasticizer molecules to lubricate the chains?
- Lubrication Theory
 - Gel Theory
 - Free Volume Theory
 - Mechanistic Theory
95. The first phase of a growth curve is
- Log phase
 - Lag phase
 - Stationary phase
 - Decline Phase
96. Which of the following mechanisms is referred for shank material used in shoe?
- Double side supported beam mechanism
 - Roller mechanism
 - Cantilever beam mechanism
 - Slider crank mechanism
97. What is the abbreviation of FRP?
- Fibre Reinforced Plastics
 - Fabric Reinforced Polymer
 - Fibre Re-Structured Plastics
 - None of the above
98. Which is not considered in basic styles of footwear?
- Derby
 - Oxford
 - Peep Toe
 - Slip on
99. Hotmelts adhesive is
- Thermoplastic in nature
 - Thermosetting in nature
 - Electrostatic in nature
 - None of the above
100. Primary treatment of waste water includes
- sedimentation
 - aerobic treatment
 - anaerobic treatment
 - biological oxidation