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

18 — PHARMACEUTICAL TECHNOLOGY

(Answer ALL questions)

41. Which of the following is an imino acid?
    a. Serine
    b. Alanine
    c. Glycine
    d. Proline

42. Which of the following is an example of reversible inhibitor?
    a. DIPF
    b. Penicillin
    c. Iodoacetamide
    d. Protease inhibitors

43. Mycoplasma are different from other prokaryotes by
    a. Absence of cell wall
    b. Presence of chitin
    c. Presence of murein
    d. Presence of proteins in cell wall

44. Where does inhibitor bind on enzyme in mixed inhibition?
    a. At active site
    b. Allosteric site
    c. Enzyme – substrate complex
    d. Binds on substrate

45. What is the general mechanism of an enzyme?
    a. It acts by reducing the activation energy.
    b. It acts by increasing the activation energy.
    c. It acts by decreasing the pH.
    d. It acts by increasing the pH.

46. Which of the following is NOT an Cell Adhesion molecule?
    a. Selectin
    b. Integrins
    c. Cadherins
    d. Tubulins

47. Which of the following sites is represented by Loops in lamp brush chromosomes?
    a. Crossing over
    b. Cell division
    c. Replication
    d. Transcription

48. The Feulgen stain is used for staining
    a. plasma membrane
    b. chromosomes
    c. phospholipids
    d. mitochondria

49. A fixative ———————— the macromolecular components of a cell.
    a. Degrades
    b. Immobilizes
    c. Penetrates
    d. granulates

50. Differential staining property of Gram staining is due to
    a. Difference in lipid content in Gram positive and negative bacteria
    b. Difference in protoplasmic contents in Gram positive and negative bacteria
    c. Difference in teichoic content in Gram positive and negative bacteria
    d. None of the above

51. In Gram staining, if some bacteria retain the crystal violet stain after alcohol treatment, then the bacteria is
    a. Incomplete experiment
    b. Gram positive
    c. Gram negative
    d. None of these

52. DNA gyrase is inhibited by
    a. Tetracycline
    b. Cephalosporin
    c. Nalidixic acid
    d. Aurin tricarboxylic acid

53. Which of the following is a humanized antibody?
    a. Doxorubicin
    b. Sulforaphane
    c. Vimentin
    d. Herceptin

54. Cyclosporin A is a drug that ————————
    a. suppresses the immune system
    b. increases body temperature
    c. increases the production of antibodies
    d. decreases body temperature

55. Which one of the following is the only immunoglobulins to cross the placenta?
    a. IgM
    b. IgG
    c. IgA
    d. IgD

56. The phenomenon of expression of only one allele of an immunoglobulin gene in lymphocytes is known as
    a. Allelic exclusion
    b. Allelic inclusion
    c. Allelic variation
    d. Allelic heterogeneity

57. Which of the following graft is transplanted between two genetically different individuals of same species?
    a. Autograft
    b. Xenograft
    c. Allograft
    d. Syngraft

58. Identify autoimmune diseases among the following.
    a. Pernicious Anemia
    b. Type II diabetes
    c. Type I diabetes
    d. Gestational diabetes

59. Mast cells contain vesicles that store large amount of histamine. After staining with eosin, these vesicles are stained in red color. Which of the following interactions involved between histamine and eosin?
    a. Electrostatic interaction
    b. Hydrogen bonding
    c. Hydrophobic interaction
    d. Covalent bonding

60. During an allergic immune response, histamine is released from
    a. Mast cells
    b. T lymphocytes
    c. B lymphocytes
    d. Special lymphocytes that also secrete IgE

61. Kupffer cells are found in
    a. Small intestine
    b. Liver
    c. Stomach
    d. Large intestine

62. Which of the following is Not an example of a live attenuated vaccine?
    a. Tetanus vaccine
    b. MMR vaccine
    c. Varicella (chickenpox) vaccine
    d. Influenza vaccine

63. Which of the following is an example of subunit vaccine?
    a. Small pox vaccine
    b. Hepatitis B vaccine
    c. MMR vaccine
    d. Yellow fever vaccine

64. Type II hypersensitivity
    a. Is antibody independent
    b. Is complement independent
    c. Is mediated by CD8+ cells
    d. Involves antibody mediated destruction of cells.

