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 $^\circ\rho$, 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:

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

06 – AUTOMOBILE ENGINEERING

(Answer ALL questions)

41. The resultant of two forces P and Q (such that $P > Q$) acting along the same straight line, but in opposite direction, is given by
    a. $P + Q$
    b. $P - Q$
    c. P / Q
    d. Q / P

42. Mass moment of inertia of a tin rod about its one end is ———— the mass moment of inertia of the same rod about its mid-point.
    a. Same as
    b. Twice
    c. Thrice
    d. Four times

43. The ratio of static friction to dynamic friction is always
    a. Equal to one
    b. Less than one
    c. Greater than one
    d. Zero

44. Which one of the following is an open pair?
    a. Ball and socket joint
    b. Journal bearing
    c. Lead screw and nut
    d. Cam and follower

45. The train value of a gear trains is.
    a. Equal to velocity ratio of the gear train
    b. Reciprocal of velocity ratio of the gear train
    c. Always greater than unity
    d. Always less than unity

46. A porter governor is a ———— governor.
    a. Pendulum type
    b. Dead weight
    c. Spring loaded
    d. Inertia

47. Consider the following statements about theory of simple bending
    (i) Beam material is isotropic and homogenous
    (ii) Elastic modulus of beam material is more in tension than in compression
    (iii) Radius of curvature is large
    Of these statements,
    a. (i) and (ii) are true
    b. (i) and (iii) are true
    c. (ii) and (iii) are true
    d. (i), (ii), (iii) are true

48. If the diameter of a shaft is subjected to torque alone is doubled, then the horse power can be increased to
    a. 2P
    b. 4P
    c. 8P
    d. 16P

49. A higher value of flexural rigidity indicates
    a. Lower stiffness and lower deflection
    b. Lower stiffness and higher deflection
    c. Higher stiffness and lower deflection
    d. Higher stiffness and higher deflection

50. Match list I with list II and select the correct answer using the code given

List I	List II (Description)
1. Parallel shaft with slight offset	i. Universal joint
2. Parallel shaft at a reasonable distance	ii. Worm and worm wheel
3. Perpendicular shaft	iii. Oldham coupling
4. Intersecting shaft	iv. Belt and pulley

    a. 1 – iv, 2 – iii, 3 – ii, 4 – i
    b. 1 – iv, 2 – iii, 3 – i, 4 – ii
    c. 1 – iii, 2 – iv, 3 – i, 4 – ii
    d. 1 – iii, 2 – iv, 3 – ii, 4 – i

51. Match list I with list II and select the correct answer using the code given

List I		List II (Description)
1.	Spur gear	i. Helical tooth
2.	Bevel gear	ii. Two sets of helical tooth of opposite pair
3.	Herringbone gear	iii. Straight tooth on taper surface
4.	Helical gear	iv. Straight parallel teeth on cylinder surface

a. 1 – iv, 2 – iii, 3 – ii, 4 – i
b. 1 – iv, 2 – iii, 3 – i, 4 – ii
c. 1 – iii, 2 – iv, 3 – ii, 4 – i
d. 1 – iii, 2 – iv, 3 – i, 4 – ii

52. In the case of a flywheel, the maximum fluctuation of energy is the
a. Sum of the maximum and minimum energies
b. Difference between the maximum and minimum energies
c. Variations of energy above the mean resisting torque line
d. Variations of energy below the mean resisting torque line

53. Consider the following statements :
i. Volume, temperature and pressure are macroscopic quantities
ii. Intensive properties are independent of mass
iii. Extensive properties are related to mass
iv. Volume and temperature are intensive properties

Of these statements
a. i alone is true
b. ii and iii are true
c. ii, iii and iv are true
d. i, ii, iii and iv are true

54. The ideal vapour power cycle is
a. Diesel cycle
b. Otto cycle
c. Rankine cycle
d. Brayton cycle

55. For the same maximum pressure and temperature, what is the order of efficiency of Otto, Diesel and Dual cycle?
a. $\eta_{otto} > \eta_{diesel} > \eta_{dual}$
b. $\eta_{otto} > \eta_{dual} > \eta_{diesel}$
c. $\eta_{dual} > \eta_{otto} > \eta_{diesel}$
d. $\eta_{diesel} > \eta_{dual} > \eta_{otto}$

56. Consider the following statements :
i. Heat can flow of itself from lower temperature body to a higher temperature body
ii. A heat pump maintains a body at a temperature higher than the temperature of the surroundings
iii. The COP of a heat pump is greater than the COP of a refrigerator by unity
iv. The COP of a refrigerator using heat addition(Q1) and heat rejection(Q2) is expressed as

$$\frac{Q_1}{Q_1 - Q_2}$$

a. i and ii are true
b. i and iv are true
c. ii and iii are true
d. ii, iii and iv are true

57. Which of the following methods requires medium for heat transfer?
a. Conduction
b. Convection
c. Radiation
d. Conduction and convection

58. "The emissive power of a black body varies linearly to the fourth power of its absolute temperature" This statement is called
a. Fourier's law
b. Stefan-Boltzmann law
c. Kirchhoff's law
d. Wein's displacement law

59. Match list I with list II and select the correct answer using the code given

List I (Casting Process)		List II (Description)
1. Investment casting	(i)	Rotating method
2. Cold chamber die casting	(ii)	Low melting point metals
3. Centrifugal casting	(iii)	Wax pattern
4. Hot chamber die casting	(iv)	High melting point metals

a. 1 – iii, 2 – ii, 3 – i, 4 – iv
b. 1 – iii, 2 – iv, 3 – i, 4 – ii
c. 1 – i, 2 – iv, 3 – iii, 4 – ii
d. 1 – i, 2 – ii, 3 – iii, 4 – iv

60. Nose radius is expressed in
a. Degree
b. Radian
c. Millimetre
d. Meter

61. In which of the following welding methods Heat affected zone is minimum?
a. LASER welding
b. Gas welding
c. Arc welding
d. Thermit welding

62. Consider the following statements about non-conventional machining processes.
i. Hard materials can be easily machined without being damaged
ii. Complex shapes are easily produced
iii. They have low specific energy consumption
iv. Tools need not be harder than work piece

Of these statements
a. i, ii and iii only
b. i, ii and iv only
c. i, iii and iv only
d. ii, iii and iv only

63. Match list I with list II and select the correct answer using the code given

List I	List II (Description)
1. Quick return mechanism	i. Lathe
2. Apron mechanism	ii. Milling machine
3. Indexing mechanism	iii. Shaper
4. Regulating wheel	iv. Centerless grinding

a. 1 – iii, 2 – ii, 3 – i, 4 – iv
b. 1 – ii, 2 – iii, 3 – iv, 4 – i
c. 1 – iv, 2 – ii, 3 – iii, 4 – i
d. 1 – iii, 2 – i, 3 – ii, 4 – iv

64. Match list I with list II and select the correct answer using the code given

List I	List II (Description)
1. Interpolation	i. Tape preparation
2. Parity check	ii. Canned cycle
3. Preparatory function	iii. Drilling
4. Point to point control	iv. Contouring

a. 1 – iii, 2 – ii, 3 – i, 4 – iv
b. 1 – ii, 2 – iii, 3 – iv, 4 – i
c. 1 – iv, 2 – i, 3 – ii, 4 – iii
d. 1 – iii, 2 – i, 3 – ii, 4 – iv

65. What is the angle between the steering axis and the vertical when viewed from side of the vehicle?
a. Camber
b. Castor
c. Steering axis inclination
d. Kingpin inclination

66. The following diverts the power at right angles towards the driving wheels
a. Torque tube
b. Transfer case
c. Final drive
d. Gear box

67. Transfer case is used in a
    a. Front engine front wheel drive
    b. Rear engine rear wheel drive
    c. All wheel drive
    d. Front engine rear wheel drive

68. Wheel alignment servicing equipment is used to measure
    a. tire wear and tear
    b. brake pad and rotor angles wear
    c. steering and suspension alignment angles
    d. wear in the joints and bushings

69. Which type of rear axle is used in heavy vehicles?
    a. Semi- floating
    b. Three quarter - floating
    c. Full – floating
    d. Stub axle

70. In a modern final drive, the type of gearing used for the drive pinion and ring gear is
    a. Spur
    b. Spiral bevel
    c. Hypoid
    d. Helical

71. What is the maximum power transmitted by a single plate clutch at speed of 3600 rev/min if the coefficient of friction is 0.4 and the linings have a radius of 160mm inner and 190mm outer? The total spring force is 2.5 kN.
    a. 132Kw
    b. 139Kw
    c. 152Kw
    d. 160Kw

72. What is gear ratio of second year if Gear ratio of first and third gears are 4 and 1.55?
    a. 2.5
    b. 2.1
    c. 3
    d. 3.5

73. In a fluid coupling, power is transferred due to
    a. Change in pressure of the circulating fluid
    b. Change of mechanical energy to fluid energy
    c. Change in kinetic energy of the circulating fluid
    d. Conversion of fluid energy to mechanical energy

74. Janney transmission is working as per ———— principle
    a. Hydrodynamic
    b. Hydrostatic
    c. Centrifugal
    d. None of the above

75. The vehicle having a passenger cabin with two rows of seats and integrated cargo space, accessed from behind by a single tail gate is
    a. Saloon
    b. Limousine
    c. Estate car
    d. Coupe

76. As per AIS 052, School Bus are come under the TYPE
    a. I
    b. II
    c. III
    d. IV

77. Solar radiation is increased inside the passenger compartment by increasing ———— of a car.
    a. Roof camber
    b. Wind screen angle
    c. Bonnet angle
    d. Diffuser angle

78. In a wind tunnel, the honeycomb has a longer length that reduces the ———— velocity components of the flow with minimal pressure drop in the stream wise direction.
a. longitudinal
b. axial
c. traverse
d. lengthwise

79. When there is a reduction in amplitude over every cycle of vibration, then the body is said to have
a. free vibration
b. forced vibration
c. damped vibration
d. logarithmic decrement

80. Outer part of the tyre that extends from the bead to the tread is
a. Plies
b. Chords
c. Sidewall
d. Liner

81. The rolling resistance does not depend upon
a. Velocity of the vehicle
b. Density of air
c. Construction of tyre
d. Mass of the vehicle

82. Which of the following is the longitudinal framing of the roof at the joining?
a. Cant panel
b. Cant rail
c. Cowl panel
d. Drip rail

83. The negative plates of a lead acid battery have
a. Lead peroxide (PbO_2)
b. Spongy lead (Pb)
c. Lead sulphate $(PbSO_4)$
d. Lead Hydrate (PbH)

84. Why slip rings in an alternator are necessary?
a. They permit the stator to rotate
b. They provide a high resistance connection to the stator windings
c. They prevent a delta from forming.
d. They permit current to flow through a rotating component called the rotor

85. Which of the following is not a component of a starter motor?
a. Armature
b. Battery
c. Commuter
d. Field windings

86. Which of the following sensors is usually installed in the exhaust manifold?
a. Crank position
b. LAMDA
c. Wheel speed
d. Cam position

87. Increasing a proportional gain will :
a. increase the overshoot, decrease the steady state error
b. decrease the overshoot, increase the steady state error
c. increase the overshoot, increase the steady state error
d. decrease the overshoot, decrease the steady state error

88. Which of the following is measured by Linear Variable Differential Transformer (LVDT)?
a. Crank angle
b. Engine speed
c. Displacement
d. Gas Temperature

89. Adblue is
a. 32.5 % Urea and water
b. 37.5 % Urea and water
c. 40 % Urea and water
d. 88 % Urea and water

90. The unit of emission for heavy vehicles are measured in
    a. Mg/ms
    b. g/km-s
    c. g/km
    d. g/kW-h

91. Piston crevice volume is one of the reasons for ———— emission
    a. Unburned hydrocarbon
    b. Carbon mono oxide
    c. Oxides of nitrogen
    d. Particulate matter

92. Which of the following is not a stage of combustion in SI engine
    a. Ignition lag
    b. Flame propagation
    c. After burning
    d. Stratified combustion

93. Which of the following materials is used in Engine noise control?
    a. Aluminum
    b. Austempered ductile iron
    c. Magnesium
    d. Lead oxide

94. Blue smoke is caused by
    a. Lubricant oil
    b. High load conditions
    c. Lean mixture
    d. Worn out piston rings

95. The self-ignition Temperature of Methanol is
    a. Lower than Gasoline
    b. Higher than Gasoline
    c. Lower than diesel
    d. Lower than Ethanol

96. The presence of oxygen in vegetable oils
    a. Increases the energy content of the fuel
    b. Forms Gum in engine components
    c. Increases the cetane rating of the fuel
    d. Reduces the viscosity of the fuel

97. Micro explosion occurs at the temperature of about
    a. 100°C
    b. 200°C
    c. 300°C
    d. 400°C

98. Hydrogen Induction in diesel engine will
    a. Decrease the Thermal Efficiency
    b. Reduce the Power output
    c. Increase the ignition Delay
    d. Increase the combustion Duration

99. Hydrogen combustion with air at stochiometric condition results in
    a. Reduced HC, CO and NOx emissions
    b. Reduced HC and CO with increased NOx emissions
    c. Reduced HC with increased CO and NOx emissions
    d. Reduced CO with increased HC and NOx emissions

100. Biogas is
    a. Heavier than Air
    b. Lighter than Air
    c. Equal in weight of Air
    d. Lighter than Hydrogen

PART III

07 - AERONAUTICAL AND AEROSPACE ENGINEERING

(Answer ALL questions)

41. The ratio of modulus of rigidity to bulk modulus for a Poisson's ratio of 0.25 would be
    a. 2/3
    b. 2/5
    c. 3/5
    d. 1

42. The stress due to suddenly applied load is ———— compared to that of the gradually applied load?
    a. Half
    b. Same
    c. 3 times
    d. 2 times

43. In a short column with eccentric loading, the neutral axis
    a. passes through the centroid of the section.
    b. passes through the point of application of load.
    c. passes through the shear center of the section.
    d. does not pass through the centroid of the section.

44. A rectangular section beam subjected a bending moment M varying along its length is required to develop same maximum bending stress at any cross section. If the depth of the section is constant, then its width will vary as
    a. M
    b. $M^{1/2}$
    c. M^2
    d. 1/M

45. The deflection of the free end of a cantilever beam subjected to a concentrated load at its mid span is given by
    a. $PL^3/3EI$
    b. $PL^3/8EI$
    c. $PL^3/24EI$
    d. $5PL^3/48EI$

46. If two shafts of same length, one of which is hollow, transmit equal torque and have equal maximum shear stress, then they should have equal
    a. polar moment of inertia
    b. polar modulus of section
    c. diameter
    d. angle of twist

47. A closely coiled helical spring has a stiffness of 8N/mm. If it extends by 5 mm , the energy absorbed is
    a. 0
    b. 50 N mm
    c. 100 N mm
    d. 10 N mm

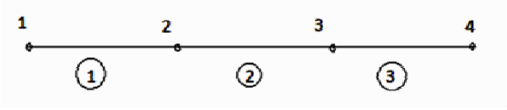
48. Modified Tsai-Hill theory
    a. distinguishes between tensile and compressive strength
    b. gives the mode of failure
    c. does not relate the different strength parameters
    d. relates only tensile and shear strength

49. If a laminate consists of pairs of layers with identical thickness and elastic properties, but with orientation of $+\theta$ and $-\theta$ with respect to the laminate reference axis, then the laminate is called as
    a. angle ply laminate
    b. symmetric Angle ply laminate
    c. quasi isotropic laminate
    d. balanced laminate

50. The Shear stresses in the fiber and matrix are 200GPa and 20GPa respectively. If the fiber volume fraction is 70%, then the longitudinal compressive strength of the lamina is
    a. 112 GPa
    b. 64.8 GPa
    c. 146 GPa
    d. 292 GPa

51. The function $y = A(1 - \cos(2\pi x)/L)$ is an allowed approximate function for a
    a. fixed-fixed beam
    b. cantilever beam
    c. simply-supported beam
    d. propped cantilever beam

52. Which of the following statements is NOT true of a 1-D problem represented using 2-node line elements as indicated?



    a. this could represent a finite element model of a bar under axial loading
    b. size of global stiffness matrix is 4×4
    c. size of global force vector is 4×1
    d. size of global stiffness matrix is 8×8

53. Which of the following assumptions / statements is NOT true about the Euler-Bernoulli beam theory?
    a. cross-sections which are normal and plane to the longitudinal axis before bending remain normal and plane to it after bending deformation
    b. shear deformations are small
    c. rotations are small
    d. the Euler-Bernoulli beam has a lower stiffness than compared to the Timoshenko beam

54. The shape functions indicated here are for a
$N_1 = L_1(2L_1 - 1),\ N_2 = 4L_1 L_2$
$N_3 = L_2(2L_2 - 1),\ N_4 = 4L_2 L_3$
$N_5 = L_3(2L_3 - 1), N_6 = 4L_3 L_1$
    a. constant strain triangle, in area coordinates
    b. linear strain triangle, in area coordinates
    c. 4-node quadrilateral element
    d. 8-node brick element

55. Axisymmetric problems involving axisymmetric loading and solids of revolution can be conveniently formulated with the following element type.
    a. 1-D line element
    b. 2-D plane stress element
    c. 8-node brick element
    d. higher order element

56. Which of the following statements is true about Finite Element Analysis (FEA)?
    a. Residue obtained equals zero
    b. The solution is exact.
    c. The solution is exact at the boundaries.
    d. It is an analytical technique.

57. Consider an equal-leg angle section cantilever beam subject to a vertical shearing load at the tip where the line of action of the applied vertical force passes through the centroid. This beam will experience
    a. symmetrical bending with twist
    b. symmetrical bending without twist
    c. unsymmetrical bending and twisting
    d. unsymmetrical bending

58. The shear centre position of a thin-walled symmetrical channel section will lie
    a. on the centroid
    b. very close to the centroid
    c. between the centroid and the web mid-point
    d. away from the web, on the line of symmetry

59. Shear flow has the same units as
    a. shear stress
    b. force
    c. force per unit length
    d. torque per unit length

60. AB = 40 cm while BC = 30 cm. Areas A and C are equal to 8 cm^2 while areas B and D are 6 cm^2. The given section is subject to M_x = 100 kNm and M_y = 40 kNm. Find an expression for the bending stress. Assume that the webs are ineffective in bending.
    a. $\sigma = -0.191x + 1.551y$
    b. $\sigma = 0.191x + 2.268y$
    c. $\sigma = 2.268x + 1.675y$
    d. $\sigma = -0.872x + 1.675y$

61. The physical principle used for the derivation of momentum equation is
    a. First law of thermodynamics
    b. Second law of thermodynamics
    c. Newtons second law
    d. Law of conservation of mass

62. Potential function for three dimensional doublet of strength μ is

a. $\frac{\mu}{4\pi}\frac{\cos\theta}{r^2}$

b. $-\frac{\mu}{4\pi}\frac{\cos\theta}{r^2}$

c. $\frac{\mu}{4\pi}\frac{\sin\theta}{r^2}$

d. $-\frac{\mu}{4\pi}\frac{\sin\theta}{r^2}$

63. The lifting flow over circular cylinder is obtained by the combination of
a. Uniform flow +sink + vortex
b. Uniform flow + doublet + vortex
c. Uniform flow + source
d. Uniform flow + sink + source

64. Which of the following is usually measured as the angle between the line of 25% chord and a perpendicular to the root chord?
a. Anhedral angle
b. Dihedral angle
c. Sideslip angle
d. sweep angle

65. Winglets are used to reduce
a. Pressure drag
b. Wave drag
c. Induced drag
d. Trim drag

66. When a nozzle is said to be over expanded?
a. Pressure at exit is less than the backpressure
b. Pressure at exit is higher than the backpressure
c. Pressure at exit is equal to backpressure
d. Pressure at exit is equal to zero

67. For a flow a Prandtl-Meyer expansion wave is
a. Mach Number remains constant
b. Entropy remains constant
c. Density remains constant
d. Temperature remains constant

68. Which of the following is a barotropic flow?
a. Density depends only on the temperature
b. Density independent of pressure
c. Density depends only on the pressure
d. Density independent of temperature

69. The shadowgraph flow visualization technique depends on
a. the variation of the value of density in the flow
b. the first derivative of density with respect to spatial coordinate
c. the second derivative of density with respect to spatial coordinate
d. the third derivative of density with respect to spatial coordinate

70. Flow separation is due to
a. Adverse pressure gradient
b. Negative pressure gradient
c. Density gradient
d. Velocity gradient

71. The semi-span of a rectangular wing of plan form area 8.4 m^2 is 3.5 m. The aspect ratio of the wing is
a. 1.458
b. 8.53
c. 3.85
d. 1.2

72. What is the center pressure if the lift coefficient and lift curve slope of an aerofoil of percentage camber 0.6 are 1.02 and 2, respectively?
a. 0.2685
b. 0.6852
c. 0.8526
d. 0.6825

73. Consider an infinitely thin flat plate at an angle of attack of 5^o in a Mach 2.3 flow. Pressure is 101 kPa. The lift coefficient as per shock expansion theory is
a. 0.1735
b. 0.3735
c. 0.6735
d. 0.8735

74. Aerodynamic center is defined as point on the airfoil at which
a. moments are independent of angle attack
b. moments are zero
c. moments are dependent of aspect ratio
d. moments are independent of chord

75. What is the Coefficient of pressure, where velocity at surface of the cylinder is equal to free stream velocity?
    a. 1
    b. 0
    c. infinity
    d. maximum

76. Which of the following states that the time rate of change of circulation around a closed curve consisting of the same fluid elements is zero?
    a. KuttaJoukowski's theorem
    b. Kelvin's circulation theorem
    c. Helmholtz theorem
    d. Blasius theorem

77. For calorically perfect gas, specific heats C_p and C_v are
    a. constant
    b. function of temperature
    c. function of pressure
    d. function of density

78. The free stream Mach number for which the entire flow around the body is subsonic is called
    a. Critical Mach number
    b. Lower critical Mach number
    c. Upper critical Mach number
    d. Supercritical Mach number

79. When airfoil thickness decreases, the critical Mach number
    a. increases
    b. decreases
    c. constant
    d. infinity

80. What is the purpose of supercritical airfoil?
    a. to increase the value of drag divergence Mach number
    b. to decrease the value of drag divergence Mach number
    c. to increase the value of critical divergence Mach number
    d. to decrease the value of critical divergence Mach number

81. A turbojet powered aircraft is suitable for which of the following type of applications?
    a. low speed and heavy load applications.
    b. high speed and heavy load applications.
    c. high speed and high altitude applications.
    d. low speed and high altitude applications.

