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. $\left(\sqrt{14}, \sqrt{46}\right)$

   b. (14, 46)

   c. $\left(\sqrt{24}, \sqrt{56}\right)$

   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

a. $\frac{3\sqrt{2}}{16}$

b. $\frac{16\sqrt{3}}{5}$

c. $\frac{5\sqrt{3}}{16}$

d. $\frac{16\sqrt{2}}{3}$

8. The value of the integral $\int_0^a \int_0^b \int_0^c e^{x+y+z}\, dz\, dy\, dx$ is

a. e^{a+b+c}

b. $e^a + e^b + e^c$

c. $\left(e^a - 1\right)\left(e^b - 1\right)\left(e^c - 1\right)$

d. e^{abc}

9. If $\nabla\phi = 2xyz^3\,\vec{i} + x^2z^3\,\vec{j} + 3x^2yz^2\,\vec{k}$, then $\phi(x, y, z) =$

a. $\phi = xyz^2 + c$

b. $\phi = x^3yz^2 + c$

c. $\phi = x^2yz^3 + c$

d. $\phi = x^3yz + c$

10. The only function from the following that is analytic is

a. $F(z) = \mathrm{Re}(z)$

b. $F(z) = \mathrm{Im}(z)$

c. $F(z) = z$

d. $F(z) = \sin z$

11. The value of m so that $2x - x^2 + my^2$ may be harmonic is

a. 0

b. 1

c. 2

d. 3

12. The value of $\int_C \frac{1}{z} dz$, where C is the circle $z = e^{i\theta}$, $0 \le \theta \le \pi$ is,

a. πi

b. $-\pi i$

c. $2\pi i$

d. 0

13. The Region of convergence of the signal $x(n) = \delta(n - k),\ k > 0$ is

a. $z = \infty$

b. $z = 0$

c. Entire z-plane, except at $z = 0$

d. 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

a. 0

b. 4

c. 1/6

d. 4/3

15. Given the inverse Fourier transform of $f(s)=\begin{cases} a-|s|, & |s|\le a \\ 0, & |s|>a \end{cases}$ 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

a. π

b. $\frac{2\pi}{3}$

c. $\frac{\pi}{2}$

d. $\frac{\pi}{4}$

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. A is strictly diagonally dominant

b. $|a_{ii}|=1$

c. $\det(A)\neq 0$

d. $\det(A)>0$

17. Which of the following formula is used to fit a polynomial for interpolation with equally spaced data?

a. Newton's divided difference interpolation formula

b. Lagrange's interpolation formula

c. Newton's forward interpolation formula

d. 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?

a. odd

b. two

c. even

d. 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

a. 1/5

b. 1/10

c. 1/15

d. 1/20

20. For a Binomial distribution with mean 4 and variance 2, the value of 'n' is

a. 2

b. 4

c. 6

d. 8

PART II — BASIC ENGINEERING AND SCIENCES

(Common to all candidates)

(Answer ALL questions)

21. Speed of the processor chip is measured in
    a. Mbps
    b. GHz
    c. Bits per second
    d. Bytes per second

22. A program that converts Source Code into machine code is called
    a. Assembler
    b. Loader
    c. Compiler
    d. Converter

23. What is the full form of URL?
    a. Uniform Resource Locator
    b. Unicode Random Locator
    c. Unified Real Locator
    d. Uniform Read Locator

24. Which of the following can adsorb larger volume of hydrogen gas?
    a. Finely divided platinum
    b. Colloidal solution of palladium
    c. Small pieces of palladium
    d. A single metal surface of platinum

25. What are the factors that determine an effective collision?
    a. Collision frequency, threshold energy and proper orientation
    b. Translational collision and energy of activation
    c. Proper orientation and steric bulk of the molecule
    d. Threshold energy and proper orientation

26. Which one of the following flows in the internal circuit of a galvanic cell?
    a. atoms
    b. electrons
    c. electricity
    d. ions

27. Which one of the following is not a primary fuel?
    a. petroleum
    b. natural gas
    c. kerosene
    d. coal

28. Which of the following molecules will not display an infrared spectrum?
    a. CO_2
    b. N_2
    c. Benzene
    d. HCCH

