NG 24 (GROUP A)

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

01 – CIVIL ENGINEERING

(Answer ALL questions)

41. As compared to uniaxial tension or compression, the strain energy stored in bending is only
    a. 1/8
    b. 1/4
    c. 1/3
    d. 1/2

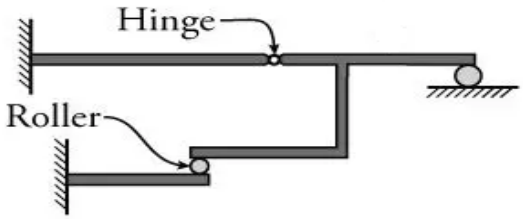
42. How many elastic constants will be in a non homogeneous, non isotropic material?
    a. 9
    b. 15
    c. 20
    d. 21

43. In a simply supported beam ($l + 2a$) with equal overhangs (a) and carrying a uniformly distributed load over its entire length, B.M. at the middle point of the beam will be zero if
    a. $l = 2a$
    b. $l = 4a$
    c. $l < 2a$
    d. $l > a$

44. The ratio of the maximum deflections of a beam simply supported at its ends with an isolated central load and that of with a uniformly distributed load over its entire length, is
    a. 1
    b. 3/4
    c. 8/5
    d. 2/3

45. A thin cylindrical shell of diameter (d) and thickness (t) is subjected to an internal pressure (p). The ratio of longitudinal strain to volumetric strain is
    a. $(m - 1)/ (2m - 1)$
    b. $(2m - 1)/ (m - 1)$
    c. $(m - 2)/ (3m - 4)$
    d. $(m - 2)/ (5m - 4)$

46. The degree of static indeterminacy for the frame shown in the figure is



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

47. If the hinged end of a propped cantilever of span "L" settles by an amount "δ" then the rotation of the hinged end will be
    a. $\frac{\delta}{L}$
    b. $\frac{1.5\,\delta}{L}$
    c. $\frac{2\,\delta}{L}$
    d. Zero

48. The shape of the influence line diagram for horizontal thrust in a symmetrical three hinged parabolic arch is
    a. Rectangular
    b. Parabolic
    c. Triangular
    d. Trapezoidal

49. The vertical deflection at free end of a quadrantal ring (Radius "R" with uniform flexural rigidity "EI") which is fixed at the base and subjected to a vertically downward load "W" at the free end is
    a. $\frac{WR^3\pi}{4EI}$
    b. $\frac{W\,R^3\pi}{2\,EI}$
    c. $\frac{WR^3\pi}{3\,EI}$
    d. $\frac{W\,R^3\,\pi}{EI}$

50. A fixed beam of uniform cross-section carries a point load P at the mid-span. If the moment of inertia of the middle half portion is reduced to half its previous value, then the fixed end moments will
    a. Increase
    b. Decrease
    c. Remain constant
    d. Change direction

51. The bulking of the sand is increased in volume from 20% to 40 of various sand and moisture content ranges from ———— to ———— percent.
    a. 50 to 80
    b. 30 to 50
    c. 5 to 8
    d. 8 to 11

52. In the preservation process of timber, the surface is burnt and the burnt part acts as a protective coating is named as
    a. Charring
    b. Painting
    c. Spraying
    d. Diffusion

53. A scratch is made on the surface of the brick. In a good brick, no impression will be left on the surface. This process of testing of bricks is called as
    a. Efflorescence
    b. Hardness
    c. Wetness
    d. Dimensional tolerance

54. It is the kind of concrete to which various fibres of very small diameter (10 to 20 microns and short lengths (10 to 50mm length) are added to make a concrete. The name of the concrete is
    a. Self compacting concrete
    b. Flysah Concrete
    c. Fibre reinforced concrete
    d. Light weight concrete

55. The 18-8 stainless steel indicates the one of the following compositions
    a. 18% Copper and 8% Nickel
    b. 18% Chromium and 8% Nickel
    c. 18% Nickel and 8% Chromium
    d. 18% Nickel and 8% Copper

56. In limit state design of concrete structures the strain distribution is assumed to be
    a. linear
    b. non-linear
    c. parabolic
    d. parabolic and rectangular

57. The loss of stress with time at constant strain in steel is called
    a. relaxation
    b. creep
    c. shrinkage
    d. ductility

58. The effective length of a column in a reinforced concrete building frame, as per IS : 456- 2000, is independent of the
    a. frame type (i.e) braced (no sway) or unbraced (with sway)
    b. span of beams
    c. height of the column
    d. loads acting on the frame

59. The main function of lateral ties in a reinforced concrete rectangular column under axial compression is to
    a. avoid the buckling of the longitudinal steel under compression
    b. provide adequate shear capacity
    c. provide adequate confinement to concrete
    d. reduce the axial deformation of the column

60. As per IS 456 : 2000, Limit state of collapse – flexure, the maximum strain in reinforcing bars under tension at failure shall not be less than _____, where f_y is the characteristic strength of steel and E_s is the Modulus of elastic of steel.
    a. f_y/E_s
    b. $0.002 + (f_y/E_s)$
    c. $f_y/1.15\ E_s$
    d. $0.002 + (f_y/1.15E_s)$

61. As per IS800-2007, the minimum centre-to-centre bolt spacing measured in the direction of stress is ————, where 'd' is the nominal diameter of bolt.
    a. 1.5 d
    b. 2.0 d
    c. 2.5 d
    d. 3.0 d