82. For which of these applications is the turbo shaft engine most suited?
    a. Low-speed fixed-wing aircraft
    b. Helicopters
    c. High altitude reconnaissance aircraft
    d. High-speed combat aircraft

83. In the subcritical operation mode of a supersonic inlet, shock strands
    a. at some distance away from the inlet
    b. at the lip of inlet
    c. inside the inlet
    d. at the entry of combustion chamber

84. Ram efficiency is defined as
    a. Real local temperature rise/ ideal temperature rise
    b. Actual rise in static pressure/ ideal rise in static pressure
    c. Actual total temperature rise/ ideal total temperature rise
    d. Real total pressure rise/ ideal total pressure rise

85. The combustion in a gas turbine is a
    a. Isochoric process
    b. Isobaric process
    c. Isothermal process
    d. Partially isobaric and partially isochoric process

86. What is the purpose of a fuel injection system in the combustor?
    a. to accelerate the flow in the combustor.
    b. to increase the stagnation pressure of the fuel-air mixture.
    c. to ignite the fuel-air mixture.
    d. to convert the bulk fuel into tiny droplets.

87. The critical mass flow rate through a converging-diverging nozzle
    a. is inversely proportional to stagnation speed of sound
    b. is directly proportional to stagnation speed of sound
    c. is directly proportional to stagnation temperature
    d. is inversely proportional to stagnation pressure

88. For a given rotational speed of a rotor of an axial flow compressor, as the fan tip radius increases, the centrifugal stress on the fan blade
    a. Increases
    b. Decreases
    c. remains constant
    d. first increases and then decreases

89. Pressure gradient in the flow direction
    a. is adverse in axial flow compressor
    b. is negative in axial flow compressor
    c. is positive in axial flow turbine
    d. is adverse in the front stages of compressor and later becomes zero

90. If there is no change in static enthalpy and static pressure across a rotor, then the turbo-machine is called
    a. reaction machine
    b. impulse machine
    c. 50% reaction machine
    d. free vortex machine

91. In a turbojet engine, thrust specific fuel consumption _____ with increasing compressor pressure ratio and _____ with increasing turbine inlet temperature (within range of operation).
    a. decreases, increases
    b. decreases, decreases
    c. increases, increases
    d. increases, decreases

92. Characteristic velocity of a rocket engine is equal to
    a. twice the discharge coefficient
    b. square root of discharge coefficient
    c. inverse of discharge coefficient
    d. thrust of the rocket divided by initial mass of rocket

93. Specific impulse of a rocket
    a. is proportional to combustion chamber temperature
    b. is inversely proportional to square root of molecular weight of combustion products
    c. is proportional to molecular weight of combustion products
    d. is proportional to square root of molecular weight of combustion products

94. The concept of erosive burning in solid propellant rocket operation pertains to
    a. erosion of propellant grain due to ageing
    b. decreased burning rate of propellant grain due to melting of propellant
    c. increased burning rate of propellant grain due to high velocity cross flow gases
    d. increased burning rate of propellant grain due to rocket motion

95. Which one of the following is not an example of an adapted nozzle?
    a. Expansion-Deflection nozzle
    b. Plug nozzle
    c. Spike nozzle
    d. Bell nozzle

96. The laminar flame speed in a combustion chamber of a jet engine is
    a. inversely proportional to square root of thermal diffusivity of reactant mixture
    b. proportional to thermal diffusivity of reactant mixture
    c. inversely proportional to the temperature of reactant mixture
    d. proportional to viscosity of reactant mixture

97. For isentropic flows the value of work-done factor for a turbo machine (ψ) will be
    a. $\Psi = 0$
    b. $\Psi = 1$
    c. $\Psi > 1$
    d. $\Psi < 1$

98. Which of these analyses needs a stretched grid?
    a. Transient flow over a flat plate
    b. Incompressible flow over a flat plate
    c. Viscous flow over a flat plate
    d. Subsonic flow over a flat plate

99. Numerical panel methods are applicable for
    a. steady, incompressible and inviscid flows only
    b. unsteady, incompressible and inviscid flows
    c. steady, compressible and inviscid flows
    d. unsteady, compressible and inviscid flows

100. Which type of grids is the best for flow over an airfoil?
    a. Stretched grids
    b. Adaptive grids
    c. Boundary-fitted grids
    d. Elliptic grids

PART III

08 - ARCHITECTURE

(Answer ALL questions)

41. The time taken by hydraulic lime to slake is
    a. 6 to 10 hrs
    b. 12 to 48 hrs
    c. 2 to 6 hrs
    d. More than 60 hrs

42. Surkhi is added to lime mortar to impart the following property
    a. Improve workability
    b. Improve solubility
    c. Impart hydraulicity
    d. Impart ductility

43. What are the limitations of Timber Framed Structures?
    a. heavy-weight
    b. difficult to transport materials
    c. cannot withstand tensile load
    d. prone to fire

44. How alternate header and stretcher in each course of brickwork is known as?
    a. Garden wall bond
    b. Flemish bond
    c. English bond
    d. Dutch bond

45. The defect of white decayed spots concealed by healthy wood in timber is known as
    a. Burls
    b. Foxiness
    c. Druxiness
    d. Dead wood

46. The timber which is fully or partially covered with resin is known as
    a. Impreg timber
    b. Lamin board
    c. Compreg timber
    d. Fibre board

47. What is the maximum level of background noise allowed in the classroom?
    a. 35 dB
    b. 60 dB
    c. 20 dB
    d. 10 dB

48. The formation of dull patches on finished polished surface is
    a. Grinning
    b. Saponification
    c. Fading
    d. Bloom

49. Which one of the following statements regarding distemper is wrong?
    a. They are treated as water paints
    b. They are durable than oil paints
    c. They exhibit poor workability
    d. They provide a good reflective coating

50. For M10 grade concrete the proportion of cement, sand and coarse aggregate is
    a. 1:1:2
    b. 1:3:6
    c. 1:2:4
    d. 1:4:8

51. What is the recommended slump of concrete for normal RCC work?
    a. 25 mm to 50 mm
    b. 70 mm to 80 mm
    c. 80 mm to 150 mm
    d. 160 mm to 180 mm

52. Who pioneered the Domino House?
    a. Frank Lloyd Wright
    b. Louis Sullivan
    c. Le Corbusier
    d. Auguste Perret

53. Which of the following elements was commonly used in Gothic Architecture?
    a. Round Arches
    b. Pendentives
    c. Rose windows
    d. Battlemented parapets

54. The middle portion of an Entablature is called as
    a. Pediment
    b. Cornice
    c. Frieze
    d. Corbel

55. Which of the following mosques does not have a courtyard?
    a. Jama masjid, Cambay
    b. Atala Masjid, Jaunpur
    c. Jama Masjid, Mandu
    d. Jama Masjid, Gulbarga

56. Who designed Centre for Development Studies building in Trivandrum?
    a. Laurie Baker
    b. Raj Rewal
    c. A. Kanvinde
    d. B.V.Doshi

57. The cold bath area in a Roman bath is called as
    a. Calidarium
    b. Apodyterium
    c. Palaestra
    d. Frigidarium

58. Which of the following is not a character of Saxon Building?
    a. Pilaster Strips
    b. Double Splayed windows
    c. Long and short quoins
    d. Buttressed walls

59. Ogee arch tracery is used widely in ———— style of architecture.
    a. Perpendicular Gothic
    b. Decorated Gothic
    c. Romanesque
    d. Greek

60. Which of the building is designed by Louis Kahn?
    a. Capitol Complex in Chandigarh
    b. Kimbell Art Museum
    c. Yale School of Architecture
    d. Tokyo Imperial Hotel

61. Which of the following architects designed Carson Pirie Scott Store building?
    a. Louis Sullivan
    b. Mies van der Rohe
    c. William Le Baron Jenney
    d. Richardson

62. What was the population of contemporary city proposed by Le Corbusier?
    a. 1 million
    b. 4 million
    c. 3 million
    d. 5 million

63. Santa Maria del Fiore cathedral has
    a. Pendentive dome
    b. double shell dome
    c. a conical dome
    d. hemispherical dome

64. The Mysore Palace was designed by
    a. George Willet
    b. Henry Irwin
    c. Edwin Lutyens
    d. James Ransome

65. The alteration or repetition of elements with defined intervals between them, creates a sense of movement and it is used to establish a texture or pattern
    a. Contrast
    b. Rhythm
    c. Monotony
    d. Emphasis

66. Gandhi Nagar plan in Gujarat is an example for
    a. Clustered organization
    b. Organic organization
    c. Radial organization
    d. Grid organization

67. Which of the following architects is NOT a part of De-constructivist movement?
    a. Rem Koolhass
    b. Mies Van de Rohe
    c. Peter Eisenmann
    d. Bernard Tschumi

68. Which one of the following DOES NOT come under Schmitt's classification of design method?
    a. Routine design method
    b. Creative design Method
    c. Innovative design method
    d. Craft design method

69. The book "The Pattern Language" is written by
    a. Frank Gehry
    b. Walter Gropius
    c. Le Corbusier
    d. Chirstopher Alexander

70. Post-Facto Explications diagram illustrates
    a. abstract notions and contains scaled comparison of volumes
    b. elements in relation to building form after the design is completed
    c. relation to Sensorial or Experiential aspects of the design concept
    d. the details of Sequence of steps in a design development process

71. The Visionary diagram named "Plug-in City" is done by
    a. Cedric Price
    b. Peter Cook
    c. Yona Freidmann
    d. Arato Isazaki

72. Which of the following will not produce echo?
    a. Mirror
    b. Rock
    c. Marble
    d. Porous materials

73. Bulking of sand is highest in
    a. Coarse sand
    b. Fine Sand
    c. Medium sand
    d. Coarse and medium sand

74. One of the fractal types, Koch Snow flake starts with the basic shape is
    a. Dodecahedron
    b. Circle
    c. Square
    d. Equilateral triangle

75. Which of the following characteristics is NOT related to fractal?
    a. Deterministic
    b. Evolutionary
    c. Self-Similar
    d. Recursive

76. Who said the statement, "Liquid Architecture is an architecture, whose form is contingent on the interest of the beholder"?
    a. Greg Lynn
    b. Marcos Novak
    c. Peter Eisenmann
    d. Bernard Tschumi

77. The use of dimming systems for street lighting is recommended when the supply voltage exceeds
    a. 220 V
    b. 240 V
    c. 440 V
    d. 415 V

78. Through Solids, Sound travels as
    a. Longitudinal waves
    b. Transverse waves
    c. Transverse and Longitudinal waves
    d. Compression waves

79. An anechoic chamber is a room designed to
    a. Completely absorb reflections of either sound or electromagnetic waves
    b. Reflect sound or electromagnetic waves
    c. Absorb electromagnetic waves
    d. transmit electromagnetic waves

80. Which is the valve used to maintain constant water level and to prevent overflow in plumbing?
    a. Float valve and ball cock
    b. Gate Valve
    c. Globe Valve
    d. Butterfly Valve

81. Low pressure sodium vapor lamps have the following disadvantage compared to high pressure sodium vapor lamps
    a. Costly
    b. Poor color rendering
    c. Inefficient
    d. Can only be used for indoor applications

82. What is the color code for single live wiring in India?
    a. Red
    b. Black
    c. Yellow
    d. Green

83. As per Indian Standards, the number of water closets for male personnel should be ———— in office buildings.
    a. 1 for every 25 persons or part thereof
    b. 1 for every 30 persons or part thereof
    c. 1 for every 40 persons or part thereof
    d. 2 for every 40 persons or part thereof

84. Where Busbars are used in?
    a. Electrical systems
    b. Barrier free system
    c. Bus handles
    d. None of the above

85. Which one of the following is Sound absorbing material?
    a. porous
    b. solid
    c. transparent
    d. none of the above

86. Urban mountain at Copenhagen was designed by
    a. Bjarke Ingels
    b. Chris Precht
    c. Sir Norman Foster
    d. Daniel Libeskind

87. Where Biometrics is used in?
    a. Automation
    b. Smart buildings
    c. Security systems
    d. All of the above

88. Creep in concrete is defined as deformation of structure
    a. Due to increase in load
    b. Under sustained load
    c. Under acute shocks
    d. All of the above

89. Neighbourhood unit concept was crystalised by
    a. John F C Turner
    b. C A Perry
    c. Doxiadis
    d. William Drummond

90. The Radbum planning in New Jersey constituted of
    a. Small walkable blocks
    b. Hierarchical transportation systems
    c. Parks as backbone
    d. All of the above

91. What is the aim of the National Slum Development Programme?
    a. Improve physical amenities like water supply and drainage in non-notified slums
    b. Improve community infrastructure such as Schools and Community Centers in notified slums
    c. Upgrade housing in non-notified slums
    d. All of the above

92. The building sector accounts for ———— of global energy consumption
    a. 30 — 40 %
    b. 10 — 15 %
    c. 50 — 60 %
    d. 20 — 25 %

93. What is the Core focus of Urban housing and habitat policy 2007?
    a. Increased supply of service land
    b. Regional planning approach
    c. Affordable housing for all
    d. Slum redevelopment

94. What is the name of the housing unit constructed under Pradhan Mantri Gramin Awas Yojana?
    a. Female of the household
    b. Male of the household
    c. Village administrative officer
    d. Community head

95. Prefabrication production was pioneered in India by
    a. Tata housing
    b. DTH manufacturing
    c. Hindustan Housing Factory
    d. Pressmach

96. Tax incremental financing in Hyderabad model is to pay for
    a. Urban Infrastructure such as Storm water drains, parks and roads
    b. Education
    c. Land
    d. Institutions

97. Missing middle in housing describes
    a. Highrise housing
    b. Duplexes, town houses and small apartments
    c. Social, affordable housing
    d. Eco, sustainable housing

98. Which of the following is organically developed?
    a. Old Delhi
    b. New Delhi
    c. Dwaraka sub-city
    d. Chandigarh

99. Which of the following constitutes landslides due to geologic factors?
    a. Weak strength of material below ground surface
    b. Excavation of slope for construction
    c. Cutting/filling done near stream
    d. All of the above

100. To withstand flooding, shelters and settlement should be
    a. sited above flood level
    b. sited in low lying areas
    c. of rectangular configuration
    d. built on uncompacted ground

———————

PART III

09 – AGRICULTURAL AND IRRIGATION ENGINEERING

(Answer ALL questions)

41. Which one of the following is not a movable pulley?
    a. Elevator
    b. Construction Crane
    c. Weight Lifting machine
    d. Pulley at the flag pole

42. Which Gear is used in conveyer systems to lock?
    a. Spur gear
    b. Worm gear
    c. Helical gear
    d. Bevel gear

43. Which type of mould board is used in sticky soils as primary tillage equipment?
    a. General purpose mould board
    b. Slat mould board
    c. Stubble mould board
    d. Sod mould board

44. While designing seed drill, the normal width of seed drill (w) is based on Number of furrow opener (N) and spacing between furrows. Then the relationship to determine width of seed drill is
    a. $W = N/S$
    b. $W = N \times S$
    c. $W = S/N$
    d. $S = W/N$

45. When energy expressed is 10 calorie, it is equal to
    a. 41.86 J
    b. 4.186 J
    c. 418.6 J
    d. 0.4186 J

46. How the connecting rod in a conventional mower which is pinned to crank shaft with a pin to transmits reciprocating motion to knife head is called?
    a. Ledger Plate
    b. Wearing Plate
    c. Pitman
    d. Grass board

47. Which of the following estimates the potential wind energy sites by power density of the site?
    a. $P = ½\ mv^2$
    b. $P = ½\ \rho v^3$
    c. $P = ½\ \rho A v^2$
    d. $P = ½\ \rho A v^3$

48. Which one of the following is the most efficient in energy storage as a rechargeable battery?
    a. Lead Acid
    b. Nickel – Cadmium
    c. Zinc – Air
    d. Lithium – Ion

49. What is the displacement volume for a four stroke engine, with 10 cm bore diameter and 8 cm stroke length?
    a. 2512 cm^3
    b. 25.12 cm^3
    c. 251.2 cm^3
    d. 25120 cm^3

50. What is the speed required if a tractor engine has constant hp, to get high torque at rear wheel?
    a. Very high
    b. High
    c. Low
    d. Constant

51. Which of the following anti freeze solution is mixed with water in cooling system of tractors under very cold condition?
    a. Sodium chloride
    b. Glycerine
    c. Caustic soda
    d. Sodium hydroxide

52. Which of the following is highly power intensive in farm operations?
    a. Plant protection
    b. Tilling
    c. Transplanting
    d. Weeding

53. Which of the following is **Not** a part of Dash board of a tractor?
    a. Main Switch
    b. Decompression Lever
    c. Water temperature
    d. Steering Wheel

54. How the horizontal distance between front and rear wheel measured at ground contact is called?
    a. Ground clearance
    b. Track
    c. Wheel base
    d. Turning space

55. In a power tiller, when main clutch transmits power to the transmission gear, the power is transferred to
    a. Steering clutch
    b. Tilling attachment
    c. Brakes
    d. Centre drive

56. How a real fluid in which shear stress is directly proportional to rate of shear strain is called?
    a. Ideal plastic
    b. Newtonian fluid
    c. Non- Newtonian fluid
    d. Ideal fluid

57. What is the Reynolds number for the flow with velocity 2 m/s, flowing through a 10 cm diameter pipe carry water with viscosity 1 centi poise?
    a. 2.00×10^3
    b. 2.00×10^4
    c. 2.00×10^5
    d. 2.00×10^6

58. In the downstream of spill ways hydraulic jump occurs mainly to
    a. Increase discharge
    b. Increase velocity of flow
    c. Dissipate energy
    d. Avoid siltation

59. The shear strength of soil is approximately 1.7 kN/m^2 when it is said to be at
    a. Liquid limit
    b. Plastic limit
    c. Shrinkage limit
    d. Extremely firm

60. Flow nets are constructed such that the head lost between successive ———— line remain the same
    a. Stream line
    b. Streak lines
    c. Equipotential line
    d. Stream tubes

61. Which one of the following is not a layout of tile drain?
    a. French drain system
    b. Herringbone system
    c. Grid iron system
    d. Intercepting drain system

62. Which of the following is a region above water table where water rises in a porous medium?
    a. Water table
    b. Capillary fringe
    c. Phreatic zone
    d. Aquifer

63. In a Darcy's equation, the constant K which is the property of the media is called
    a. Density
    b. Dynamic viscosity
    c. Kinematic viscosity
    d. Intrinsic permeability

64. In ground water hydrology, the term used to describe, saturated flow directed away from water table is called
    a. Discharge area
    b. Recharge area
    c. Midline
    d. Pathline

65. Which of the following occurs when Land surface dips to intersect the water table?
    a. Fault spring
    b. Sinkhole spring
    c. Fracture spring
    d. Depression spring

66. If i is intensity of rain in cm/hr, f is rate of infiltration in cm/hr and fc is infiltration capacity in cm/hr. Maximum rate at which, soil can absorb water is
    a. $f = i$ when $i < fc$
    b. $f \leq i$ when $i > fc$
    c. $f < i$ when $i > fc$
    d. $f \geq fc$ when $i = fc$

67. How Lumped hydrologic flow routing of flood, when flow is calculated as a function of time alone is called?
    a. Distributed routing
    b. Lumped routing
    c. Hydraulic routing
    d. Dynamic wave routing

68. Which of the following is **Not** a recording rain gauge?
    a. Tipping bucket type
    b. Weighing bucket type
    c. Symon's gauge
    d. Natural siphon type

69. Wells which are excavated pits through the geological formation which needs lining only for a couple of meter from top are usually found in
    a. Alluvial formation
    b. Rocky formation
    c. Fracture zones
    d. Fault zones

70. Aquifer testing conducted to determine hydraulic parameter is
    a. Time draw down test
    b. Step – draw down test
    c. Step – injection test
    d. Time – ground water level rise test

71. An agricultural pump has lifting water from well has a discharge of 1,00,000 litres/hour against its head of 20 m, What is the water power in watts?
    a. 5.4936
    b. 54.936
    c. 549.36
    d. 5493.6

72. The Branch of Surveying, which takes into consideration the true shape of earth is called
    a. Plane surveying
    b. Compass Surveying
    c. Topographic Surveying
    d. Geodetic Surveying

73. Lines are first run around the perimeter of a plot, then details are fixed in relation to established lines. This process in Surveying is called
    a. Transverse Survey
    b. Plain table Survey
    c. Theodolite Survey
    d. Triangulation Survey

74. In surveying using a compass, _____ is the operation in which compass is kept exactly over the station from where the bearing is to be determined
    a. Levelling
    b. Focussing
    c. Centering
    d. Bearing

75. Which of the following soil structures impedes downward movement of water?
    a. Granular
    b. Columnar
    c. Platy
    d. Prismoidal

76. A soil sample has a mass of 20 g and the volume of the soil sample in 15 cm^3. The bulk density of soil is
    a. 1.1 g/cm^3
    b. 1.2 g/cm^3
    c. 1.3 g/cm^3
    d. 1.4 g/cm^3

77. At a given matric potential, ———— retains more water
    a. Clay soil
    b. Loam soil
    c. Silty soil
    d. Sandy soil

78. One of the erosion control measures for slope management is
    a. Conservation tillage
    b. Vegetative hedge
    c. Check dam
    d. Terraces

79. Tree wind breaks protects soil carrying capacity of wind for approximately ———— times the height of the tall tree on windward side
    a. 3-4
    b. 15-20
    c. 5-10
    d. 11-15

80. The design velocity of flow in grassed water way is 2.0 m/s, then the cover condition should be
    a. Good grass cover
    b. Sod of excellent cover
    c. Sparse grass cover
    d. No vegetation

81. If rice requires 10 cm depth of water at an average interval of about 10 days and if crop period of rice is 120 days. The delta for rice is
    a. 10 cm
    b. 12 cm
    c. 100 cm
    d. 120 cm