29. Which one of the following behaves like an intrinsic semiconductor, at the absolute zero temperature?
    a. Superconductor
    b. Insulator
    c. n-type semiconductor
    d. p-type semiconductor

30. The energy gap (eV) at 300K of the material *GaAs* is
    a. 0.36
    b. 0.85
    c. 1.20
    d. 1.42

31. Which of the following ceramic materials will be used for spark plug insulator?

a. SnO_2

b. α-Al_2O_3

c. TiN

d. $YBaCuO_7$

32. In unconventional super-conductivity, the pairing interaction is

a. non-phononic

b. phononic

c. photonic

d. non-excitonic

33. What is the magnetic susceptibility of an ideal super conductor?

a. 1

b. –1

c. 0

d. infinite

34. The Rayleigh scattering loss, which varies as _____ in a silica fiber.

a. λ^0

b. λ^{-2}

c. λ^{-4}

d. 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)?

a. $D^2 / 2\lambda$

b. $D^2 / 4\lambda$

c. $2D^2 / \lambda$

d. $4D^2 / \lambda$

36. Which one of the following represents open thermodynamic system?

a. Manual ice cream freezer

b. Centrifugal pump

c. Pressure cooker

d. Bomb calorimeter

37. In a new temperature scale say $°\rho$, the boiling and freezing points of water at one atmosphere are $100°\ \rho$ and $300°\rho$ respectively. Correlate this scale with the Centigrade scale. The reading of $0°\rho$ on the Centigrade scale is:

a. 0°C

b. 50°C

c. 100°C

d. 150°C

38. Which of the cross-section of the beam subjected to bending moment is more economical?

a. Rectangular cross-section

b. I - cross-section

c. Circular cross-section

d. 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?

a. 8.33 s

b. 0.833 s

c. 0.0833 s

d. 1 s

40. What will happen if the frequency of power supply in a pure capacitor is doubled?

a. The current will also be doubled

b. The current will reduce to half

c. The current will remain the same

d. The current will increase to four-fold

PART III

16 – LEATHER TECHNOLOGY

(Answer ALL questions)

41. What is the diameter of the collagen molecule?
    a. 15 A°
    b. 24 A°
    c. 14 nm
    d. 24 nm

42. Which of these is a post translational modification in collagen biosynthesis?
    a. mRNA formation
    b. Peptide bond formation
    c. Glycosylation
    d. Transcription

43. Electronegativity is defined as the power of an atom in a molecule to _____
    a. Repel electrons towards itself
    b. Attract electrons towards itself
    c. Expand itself
    d. All of the above

44. Which of the following is function of Flame or Emission system in Atomic Absorption Spectroscopy?
    a. To split the beam into two
    b. To break the steady light into pulsating light
    c. To filter unwanted components
    d. To reduce the sample into atomic state

45. What is the Shrinkage temperature of native collagen fibers in skin?
    a. ~60°C
    b. ~37°C
    c. ~90°C
    d. ~120°C

46. What is the major protein constituent in a hide?
    a. Collagen
    b. Gelatin
    c. Mucin
    d. Keratin

47. During staining, the smear is heat-fixed in order to ————————
    a. kill the organism so that dyes will penetrate
    b. attach the organism firmly to the slide
    c. kill the organism and attach the organism firmly to the slide
    d. 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?
    a. Keratinocytes
    b. Sweat glands
    c. Nerve cells
    d. Fibroblast cells

49. Which enzyme is used for unhairing?
    a. Protease
    b. Amylase
    c. Lipase
    d. Glycosidase

50. Which of the following is the commonly used to reduce acid swelling during pickling process?
    a. Sodium chloride
    b. Silver chloride
    c. Barium chloride
    d. Ammonium chloride

51. Bio-deterioration of hides and skin before tanning process, Hair slip occurs due to
    a. Aspergillus niger
    b. Streptococcus sp
    c. Aspergillus fumigates
    d. Pseudomonas sp