65. The centrifugal effect counteracts one of the following forces
    a. Brownian forces
    b. Cohesive forces
    c. Electrostatic forces
    d. Gravitational forces

66. Which centrifugation depends on buoyant densities?
    a. Isopynic centrifugation
    b. Gradient centrifugation
    c. Density gradient centrifugation
    d. Differential centrifugation

67. What is the problem in the evaporation in the climbing film evaporator?
    a. Boiling point of liquid
    b. Droplet formation
    c. Entrainment of liquid
    d. Film formation

68. Calandria consists of several
    a. Baffles
    b. Jackets
    c. Outlets
    d. Tubular surfaces

69. Which one of the following parameters of the finished product is NOT influenced by the selection of size reduction equipment?
    a. Porosity
    b. Shape
    c. Surface roughness
    d. True density

70. A tablet to treat a headache must first be dissolved in water before swallowing. Which one of the following best describes this type of tablet?
    a. Modified release
    b. Oral disintegrating
    c. Effervescent
    d. Buccal

71. A drug suspension decomposes by zero-order kinetics with a rate constant of 2 mg mL^{-1} $month^{-1}$. If the initial concentration is 100 mg mL^{-1}, what is the shelf life ($t_{10\%}$)?
    a. 2 months
    b. 3 months
    c. 4 months
    d. 5 months

72. A drug solution decomposes via first-order kinetics with a rate constant, *k*, of 0.0077 $days^{-1}$. What is the half-life of the drug in solution?
    a. 0.033 day
    b. 33 days
    c. 70 days
    d. 90 days

73. Simple syrup is a saturated solution of
    a. Sucrose
    b. Fructose
    c. Dextrose
    d. None of these

74. The spatulation process is well suited for mixing of which of the following powder?
    a. Hygroscopic
    b. Volatile
    c. Eutectic
    d. Effervescent

75. A suspension is formed from uniform particles of solid, of diameter 10 Mm, suspended in a solvent. What is the best description of this system?
    a. Monodisperse and coarse
    b. Monodisperse and colloidal
    c. Polydisperse and coarse
    d. Polydisperse and colloidal

76. In the DLVO theory of colloids, normal thermal motion may be sufficient to overcome the energy barrier that leads to irreversible particle aggregation. Which one of the following is the name of this energy barrier?
    a. Primary maximum
    b. Secondary maximum
    c. Primary minimum
    d. Secondary minimum

77. An Isosbestic point is a
    a. Specific wavelength at which a single component has maximum absorptivity
    b. Specific wavelength at which the solvent has maximum absorptivity
    c. Specific wavelength at which two or more components have the same absorptivity
    d. Specific wavelength at which extinction co efficiency of a component is zero

78. DNA denaturation is an example of which type of shift ?
    a. Bathochromic
    b. Blue shift
    c. Hyperchromic shift
    d. Red shift

79. Which movement is required for the IR spectroscopy?
    a. Dipole movement
    b. Spin movement
    c. Round movement
    d. All of the above

80. In which bending type of vibration bond angle is constant ?
    a. Scissoring
    b. Twisting
    c. Rocking
    d. All of the above

81. Which of the following is the disadvantage of reciprocating pump used in liquid chromatography?
    a. Produces pulsed flow
    b. Corrosive components
    c. Does not have small hold-up value
    d. Does not have moderate flow rate

82. Which of the following will improve the efficiency of separation process in liquid chromatography?
    a. Increase in sample size, increase in column diameter
    b. Reduction in sample size, increase in column diameter
    c. Increase in sample size, reduction in column diameter
    d. Reduction in sample size, reduction in column diameter

83. Which of the following cannot be done to reduce ripple in High-pressure liquid chromatography?
    a. Using bellows
    b. Using restrictors
    c. Using long nylon tube between pump and column
    d. Avoiding the use of solvent pump

84. In reverse phase chromatography, the stationary phase is made by
    a. Non – polar
    b. Polar
    c. Both (a) and (b)
    d. None of these

85. Which of the following HPLC detectors is used as a bulk property or general-purpose detector?
    a. Electrochemical detector
    b. Fluorescence detector
    c. UV-Visible detector
    d. Evaporative Light scattering detector