82. For which of the following crops Furrow irrigation is **Not** suited for?
    a. Cotton
    b. Rice
    c. Sugarcane
    d. Potato

83. Which one the following is **not** suitable for fertigation under drip irrigation because of its slow solubility in water?
    a. Urea
    b. Super phosphate
    c. Gypsum
    d. Muriate of potash

84. When the soil concentration in water extracted from saturated soil is found to be greater than 18 mmhos/cm . Then the soil is said to be
    a. Highly saline
    b. Medium saline
    c. Slightly saline
    d. Non saline

85. What is the drainage co-efficient in an agricultural watershed of 1500 ha is discharging through a drain at an average rate of 2.5 m^3/s?
    a. 1.22 cm/day
    b. 1.44 cm/day
    c. 1.66 cm/day
    d. 1.88 cm/day

86. In a subsurface drainage network of an agricultural watershed had 10 lateral drain laid at a spacing of 40 m and each is 150 m long, join a collector drain. If average discharge at the outlet of collector drain is 10 L/s, the water table drops 40 cm below the ground in 3 days. The average drainable porosity of soil is
    a. 5.8%
    b. 7.8%
    c. 10.8%
    d. 15.8%

87. For which of the following Magnetic separators equipment is used?
a. Sorting
b. Cleaning
c. Grading
d. Milling

88. Which component of rice, is rich in dietary fibre, essential fatty acids, starch, protein and vitamin?
a. Whole kernel
b. Husk
c. Bran
d. Oil

89. What is the main purpose of blanching vegetables before freezing?
a. to soften cellulose
b. to deactivate enzymes
c. to increase color
d. to prevent loss of vitamin C

90. Pantnagar process of milling is designed for
a. Black gram
b. Green gram
c. Green pea
d. Pigeon pea

91. Where Compression force is used as a means of size reduction?
a. In Hammer mill
b. In Disc attrition mill
c. In Roller mill
d. In Knife cutter

92. For transporting grains, bed speed recommend in a belt conveyor is
a. ≤ 1 m/s
b. 2.5 to 2.8 m/s
c. 3.5 to 3.8 m/s
d. ≥ 5 m/s

93. The portal for farmers to get information services/advisories by SMS is
a. Pusa Krishi
b. m Kisan
c. Farm Opera
d. Kisan Suvidha

94. FAO has used Google's earth engine to forecast and control occurrence of
a. H_5 N_i Virus
b. Avian influenza
c. Locust
d. Corona Virus

95. How Crop growth monitoring and management are possible?
a. By Remote sensing
b. By GIS
c. By Unmanned Aerial vehicle
d. By Modelling

96. Who has developed Linear programming?
a. George B.Dantzig
b. Richard Bellman
c. Narendra Karmarkar
d. Bolton

97. OFD works are part of
a. CADP
b. HADP
c. DPAP
d. RVP

98. Neerkatti is a water management institution of Tamil Nadu which is
a. Formal
b. Traditional
c. Informal
d. Official

99. How Voluntary contribution in rehabilitation of tanks in Tamil Nadu is called?
a. Erivariam
b. Kudimaramathu
c. Toorvaruthal
d. Ayacutudar Kuzhu

100. Shejpali system of irrigation is a water system practised in the state of
a. Bihar
b. Karnataka
c. Maharashtra
d. Andhra Pradesh

PART III

10 - BIO-TECHNOLOGY

(Answer ALL questions)

41. In scaling up agitators from lab model to Industrial scale, which one of the following is preferred as scale-up criterion?
    a. Mixing time
    b. Reynolds No.
    c. Power number
    d. Power / volume of fermenter

42. Which of the following cells are most shear sensitive?
    a. mammalian
    b. plant
    c. bacteria
    d. fungi

43. Majority of fermentation medium are pseudoplastic. Therefore, heat transfer and mass transfer rates are poor away from the impeller because
    a. density decreases
    b. viscosity decreases
    c. density increases
    d. viscosity increases

44. The term k_La during operation of bioreactors refers to
    a. Liquid-liquid mass transfer coefficient
    b. Distribution of gas bubble size as a function of mixing
    c. Volumetric oxygen mass transfer coefficient
    d. Dankwerts gas-liquid interfacial energy coefficient

45. Partition coefficient in two phase aqueous extraction is defined as concentration of solute in
    a. Extracte/raffinate
    b. Extract/feed
    c. Upper aqueous layer/ lower aqueous layer
    d. Amount of solute extracted / amount of solute in feed

46. Michaelis Menten reaction is
    a. first order reaction
    b. zero order reaction
    c. changing order reaction
    d. fractional order reaction

47. Arrhenius equation shows the variation of ———— with temperature
    a. reaction rate
    b. rate constant
    c. energy of activation
    d. frequency factor

48. While $DV\rho/\mu$ is the general expression for Reynolds number and for agitator it is
    a. $n^2D^2\rho/\mu$
    b. $n^2D\rho/\mu$
    c. $nD^2\rho/\mu$
    d. $nD\rho/\mu$

49. Which parameter gives performance of a centrifuge?
    a. g. number
    b. sigma factor
    c. separation ratio
    d. capacity factor

50. A batch reactor is characterized by
    a. constant residence time
    b. variation in extent of reaction and properties of the reaction mixture with time
    c. variation in reactor volume
    d. very low conversion

51. RNA primer at the 5' ends of Okazaki fragments in prokaryotes are removed by
    a. Ribonuclease Z
    b. S1 nuclease
    c. P1 nuclease
    d. DNA pol I

52. Phosphorylation of serine residue on the eIF2 bound to GDP results in
    a. Initiation of protein synthesis
    b. Inhibition of protein synthesis
    c. Inhibition of DNA synthesis
    d. Initiation of RNA synthesis

53. Premature or incomplete protein synthesis happens due to
    a. Nonsense mutation
    b. Mutation of promoter region
    c. Missense mutation
    d. Frameshift mutation

54. Which one of the following has the ability to inhibit transcription?
    a. Neomycin
    b. Kanamycin
    c. Rifampicin
    d. Quinolones

55. A double stranded DNA contains 42% of G and C. The percentage of 'T' is
    a. 58
    b. 23
    c. 29
    d. 21

56. Which enzyme is involved in the base excision repair of DNA?
    a. Purine glycosylase
    b. P1 nuclease
    c. Endonuclease II
    d. DNA glycosylase

57. Mitochondrial DNA replication is carried out by
    a. DNA polymerase gamma
    b. DNA polymerase I
    c. Pfu DNA polymerase
    d. DNA polymerase alpha

58. Which one of the following is not true about promoter?
    a. They are sequence of DNA
    b. Binds to RNA polymerase II during transcription
    c. Located between operator and coding region
    d. Mutation of promoter region affects transcription rate

59. Telomerase functions as
    a. DNA dependent RNA polymerase
    b. DNA dependent DNA polymerase
    c. RNA dependent DNA polymerase
    d. RNA dependent RNA polymerase

60. The sequence of the structural genes in the lac operon is in the order of
    a. lacZ-lacA-lacY
    b. lacZ-lacY-lacA
    c. lacA-lacY-lacZ
    d. lacA-lacZ-lacY

61. Which separation technique uses ligand to purify its receptor protein?
    a. Ion exchange chromatography
    b. Expanded Bed Adsorption chromatography
    c. Affinity chromatography
    d. Size-exclusion chromatography

62. Lipogenesis is enhanced by
    a. Insulin
    b. Epinephrine
    c. Glucagon
    d. Thyroxine

63. The cell organelle primarily responsible for the source of reactive oxygen species is
    a. Nucleus
    b. Endoplasmic reticulum
    c. Golgi apparatus
    d. Mitochondria

64. Which one of the following cells depends primarily on glucose for energy?
    a. Lymphocyte
    b. Differentiated adipocytes
    c. Matured RBC
    d. Muscle cells

65. Which of the tests is used to differentiates that the oil is rich in saturated or unsaturated fatty acids?
    a. Iodine number
    b. Acid value
    c. Saponification value
    d. Acrolein test

66. Which is not a selective medium but is a differential medium?
    a. Blood agar
    b. Mannitol salt agar
    c. Mac Conkey agar
    d. Eosin methylene blue agar

67. The time taken to kill 90% of the organisms or spores in a sample under specified condition is
    a. Thermal death time (TDT)
    b. Decimal reduction time (D value)
    c. Generation time
    d. Doubling time

68. Phenolics control microorganisms by
    a. Denaturing proteins
    b. Oxidising cellular components
    c. Preventing cell wall formation
    d. Inhibiting DNA replication

69. Which of the following binds to the small ribosomal subunit (30S) and interfere with protein synthesis by causing misreading of the mRNA?
    a. Macrolides
    b. Aminoglycosides
    c. Lincosamines
    d. Quinolones

70. Which is an example of a biopolymer?
    a. Scleroglucan
    b. Aconitase
    c. Lyase
    d. Phenyl acetic acid

71. Which is true regarding a cosmid vector?
    a. Plaques are not produced
    b. Use lac selection system
    c. Can carry small DNA fragments
    d. Uses lambda origin of replication

72. The most important use of BAC vector is for
    a. Stable transfection
    b. Human genomic library construction
    c. E. coli protein expression
    d. E. coli genomic library construction

73. Creating mutant protein with novel characteristics and properties is called
    a. Cloning
    b. Mutagenesis
    c. Sequencing
    d. Protein engineering

74. The mismatch repair system of *E. coli* is
    a. Prenyl directed repair system
    b. Cysteine directed system
    c. Mutated system
    d. Methyl directed system

75. Which is not true for karyotyping?
    a. used to determine chromosome number
    b. used to determine chromosome size
    c. used in DNA amplification
    d. used to detect diseases

76. Pyrolysis mass spectroscopy is used to differentiate organisms to ———— level
    a. Phyla and kingdom
    b. Genus and species
    c. Kingdom and species
    d. Kingdom and Genus

77. Which of the following methods can be used to detect single nucleotide change in DNA?
    a. ELISA
    b. WESTERN Blotting
    c. SDS-PAGE
    d. PCR

78. Why is enhancer region included in many vectors based on alphaviruses?
    a. Expression of protein in N terminus
    b. Expression of protein on P terminus
    c. Expression as fusion protein
    d. To decrease the expression

79. All these statements are true regarding RFLP and RAPD except
    a. RAPD is quicker when compared to RFLP
    b. RFLP is more reliable than RAPD
    c. Species specific primers are required for RAPD
    d. Radioactive probes are not used in RAPD

80. The variation in the number of tandem repeats between two or more individuals is called
    a. Variable number of tandem repeats (VNTRs)
    b. Restriction fragment length polymorphism (RFLP)
    c. Simple sequence repeats (SSRs)
    d. Amplified fragment length polymorphism (AFLP)

81. Which of the following transcription factor is said to be a master switch of immune system, that promotes the cytokine expression during inflammation?
    a. Nuclear factor kappa B
    b. Transcription factor II
    c. DNA transcriptase
    d. RNA transcriptase

82. Which of the following is the opsonin?
    a. C5b
    b. C1q
    c. C3a
    d. C3b

83. Which of the following is the suppressive cytokine?
    a. IL-1
    b. IL-2
    c. IL-10
    d. IL-12

84. Which of the following is NOT a mechanism of action of cyclosporine leading to immunosuppression
    a. Inhibition of transcription of IL-2 gene
    b. Inhibition of Calcineurin pathway
    c. Inhibition of Cytochrome P450 3A4
    d. Inhibition of dephosphorylation of NF-AT

85. Which of the following drug is used to prevent graft rejection?
    a. Azathioprine
    b. Methotrexate
    c. Rapamycin
    d. Tacrolimus

86. BCG vaccine contain non virulent strain of
    a. *Bacillus subtilis*
    b. *Bacillus Pumilus*
    c. *Mycobacteriumleprae*
    d. *Mycobacterium bovis*

87. Which of the following methods is correct for producing vector vaccines?
    a. By inserting genes for antigens of a pathogen into a nonpathogenic viral vector
    b. By inserting attenuated antigen to the pathogenic virus
    c. By inserting whole antigen to the pathogenic virus
    d. By inserting the antigenic component to host

88. Which of the following enzymes plays a vital role in the pathogenesis of HIV infection?
    a. RNA polymerase
    b. RNA polymerase II
    c. Tag polymerase
    d. Reverse Transcriptase

89. When in skin allograft, second set of rejection occurs?
    a. 10-14 days
    b. 5-7 days
    c. After a month
    d. After a week

90. What are passenger cells in transplantation?
    a. Donor leukocytes in graft tissue
    b. Recipient leukocytes around graft tissue
    c. Recipient dendric cells
    d. Recipient T cells

91. A data mining method especially for studying biological networks based on pairwise correlations between variables is:
    a. Hidden markov model
    b. Convoluted network analysis
    c. Artificial neural networks
    d. Weighted correlation network analysis

92. The preference for the 20 standard amino acid residue types at each position in a given multiple sequence alignment refers to the:
    a. Pattern
    b. Profile
    c. Motif
    d. Feature

93. What is the approximate time taken in dynamic programming for the alignment of 3 sequences of length n?
    a. $5n^3$
    b. $6n^3$
    c. $7n^3$
    d. $8n^3$

94. Which of the following models assumes constant rates of evolution with two substitution types?
    a. Jukes cantor model
    b. Kimura Model
    c. BLOSUM model
    d. PAM model

95. The machine learning model associated with supervised learning is:
    a. Support vector machine
    b. K-mean clustering
    c. Principle Component analysis
    d. Independent Component analysis

96. The concept of DNA computing was kick-started by the famous scientist
    a. Craig Venter
    b. Margarette Dayhoff
    c. Saul Needleman
    d. Len Adleman

97. The phylogenetic tree following the principles of occam's razor is
    a. Maximum likelihood tree
    b. Ultrametric tree
    c. Additive tree
    d. Maximum parsimony tree

98. In a microarray experiment, the typical *p* value for a reliable analysis of differentially gene expression is
    a. 0.05
    b. 0.1
    c. 1.0
    d. 1.5

99. The term T2T-CHM13 refers to
    a. Recently sequenced Human genome
    b. A new docking algorithm
    c. A structure prediction method
    d. A phylogenetic software

100. Similarity due to parallel evolution, convergent evolution or secondary loss is called
    a. Homoplasy
    b. Homology
    c. Heteroplasy
    d. Heterogenecy

PART III

11 - BIO-MEDICAL ENGINEERING

(Answer ALL questions)

41. Which type of collagen represents 90% to 95% of the collagen in ECM and forms fibrils and fibres interwines with proteoglycan aggregates?
    a. Type II
    b. Type I
    c. Type IX and X
    d. Type L

42. Which of the following is the cardiac output?
    a. Stroke volume/heart rate
    b. Stroke volume × heart rate
    c. Stroke volume × resistance
    d. Heart rate/resistance

43. During respiration, the gaseous exchange takes place in
    a. Trachea and larynx
    b. Alveoli and throat
    c. Throat and Lungs
    d. Lungs and Alveoli

44. Centre for Pressure and Touch lies in
    a. Midbrain
    b. Occipital lobe
    c. Frontal lobe
    d. Parietal lobe

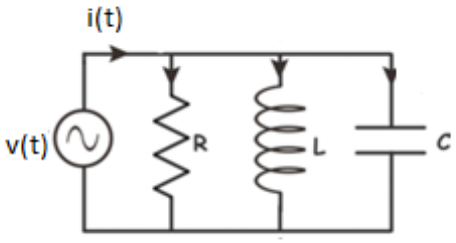
45. Which of the following is the TCA cycle metabolite used in the detoxification of ammonia in brain?
    a. Ornithine
    b. α -ketoglutarate
    c. Oxaloacetate
    d. Glycine

46. Which of the following does not have a negative effect on PFK?
    a. ATP
    b. Citrate
    c. pH
    d. AMP

47. Which of the following inhibits acetyl-coA carboxylase in fatty acid synthesis?
    a. ATP
    b. Malonyl coA
    c. Palmitic acid
    d. Glucose

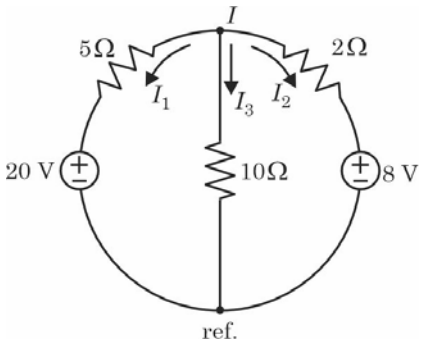
48. Which of the following behaves as a precursor for the synthesis of TGL and PL?
    a. Glycerol-3-phosphate
    b. Pyruvic acid
    c. Acetyl coA
    d. 2-Phospho glycerate

49. Find i(t) in the following circuit, given $R = 1/3\,\Omega$, L = 1/4 H, C = 3F and $v(t) = \sin 2t$



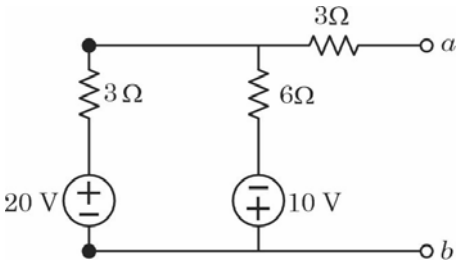
    a. $5\sin(2t + 53.1°)$
    b. $5\sin(2t - 53.1°)$
    c. $25\sin(2t + 53.1°)$
    d. $25\sin(2t - 53.1°)$

50. Find I_1, I_2 and I_3 for the following circuit



    a. –2A, –1A and 1A respectively
    b. 2A, 1A and 1A respectively
    c. –2A, 1A and 1A respectively
    d. –2A, 2A and 1A respectively

51. Find V_{th} and R_{th} for the following circuit



a. V_{th} = 10V and R_{th} = 5 Ω respectively

b. V_{th} = 20V and R_{th} = 5 Ω respectively

c. V_{th} = 10V and R_{th} = 9 Ω respectively

d. V_{th} = 20V and R_{th} = 9 Ω respectively

52. The voltage v = 12 cos (60t + 45°) is applied to a 0.1-H inductor. Find the steady-state current through the inductor.

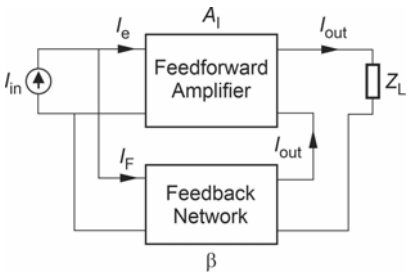
a. i(t) = 2 sin (60t –45°) A

b. i(t) = 2 cos (60t - 45°) A

c. i(t) = 2 cos (60t + 45°) A

d. i(t) = 2 sin (60t + 45°) A

53. Consider the negative feedback system shown in the Fig. with Ro as output resistance of the feedforward amplifier. The overall output resistance of the negative feedback amplifier is



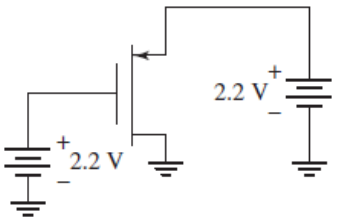
a. $Ro(1 + A_I\beta)$

b. $\dfrac{R_o}{1 + A_i\beta}$

c. $R \circ \beta$

d. $\dfrac{R_o}{\beta}$

54. For the MOSFET transistor shown in the below Figure, operating region of the transistor is



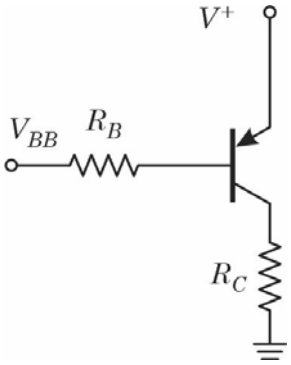
a. Triode

b. Saturation

c. Cutoff

d. Velocity Saturation

55. What is the slope of the output load line characteristic for the circuit shown in the below Figure?



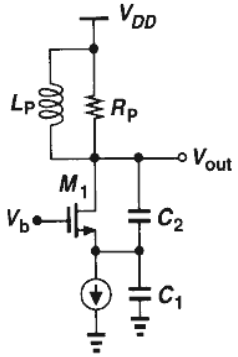
a. $-1/R_C$

b. $-1/(R_C + R_B)$

c. $-1/(R_B)$

d. $-1/(R_C \parallel R_B)$

56. What is the minimum voltage gain required for the Colpitts Oscillator shown in the below Figure for sustained oscillation is?