52. Which of the following amino acids has higher percentage in Type I collagen?
    a. Methionine
    b. Proline
    c. Glycine
    d. Guanosine

53. What is the average molecular weight of Type I collagen molecule?
    a. 300 KDa
    b. 3000 KDa
    c. 30 KDa
    d. 3 KDa

54. Defective cross-linking of collagen results in
    a. marfan syndrome
    b. lathyrism
    c. fibrosis
    d. osteogenesis imperfecta

55. Which of the following vitamins require sun light exposure to skin for its synthesis?
    a. Vitamin A
    b. Vitamin B
    c. Vitamin C
    d. Vitamin D

56. Which of the following is a non-fibrous protein present in skin?
    a. Collagen
    b. Reticulin
    c. Keratin
    d. Globulin

57. Which of the following raw materials is most suitable for making spongy garment leather?
    a. Cow hide
    b. Sheep skin
    c. Buffalo hide
    d. Goat skin

58. Which of the following enzymes is involved in the crosslinking of collagen fibrils?
    a. Prolyl hydroxylase
    b. Lysyl hydroxylase
    c. Prolyl oxidase
    d. Lysyl oxidase

59. The major force, which affects the wetting back of wet blue skins is
    a. adhesive
    b. cohesive
    c. hydrogen bonds
    d. 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?
    a. Glycosidase
    b. Trypsin
    c. Chymotrypsin
    d. Bacterial Collagenase

61. Pick out the right order which has high fiber density
    a. Epidermis > Corium minor > Adipose
    b. Epidermis > Dermis > Adipose
    c. Corium minor > Corium Major > Adipose
    d. Adipose > Corium major > Grain

62. What is the functional role of vegetable tannins in plants?
    a. To resist microbial attack
    b. To increase water uptake
    c. To act as secondary metabolites
    d. To involve in photosynthesis