86. Which of the following techniques would be most useful to identify as well as quantify the presence of a known impurity in a drug substance?
    a. NMR
    b. MS
    c. IR
    d. HPLC

87. Which of the following is not true about the guard column used in liquid chromatography?
    a. It filters particles that clog the separation column
    b. It extends the life time of separation column
    c. It allows particles that cause precipitation upon contact with stationary or mobile phase
    d. The size of packing varies with the type of protection needed

88. Which of the following is not true about Hydraulic capacitance flow control system used in HPLC?
    a. It can be used only for liquids with low viscosity
    b. It is irrespective of solvent compressibility
    c. It maintains constant flow
    d. It smoothens high-pressure pump pulsations

89. Morphine is the structure chiefly responsible for the biological activity of opium. What is the name given to the chemical that is chiefly responsible for the biological activity of a natural extract?
    a. Lead compound
    b. Pharmacophore
    c. Active principle
    d. Lead principle

90. What is the predominant β-adrenoceptor in bronchial smooth muscle?
    a. β_1-adrenoceptor
    b. β_2-adrenoceptor
    c. β_3-adrenoceptor
    d. β_4-adrenoceptor

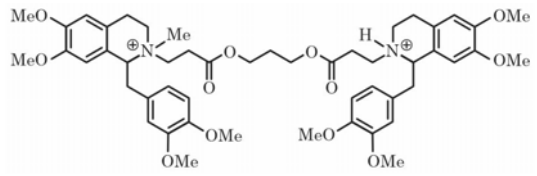
91. To which class of compounds do adrenaline, noradrenaline and dopamine belong?
    a. Phenethylamines Opium
    b. Diphenolethylamines
    c. Catecholamines
    d. Adrenergics

92. What is the predominant adrenoceptor in heart muscle?
    a. α_1 - adrenoreceptor
    b. α_2 - adrenoreceptor
    c. β_1-adrenoceptor
    d. β_2-adrenoceptor

93. What sort of receptor is the muscarinic receptor?

a. A G-protein coupled receptor.
b. A kinase linked receptor.
c. An intracellular receptor
d. An ion channels.

94. Atracurium is used intravenously as a neuromuscular blocker.



The molecule undergoes a chemical degradation at slightly alkaline pH. What is the name of this reaction?

a. Hofmann rearrangement
b. Hofmann elimination
c. Cope rearrangement
d. McLafferty rearrangement

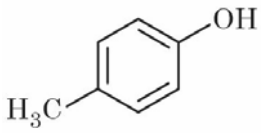
95. What does the symbol *P* represent in a QSAR equation?

a. pH
b. plasma concentration
c. partition coefficient
d. prodrug

96. Which of the following statements is untrue when comparing 3D QSAR with conventional QSAR?

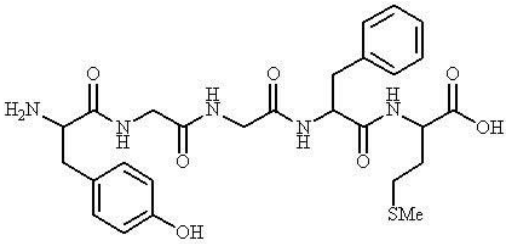
a. Only drugs of the same structural class should be studied by 3D QSAR or QSAR.
b. 3D QSAR has a predictive quality unlike QSAR.
c. Experimental parameters are not required by 3D QSAR, but are for QSAR.
d. Results can be shown graphically in 3D QSAR, but not with QSAR.

97. Calculate the $\log P$ value for the structure shown; $\log P$ for benzene = 2.13; π(OH) -0.67; π(CH3) 0.52



a. 3.32
b. 0.94
c. 1.98
d. 2.13

98. Consider the following analgesic.



What is the source of this structure?

a. Opium
b. Frog
c. An endogenous compound present in the body
d. Snake Venom

99. What does a negative value of σ signify for a substituent?

a. It is electron donating
b. It is electron withdrawing
c. It is neutral
d. It is hydrophobic

100. Which of the following is one of the rules in Lipinski's rule of five?

a. A molecular weight equal to 500
b. No more than five hydrogen bond acceptor groups
c. No more than 10 hydrogen bond donor groups
d. A calculated $\log P$ value less than +5