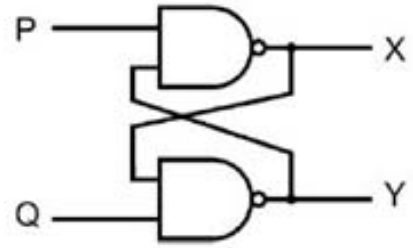
a. 1

b. 3

c. 4

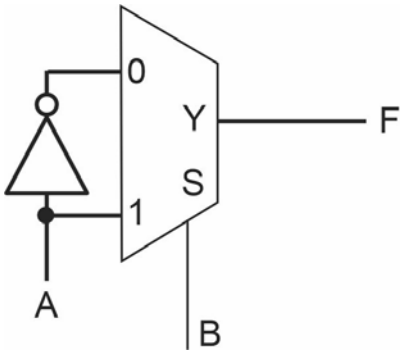
d. 2

57. What are the invalid inputs in the following flip flop?



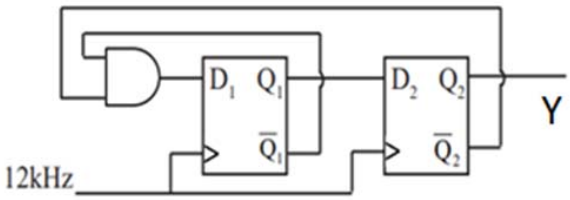
a. P = 0, Q = 0
b. P = 0, Q = 1
c. P = 1, Q = 0
d. P = 1, Q = 1

58. Which is the boolean expression at F in the following figure?



a. F = AB
b. F = A + B
c. F = A XOR B
d. F = A XNOR B

59. What is the frequency of the waveform at Y?



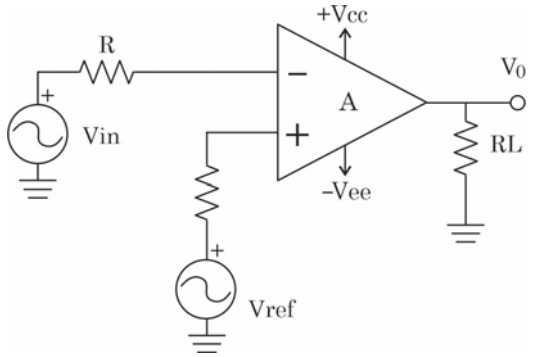
a. 2 kHz
b. 3 kHz
c. 4 kHz
d. 6 kHz

60. Which is the Hexadecimal equivalent of 1100101011101011_2?
a. 6FA3
b. CAEB
c. ED2F
d. 4FAB

61. The basic step of an 8-bit DAC is 12.4 mV. If the binary input 00000000 represents 0V. Determine the output, if the input is 10110111?
a. 1.36 V
b. 2.27 V
c. 5.45 V
d. 3.25 V

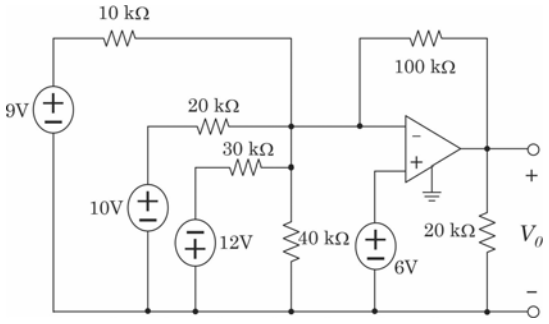
62. Which IC is a fixed positive voltage regulator?
a. LM78XX
b. LM79XX
c. LM2576
d. LM2596

63. Which is the correct option for the circuit shown below to get an output Vo as -Vcc?



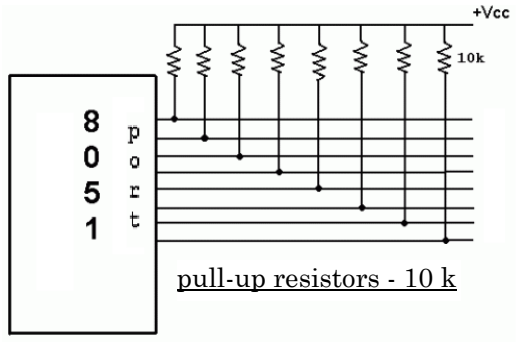
a. $V_{ref} > V_{in}$
b. $V_{ref} < V_{in}$
c. $V_{ref} = V_{in}$
d. None of the above

64. What is the output voltage Vo for the circuit shown below?



a. 31
b. 12
c. 21
d. 11

65. Which port in 8051microcontroller requires external pull up as shown below?



a. Port 0
b. Port 1
c. Port 2
d. Port 3

66. The instruction XLAT in 8086 microprocessor is used to
a. Translate a byte in AL using a table index
b. Transfer data from source to destination
c. Push the contents of specified source on to the stack
d. Exchange the contents of source with destination

67. In 8085 microprocessor, two address lines namely A13 and A6 have become faulty and are stuck at logic 0. Which of the following address locations cannot be accessed in the memory?
a. 0000H
b. 1F1FH
c. 1FFFH
d. 1F0FH

68. For the given 8086 microprocessor instructions below, which of the following is an invalid instruction?
a. MOV BX, [0301 H]
b. MOV CX, 037AH
c. MOV AL,BL
d. MOV DS, 4100H

69. Consider a system output $y(t)$ is related to its input $x(t)$ as, $y(t) = x(t) + \cos(x(t))$. This system is
a. linear and time invariant
b. linear and time variant
c. non-linear and time invariant
d. non-linear and time variant

70. A continuous system is described by $y(t) = x(t)\cos(200\pi t)$. If $x(t)$ is a two tone signal with frequencies 25 Hz & 50 Hz then, the frequency components present in $y(t)$ will be
a. 25 Hz & 50 Hz
b. 100 Hz
c. 50 Hz, 75 Hz, 125 Hz & 150 Hz
d. 25 Hz, 50 Hz, 75 Hz & 150 Hz

71. Let a discrete time signal $x(n)$ has Z-transform $X(z) = 1/(1+2\,z^{-1})$, $|z| > 2$. If its Fourier transform is denoted as $X(e^{j\omega})$ then,
a. $X(e^{j\omega}) = 1/(1+2e^{j\omega})$
b. $X(e^{j\omega}) = 1/(j\omega+2)$
c. $X(e^{j\omega}) = 1/(1+2\,e^{-j\omega})$
d. $X(e^{j\omega})$ does not exist

72. A single tone real signal $x[n]$ has its 8 point DFT denoted by $X(k)$ which has $X(2) = 2$. Then, the signal $x[n]$ will be equal to
a. $2e^{j\pi n/4}$
b. $2\cos(\pi n/2)$
c. $2\sin(\pi n/2)$
d. $4\cos(\pi n/2)$

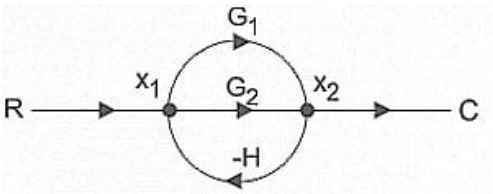
73. The number of stages in radix-2 DIT FFT for N = 8 is
a. 5
b. 3
c. 4
d. 1

74. The minimum number of delay elements and multipliers required to implement linear phase filter with impulse response $h(n)$ defined for $n > 0$ and $n < 8$ are
a. 7, 8
b. 7, 4
c. 6, 6
d. 7, 5

75. In 1024 point DFT of a signal sampled at 8192 Hz, k = 8 corresponds to a frequency of
a. 64 Hz
b. 32 Hz
c. 16 Hz
d. 8 Hz

76. The width of the transition band of a linear phase band pass FIR filter is given as 0.1π. The order of the filter designed using Blackman window is
a. 12
b. 25
c. 54
d. 110

77. Use mason's gain formula to find the transfer function of the given figure

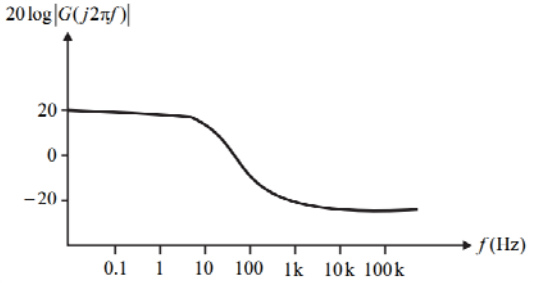


a. G_1+G_2
b. $G_1+G_1/1-G_1H+G_2H$
c. $G_1+G_2/1+G_1H+G_2H$
d. G_1-G_2

78. The transfer function of the system is $G(s) = 100/(s+1)(s+100)$. For a unit step input to the system the approximate settling time for 2% criterion is:
a. 100 sec
b. 4 sec
c. 1 sec
d. 0.01 sec

79. The range of K for the stability of system is $0 < K < 100$. For $K = 10$, The gain Margin of the system
a. 10
b. 5
c. 0.1
d. 0.5

80. A Bode magnitude plot for the transfer function $G(s)$ of a plant is shown below. Which one of the following transfer functions best describes the plant?



a. $\frac{1000(s+10)}{s+100}$
b. $\frac{10(s+10)}{s(s+1000)}$
c. $\frac{s+1000}{10s(s+10)}$
d. $\frac{s+1000}{10(s+10)}$

81. Which of following techniques requires timing synchronization between transmitter and receiver?
a. AM
b. FM
c. FDMA
d. TDMA

82. If a uniform quantizer with sinusoidal input signal produces the output SNR of 43.76 dB, determine the number of quantization levels used
a. 256
b. 128
c. 32
d. 64

83. An AM modulator develops an unmodulated power of 400 W and power of 450 W when modulated with modulation index of μ across the resistive load. Then the value of μ is
a. 0.5
b. 0.6
c. 0.7
d. 0.8

84. If a discrete memory less source emits symbols with probabilities 0.2, 0.2, 0.2, 0.2 and 0.2, determine the entropy of the source
a. 2
b. 3
c. 2.32
d. 3.23

85. Respiration rate is measured using _____.
a. RTD
b. Strain gauge
c. Ultrasonics
d. Thermocouple

86. The impedance of Biopotential electrode is _____ at high frequency.
a. Low
b. High
c. Moderate
d. Zero

87. Muscle artifacts in ECG signal are eliminated using
a. Highpass filter with cutoff frequency 0.05 Hz
b. Highpass filter with cutoff frequency 100 Hz
c. Lowpass filter with cutoff frequency 0.05 Hz
d. Lowpass filter with cutoff frequency 100 Hz

88. The greatest volume of gas that can be inspired by voluntary effort after maximum expiration is a
a. Inspiratory capacity
b. Total lung capacity
c. Vital capacity
d. Tidal Volume

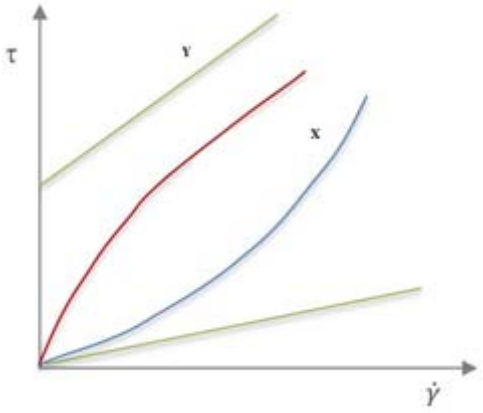
89. In surgical diathermy when the needle point electrode are stuck into the tissue and kept steady. This refers to
a. Electrotomy
b. Fulguration
c. Coagulation
d. Desiccation

90. Which of the following are the requirements for a single channel ECG telemetry system?
a. Muscle potential interference alone should be kept maximum
b. Motion artifacts and muscle potential interference to be kept maximum
c. Motion artifacts and muscle potential interference to be kept medium
d. Motion artifacts and muscle potential interference to be kept minimum

91. The equipment used for extra corporeal circulation of blood during cardiac surgery is called
a. Ventilator
b. Dialyser
c. Heart lung machine
d. Pacemaker

92. The membrane used for dialysis is made of
a. Polyethylene
b. Cellulose
c. Polyvinyl Chloride
d. Chitin

93. From the given graph of shear stress Vs strain rate the *X* and *Y* depicts _____ fluid property.



a. X-Pseudo plastic, Y-Newtonian
b. X-Dilatant, Y-Bingham plastic
c. X-Newtonian, Y-Thixotropic
d. X-Thixotropic, Y-Dilatant

94. A high strength steel rod E = 200 GPa and poisons ratio is 0.31 with a diameter of 5 cm is being subjected to a compressive load of 10 KN and experiencing a stress of 5 MPa. Compute the axial strain and the lateral strain.

a. Axial strain-25 μ strain, Lateral strain-8 μ strain

b. Axial strain-25 μ strain, Lateral strain-78 μ strain

c. Axial strain-78 μ strain, Lateral strain-25 μ strain

d. Axial strain-8 μ strain, Lateral strain-25 μ strain

95. A small artery has a length of 1.1 mm and a radius of 25 μ m. If the pressure drop across the artery is 1.3 KPa, calculate the flow rate. The viscosity of the blood is 3 Pa.second.

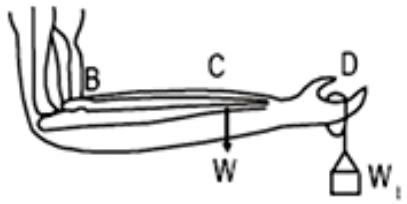
a. 16×10^{-16} m^3/sec

b. 25×10^{-17} m^3/sec

c. 6×10^{-14} m^3/sec

d. 32×10^{-15} m^3/sec

96. For the given figure BC = 15 cm, BD = 35 cm, W = 20 N, W1 = 80 N compute the net moment at the joint B



a. 19 Nm

b. 31 Nm

c. 28 Nm

d. 300 Nm

97. Which one of the following is not a characteristic of PET?

a. Positron emitters

b. Lead collimators

c. 511 keV photons

d. Absolute attenuation correction

98. The visibility of anatomical detail in a CT image will increase when:

a. The field of view is increased.

b. The matrix size is decreased.

c. The smoothing filter algorithm is used.

d. The slice thickness is decreased

99. S1: Ultrasound velocity in bone is greater than in the brain

S2: Ultrasound acoustic impedance is not related to the density of matter

a. S1 is True & S2 True

b. S1 is True & S2 False

c. S1 is False & S2 False

d. S1 is False & S2 True

100. What is T1 Relaxation time?

a. Spin-Lattice relaxation

b. Spin-Spin relaxation

c. Spin-recovery relaxation

d. Spin-echo relaxation

PAPER III

12 – CHEMICAL ENGINEERING

(Answer ALL questions)

41. Tooth paste is an example of ———— fluid.
    a. Newtonian
    b. Power law
    c. Bingham plastic
    d. Pseudo plastic

42. Friction factor in flow through conduit is analogous to ———— in flow around submerged objects.
    a. Shape factor
    b. Roughness factor
    c. Drag coefficient
    d. Shear stress

43. Same force will prevail in model and Prototype under
    a. Conditional similarity
    b. Dynamic similarity
    c. Geometric similarity
    d. Kinematic similarity

44. Inclined manometer is used for
    a. determining high pressure
    b. determining low pressure
    c. determining small differences in pressure
    d. highly viscous liquids

45. A suspension of uniform particles in water at a concentration of 500 kg of solids per cubic meter of slurry is settling in a tank. Density of the particles is 2500 kg/m3 and terminal velocity of a single particle is 20 cm/s. What will be the settling velocity of suspension? Richardson and Zaki index is 4.6.
    a. 20 cm/s
    b. 4.3 cm/s
    c. 7.16 cm/s
    d. 3.58 cm/s

46. Which of the following statements are CORRECT?
    (P) For a rheopectic fluid, the apparent viscosity increases with time under a constant applied shear stress
    (Q) For a pseudoplastic fluid, the apparent viscosity decreases with time under a constant applied shear stress
    (R) For a Bingham plastic, the apparent viscosity increases exponentially with the deformation rate
    (S) For a dilatant fluid, the apparent viscosity increases with increasing deformation rate
    a. P and Q only
    b. Q and R only
    c. R and S only
    d. P and S only

47. Which of the following minerals is not subjected to magnetic separation method?
    a. Rutile
    b. Galena
    c. Chromite
    d. Siderite

48. Equivalent diameter of a particle is the diameter of the sphere having the same
    a. Ratio of surface to volume as the actual volume
    b. Ratio of volume to surface as the particle
    c. Volume as the particle
    d. Surface as the particle

49. The unit of filter medium resistance is
    a. kg m^{-1}
    b. m^{-1}
    c. m kg^{-1}
    d. kg^{-1}

50. A generalized relation for crushing is $d\left(\frac{P}{m}\right) = -K\frac{d\overline{D}_s}{D_s^n}$ the solution for this equation leads to the Rittengers law for 'n' equal to

a. 1

b. 2

c. 3

d. 4

51. The Value of Gibbs free energy change at equilibrium condition is

a. Greater than one

b. Less than one

c. Equal to one

d. Equal to zero

52. Match the technologies in Group 1 with the entries in Group 2 :

Group – 1	Group 2
(P) Urea manufacture	(I) Microencapsulation
(Q) Coal gasification	(II) Ultra-low sulphur diesel
(R) Controlled release of chemicals	(III) Shale oil
(S) Deep hydro-desulphurization	(IV) Prilling tower
	(V) Gas hydrates
	(VI) Gas – solid non-catalytic reaction

a. P-I, Q-V, R -II, S-VI

b. P-IV, Q-VI, R-I, S-II

c. P-IV, Q-I, R-III, S-II

d. P-V, Q-VI, R-IV, S-II

53. An arbitrary scale used in sugar industry is

a. °API

b. ° Baume

c. ° Brix

d. ° Twaddle

54. A typical example of an exothermic reversible reaction conducted at high pressures in industry is

a. dehydration of ethanol,

b. methanol synthesis,

c. reformation of ethane,

d. polymerisation of ethylene,

55. Aniline point test of an oil qualitatively indicates

a. Naphthalene content

b. Paraffin content

c. Aromatic content

d. Olefin Content

56. What is the Temperature at which ^oC is equal to ^oF?

a. 0

b. 32

c. – 40

d. – 32

57. $CaCO_3$ Contains _____ of Calcium.

a. 12%

b. 35%

c. 60%

d. 40%

58. What mass of 75% pure $CaCO_3$ will be required to neutralize 50 ml of 0.5M HCL solution according to following reaction?

$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

a. 1.67 g
b. 3.35 g
c. 4.23 g
d. 5.05 g

59. What is the heat capacity of $Na_2SO_4.10H_2O$ at room temperature using Kopp's rule? (The atomic heat capacities of elements (J/g-atomK) are 26.04 for Na, 22.6 for S, 16.8 for O and 9.6 for H)

a. 325.4
b. 501.9
c. 65.44
d. 177.90

60. In the process of producing caustic (NaOH), 4000 kg/h of a solution containing 10 wt% NaOH is evaporated in the first evaporator, giving a 20% NaOH solution. This is then fed into a second evaporator which gives a product of 50% NaOH. The amount of water removed from each evaporator is

a. 2000 kg, 1200 kg
b. 1000 kg, 1200 kg
c. 2000 kg , 1000 kg
d. 1200 kg, 600 kg

61. The change in the Gibbs free energy for the vapourisation of a pure substance is

a. Positive
b. Negative
c. Zero
d. May be positive or negative

62. Assuming that CO_2 obeys the perfect gas law, the density of CO_2 in kg/m^3 at 536 K and 202.6 kPa is

a. 1
b. 2
c. 3
d. 4

63. A three stage compressor is used to compress a gas at 1 bar to a final pressure of 125 bar. For minimum work, the pressure ratios in each stage should be

a. 25
b. 5
c. 41.67
d. 26.24

64. The ordinary vapour compression cycle for refrigeration is less efficient than the Carnot cycle , because in the former,

a. Evaporation process is non-isothermal
b. A two–phase mixture is to be compressed
c. Vapour leaving the compressor is superheated
d. Expansion process results in liquefaction

65. A cyclic engine exchanges heat with two reservoirs maintained at 100° C and 300° C, respectively. The maximum work (in J) that can be obtained from 1000 J of heat extracted from the hot reservoir is

a. 349
b. 651
c. 667
d. 1000

66. An irreversible, homogeneous reaction A→products, has the rate expression :

$$\text{Rate} = \frac{2C_A^2 + 0.1C_A}{1 + 50\,C_A}$$

where C is the concentration of A.

CA varies in the range 0.5 – 50 mol/m^3.

For very high concentration of A, the reaction order tends to :

a. 0
b. 1
c. 1.5
d. 2

67. A gaseous reaction A→ 2B + C takes place isothermally in a constant pressure reactor. Starting with a gaseous mixture containing 50% A (rest inerts), the ratio of final to initial volume is found to be 1.6. The percentage conversion of A is

a. 30

b. 50

c. 60

d. 74

68. A reaction A→B is to be conducted in two CSTR in series. The steady state conversion desired is Xf The reaction rate as a function of conversion is given by r = –1/(1+X). If the feed contains no B, then the conversion in the first reactor that minimizes the total volume of the two reactors is

a. $1–X_f$

b. $0.2\ X_f$

c. $0.5\ X_f$

d. $0.5\ (1–X_f)$

69. Catalyst pellets have a density of 2.0 g/cc. If the specific surface area is 75 m^2/g and the average pore diameter is 8×10^{-7} cm. What is the porosity of the catalyst?

a. 0.4

b. 0.5

c. 0.3

d. 0.7

70. What is the Knudsen diffusion coefficient for cumene at 510° C through the pores of a catalyst of porosity 0.51 and density 1.14 gm/cm^3 . The specific surface area is 342 m^2/gm

a. 2.46 cm^2/sec

b. 6.46×10^{-3} cm^2/sec

c. 8.46×10^{-3} cm^2/sec

d. 1.05×10^{-4} cm^2/sec

71. For true counter current flow in a shell and tube heat exchanger, the value of correction factor FT is

a. 1

b. 0.75

c. 0.95

d. 0.75 – 0.95

72. In a completely opaque medium, if 50% of the incident monochromatic radiation is absorbed, then which of the following statements are **CORRECT**?

(P) 50% of the incident radiation is reflected

(Q) 25% of the incident radiation is reflected

(R) 25% of the incident radiation is transmitted

(S) No incident radiation is transmitted

a. P and S only

b. Q and R only

c. P and Q only

d. R and S only

73. In a furnace the wall thickness is 60 cm and is 100 cm wide by 150 cm height made of material with thermal conductivity 0.4 w/mk. The temperature inside and outside are 1000° and 4° C respectively.