63. Which chemical is used to remove hair from the skin?

a. Calcium hydroxide

b. Sodium Sulfide

c. Hydrogen sulfide

d. Calcium carbonate

64. Chrome soaps give ———————— stains in wet blue skins

a. Black

b. Pink

c. Brown

d. Red

65. Permissible limit of total chromium discharge as Cr in treated effluent is

a. 1 ppm

b. 2 ppm

c. 3 ppm

d. 4 ppm

66. Mechanism of chrome tanning is based on

a. Coordinate covalent cross-linking

b. Hydrogen bonding

c. Covalent crosslinks

d. Unipoint fixation through ionic interactions

67. Which tanning system is more suitable for football leather manufacturing?

a. Zirconium tanning

b. Chrome tanning

c. Oil tanning

d. Aldehyde tanning

68. Which the mixed indicator is used for nitrogen estimation?

a. bromophenol blue and thymol blue

b. thymol blue and cresol red

c. methyl orange and methyl red

d. methyl red and bromocresol green

69. Which type of crosslinking occurs in collagen stabilization during oil tanning?

a. Hydrogen bonding

b. Co-ordinate covalent

c. Covalent

d. Ionic bond

70. Aldehyde pre-treatment is generally carried out for

a. Garment leather

b. Chamois leather

c. Sole leather

d. Lining leather

71. Snuffing on grain is called ———————— leather

a. Nubuck

b. Suede

c. Full grain

d. Oil finish

72. Which chemical is used as an indicator in determining the purity of sodium chloride?

a. Potassium chromate

b. Potassium permanganate

c. Silver nitrate

d. Silver chloride

73. How Sulfonation followed by condensation process is called during syntan manufacture?

a. Neradol

b. Novolak

c. Sulfone

d. Neutralization

74. Which property is mainly incorporated by melamine syntan?

a. Grain Tightness

b. Selective Filling

c. Bleaching

d. Neutralization

75. Which one of the following is the shape of test specimens for tensile strength of leather?

a. Rectangle

b. Trapezoidal

c. Dumbbell

d. Square

76. Condensation is an important step in syntan manufacture which contributes towards

a. Solubility

b. Crosslinking

c. Dispersion

d. Diffusion

77. Which of the following is used as a reducing agent in the preparation of BCS?

a. Hydrogen Peroxide

b. Fluorine

c. Molasses

d. Hydroxide ions

78. Barkometer is used to:

a. Determine the shrinkage temperature of leather

b. Determine the concentration of tannin solution

c. Determine the protein content in solution

d. Determine the fat content in solution

79. What is the water solubility properties of a surfactant with HLB range of 1-4?

a. Insoluble

b. Soluble

c. Stable

d. Milky dispersion

80. Protein finishing is preferred for which type of leather?

a. Glaze leathers

b. Nubuck

c. Laminated

d. Suede

81. Chromophores consists of _____ which are responsible for color.

a. Functional groups with localized electrons

b. Functional groups with localized protons

c. Functional groups with delocalized protons

d. Functional groups with delocalized electrons

82. Which deliming agent is ideal for the manufacture of glove leather?

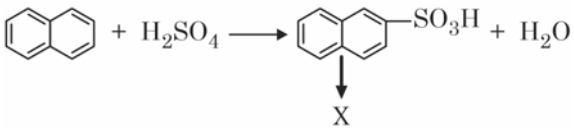
a. Ammonium chloride

b. Ammonium sulphate

c. Sodium bicarbonate

d. Sodium sulphate

83. What is the product name (X)?



a. Phenol sulfonic acid

b. Naphthalene sulfonic acid

c. Polyhydroxy sulfonic acid

d. Benzesulfonic acid

84. Washing after neutralization is necessary to ensure

a. removal of excess alkali

b. removal of chromium hydroxide formed

c. removal of neutral salts

d. effective fixation of dyes and fat liquors

85. For making light and bright colored leathers ———— syntans are preferable.

a. Quebracho tannins

b. Sulphone

c. Phenolic

d. Replacement

86. The position of an auxochromic group in a dye molecule influences

a. colour characteristics

b. solubility

c. Fastness property

d. Charge

87. What is an ideal cutting direction of leather?

a. Parallel to stretch direction

b. Perpendicular to stretch direction

c. Diagonal to stretch direction

d. None of the above

88. Snuffing is an important machinery operation for which type of leathers?

a. Suede

b. Nubuck

c. Upper

d. Sole

89. Which technique is used to determine the particle size?

a. Dynamic Light scattering

b. Xray Diffraction

c. Vibrational Spectroscopy

d. 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?

a. 300-350 dalton

b. 750-900 dalton

c. 1500-2000 dalton

d. 2500-3000 dalton

91. Which base coat is preferred for a low absorbency crust leather?
    a. Sealing Coat
    b. Clearing Coat
    c. Impregnation Coat
    d. Both (a) and (c)

92. Which type of thread is used in shoe stitching that provides excellent sewing and superior tensile strength?
    a. Cellulose
    b. Polyamide base
    c. Cotton
    d. Spandex

93. The purpose of skiving machine is to _____ the thickness of a leather component along the edge to the desired thickness
    a. Increase
    b. Maximize
    c. Improve
    d. 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?
    a. Lubrication Theory
    b. Gel Theory
    c. Free Volume Theory
    d. Mechanistic Theory

95. The first phase of a growth curve is
    a. Log phase
    b. Lag phase
    c. Stationary phase
    d. Decline Phase

96. Which of the following mechanisms is referred for shank material used in shoe?
    a. Double side supported beam mechanism
    b. Roller mechanism
    c. Cantilever beam mechanism
    d. Slider crank mechanism

97. What is the abbreviation of FRP?
    a. Fibre Reinforced Plastics
    b. Fabric Reinforced Polymer
    c. Fibre Re-Structured Plastics
    d. None of the above

98. Which is not considered in basic styles of footwear?
    a. Derby
    b. Oxford
    c. Peep Toe
    d. Slip on

99. Hotmelts adhesive is
    a. Thermoplastic in nature
    b. Thermosetting in nature
    c. Electrostatic in nature
    d. None of the above

100. Primary treatment of waste water includes
    a. sedimentation
    b. aerobic treatment
    c. anaerobic treatment
    d. biological oxidation