The thermal resistance is

a. 1 K/W

b. 2 K/W

c. 18 K/W

d. 15 K/W

74. Sun's surface at 5800 K emits radiation at a wavelength of 0.5μ . A furnace at 300°C will emit through a small opening, radiation at a wavelength of nearly

a. 10μ

b. 5μ

c. 0.25μ

d. 0.025μ

75. A chemical having specific heat of 3.3 kJ/kg K flowing at the rate of 20000 kg/h enters a parallel flow heat exchanger at 120°C. The flow rate of cooling water is 50000 kg/h with an inlet temperature of 20°C. The overall heat transfer coefficient is 1050 W/m^{2}K. The heat transfer area is 10 m^2 Take for water, specific heat = 4.186 kJ/kgK. Effectiveness of the heat exchanger will be

a. 0.2
b. 0.3
c. 0.4
d. 0.6

76. Which of the following happens in the use of Raschig rings in place of crushed stones as packing in packed beds (other things being same)?

a. increases pressure drop, increases surface area
b. increases pressure drop, decreases surface area
c. decreases pressure drop, increases surface area
d. decreases pressure drop, decreases surface area

77. Kirkbride equation is used for determining the

a. Rmin
b. Nmin
c. Nopt
d. Feed tray location

78. In a triple effect backward feed evaporator, the pressure of vapor space in each of the effect is related by (Hint: Use steam entry as the I effect)

a. P1=P2=P3
b. P1>P2>P3
c. P1<P2<P3
d. cannot be said

79. A mixture of toluene (40%) and benzene (60%) is fed to the Distillation column; recovery of benzene is 20% at the top, what is the ratio of flow rate of benzene from Distillate to the bottoms? (Based on 1000 Kg of feed)?

a. 0.6
b. 0.2
c. 0.25
d. 0.4

80. A spherical naphthalene ball of 2mm diameter is subliming very slowly in stagnant air at 25°C. The change in the size of the ball during the sublimation can be neglected. The diffusivity of naphthalene in air at 25°C is 1.1×10^{-6} m^2/s. The value of mass transfer coefficient is B $\times 10^{-3}$ m/s, where B (up to one decimal place) is

a. 1.1
b. 1.2
c. 1.3
d. 1.4

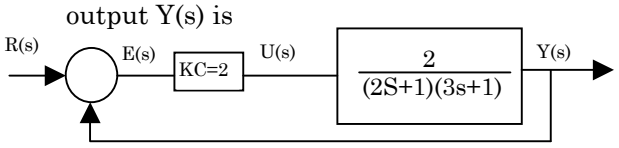
81. The inverse Laplace transform of $\frac{1}{2s^2+3s+1}$ is

a. $e^{-t/2} - e^{-t}$
b. $2e^{-t/2} - e^{-t}$
c. $e^{-t} - 2e^{-t/2}$
d. $e^{-t} - e^{-t/2}$

82. The characteristic equation of a closed loop system using a proportional controller with gain K_C is $12s^3 + 19\ s^2 + 8s + 1 + K_C = 0$. At the onset of instability, the value of K_C is

a. 35/3
b. 10
c. 25/3
d. 20/3

83. The block diagram for a control system is shown below: for a unit step change in the set point, R(s), the steady state offset in the output Y(s) is



a. 0.2
b. 0.3
c. 0.4
d. 0.5

84. Given the characteristic equation below, what is the number of roots which will be located to the right of the imaginary axis
$s^4+5s^3-s^2-17s+12 = 0$?
a. One
b. Two
c. Three
d. Zero

85. Given the process transfer function $G_P = 4/(\tau s+1)^2$ and the disturbance transfer function $G_d = 2/(\tau s+1)$, what is the correct transfer function for the Feed Forward Controller for perfect disturbance rejection?
a. $-2(\tau s+1)$
b. -1
c. $-0.5(\tau s+1)$
d. $-(\tau s+1)^2$

86. Given the process transfer function $G_P = 20/(s-2)$, and controller transfer function $G_C = K_C$, and assuming the transfer function of all other elements in the control loop are unity, what is the range of K_C for which the closed loop response will be stable?
a. $K_C < 1/10$
b. $K_C < 1/100$
c. $1/100 < K_C < 1/10$
d. $K_C > 1/10$

87. The value of ultimate period of oscillation P_u is 3 minutes, and that of the ultimate controller gain K_{cu} is 2. What is the correct set of tuning parameters (controller gain K_C, the derivative time constant τ_D in minutes, and the integral time constant τ_1 in minutes) for a PID controller using Zielger-Nichols controller settings?
a. $K_C = 1.1$; $\tau_1 = 2.1$; $\tau_D = 1.31$
b. $K_C = 1.5$; $\tau_1 = 1.8$; $\tau_D = 0.51$
c. $K_C = 15$; $\tau_1 = 1.8$; $\tau_D = 0.51$
d. $K_C = 1.2$; $\tau_1 = 1.5$; $\tau_D = 0.38$

88. A system has poles at 0.01 Hz, 1 Hz and 80 Hz, zeros at 5 Hz, 100 Hz, and 200 Hz. The approximate phase of the system responds at 20 Hz is
a. $+90^\circ$
b. -90°
c. $+180^\circ$
d. -180°

89. The numerical technique used to solve simultaneous equation is
a. Newton's method
b. Regression method
c. Intersection method
d. Gauss Elimination method

90. The Antoine constant for the component is given by A = 16.678; B = 3640.2; C = 219.61. The pressure (kPa) for the temperature 373 K is
a. 100
b. 200
c. 37.6
d. 50.8

91. Which one of the following adsorbents is preferred for adsorbing components from aqueous solutions and moist gases because of its poor affinity with water?
a. Activated carbon
b. Silica Gel
c. Activated alumina
d. Molecular sieve zeolites

92. Favourable adsorption isotherms are those
    a. Which are linear and pass through the origin
    b. Which are concave towards the solid-concentration axis throughout
    c. Which are concave towards the fluid-concentration axis throughout
    d. Which possess one or more points of inflection

93. Mass transfer zone in fixed bed adsorber is
    a. The portion of the bed with constant adsorbate concentration
    b. The portion of the bed saturated with adsorbate
    c. The portion of the bed in which concentration changes from feed concentration to zero
    d. The zone that follows the unused bed and saturated bed

94. Adsorption of acetone from aqueous solution on activated carbon can be represented by the Langmuir equation $q = \frac{0.190\,C}{1 + 0.146C}$ where q is the adsorbate loading mol/kg, C = solute concentration in aqueous solution mol/m^3. The maximum adsorbate loading in kg acetone/kg carbon is
    a. 0.0755
    b. 1.3014
    c. 0.1658
    d. 0.0096

95. Rancidity of oil can be reduced by
    a. Decoloration
    b. Hydrogenation
    c. Oxidation
    d. purification

96. Which of the following is not a method of source reduction?
    a. Recycling
    b. Municipal composting
    c. Incineration
    d. Making package that weight less

97. The major contributor of carbon monoxide is
    a. Motor vehicle
    b. Industrial processes
    c. Stationary fuel combustion
    d. Domestic usage

98. What is the value of BOD of industrial sewage in kg/day, given population equivalent as 6000 persons?
    a. 480
    b. 160
    c. 270
    d. 100

99. The aerobic decomposition of sulfurous organic matter gives
    a. Nitrites and water
    b. Carbon dioxide and water
    c. Sulfates and water
    d. Nitrogen and Ammonia

100. Which of the following is an example of attached growth reactor?
    a. Trickling filter
    b. Up-flow anaerobic sludge reactor
    c. Lagoon
    d. Aerobic digestion

PART III

13 – FOOD TECHNOLOGY

(Answer ALL questions)

41. Tetany is caused by deficiency of
    a. Zinc
    b. Selenium
    c. Copper
    d. Calcium

42. Which of the followings are considered as micronutrients?
    a. Vitamins and water
    b. Mineral and protein
    c. Vitamins and mineral
    d. Protein and lipids

43. Excess intake of food rich in phytic acid reduces absorption of
    a. Folic acid
    b. Protein
    c. Vitamin D
    d. Minerals

44. Chelating agents are used to reduce enzymatic browning of food because it reduces availability of the following cofactor
    a. Iron
    b. Copper
    c. Zinc
    d. Calcium

45. Which one of the following lipid molecules exhibit emulsification property?
    a. Lecithin
    b. Unsaturated fatty acids
    c. Steroids
    d. Sphingosine

46. What is the most important fatty acid for development of brain and function?
    a. Linoleic acid
    b. Stearic acids
    c. Palmitic acid
    d. Docosahexaenoic acid

47. The method of evaluating the quality of a protein is
    a. PDCAAS
    b. PDDAC
    c. PAADS
    d. PCAAS

48. Hemicellulose is an example for
    a. Low calorie sweetener
    b. Artificial sweetener
    c. Homopolysaccharide
    d. Heteropolysaccharide

49. Which one of the following is not the application of starch in food preparation?
    a. Thickener
    b. Shortening agent
    c. Gelling agent
    d. Bulking agent

50. Low protein diet is recommended for people with following condition
    a. Marasmus
    b. Immunodeficiency
    c. Renal failure
    d. Kwashiorkor

51. Which one of the following is not true about the naturally occurring colours?
    a. Mostly stable at extreme condition during food processing
    b. It can be isolated from plants
    c. It can exhibit antioxidant activity
    d. Also called as pigment

52. Which of the following methods is used to measure the water content of food?
    a. Formol titration
    b. Zak's method
    c. Polarimetry
    d. Karl Fischer titration

53. Which of the following is processing contaminants?
    a. Mycotoxins
    b. Aflatoxins
    c. Nitrosamines
    d. Scombrotoxin

54. Which of the following is a Intrinsic Parameters that affects microbial Growth?
    a. Temperature
    b. Water activity
    c. Time
    d. Atmospheric conditions

55. Proximate analysis of major components in food generally does not include
    a. Amino acid composition
    b. Fat
    c. Carbohydrates
    d. Protein

56. What is the main type of micro-organism responsible for food poisoning?
    a. Bacteria
    b. Mould
    c. Virus
    d. Parasite

57. Which of the following is not a major parameter in Sensory food evaluation?
    a. Colour
    b. Length of the fibre
    c. Texture
    d. Smell and taste

58. Which of the following is mandatory before HACCP certification?
    a. GMP
    b. Risk assessment
    c. ISO 9000
    d. ISO 22000

59. Food business including small scale or cottage or Petty food businesses whose annual turnover does not exceed Rs 12 lakhs by default falls under the purview of
    a. Central Licensing Authority
    b. State Licensing Authority
    c. Registration Authority
    d. National Certification Authority

60. Which of the following is right about Food Recall?
    a. Call from the food industry to the consumers to visit the industry
    b. Recalling the production methods involved in a food industry by the production manager
    c. Action taken by a manufacturer or distributor to protect the public from products that may cause health problems
    d. Action taken to segregate the produced food inside the industry

61. CCP in HACCP stands for
    a. Cross contact points
    b. Critical control points
    c. Critical contact points
    d. Critical certification points

62. The main objective of ISO 22000 is to
    a. Increase the employee productivity
    b. Increase the employee morale
    c. To certify the plant
    d. To establish a food safety management system

63. Which is the main index organism to achieve complete safety of milk in pasteurization of milk?
    a. *Mycobacterium tuberculosis*
    b. *Staphylococcus Aureus*
    c. *E. Coli.*
    d. *Listeria Monocytogenes*

64. "Date of manufacture" indicates the
    a. Date on which the food is procured
    b. Date on which the food becomes the product as described
    c. Date on which the food is placed in container in which it will be ultimately sold
    d. Date on which it is packed

65. A standard practice ————, which restores nutrients that were lost in processing to near original levels.
    a. Ergonomics
    b. Functional
    c. Fortification
    d. Enrichment

66. What is produced in a calf's stomach to help curdle milk and used in the production of cheese?
    a. chymosin
    b. bacteriophage
    c. antibiotic
    d. pasteurization

67. Fruit juices are deaerated before allowed in to the pasteuriser is done in order to
    a. Reduce fouling of pasteuriser
    b. Reduce oxidation deterioration
    c. Increase the rate of heat transfer
    d. Decrease the rate of heat transfer

68. Which of the following foods cannot be treated at high pressure?
    a. Bread
    b. Meat
    c. Fruit juice
    d. Jam

69. Which of the following food preservation methods are suitable to reduce the loss of nutrients when preparing fruits and vegetables?
    a. Freezing
    b. Using preservatives
    c. Drying and blanching
    d. All of the above

70. In freeze drying, removal of moisture is due to
    a. Boiling
    b. Condensation
    c. Sublimation
    d. Pressure reduction

71. The water activity of the food product at the end of constant drying rate is
    a. Less than 1
    b. Remains constant at 1
    c. Equals to zero
    d. Drops below 2

72. In high fructose corn syrup production, the enzyme used for the conversion of glucose to fructose is
    a. Isomerase
    b. Invertase
    c. Amylase
    d. Epimerase

73. Unplanned crystallization of sugar in a confectioneries is called
    a. Winnowing
    b. Panning
    c. Fudging
    d. Engrossing

74. What is the form of Iodine in Iodized Salt?
    a. I_2
    b. KIO_3
    c. KI
    d. NaI

75. Tocopherol is an example of
    a. Anticaking agent
    b. Flavouring agent
    c. Antioxidant
    d. None of the above

76. At which temperature frozen storage is generally operated?
    a. –0°C
    b. –18°C
    c. –50°C
    d. –60°C

77. A solution is made by dissolving 1 kilo mole of solute in 2000 kg of solvent. The molality of the solution is
    a. 2
    b. 1
    c. 0.5
    d. 1.5

78. A very dilute solution is prepared by dissolving 'x_1' mole of solute in 'x_2' mole of a solvent. The mole fraction of solute is approximately equal to
    a. x_1 / x_2
    b. x_2 / x_1
    c. $1-(x_1 / x_2)$
    d. $1 / x_2$

79. The increase in the temperature of the aqueous solution will result in decrease of its
    a. weight % of the solute
    b. mole fraction of the solute
    c. molarity
    d. molality

80. What percent of Ca by weight is present in $CaCO_3$?
    a. 40
    b. 48
    c. 96
    d. 12

81. What is the equivalent weight of Na_2CO_3 in the reaction, represented by $Na_2CO_3+HCl \rightarrow NaHCO_3+NaCl$?
    a. 53
    b. 5.3
    c. 106
    d. 10.6

82. Multistage compressors are used in industry, because they
    a. reduce the cost of compressor
    b. reduce the size requirement
    c. resemble closely to isothermal compression
    d. are easy to control

83. At which of the following conditions it is easy to control.Net positive suction head (NPSH) of a centrifugal pump?
   a. greater than the vapour pressure of the liquid
   b. less than the vapour pressure of the liquid
   c. equal to the vapour pressure of the liquid
   d. less than barometric pressure

84. Assuming flow to be laminar, if the diameter of the pipe is halved, then the pressure drop will
   a. increase
   b. decrease
   c. remain same
   d. be quadrupled

85. Which type of pump is used for the transfer of solution of thick slurry?
   a. reciprocating
   b. gear
   c. diaphragm
   d. centrifugal

86. Cavitation in a pump creates so many undesirable effects. Out of the following, which is not an undesirable effect created by cavitation?
   a. Decrease in effect
   b. Increase in thrust
   c. Develops noise
   d. Develops high pressure

87. How the head loss in turbulent flow in a pipe varies?
   a. directly as the velocity
   b. inversely as the square of the velocity
   c. approximately as the square of the velocity
   d. inversely as the square of the diameter

88. Power required by a centrifugal pump is proportional to (Where, D = diameter, N = rpm)
   a. N^2D^3
   b. ND^2
   c. N^2D
   d. N^3D

89. Apples are wrapped in waxed paper to
   a. Prevent sunlight for changing its colour
   b. Prevent aerobic respiration
   c. Prevent injury
   d. To make it attractive

90. Which of the following is a unique example of emulsion technology?
   a. Butter making
   b. Ice cream preparation
   c. Cream separation
   d. Chips making

91. In which of the following different plastics are combined to get certain desirable properties?
   a. Monomers
   b. Plasticizers
   c. Homopolymer
   d. Copolymer

92. Which of the following is a secondary refrigerant?
   a. NH_3
   b. H_2O
   c. CO_2
   d. R_{12}

93. Which of the following evaporators is always kept filled with liquid refrigerant?

a. Plate

b. Fin and tube

c. Flooded

d. Dry expansion

94. In ball mill, at which speed there will be centrifugation?

a. Operating

b. Normal

c. Critical

d. Below normal

95. If added sugar appear first or second on food label list for a packaged food, it means

a. List is in alphabetical

b. Its high in sugar

c. Its low in sugar

d. Position on the list is arbitrary

96. Angle formed by pouring flour as heap on flat surface is known as

a. Contact angle

b. Angle of repose

c. Angle of rip

d. Critical angle

97. In which of the following evaporators fruit juices can be concentrated?

a. Long tube

b. High pressure

c. Falling film

d. Crude filter paper

98. Heat sensitive material's with high heat of vaporization may be economically separated using

a. Liquid extraction

b. Distillation

c. Evaporation

d. Adsorption

99. Vertical screw mixers are used for mixing of

a. High viscous liquids

b. Low viscous liquids

c. Moderate viscous fluids

d. Dry solids

100. Zero energy cool chambers work on the principle of ———— cooling.

a. Hydro

b. Evaporative

c. Vacuum

d. Room

PART III

14 – GEO-INFORMATICS

(Answer ALL questions)

41. Chaining along a straight line, the leader of the party has 4 arrows in his hand while the follower has 6 arrows. Distance of the follower from the starting point is

a. 4 Chains

b. 5 Chains

c. 6 Chains

d. 10 Chains

42. In a closed traverse ABC, the following readings were taken: If station A is free from local attraction, correct bearing of CB is

Line	Fore bearing	Back bearing
AB	19°	200°
BC	100°	277°
CA	227°	49°

a. 280°

b. 279°

c. 276°

d. 277°

43. The following readings were taken on a uniformly sloping ground 0.500m, 1.000m, 1.500m, 2.000m, 1.200m, 1.700m, 2.200m, 2.700m. The difference in elevation between the first and last station is

a. 3.000m (fall)

b. 3.000m (rise)

c. 2.200m (fall)

d. 2.200m (rise)

44. The coordinate of A is 100m, 100m. The coordinate of B is 50m, 50m. The bearing of line AB is

a. 45°

b. 135°

c. 225°

d. 315°

45. How much time is required by GPS satellites to make one complete revolution around the Earth?

a. 12 hours (Standard Time)

b. 12 hours (Solar Mean Time)

c. 12 hours (Solar apparent Time)

d. 12 hours (Sidereal Time)

46. Two straight lines intersect at an angle of 120°. The radius of curve joining the straight lines is 500m. The length of long chord and mid ordinate in metres of the curve are

a. 250, 33.493

b. 500, 66.987

c. 866.025, 250

d. 500, 250

47. The star's hour circle coincides with the observer meridian, the star said to be

a. Culminate

b. Prime vertical crossing

c. Elongation

d. Nutation

48. The maximum spectral radiant exitance from earth features occurs at a wavelength of

a. about 0.7 μm

b. about 1.7 μm

c. about 9.7 μm

d. about 19.7 μm

49. Plant reflectance in the range of 0.7 to 1.3 μm caused generally by the

a. water content in the plant

b. cell structure of the plant

c. age of the plant

d. chlorophyll in the plant

50. The orbital period of geo-synchronous satellite is

a. one sidereal day

b. one solar day

c. 28 sidereal days

d. 28 solar days

51. (Green reflectance – SWIR reflectance)/ (Green reflectance + SWIR reflectance) is known as

a. NDSI

b. NDVI

c. EVI

d. GARI

52. The constructive and destructive interference from the multiple scattering returns that occur within each resolution cell is called

a. Surface roughness

b. Speckle

c. Volume scattering

d. Facet backscatter

53. The first experimental space borne SAR satellite is named as

a. JERS-1

b. ERS-1

c. SEASAT-A

d. RADARSAT-1

54. NISAR can be expanded as

a. NASA-ISRO Synthetic Aperture Radar

b. NASA-Indian Synthetic Aperture Radar

c. NASA Interferometric Synthetic Aperture Radar

d. NASA Indian Space Atmospheric Radar

55. End member in hyper spectral remote sensing is known as

a. Pure Pixel

b. Mixed Pixel

c. Linear Pixel

d. Non linear pixel

56. Which of the following is not the hyperspectral sensor?

a. Hyperion

b. HIRS

c. CHRIS

d. HYDICE

57. Which of the following equipments is used to determine the sensor position in aerial and satellite based LIDAR platforms?

a. DIAL

b. LRA

c. IMU

d. Doppler LIDAR

58. The process of extracting information from the image is called as

a. Image enhancement

b. Image restoration

c. Image Analysis

d. Image compression

59. When linearly enhancing an image to higher radiometry, the count of unique digital numbers of the image

a. Increases

b. Decreases

c. Remain the same

d. Made to 1

60. Which of the following indices is generally used for yield forecast model?

a. NDVI

b. SAVI

c. Soil brightness index

d. None of the above

61. Resampling is done to apply correction on a pixel with respect to its

a. Value

b. Location

c. Both

d. None of the above

62. Fourier transform operates in which of the following domain?

a. Chromacity Plot

b. Band spectral scatter Plot

c. Frequency spectrum

d. None of the above

63. Mixel refers to

a. Combination of two or many pixels

b. Combined value for the same pixel at different bands

c. Combined reflection values from different land cover features

d. Combined reflection atmospheric effect with land cover features

64. Wavelet transform decomposes image into ———— number of components

a. 2

b. 1

c. 4

d. 3

65. Which is a colour attribute that describes a pure colour?

a. Saturation

b. Hue

c. Brightness

d. Intensity

66. Which of the following is not univariate statistical parameter?

a. mean

b. standard deviation

c. variance

d. correlation

67. The truth values of traditional set theory is ———— and that of fuzzy set is ————

a. Either 0 or 1, between 0 & 1

b. Between 0 & 1, either 0 or 1

c. Between 0 & 1, between 0 & 1

d. Either 0 or 1, either 0 or 1

68. Aerial photographs were taken with a camera having a 210-mm-square format and a 305mm focal length of the field of view of camera is

a. 103^{o} 50'

b. 77^{o} 53'

c. 51^{o} 55'

d. 25^{o} 58'

69. Metric cameras must have

1. Low lens distortions
2. Fixed focal length
3. Adjustable focal length
4. Reseau mark
5. Fiducial mark

a. 1, 2, 4 and 5

b. 1, 2 and 5

c. 1, 2 and 4

d. 1, 3, 4 and 5

70. A camera equipped with a focal length of 150mm is used to take a vertical photograph from a flying height of 2750m above mean sea level. If the terrain is flat and located at an elevation of 500m above mean sea level. The scale of the photograph will be

a. 1: 1500

b. 1: 1833

c. 1: 15000

d. 1: 18330

71. Minimal number of ground control points are required for

a. Analogue aerotriangulation

b. Analytical aerotriangulation

c. Automated aerotriangulation

d. GPS aerotriangulation

72. The operator measures the y-parallaxes at six or more points and the ———— relative orientation parameters are computed by least squares adjustment.

a. Four

b. Five

c. Six

d. Eight

73. ATM is to be carried out for a strip of 20 aerial photographs with an end lap of 81%. How many number of photographs will have a ground control point that exists in extreme lower right corner of the third photograph?

a. 4

b. 5

c. 8

d. 10

74. A square area flat on the surface of the earth with a side of 100 m appears as 100 mm^2 on a vertical aerial photograph. The topographic map shows that a contour of 750 m passes through the area. If focal length of the camera is 250 mm^2, the height from which the aerial photograph was taken, is

a. 3250m

b. 2500m

c. 1750m

d. 1000m

75. If the height of features like buildings and trees are subtracted from the digital surface model, then the result is known as

a. Digital Exterior Model

b. Digital Interior Model

c. Digital Height Model

d. Digital Elevation Model

76. Which of the following statements are relevant to Digital photogrammetry work station?

i. The ability to store, manage, and manipulate very large image files

ii. The ability to perform computationally demanding image processing tasks

iii. To provide smooth roaming across entire image files and supporting zooming at various resolutions

iv. Scanning facility

a. i and ii

b. i and iv

c. i, ii and iii

d. i, ii and iv

77. What is the travel time for laser pulse to reach an object with an elevation of 210m, when the flying height is 510m?

a. 2000 second

b. 2000 millisecond

c. 2000 microsecond

d. 2000 nanosecond

78. An imaginary line drawn on a map joining places with the same rainfall is called
    a. Isohyet
    b. Isotherm
    c. Isobars
    d. Isopleth

79. Universal Transverse Mercator projection is
    a. Conical projection
    b. Cylindrical projection
    c. Zenithal projection
    d. Planner projection

80. What will be the ground distance, if map distance on 1 : 50,000 Scale map is measured as 5cm?
    a. 0.5 km
    b. 2.5 km
    c. 50 m
    d. 25 m

81. Projection most commonly used for mapping polar regions is
    a. Azimuthal
    b. Conic
    c. Oblique
    d. Cylindrical

82. Which of the following model is users Perception of Real World?
    a. Logical model
    b. Conceptual model
    c. Physical model
    d. Network model

83. A global mean sea level model used as reference surface for elevation is known as
    a. Datum
    b. Ellipsoid
    c. Geoid
    d. Sphere

84. Which one of the following is not a primary color in color wheel?
    a. Red
    b. Green
    c. Yellow
    d. Blue

85. What is meta data?
    a. Data about data
    b. Meteorology data
    c. Contour data
    d. Metamorphic data

86. Local operations can be applied on
    a. Single raster only
    b. Multiple raster only
    c. Single and multiple raster
    d. Vector

87. In OGC standards, OGC means
    a. Other Geoapatial consortium
    b. Open GIS Committee
    c. Open Geological Committee
    d. Open Geospatial Consortium

88. The third dimension used in GIS represents
    a. Latitude
    b. Altitude
    c. Magnitude
    d. Longitude

89. Which kind of data is mostly used in GIS?
    a. Numerical data
    b. Binary data
    c. Spatial data
    d. Boolean data

90. The abbreviation of TIN is
   a. Triangulated Irregular Network
   b. Temporal Information Network
   c. Traffic Internet Network
   d. Temperature Irregular Node

91. Which of the following is not a topological error?
   a. A gap between polygons
   b. Overlapped polygon
   c. Unclosed polygon
   d. Sliver polygon

92. Which of the following scale has absolute zero?
   a. Nominal Scale
   b. Ratio scale
   c. Interval scale
   d. Ordinal scale

93. Land cover in remote sensing corresponds to
   a. physical condition of ground surface
   b. physical condition of vegetation
   c. topography of the ground surface
   d. soil cover on land

94. SAR data is suitable for assessing the
   a. health of crop
   b. crop type
   c. phenology of crop
   d. moisture content of the crop

95. Barren rock will have NDVI of
   a. 0.1 or less
   b. 0.4 or less
   c. 0.1 or more
   d. 0.4 or more

96. Which of the following imagery can facilitate delineation and identification of local reliefs?
   a. Ortho imagery
   b. Stereo imagery
   c. PAN imagery
   d. Geocoded imagery

97. Identification and geo-location of anthropogenic features in x-y plane is called as
   a. Anthrometry
   b. Geo-anthrometry
   c. Planimetry
   d. Geo-planimetry

98. The spatial resolution of imagery recommended for assessing the damages of cultural features due to flood disaster is
   a. 20 m
   b. 30 m
   c. 60 m
   d. 90 m

99. Which of the following satellite data is useful for ocean monitoring?
   a. Sentinel – 1A
   b. Sentinel – 2B
   c. Sentinel – 3
   d. Sentinel – 5R

100. Satellite remote sensor captures the sea surface temperature upto a depth of
   a. 10 micron
   b. 50 micron
   c. 100 micron
   d. 150 micron

PART III

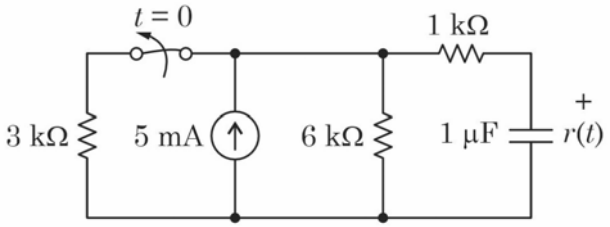
15 –INSTRUMENTATION, ELECTRONICS AND CONTROL ENGINEERING

(Answer ALL questions)

41. An inductor of 25 mH is subjected to an ac voltage of $v(t)$ = 100 cos (1000 t + 30°) V. Instantaneous power in the inductor at t = 0, will be,

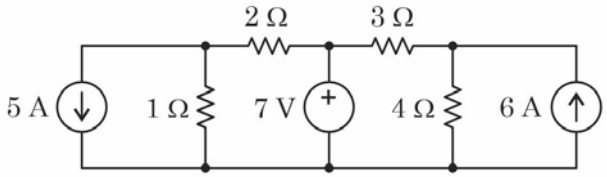
a. 25 W
b. 86.6 W
c. 150 W
d. 173.2 W

42. Assuming the circuit shown in figure below is in steady state before the switch opened at t = 0. The value of voltage across the capacitor $v(t)$ at $t = 0^+$ is,



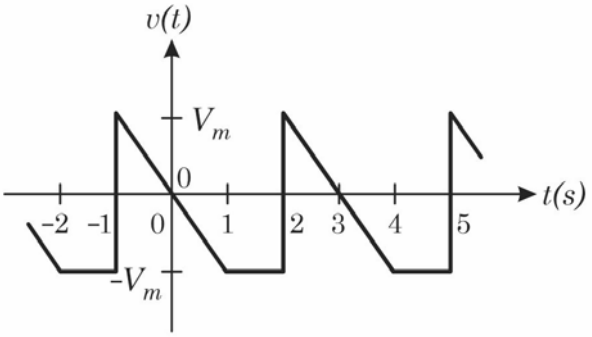
a. 10 V
b. 15 V
c. 20 V
d. 30 V

43. In the linear-bilateral network shown below according to superposition theorem the current through 1Ω resistor due to 5 A current source alone acting is,



a. 0.83 A
b. 3.33 A
c. 4.16 A
d. 5.31 A

44. The root mean square (rms) value of the voltage waveform shown below is

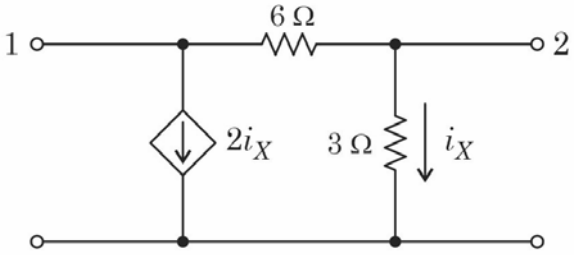


a. $V_m\sqrt{\frac{3}{2}}$
b. $V_m\sqrt{\frac{2}{3}}$
c. $V_m\sqrt{\frac{1}{2}}$
d. $V_m\sqrt{\frac{1}{3}}$

45. In a series RLC circuit, R=10 Ω , L= 1mH and C = 1nF. If the source voltage has a peak value of, V_m = 10 V, the power dissipated in the circuit at resonance is

a. 1 W
b. 2 W
c. 5 W
d. 10 W

46. In the two port network shown in figure below, the z-parameter, Z_{21} is



a. 1
b. –1
c. 3
d. –3

47. The system defined by the difference equation $y(n) = 0.3x(n) + 2$ can be classified as
a. Linear and Causal
b. Linear and Non-causal
c. Non-Linear and Causal
d. Non-Linear and Non-Causal

48. The Fourier transform of the signal $x(n) = 2^n u(n)$ is given by
a. $1/(1 - 2e^{j\omega})$
b. $1/(1 - 2e^{-j\omega})$
c. $1/(1 + 2e^{-j\omega})$
d. Fourier Transform does not exist for the given $x(n)$

49. The step response of a CT LTI system whose $h(t) = u(t)$ is given by
a. $e^{-t}u(t)$
b. $u(t)$
c. $tu(t)$
d. $\delta(t)$

50. Given $X(s) = 1/(s+a)$, ROC: $\sigma < -a$, the CT signal $x(t)$ is given by
a. $x(t) = -e^{-at}u(-t)$
b. $x(t) = -e^{at}u(t)$
c. $x(t) = e^{-at}u(-t)$
d. $x(t) = e^{at}u(t)$

51. The circular convolution of the sequences $x(n) = \{1,1,2,1\}$ and $x2(n) = \{1,2,3,4\}$ is given by
a. {2,3,5,5}
b. {13,14,12,12}
c. {1,2,6,4}
d. {13,14,11,12}

52. The desirable characteristics of the window sequence used in FIR filter design include
a. Narrow central lobe
b. Broad side lobes
c. Small central lobe energy
d. Gradually increasing side lobe energy

53. The reverse saturation current of a PN junction diode at room temperature is 10uA and the thermal voltage is 26mV. If η =2 for Silicon, the diode current for a forward bias voltage of 0.6V is approximately
a. 1 A
b. 1 mA
c. 10 A
d. 10 mA

54. A BJT has I_B = 80uA and I_C = 2mA. If I_B increases by 25%, find I_C.
a. 25 mA
b. 2.5 mA
c. 2 mA
d. 20 mA

55. Compared to the P-Channel MOSFET, N-Channel MOSFET has
   a. Smaller drain resistance and smaller size
   b. Smaller drain resistance and larger size
   c. Larger drain resistance and smaller size
   d. Larger drain resistance and larger size

56. With respect to the performance of CE, CB and CC configurations of BJT, Choose the wrong statement from the following:
   a. CB and CC have nearly the same voltage gain
   b. CC amplifier has the largest current gain
   c. CE amplifier has the smallest input impedance
   d. CB has the largest output impedance

57. An OPAMP is configured as a non-inverting amplifier with 10K resistance in the feedback path and 2K resistance connected between inverting terminal and GND. What is the gain of the amplifier?
   a. –5
   b. +5
   c. –6
   d. +6

58. An active HPF filter is designed with $R_f = R_i = 10K$, C = 0.01uF and R = 15.9K. The cut-off frequency f_0 and Pass band gain A are calculated as
   a. f_0 = 10kHz, A = –2
   b. f_0 = 10kHz, A = 1
   c. f_0 = 1kHz, A = –1
   d. f_0 = 1kHz, A = 2

59. The expression $(A + B)(\overline{B} + C)(\overline{A} + C)$ when converted to sum of products form, will become
   a. $\overline{A}\,BC$
   b. $\overline{A}\,BC + A\overline{B}C$
   c. $\overline{A}\,BC + A\overline{B}C + AC$
   d. $\overline{A}\,BC + A\overline{B}C + AC + BC$

60. In a 1- to -16 demultiplexer, the number of control inputs will be
   a. 4
   b. 1
   c. 2
   d. 16

61. Data sheet of a certain eight bit A/D convertor lists the following specification: 8 bits, full scale error: 0.02% of full scale; full scale analog input : +5V. What is the quantization step size?
   a. 1.96 mv
   b. 19.607 mv
   c. 1 mv
   d. 20.607 mv

62. Of the logic families mentioned below, which one that consumes the least power?
   a. Low power TTL
   b. Low power schottky TTL
   c. CMOS
   d. ECL

63. A 4 - bit binary UP/DOWN counter is initially reset to 0000. The UP/DOWN mode select terminal designated as $\overline{U}/D$ on the pin configuration diagram of the IC is tied to logic HIGH level. What will be Counter's output state at the end of first clock pulse?
   a. 0001
   b. 1000
   c. 1111
   d. 0000

64. The largest number that can be processed by a microprocessor in a single operation is determined by the size of its
   a. external data bus
   b. internal data bus
   c. address bus
   d. control bus

65. Which of the following is an absolute instrument?
   a. Permanent Magnet Moving Coil Instruments
   b. Moving Iron Instruments
   c. Tangent galvanometer
   d. Energy meter

66. Two resistors R1 and R2 are connected in series. The values of resistance are R1 = $100 \pm 0.2\ \Omega$ and R2 = $150 \pm 0.04\ \Omega$. What is the uncertainty in the combined resistance for series arrangements?
   a. $-50 \pm 0.01734\ \Omega$
   b. $250 \pm 0.24\ \Omega$
   c. $250 \pm 0.01734\ \Omega$
   d. $50 \pm 0.0209\ \Omega$

67. A Potentiometer is a device for
   a. Comparing two Current
   b. Comparing two Voltage
   c. Measuring Current
   d. Measuring Current and Voltage

68. Maxwell's Inductance-Capacitance bridge is used for measurement of Inductance of
   a. low Q coils
   b. medium Q coils
   c. high Q coils
   d. low and medium Q coils

69. The rise time of an oscilloscope is expressed as
   a. $t_r = \frac{0.35}{BW}$
   b. $t_r = 0.35 \times BW$
   c. $t_r = \frac{0.25}{BW}$
   d. $t_r = 0.25 \times BW$

70. Electrodynamometer-type wattmeters have a construction where
   a. current coil is fixed
   b. voltage coil is fixed
   c. both voltage and current coils are movable
   d. both voltage and current coils are fixed

71. The PH value of a solution is 4. It indicates that concentration of hydrogen ions is
   a. 10^{-4} g/L and the solution is acidic
   b. 10^{-4} g/L and the solution is alkaline
   c. 10^{-4} mg/L and the solution is acidic
   d. 10^{-4} mg/L and the solution is alkaline

72. Charge amplifiers are used in order to amplify the output signals of
   a. Inductive
   b. Capacitive
   c. Resistive
   d. Piezoelectric and capacitive transducers

73. A thermistor has a resistance temperature coefficient of -5% over a temperature range of 25°C to 50°C. If the resistance of the thermistor is 100 Ω at 25°C, what is the resistance at 35°C?
   a. 50 Ω
   b. 100 Ω
   c. 150 Ω
   d. 200 Ω

74. A linear resistance potentiometer is 50 mm long and is uniformly wound with wire having a resistance of 10000 Ω. Under normal conditions, the slider is at the center of the potentiometer. What is the linear displacement when the resistance of the potentiometer as measured by a Wheatstone bridge is 3850 Ω ?
    a. 5.75 mm
    b. 6.25 mm
    c. 6.50 mm
    d. 6.75 mm

75. A 2.5 mm thick quartz piezoelectric crystal having a voltage intensity of 0.055 Vm/N is subjected to a pressure of 1.4 MN/m^2. If the permittivity of quartz is 40.6 × 10^{-12} F/m, calculate the output voltage
    a. 190.5 V
    b. 192.5 V
    c. 194.5 V
    d. 196.5 V

76. Signal conditioning is carried out by the capillary tubes which convert gas pressure into a mercury height. The statement pertains to
    a. Bourdon tube pressure gauge
    b. Pirani gauge
    c. Mcleod gauge
    d. Diaphragm pressure transducer

77. The Detector used in IR spectroscopy is
    a. Photomultiplier tubes
    b. Electron capture detector
    c. Thermal detectors
    d. Mass analyzer

78. What is the main limitation of using Beer lambert's law?
    a. It cannot be used for concentrations less than 0.1 M
    b. It cannot be used for concentrations greater than 0.1 M
    c. It cannot be used for concentrations less than 0.01 M
    d. It cannot be used for concentrations greater than 0.01 M

79. Which of the following is false with respect to chromatography?
    a. The chromatography column must be temperature controlled
    b. Mobile phase must be sent along with the sample
    c. Mobile phase reacts with the sample
    d. Stationary phase is inside the column

80. Chromatography is preferred in industries due to
    a. High accuracy and online analysis
    b. Multicomponent analysis
    c. High accuracy
    d. Multicomponent and online analysis

81. Which of the following analyzers is used for testing the quality of boiler feedwater?
    a. Paramagnetic oxygen analyzer
    b. Dissolved oxygen analyzer
    c. Silica analyzer
    d. Hydrogen disulphide (H_2S) analyzer

82. pH value from a pH meter should always be reported along with
    a. Temperature
    b. Conductivity value
    c. Total dissolved solids
    d. Pressure

83. An Optical Time Domain Reflectometer (OTDR) is a device used for _____.
    a. measurement of current
    b. measurement of voltage
    c. measurement of pressure
    d. determining the characteristics of an optical fiber cable

84. How many number of Modes of an optical fiber are there whose core diameter is 50 μm, refractive index of core is 1.484, refractive index of cladding is 1.470, and the wavelength of the light source is 850 nm?
    a. 682
    b. 37
    c. 1098
    d. 359

85. Which one of the following is a PN junction device that emits light when a current passes through it in the forward direction?
a. Light Dependent Resistor
b. Light Emitting Diode
c. He-Ne Laser
d. Ruby Laser

86. The spectral range of a function extends from 10.0 MHz to 10.2 MHz. What is the minimum sampling rate?
a. 4000 MHz
b. 400 MHz
c. 0.4 MHz
d. 40 MHz

87. An amplitude modulated wave $10[1+0.6\cos 2\pi 10^3 t]\cos 2\pi 10^6 t$ is to be detected by a linear diode detector. Find the value of resistance R if the capacitor used is 100pF.
a. $2.12\times10^6\ ohm$
b. $200\times10^{13}\ ohm$
c. $0.199\times10^{15} ohm$
d. $900\times10^2 ohm$

88. Which of the following statements is true in the case of TV transmission?
a. Frequency Modulation is employed for both sound and picture
b. Amplitude Modulation for picture and Frequency Modulation for sound are employed
c. Frequency Modulation for picture and Amplitude Modulation for sound are employed
d. Amplitude Modulation is employed for both sound and picture

89. Gain margin for marginally stable system in dB is
a. Greater than Zero
b. Less than Zero
c. Equal to Zero
d. Equal to One

90. What is the critical gain value of the system with characteristic equation
$s^4+5s^3+5s^2+4s+K=0$?
a. 1.36
b. 2.36
c. 3.36
d. 4.36

91. Lead compensator behaves like
a. Integrator
b. Differentiator
c. Low pass filter
d. Band pass filter

92. If the transfer function of open loop system is $G(s)H(s)=\frac{10(s+3)}{(s+2)(s-1)'}$ then how many encirclements, the Nyquist plot has around $-1+j0$ point in anticlockwise direction in the G(s)H(s) plane for stable closed loop system?
a. 0
b. 1
c. 2
d. 3

93. A system is described by the following state space model:-
$\dot{X}=\begin{bmatrix}-1 & 0\\ 1 & -2\end{bmatrix}X+\begin{bmatrix}1\\0\end{bmatrix}r(t)$ and $Y=[1\quad 1]X$.
The transfer function of the system is
a. $G(s)=\frac{(s+1)}{(s+2)(s+3)}$
b. $G(s)=\frac{(s+2)}{(s+1)(s+3)}$
c. $G(s)=\frac{(s+3)}{(s+1)(s+2)}$
d. $G(s)=\frac{(s+1)}{(s-1)(s-2)}$

94. The open loop transfer function of the system with unity feedback system is given by $G(s) = \frac{K}{s^2(s+1)(s+4)}$ and the input signal applied to the system is given by $r(t) = 1 + 8t + 9t^2$

The value of K for steady state error 0.8 is

a. 60

b. 70

c. 80

d. 90

95. According to IEC-61131-3 which is **NOT** a programming types of PLC

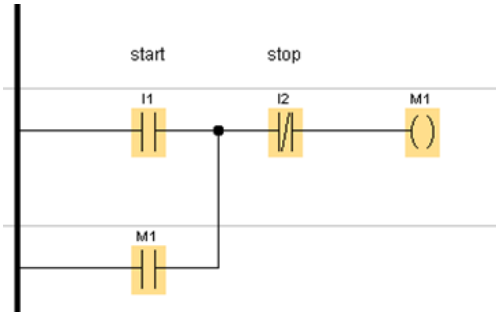
a. Functional Block Diagram

b. Sequential Function Chart

c. Continuous Function Chart

d. Ladder Logic

96. Convert the ladder logic to Structured Text program



a. m1=i1 or m1 nand i2

b. m1:=(i1 or m1) nand i2;

c. m1:=(i1 or m1) and not i2;

d. m1:=(i1 nand i2) and i2;

97. What is the role of segment coupler in the DCS?

a. Couples PROFIBUS DP devices transparently to PROFIBUS PA

b. Couples PROFIBUS PA devices transparently to PROFIBUS DP

c. Couples PROFINET devices transparently to PROFIBUS DP

d. Couples PROFIBUS PA devices transparently to PROFINET

98. Which modulation is used in HART Protocol?

a. Pulse Shift Keying

b. Amplitude Shift Keying

c. Binary phase-shift keying

d. Frequency Shift Keying

99. Which is the only digital Fieldbus protocol developed to fully meet with the original IEC 61158 requirements?

a. Foundation Fieldbus H1

b. Foundation Fieldbus HSE

c. Profibus-DP

d. ProfiNet

100. The state transition matrix of discrete time system A^k is

a. $Z^{-1}\{(ZI - A)^{-1} - Z^{-1}\}$

b. $Z^{-1}\{(ZI - A)\ Z\}$

c. $Z^{-1}\{(ZI - A)^{-1}\ Z\}$

d. $Z^{-1}\{(ZI - A) - Z^{-1}\}$

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?

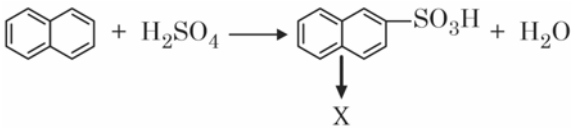
a. Ammonium chloride

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

PART III

17 - MATERIAL SCIENCE & CERAMIC TECHNOLOGY

(Answer ALL questions)

41. A cation vacancy and an anion vacancy in a crystal is called

a. Frenkel defect

b. Schottky defect

c. Dislocation

d. Surface imperfection

42. The nearest neighbor distance in case of BCC structure is

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

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

c. $\frac{a}{\sqrt{2}}$

d. a

43. In a cubic crystal a plane makes intercepts 1,2,2 on the *x*, *y* and z axes respectively.

The Miller indices of that plane is

a. (122)

b. (121)

c. (211)

d. (212)

44. The crystal structure of the following materials is FCC except

a. Aluminum

b. Magnesium

c. Nickel

d. Copper

45. How many number of atoms are present in the unit cell of HCP structure?

a. 2

b. 4

c. 6

d. 12

46. Which of the following structures has the highest density of packing?

a. Diamond cubic

b. Cesium chloride

c. Body centred cubic

d. Face centred cubic

47. The Fe-Fe bond length is 2.48Å, the radius of iron atom is

a. 0.62 Å

b. 1.24 Å

c. 2.48 Å

d. 3.96 Å

48. The correct order of co-ordination number in BCC, FCC and HCP unit cells is

a. 12,8,6

b. 8,12,12

c. 6,8,12

d. 12,6,8

49. The interplanar distance for (100) planes in a rocksalt crystal with a = 2.814Å is

a. 0.612Å

b. 1.224Å

c. 2.814Å

d. 1.926Å

50. Choose the wrong statement

a. In Laue method monochromatic X-ray beam is used

b. In powder method monochromatic X-ray beam is used

c. In rotating method monochromatic X-ray beam is used

d. In Laue method white X-radiation is used

51. In comparison to lattice diffusion, the activation energy for diffusion along surfaces and grain boundaries is

a. higher

b. lower

c. almost negligible

d. infinite

52. Frank – Reed source is a

a. Dislocation multiplier

b. Multiplier of point defects

c. Ionic defects multiplier

d. Multiplier of interstitial defects

53. The degree of freedom when ice, water and water vapour co-exist in equilibrium is

a. 1

b. 3

c. 0

d. –1

54. In a binary system of A and B if a liquid of 30% A is co-existing with a solid of 75% A, for an overall composition of 40% A, the fraction of liquid is given by

a. 0.78

b. 0.87

c. 0.22

d. 0.27

55. Which one of the following sets of constituents is expected in equilibrium cooling of a hyper-eutectoid steel from austenitic state?

a. Cementite and pearlite

b. Ferrite and pearlite

c. Ferrite and bainite

d. Cementite and martensite

56. Which one of the following statements about phase diagram is NOT correct?

a. It gives information on transformation rates

b. Relative amount of different phases can be found under given equilibrium conditions

c. It indicates the temperature at which different phases start to melt

d. Solid solubility limits are depicted by it

57. Specify the sequence correctly

a. Stress relief, grain growth, recrystallisation

b. Grain growth, recrystallisation, stress relief

c. Grain growth, stress relief, recrystallisation

d. Stress relief, recrystallisation, grain growth

58. The arm chair structure of carbon nanotube is obtained when nanotube axis is

a. Parallel to the C – C bond

b. Perpendicular to the C – C bond

c. In any random direction with respect to C – C bond

d. None of the above

59. Which of the following Heat treatment processes is used for softening hardened steel?

a. Carburizing

b. Normalizing

c. Annealing

d. Tempering

60. Choose the correct statement

a. thermoplastics are either amorphous or crystalline

b. thermoplastics are crystalline

c. thermosetting and thermoplastics polymers are essentially amorphous

d. thermosetting plastics are crystalline

61. What are the trade names of two most common aramid materials?

a. silicon carbide, silicon nitride
b. e - glass, aluminium oxide
c. kevlar, nomex
d. zircon, carborundum

62. Conductive polymers are mainly synthesized by

a. Free radical polymerization
b. Condensation polymerization
c. Electrochemical polymerization
d. Ionic polymerization

63. Polyvinyl chloride is

a. Thermoplastics
b. Thermosetting
c. Elastomers
d. None of the above

64. The carbon content required in steels to produce scissors and knives are

a. 0.8% – 0.9% C
b. 0.4% – 0.5% C
c. 0.2% – 0.3% C
d. 1.3% – 1.4% C

65. Martensitic transformations

a. Are diffusion controlled
b. Yield two products of different composition
c. Are shear processes
d. Yield a soft product in steels

66. Corrosion resistance of steel is increased by adding

a. Chromium to nickel
b. Nickel to molybdenum
c. Aluminum to zinc
d. Tungsten to sulphur

67. What will happen at the accelerating or tertiary creep stage?

a. Work hardening is less than recovery
b. Work hardening is greater than recovery
c. Work hardening is equal to recovery
d. None of the above

68. Fatigue failure occurs due to

a. Extended constant loading
b. Extended cyclic loading
c. Diffusion of atoms
d. Movement of dislocations

69. Which of the following is known as the Griffith equation?

a. $\sigma = (2\gamma E / \pi C)^{1/2}$
b. $\sigma = (\gamma E / \pi C)^{1/2}$
c. $\sigma = (\gamma E / 2\pi C)^{1/2}$
d. $\sigma = (\pi C / \gamma E)^{1/2}$

70. If K and σ be the thermal and electrical conductivities of a metal at temperature T, then

a. $\frac{KT}{\sigma}$ = constant
b. $\frac{K\sigma}{T}$ = constant
c. $\frac{\sigma}{KT}$ = constant
d. $\frac{K}{\sigma T}$ = constant

71. The faces in a tetragon are

a. 12
b. 4
c. 6
d. 2

72. The lattice constant of a BCC unit cell with atomic radius of 1.24 A° is

a. 1.432
b. 2.864
c. 1.754
d. 1.432

73. If the first reflection from an FCC crystal has a Bragg angle $\theta = 21.5^{\circ}$, the θ corresponding to second reflection is

a. 13.5°
b. 18.5°
c. 25°
d. 36.8°

74. Metallic bond is not characterized by _____

a. Opacity
b. Ductility
c. High conductivity
d. Directionality

75. The unit of diffusional flux is

a. atoms/m^2.s
b. atoms/m^3.s
c. atoms/m.s^2
d. atoms/m.s^3

76. The windows of aero plane are made in

a. PVC
b. PTFE
c. PMMA
d. PEEK

77. Cermet are examples of

a. Ceramic – Metal
b. Ceramic – Ceramic
c. Metal – Metal
d. Polymer – Metal

78. A continuous and aligned glass fibre reinforced composite consists of 40 vol% of glass fibres having a modulus of elasticity 69 GPa and 60 vol% of a polyester resin that when hardened displays a modulus of elasticity 3.4 GPa. What is the modulus of elasticity in longitudinal direction?

a. 35 GPa
b. 45 GPa
c. 30 GPa
d. 20 GPa

79. The fracture toughness values of Ceramic Matrix Composites lie between

a. 5 and 18 MPa $\sqrt{m}$
b. 6 and 20 MPa $\sqrt{m}$
c. 8 and 16 MPa $\sqrt{m}$
d. 9 and 21 MPa $\sqrt{m}$

80. Nanostructured materials have crystallites ranging in the size of _____

a. 1 – 100 nm
b. 150 – 300 nm
c. 350 – 500 nm
d. 500 – 900 nm

81. Which of the following is not an allotropic form of iron?

a. α
b. ρ
c. γ
d. θ

82. The mean grain diameter corresponding to ASTM number of 0.5 is

a. 0.33 mm
b. 0.43 mm
c. 0.53 mm
d. 0.63 mm

83. If resistivity is 1.7×10^{-6} Ωcm, area of cross section is $19.6\times10^{-8}m^2$, length is 31.4m, the resistance is found to be

a. 1.72 Ω

b. 2.72 Ω

c. 3.72 Ω

d. 4.72 Ω

84. In N Type semiconductor, the Fermi Level

a. Is lower than the centre of energy gap

b. Is at the centre of energy gap

c. Is higher than the centre of energy gap

d. Does not exist

85. The power loss (p) in a dielectric is given by _____ where V is voltage, I is current, δ is loss tangent

a. $P = VI \cos\delta$

b. $P = V/I \cos\delta$

c. $P = VI \sin\delta$

d. $P = V/I \sin\delta$

86. Which of the following is not made of calcium carbonate?

a. Calcspar

b. Witherite

c. Marl

d. Chalk

87. Zirconia is present in _____ crystal structure in the mineral baddeleyite.

a. Monoclinic

b. Triclinic

c. Tetragonal

d. Cubic

88. _____ is the property of titania.

a. Stability against ultraviolet radiation

b. High fracture toughness

c. High modulus of rupture

d. High compressive strength

89. Addition of _____ to alumina increases its toughness.

a. Magnesia

b. Silica

c. Chromia

d. Calcia

90. The limiting compositions of $Al_2O_3 : SiO_2$ in mullite solid solution series are _____

a. 1:2 and 3:2

b. 2:1 and 3:1

c. 3:2 and 2:1

d. 3:1 and 3:2

91. In flat plate test, concave glazed side refers to _____ in glaze which will lead to _____.

a. Tension, peel

b. Tension, craze

c. Compression, peel

d. Compression, craze

92. _____ is not a glass former.

a. SiO_2

b. B_2O_3

c. GeO

d. Cr_2O_3

93. Danner process is used to prepare glass ———— continuously.

a. Bulb

b. Tube

c. Sheet

d. Fiber

94. Crown glass is a ———— glass.

a. Optical

b. Safety

c. Radiation shield

d. Toughened

95. ———— is not a neutral refractory.

a. Zircon

b. Chrome

c. Carbon

d. Silicon carbide

96. ———— is used to calculate theoretical weight deposited on the electrode during electrolysis

a. Faraday's Law

b. Hess Law

c. De Bragg's Law

d. Stoke's Law

97. What is the major problem with fuel cell?

a. Inefficient

b. Produce harmful chemicals

c. Difficult to supply them with fuels

d. Less powerful than gasoline

98. Which one of the following is not a major reason to develop automotive fuel cell technology?

a. Efficiency

b. Low capacitance

c. Low or zero emission

d. Local source production

99. Which phase must form on a biomaterial surface to promote bioactive bond?

a. Amorphous silica

b. Silanols

c. Amorphous calcium phosphate

d. Hydroxyapatite

100. Which of the following substances is not used as coolant in nuclear reactors?

a. Graphite

b. Liquid sodium

c. CO_2

d. Heavy water

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

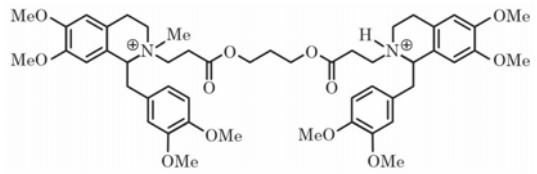
91. To which class of compounds do adrenaline, noradrenaline and dopamine belong?
    a. Phenethylamines Opium
    b. Diphenolethylamines
    c. Catecholamines
    d. Adrenergics

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

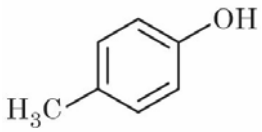
95. What does the symbol *P* represent in a QSAR equation?

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?

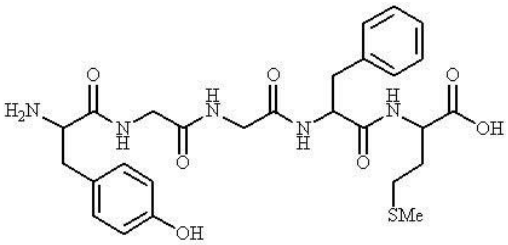
a. Only drugs of the same structural class should be studied by 3D QSAR or QSAR.
b. 3D QSAR has a predictive quality unlike QSAR.
c. Experimental parameters are not required by 3D QSAR, but are for QSAR.
d. Results can be shown graphically in 3D QSAR, but not with QSAR.

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

PART III

19 — PRINTING TECHNOLOGY

(Answer ALL questions)

41. The arrangement of the visual elements is
    a. Composition
    b. Unity
    c. Harmony
    d. Contrast

42. Which of the following in the screening technology that gives accurate screen angles but takes lot of computational time?
    a. Rational tangent Screening
    b. Irrational Screening
    c. FM Screening
    d. Supercell Screening

43. Postscript font uses _____ to describe the characters
    a. Bitmap
    b. Pixel data
    c. Vector equations
    d. Integral equations

44. Which of the following is not an advantage of FM screening?
    a. Higher resolution
    b. Higher tonal range
    c. Higher color gamut
    d. Higher dot gain

45. The shifting of hue associated with inkjet printers as the chroma increases.
    a. Grey balance
    b. Ink splittting
    c. Ink hooking
    d. Gray error

46. 10 points = _____ mm
    a. 4.2 mm
    b. 6.4 mm
    c. 12 mm
    d. 3.5 mm

47. Which test element is not present in digital plate wedge?
    a. Line patches
    b. Resolution patches
    c. Checkerboard patches
    d. Overprint patches

48. The dot shape suitable for newspaper printing is
    a. Round
    b. Ellipse
    c. Chain
    d. Brick

49. The exposure given to cure both imaging and non imaging areas of a flexo plate to make it tack free
    a. Back exposure
    b. Face exposure
    c. Post exposure
    d. Light finishing

50. In a servicing work, in which a technician can receive, via semi-transparent goggles, inserted information that corresponds with his view of the real thing, namely the machine to be serviced is an example of _____ technology.
    a. Teleportation
    b. Future vision
    c. Augmented Reality
    d. Virtual Reality

51. Which one of the following is an ISO-standardized version of the Portable Document Format (PDF) specialized for use in the archiving and long-term preservation of electronic documents?
    a. PDF/D
    b. PDF/T
    c. PDF/X
    d. PDF/A

52. Which of the following is not true under Packing and Labeling of food products?
    a. The label should contain the name, trade name and description of food contained in the package.
    b. The name of ingredients used in the product should be listed in ascending order of their composition by weight or volume.
    c. For vegetarian food, a green colour circle and square should be indicated.
    d. The complete address of the manufacturer or packer should be declared.

53. In Gravure printing unit, transfer of ink is affected by
    (i) Wetting properties of the printing substrate,
    (ii) Viscosity of the ink,
    (iii) Printing pressure
    a. Only (i) and (ii)
    b. Only (i) and (iii)
    c. Only (ii) and (iii)
    d. All the above (i), (ii) and (iii)

54. The indirect letterpress printing is known as
    a. Letterset
    b. Letteroffset
    c. Letterprint
    d. Direct letter

55. The computer feeds two signals to the engraving head, the actual image signal and the screen signal defining the ———— and ————
    a. Screen resolution and the angular position
    b. Screen size and the linear position
    c. Screen resolution and the circumferential position
    d. Screen size and the curvilinear position

56. Which of the following is not the major advantage of Collotype Continuous tones that can be reproduced without screening?
    a. Moire free
    b. High quality
    c. No screen
    d. Dotgain

57. Which of the following represents the number of single threads in the weave per linear centimeter?
    a. Mesh grading
    b. Mesh opening
    c. Mesh Count
    d. Fabric thickness

58. In electrophotography printing, duplex printing means
    a. Printing double image in aside
    b. Printing on both side
    c. Printing Gang images
    d. Printing duplex boards

59. In measuring ink trapping values of overprint patches and solid color patches, all ink densities must be measured using the
    a. Filter for the first color
    b. Filter for the second color
    c. Filter for the overprint color
    d. Any filter is suitable.

60. Which is not the Spectrometer principles for measuring spectral reflectance factors?

a. Flywheel diffraction principle;

b. Monochromator principle;

c. Filter wheel principle;

d. Diffraction grating principle.

61. Which of the following uses a periodic flash of light that is synchronized with the press speed, making it seem to the observer as if the web were standing still?

a. Optical system

b. Stroboscope

c. Rotating mirror

d. Video camera

62. Which of the following inking unit is the "shortest" inking unit?

a. Gravure

b. Flexo

c. Offset

d. All of the above

63. Match the correct pressure for the respective process

(1)	letterpress printing	(i)	0.1–0.5 MPa
(2)	flexographic printing	(ii)	1.5–5 MPa
(3)	offset printing	(iii)	0.8–2 MPa
(4)	gravure printing	(iv)	5 –15 MPa

a. (1)-(i); (2)-(ii); (3)-(iii); (4)-(iv)

b. (1)-(iv); (2)-(i); (3)-(iii); (4)-(ii)

c. (1)-(iv); (2)-(iii); (3)-(ii); (4)-(i)

d. (1)-(ii); (2)-(iv); (3)-(iii); (4)-(i)

64. The inline perfect printing, for work-and-turn needs gripper margins at

a. Both lead and left edge

b. Both lead and trail edge

c. Both lead and right edge

d. Only one edge

65. The placing of a section within another section is known as

a. Insetting

b. Inserting

c. Collating

d. Gathering

66. Buffer storage in mailroom system is used for

a. Storing the unprinted sheets

b. Storing the printed sheets

c. Storing the materials used in printing

d. Storing the rejected newspapers

67. Hot melt adhesive is a

a. Vegetable adhesive

b. Animal adhesive

c. Synthetic adhesive

d. Volatile adhesive

68. Which of the following improves the book structure by giving it a convex spine and a concave fore edge?

a. Cutting

b. Rounding

c. Folding

d. Adhesive binding

69. A series of small holes very close to each other is made so that a position of the sheet of paper may be readily torn away and this operation is called
    a. Punching
    b. Perforating
    c. Drilling
    d. Creasing

70. A small metal unit used to prevent a hole in paper or board from tearing out under stress is called
    a. Eyelets
    b. Rivets
    c. Cords
    d. Press fasteners

71. Which of the following covers is a cover made from paper or paper fiber material with greater substance than that used for the body of the book?
    a. Hard cover
    b. Soft cover
    c. Self cover
    d. Case bound cover

72. Which of the following is the type of machine used to fold thin papers?
    a. Knife folding machine
    b. Buckle folding machine
    c. Lump folding machine
    d. Former folding machine

73. Which of the following is the coating technique in which the varnish is applied to only selected portion?
    a. Overprint varnish
    b. Spot varnish
    c. Foil stamping
    d. Blanking

74. Tipping-in represents
    a. Fixing one section within another
    b. Placing loose piece of paper inside a section
    c. Affixing a single leaf inside a section
    d. Placing loose piece of paper outside a section

75. Thin layer of coating material applied to the printed material is called
    a. Varnishing
    b. Lamination
    c. Gumming
    d. Gold foiling

76. Which of the following is the package commonly used for packing tablets, capsules and electronic gadgets?
    a. Blister
    b. Bottle
    c. Container
    d. Skin

77. An opening device made of plastic normally fitted to lined carton is called as
    a. Spouted pack
    b. Tetra pack
    c. Active pack
    d. Intelligent pack

78. The paper based substrate is called as ———— material
    a. Isotropic
    b. Anisotropic
    c. Thixotrophy
    d. None of the above

79. Which of the following packaging materials is used for packing of fruits?
    a. Leno bag
    b. Piggy bag
    c. Fishy bag
    d. Birdy bag

80. VCI films are used to avoid ———— of automotive packaging
a. Migration
b. Oxidation
c. Leaching
d. Corrosion

81. The process of exposing the test specimen to a standard condition is known as
a. Conditioning
b. Calibrating
c. Characterizing
d. None of the above

82. The performance tests are mainly conducted to simulate the field conditions during
a. Handling
b. Storage
c. Transportation
d. All the above

83. The Tin coating is measured by using
a. Viscometer
b. Hygrometer
c. Elcometer
d. Luxmeter

84. Which of the following instruments is used to determine the interface of colours of glass containers during gradual cooling process?
a. Polariscope
b. Microscope
c. Stethoscope
d. Stroboscope

85. Antioxidants are added to oils and fats to protect
a. Leaching
b. Oxidative rancidity
c. Migration
d. Diffusion

86. How do you calculate water activity where P is vapor Pressure of food and P_o is vapor pressure of pure water?
a. $a_w \neq P/P_0$
b. $a_w = P_0/p$
c. $a_w \approx P/P_0$
d. $a_w = P/p$

87. Which of the following standards is used for drop testing of transport package?
a. ASTM D4169
b. ASTM D4189
c. ASTM D1169
d. ASTM D5169

88. A corona treating system is designed to increase the ———— of plastic films
a. Tensile
b. Optical value
c. Burst value
d. Surface energy

89. What is the formula to calculate Budgeted hourly rate?
a. BHR = (DDE - IDE)/DCH
b. BHR = (DDE - IDE) × DCH
c. BHR = (DDE + IDE)/DCH
d. BHR = (DDE + IDE) × DCH

90. Absorption costing is inclusive of
a. Total cost
b. Works cost
c. Variable cost
d. Fixed cost

91. Break-even point is
a. Sales at which there is no profit or loss
b. Sales at which profit is high
c. Sales at which there is high overheads
d. Sales at which there is loss

92. Angle of incidence is

a. Angle between sales and fixed cost lines

b. Angle between sales and variable cost lines

c. Angle between sales and total cost lines

d. Angle between fixed cost and total cost lines

93. Operating cost is calculated through

a. Ledger account

b. Balance sheet

c. Profit and loss account

d. Cost sheet

94. The conversion costs is inclusive of ———— and ————

a. Direct labor, overhead expenses

b. Indirect labor, overhead expenses

c. Direct material, overhead expenses

d. Indirect material, overhead expenses

95. In which of the print estimating methods, the codes are assigned for production components?

a. Price line estimation

b. Price matrix estimation

c. Computerized estimation

d. Price line and matrix estimation

96. SPANKS formula can be used to calculate

a. Paper quantity

b. Ink quantity

c. Glue quantity

d. Paste quantity

97. The Prime cost is comprises of

a. All indirect cost

b. All direct cost

c. Direct and indirect cost

d. Specific costs

98. The selling price of the product is determined by adding

a. Prime cost + profit

b. Work cost + profit

c. Cost of sales + profit

d. Overheads + profit

99. The cost of power consumption of a machinery is calculated on the basis of

a. Value of machine

b. Direct wages

c. Horse power of machines

d. Number of lights

100. Hours worked × Rate per hour is known as

a. Piece rate

b. Time rate

c. Differential rate

d. Labor turnover

———————

PART III

20 — PRODUCTION AND INDUSTRIAL ENGINEERING

(Answer ALL questions)

41. A Linear Programming problem with a bounded feasible solution space will always have
    a. Some basic feasible solutions but no optimal solution
    b. Some basic feasible solutions and at least one optimal solution
    c. No basic feasible solutions and no optimal solution
    d. No basic feasible solutions but at least one optimal solution

42. Which one of the following is not a basic assumption of linear programming?
    a. Linearity
    b. Additivity
    c. Divisibility
    d. Feasibility

43. The dual problem statement is formulated with the help of the information available statement is called
    a. Primal problem
    b. Prime Problem
    c. Optimal problem
    d. Primal constants

44. Postman needs to visit all 5 geographically distributed post offices beginning and ending at the same post office and without visiting any other post office twice. We need to find the optimum path for the postman so that he covers the minimum possible distance. This is an example of
    a. Travelling Salesman problem
    b. Chinese Postman problem
    c. Travelling Postman problem
    d. Chinese Salesman problem

45. When the total allocations of a transportation problem are less than the sum of the number of supply point and demand point values, the solution is called ———— solution.
    a. Non-degenerate
    b. Degenerate
    c. Feasible
    d. Infeasible

46. Which of the following algorithms considers all pairs of shortest paths?
    a. A* search algorithm
    b. Dijkstra's algorithm
    c. Bellman-Ford algorithm
    d. Floyd-Warshall algorithm

47. Which of the following is not an inventory?
    a. Machines
    b. Raw materials
    c. Finished products
    d. Consumables

48. Productivity is
    a. Output/Input
    b. Input/Output
    c. (Input + Output)/Input
    d. (Input + Output)/Output

49. Which of the following is the correct sequence of steps used in the method study?
    a. SELECT-RECORD-EXAMINE-DEVELOP- INSTALL- MAINTAIN
    b. SELECT-RECORD-EXAMINE-INSTALL- MAINTAIN-DEVELOP
    c. SELECT-RECORD-INSTALL-EXAMINE- MAINTAIN-DEVELOP
    d. SELECT-EXAMINE-RECORD-DEVELOP- INSTALL- MAINTAIN

50. The most frequently used components are arranged in
    a. Left side
    b. Right side
    c. Central location
    d. Any of the above

51. The Design capacity is
    a. Rate of goods output under full operating conditions
    b. Rate of goods output under actual operating conditions
    c. Rate of goods output under reduced operating conditions
    d. Rate of goods output under half operating conditions

52. The amount of time by which the completion time of job j differs from the due date is called
    a. Flow Time
    b. Processing Time
    c. Lead Time
    d. Lateness

53. The value of the smoothing constant used in exponential smoothing will be
    a. Between –1 and 1
    b. Between 0 and 1
    c. Between –1 and 0
    d. Between 0 and infinity

54. A product passes through four machines A, B, C and D with cycle times 4 min, 4 min, 3 min and 2 min respectively. Then which are the bottleneck machines?
    a. Machine A and C
    b. Machine B and C
    c. Machine A and B
    d. Machine C and D

55. Match the following group 1 (charts) with group 2 (use) and select the correct option.

(1)	R chart	(A)	study the number of defects per unit
(2)	C chart	(B)	size of a variable is studied
(3)	P chart	(C)	dispersion of measured data
(4)	X chart	(D)	defective units produced per subgroup

    a. 1 – A, 2 – B, 3 – D, 4 - C
    b. 1 – C, 2 – D, 3 – B, 4 - A
    c. 1 – A, 2 – D, 3 – B, 4 - C
    d. 1 – C, 2 – A, 3 – D, 4 – B

56. When using the SPC methodology, a system is said to be stable when
    a. the system is efficient
    b. the mean and range of variation caused by the system are controllable
    c. the mean and range of variation caused by the system are predictable
    d. the performance of the system is improving

57. C-chart follows ———— distribution.
    a. Normal
    b. Poisson
    c. Binomial
    d. Weibull

58. An estimate of the measurement error is obtained through an index is known as
    a. Precision-to-tolerance Ratio
    b. Tolerance-to-precision Ratio
    c. Capability Ratio
    d. Taguchi Capability Ratio

59. Total productive maintenance strives to produce overall equipment effectiveness, through a combination of availability, performance efficiency and
    a. Rate of quantity of products
    b. Rate of quality products
    c. Rate of Quantity process
    d. Rate of Performance products

60. The term availability is used to indicate the probability of a system or equipment being in operating condition at any time t, given that it was in operating condition at

a. 1

b. 0

c. α

d. constant

61. Blanking and piercing operations can be performed simultaneously in one stroke of the ram is

a. Progressive die

b. Simple die

c. Combination die

d. Compound die

62. In metal cutting operations, continuous chips are produced while machining

a. Brittle material

b. Ductile material

c. Hard material

d. All of the above

63. Tool life is mostly affected by

a. Tool geometry

b. Cutting speed

c. Feed and depth

d. Microstructure of material

64. Steel wire is manufactured by ———— process.

a. Deep drawing

b. Forging

c. Drawing

d. Extrusion

65. Lewis equation in spur gear is applied

a. Only to the pinion

b. Only to the gear

c. To weaker of pinion or gear

d. To stronger of pinion or gear

66. The friction torque for square thread at mean radius while raising load is given by (ω = load, R_o = mean radius, ϕ = angle of friction, α = lead angle)

a. $\omega R_o \tan(\varphi - \alpha)$

b. $\omega R_o \tan(\varphi + \alpha)$

c. $\omega R_o \tan \alpha$

d. $\omega R_o \tan \varphi$

67. The size of a cam depends upon

a. Base circle

b. Pitch circle

c. Pitch curve

d. Prime circle

68. The equation $3\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 15x = 20\cos 4t$ shows a vibrations system. The maximum amplitude of the system will be

a. 50 cm

b. 51 cm

c. 49 cm

d. 52 cm

69. In Opitz system, 2nd digit indicates

a. Type and shape

b. External shape and external shape elements

c. External plane surface finishing

d. Auxiliary hole and gear teeth

70. Which of the following is not a layout configuration used in FMS?
    a. In-line
    b. Loop
    c. Ladder
    d. Circle

71. The pattern used for mass production is
    a. Match plate pattern
    b. Skeleton pattern
    c. Split pattern
    d. Single plate pattern

72. In slush casting, ———— is used.
    a. Metallic core
    b. Sand core
    c. Wooden core
    d. No core

73. Thermit welding is a form of
    a. Resistance welding
    b. Gas welding
    c. Fusion welding
    d. Forge welding

74. Seam-welding is
    a. Multi-spot welding process
    b. Continuous spot welding process
    c. Used to form mesh
    d. Used for welding cylindrical objects

75. Last constituent to fail in fiber reinforced composites is
    a. Matrix
    b. Fiber
    c. Both fails at same time
    d. Can't define

76. Longitudinal strength of fiber reinforced composite is mainly influenced by
    a. Fiber strength
    b. Fiber orientation
    c. Fiber volume fraction
    d. Fiber length

77. The solidification of an alloy from one phase to another phase without changes in chemical composition is called
    a. Eutectic reaction
    b. Allotropy
    c. Congruent transformation
    d. Homogenization

78. A heat treatment process which will improve the machinability of hypereutectoid steel is
    a. Austempering
    b. Spheroidizing
    c. Bainitic transformation
    d. Process annealing

79. Which of the following elements strongly promote graphitization in Cast Iron?
    a. Sulphur
    b. Manganese
    c. Silicon
    d. Vanadium

80. Monel metal is an alloy of
    a. Nickel- Copper
    b. Chromium- Aluminum
    c. Silicon - Beryllium
    d. Tin - Lead

81. The energy per unit volume that can be absorbed by a material up to the point of fracture is known as
    a. Resilience
    b. Endurance limit
    c. Toughness
    d. Modulus of rigidity

82. The cost towards machining of special jigs or fixtures, pattern, tooling made for the job is
    a. Direct expense
    b. Administrative expense
    c. Indirect material cost
    d. Overhead cost

83. Tong hold loss is a
    a. Welding loss
    b. Forging loss
    c. Machining loss
    d. Casting loss

84. The time wasted by the operator due to breakdown, non-availability or supply of tool and material is
    a. Down time
    b. Setup time
    c. Unit operation time
    d. Allowance

85. An instrument which is designed to eliminate the personal element of feel when setting a measuring equipment for measurement is known as:
    a. Fiducial indicator
    b. Standard
    c. Scale
    d. Device

86. Which type of tolerance does a slip gauge have?
    a. Unilateral tolerance
    b. Bilateral tolerance
    c. Universal tolerance
    d. Zero tolerance

87. In surface photography of measuring surface finish of machined surfaces using vertical illumination, which portion appears as bright area?
    a. Hills
    b. Scratch
    c. Valleys
    d. Flat portion

88. Which of the following is a reason for pitch errors observed in threads?
    a. Lack of inspection
    b. Incorrect ratio of tool work velocity
    c. Interference between mating parts
    d. Less skilled operator

89. Which of the following is used for rolling tests?
    a. Tooth caliper
    b. Parkinson gear tester
    c. Base pitch measuring instrument
    d. Involute profile testing machine

90. Which of the following is an application of machine vision system?
    a. Assembly verification
    b. Image processing
    c. Reliability testing
    d. Cause and effect analysis

91. Which of the following the techniques that is not suitable to measure large diameter parts or large gaps?
    a. Diffraction pattern technique
    b. Scanning laser technique
    c. Photodiode array imaging
    d. Laser triangulation sensor

92. In Ultrasonic Machining, the material is removed by

a. Anodic dissolution

b. Thermal melting

c. Abrasive action

d. Electrochemical oxidation

93. Which of the following statements are true for Electro-Chemical Machining (ECM)?

1. ECM is capable of machining metals and alloys irrespective of their strength and hardness
2. No cutting forces are involved in ECM process
3. Erosion of metal takes place as a reverse process of electroplating
4. Dielectric is used in Electro-Chemical Machining

a. (1), (2) and (3)

b. (2), (3) and (4)

c. (1), (3) and (4)

d. (1), (2) and (4)

94. What is the value of gap maintained in between the electrodes while machining with Electro Discharge Machining?

a. 10 – 100 μm

b. 100 – 200 μm

c. 200 – 500 μm

d. 500 – 1000 μm

95. The range of diameters obtained using Laser drilling process is

a. 0.0001 – 0.001 mm

b. 0.001 – 0.01 mm

c. 0.005 – 1.25 mm

d. 1.5 – 10.5 mm

96. Which of the following codes is used to rotate the spindle of the CNC machine tool in clockwise direction?

a. M04

b. G03

c. G04

d. M03

97. How many number of degrees of freedom is exhibited by the robot wrist?

a. 1

b. 3

c. 2

d. 4

98. The positioning accuracy of robotic arm is the highest in the following type configuration of a robot

a. Cartesian Robot

b. Cylindrical Robot

c. Articulated jointed arm robot

d. Spherical co-ordinate robot

99. Which one of the following rapid prototyping processes uses a photosensitive liquid polymer as the starting material?

a. Fused deposition modeling

b. Laminated-object manufacturing

c. Selective laser melting

d. Stereolithography

100. Direct Energy Deposition is

a. A process in which a droplet of build material are selectively deposited

b. A process in which a thermal energy selectively fuses regions of a powder bed

c. A process in which focused thermal energy is used to fuse materials by melting as the material is being deposited

d. A process in which a material is selectively dispensed through an orifice

PART III

21 — TEXTILE TECHNOLOGY

(Answer ALL questions)

41. The glass transition temperature of polyester is
    a. 80°C
    b. 100°C
    c. 210°C
    d. 230°C

42. Which one of the following spinning system gives higher production rate?
    a. Melt spinning
    b. Dry spinning
    c. Wet spinning
    d. Spin drawing

43. Silk is a
    a. Homo polymer
    b. Random copolymer
    c. Block copolymer
    d. Alternating copolymer

44. The density of polypropylene is
    a. 1.14 g/cc
    b. 1.38 g/cc
    c. 0.92 g/cc
    d. 1.52 g/cc

45. The amount of recommended water (by weight) in dried poly (ethylene terephthalate) chips suitable for melt spinning is in the range of
    a. Approximately 1%
    b. 0.1 to 0.4%
    c. 0.04 to 0.06%
    d. 0.001 to 0.005%

46. Which one of the following is a regenerated protein fibre?
    a. Viscose
    b. Casein
    c. Cuprammonium rayon
    d. Cellulose acetate

47. The crystallinity percentage of silk is
    a. Higher than cotton but lower than wool
    b. Higher than wool
    c. Lower than cotton but higher than wool
    d. Lower than cotton and wool

48. The fibre which is having negative birefringence value is
    a. Cotton
    b. Nylon
    c. Silk
    d. Acrylic

49. The density of polyester fibre is
    a. Greater than cotton
    b. Less than cotton but greater than wool
    c. Less than nylon
    d. Greater than nylon but less than polyethylene

50. The moisture regain of nylon is
    a. Greater than wool
    b. Less than PP
    c. Greater than cotton
    d. Less than cotton but greater than polyester

51. Convolution count of a cotton fibre is defined as

a. Number of convolutions in a fibre

b. Number of convolution in a unit length of a fibre

c. The average density of a fibre

d. Average convolutions of a bunch of fibres

52. The number of amino acids in casein fibre is

a. 20

b. 18

c. 16

d. 14

53. Based on the principle of yarn formation, select the odd one among the following.

a. Rotor spinning

b. DREF 2 spinning

c. Electrostatic spinning

d. Two nozzle Airjet spinning

54. Two yarns of count X each are doubled and plied. The ratio of resultant count of two ply yarn expressed in tex system and Ne system is ————————. Neglect contraction due to twist.

a. 4

b. 2

c. ½

d. ¼

55. The surface speed of cylinder is

a. Greater than that of licker in

b. Lesser than that of licker in

c. Lesser than that of doffer

d. Greater than that of doffer but lesser than licker in

56. The winding tension at the ring frame will be highest during winding at

a. Empty portion of cop bottom

b. Empty portion of cop tip

c. Full diameter portion of cop tip

d. Full diameter portion of cop bottom

57. The number of fibres in the cross section of comber lap for best combing should be about

a. 50,000

b. 1,00,000

c. 5,00,000

d. 8,00,000

58. In the carding machine, the closest setting exists between

a. Cylinder and licker-in

b. Cylinder and flat

c. Cylinder and doffer

d. Feed plate and licker-in

59. In cotton spinning, at the ring frame, the shore hardness of front top roller is normally

a. Higher than that of back roller

b. Higher than that of middle roller

c. Lesser than that of back roller

d. Equal to that of back roller

60. Select the correct match

I	Core sheath yarn	(i)	Rotor yarn
II	Back doubling	(ii)	DREF yarn
III	Wrapped bundle of straight fibres	(iii)	Condensed spun yarn
IV	Reduced spinning triangle	(iv)	Two nozzle air jet yarn

a. I-ii, II-i, III-iii, IV-iv

b. I-i, II-ii, III-iii, IV-iv

c. I-i II-ii, III-iv, IV-iii

d. I-ii, II-i, III-iv, IV-iii

61. The trash content of cotton fed to the blow room is 5%. The blow room has three machines having individual cleaning efficiency of 25%, 30%, 25% respectively. Find the trash% present in the blow room lap.

a. 1.97 %

b. 1.00%

c. 0.09%

d. 2.53%

62. The gear A of 20 teeth meshes with gear B of 10 teeth that is compounded to wheel C of 30 teeth that meshes with gear D of 10 teeth. The velocity ratio between gear D and gear A is

a. 3

b. 5

c. 4

d. 6

63. The centrifugal force (N) acting on a material mass 2g present at the tip of a beater of radius 25 cm rotating at 600 rpm is

a. $0.1\pi^2$

b. $0.2\ \pi^2$

c. 0.005π

d. $0.05\ \pi^2$

64. The trash removal is higher at

a. Blow room

b. Ring frame

c. Roving frame

d. Cone winder

65. A reed has 15 dents/cm, and the warp is drawn in two ends per dent. If the finished fabric is 1.4 m wide compared with 1.47 m wide in the reed, what is the finished fabric sett?

a. 26

b. 28

c. 32

d. 35

66. Among the following systems of drafting, the objective of which is to reduce the friction between adjacent warp ends?

a. Point

b. Sateen

c. Herring-bone

d. Reversed

67. The contraction percentage of 1 x 1 rib structure compared to its machine width is around

a. 30

b. 40

c. 50

d. 60

68. What will be the loop length of the knitted fabric having course length 60 cm and wale length 80 cm and number of loops per course 40?

a. 0.75 cm

b. 1.5 cm

c. 2 cm

d. 3.5 cm

69. What will be the tightness factor of the plain single jersey knitted with 64 tex yarn and 1.5 cm loop length?

a. 96

b. 42

c. 5.3

d. 2.3

70. In Rib Knitting machine, the Knittable yarn count in 'Ne' is calculated by

a. $\frac{gauge}{8.4}$

b. $\frac{(gauge)^2}{8.4}$

c. $\frac{gauge}{9.6}$

d. $\frac{(gauge)^2}{9.6}$

71. In Weft knitting machine, the term 'Robbing back' is

a. Transfer of loop from one needle to another needle

b. Feeding of two yarn in one feeder

c. Pulling of few length of yarn from newly formed loop

d. Pulling of few length of yarn from already formed loop

72. Which of the following Thermal techniques utilizes the mechanical hammering for conversion of vibration energy to heat energy for bonding the fibrous web?

a. Area

b. Through air

c. Belt

d. Ultrasonic

73. Which of the following fibers can be used for manufacturing of absorbent core based nonwoven products?

a. Viscose

b. Linen

c. Jute

d. Hemp

74. In which of the following web laying techniques, high loft structures can be produced?

a. Polymer laid

b. Card laid

c. Water laid

d. Air laid

75. The temperature of the air in melt blown process is set close to _____ of the polymer.

a. Glass transition temperature

b. Melting temperature

c. Crystallisation temperature

d. Cryogenic temperature

76. Which of the following Mechanical finishings is adopted to improve the lusture of bonded fabric?

a. Creping

b. Polishing

c. Raising

d. Emerising

77. A mill spinning 40^s Ne carded yarn with the following fiber properties. Find the Fiber Quality Index?

2.5% S.L = 28 mm

Uniformity ratio = 0.47

Micronaire value = 4.3

Bundle strength (g/tex) = 22.5

Maturity ratio = 0.80

a. 59

b. 55

c. 45

d. 50

78. Calculate the tenacity (g/tex) of cotton sample (at gauge length 1/8 inch) if the breaking load is 6.1 kg and the weight of the bundle is 3.9 mg obtained from the Pressley fiber strength tester?

a. 23.39

b. 25.49

c. 16.39

d. 28.19

79. If 840 mature fibers and 160 immature fibers were found in a test specimen, the percent immaturity would be

a. 16
b. 26
c. 30
d. 32

80. If the weight of a sample of cotton decreases from 107.5 to 100 grams when heated at 105 ˚C for 2 hours. The Moisture Content and Regain is

a. 7.0 and 7.5
b. 8.0 and 8.5
c. 9.0 and 9.5
d. 8.5 and 9.0

81. If 75 km of yarn weigh 2.5 kg, the count in metric system will be

a. 30^S
b. 2.40^S
c. 10^S
d. 50^S

82. The CV % of mass irregularity of yarn generally equals U % multiplied by

a. 1.00
b. 1.25
c. 1.44
d. 1.82

83. In Yarn Evenness testing the variance length curve is more suitable for

a. Periodic faults
b. Non-periodic mass variation
c. Imperfections
d. Variation in the count

84. The U% of Single yarn is 17.3%. The expected U% of a 3 - ply yarn produced from this yarn will be

a. 5.8%
b. 10.0%
c. 12.3%
d. 17.3%

85. Crimp interchange is a phenomena associated with

a. Bursting Strength
b. Abrasion Resistance
c. Tensile Strength
d. Tear Strength

86. For spreading knitted and other stretch fabric the spreading device should include

a. Positioning devices
b. Positive feed system
c. Width Indicators
d. End treatment devices

87. The Air permeability of a fabric increases linearly with increase in twist factor. This is due to

a. The air space in the yarn is reduced
b. The warp and weft cover factor is high
c. The air space in the yarn is high
d. The warp and weft cover factor is constant

88. On a 4 point fabric grading system (ASTM D5430) when the length of the defect is more than 3.2 inches but less than 6 inches, how many demerit points are given?

a. 3 points
b. 2 points
c. 4 points
d. 1 point

89. Transfer printing is an example for
a. Direct style
b. Resist style
c. Discharge style
d. Rotary style

90. Ionic dyes used in printing is not suitable for
a. wool
b. silk
c. casein
d. polypropylene

91. Freundlich isotherm becomes Nernst isotherm when n is
a. 0.2
b. 0.5
c. 0.8
d. 1.0

92. What is the effect of Mercerization process ?
a. Decreases luster.
b. Decreases dyeability
c. Increases dyeability
d. Increases orientation of polymers

93. The enzyme preferred for desizing is
a. α-Amylase
b. ß-Amylase
c. γ-Amylase
d. Lipase

94. In case of metameric samples which one of the following will be identical?
a. Reflectance curve
b. Spectral Reflectance curve
c. ΔE values
d. Tristimulus values

95. Which of the following dyes are more prone to gas fading?
a. reactive dyes
b. disperse dyes
c. acid dyes
d. vat dyes

96. Benzotriazoles is an example for
a. Antimicrobial agent
b. UV Protective agent
c. Antistatic agent
d. Wetting agent

97. THPC flame retardant is produced by reaction of
a. Phosphine and Formaldehyde
b. Urea and Formaldehyde
c. Sulphur and Formaldehyde
d. Ammonia and Formaldehyde

98. Which of the following Dyes are used for printing of polyester?
a. Disperse Dyes
b. Reactive Dyes
c. Direct Dyes
d. Acid Dyes

99. Which one of the following chemicals is used as reducing agent in printing?
a. Sodium chlorite
b. Sodium hydrosulphite
c. Sodium nitrate
d. Sodium phosphate

100. Which one of the following fibres is mass coloured?
a. Cotton
b. Polyproylene
c. Silk
d. Wool

FOR ROUGH WORK

FOR ROUGH WORK

FOR ROUGH WORK

FOR ROUGH WORK