62. The net section strength of a tension member ———— with the increase in ductility of steel.
    a. increases
    b. decreases
    c. does not change
    d. becomes zero

63. As per IS 800 : 2007, the maximum deflection in a beam shall not exceed
    a. L/120
    b. L/150
    c. L/250
    d. L/325

64. As per IS 800-2007, the shear force does not influence the bending moment capacity when the factored design shear force does not exceed the design shear strength by
    a. 20%
    b. 40%
    c. 60%
    d. 80%

65. Intermediate vertical stiffeners are provided in plate girders to prevent
    a. local buckling
    b. web buckling
    c. excessive deflection
    d. flange buckling

66. An undrained triaxial compression test is carried out on a saturated clay sample under a cell pressure of 50 kN/m^2. The sample failed at a deviator stress of 100 kN/m^2. The cohesion of this clay sample would be
    a. 25kN/m^2
    b. 50kN/m^2
    c. 75kN/m^2
    d. 100kN/m^2

67. While computing the values of limits of consistency and consistency indices, it is found that liquidity index has negative value. Consider the following comment on this value.
    1. Liquidity index cannot have a negative value and should be taken as zero.
    2. Liquidity index can have a negative value.
    3. The soil tested is in semisolid state and stiff.
    4. The soil tested is in medium soft state.

    Which of these statements are correct?
    a. 1 and 4
    b. 1 and 3
    c. 2 and 4
    d. 2 and 3

68. Consider the following statements:
    1. 'Relative compaction' is not the same as 'relative density'.
    2. Vibroflotation is not effective in the case of highly cohesive soils.
    3. 'Zero air void line' and '100% saturation line' are not identical.

    Of these statements
    a. 1 and 2 are correct
    b. 1 and 3 are correct
    c. 2 and 3 are correct
    d. 3 alone is correct

69. Consider the following statements:
    1. Constant head permeameter is best suited for determination of coefficient of permeability of highly impermeable soils.
    2. Coefficient of permeability of a soil mass decrease with increase in viscosity of the pore fluid.
    3. Coefficient of permeability of a soil mass increases with increase in temperature of the fluid.

    Of these statements
    a. 1 and 2 are correct
    b. 1 and 3 are correct
    c. 2 and 3 are correct
    d. 1,2 and 3 are correct

70. What will be the unit weight of a fully saturated soil sample having water content of 38% and grain specific gravity of 2.65?
    a. 19.88 kN/m^3
    b. 17.88 kN/m^3
    c. 16.52 kN/m^3
    d. 14.65 kN/m^3

71. If two foundations, one narrow and another wide, are resting on a bed of sand carrying the same intensity of load per unit area, then which one is likely to fail early?
    a. Narrow foundation
    b. Wider foundation
    c. Both will fail simultaneously
    d. Difficult to judge since other conditions are unknown

72. The standard penetration resistance value obtained in a deep deposit of sand at a depth of 6.0 m was 28. The unit weight of sand is 18.0 kN/m^3. What is the corrected value of number of blows for overburden pressure?
    a. 60
    b. 57
    c. 59
    d. 55

73. A square plate of section 30 cm × 30 cm and length 10 m penetrates a deposit of clay having C = 5 kN/m^2 and the mobilizing factor m = 0.8. What is the load carries by the pile by skin friction only?
    a. 192 kN
    b. 75 kN
    c. 60 kN
    d. 48 kN

74. During a sampling operation, the drive sampler is advanced 600 mm and the length of the sample recovered is 525 mm. What is the recovery ratio of the sample?
    a. 0.125
    b. 0.140
    c. 0.875
    d. 0.143

75. A vertical cut is to be made in saturated clay with C = 15 kN/m^2, $\varphi = 0$, and $\gamma = 20$ kN/m^3. What is the theoretical depth to which the clay can be excavated without side collapse?
    a. 6 m
    b. 2 m
    c. 2.5 m
    d. 3 m

76. The Standard percentile value taken for fixing the variability of human characteristics is
    a. 80^{th} percentile
    b. 85^{th} percentile
    c. 90^{th} percentile
    d. 95^{th} percentile

77. If cross slope of a country is greater than 60%, the terrain is classified as
    a. Rolling
    b. Mountainous
    c. Steep
    d. Plain

78. The ductility value of bitumen for suitability in road construction should not be less than
    a. 30 cm
    b. 40 cm
    c. 50 cm
    d. 60 cm

79. The limiting value of cant excess for Broad Gauge is
    a. 45 mm
    b. 55 mm
    c. 65 mm
    d. 75 mm

80. In Instrumental Landing system, the middle markers are located
    a. About 1 km ahead of the runway threshold
    b. Along the extended centre line of runway end
    c. At the runway threshold
    d. About 2 km ahead of the runway threshold

81. Water having a kinematic viscosity of 0.01 stoke flows at a velocity of 2m/s in a pipe of 15 cm diameter. For dynamic similarity, the velocity of oil of kinematic viscosity 0.03 stoke in a pipe of the same diameter will be
    a. 0.33 m/s
    b. 0.66 m/s
    c. 2 m/s
    d. 6 m/s

82. The hydraulic jump in a stilling basin was found to be 10 cm in a model with Ip/Im = 36. The prototype jump height would be
    a. 0.6 m
    b. 3.6 m
    c. 21.6 m
    d. Indeterminable with this data

83. An isochrone is a line on the basin map joining the points
    a. Of equal snowfall
    b. Of rain gauge locations
    c. Of equal rainfall depth in a given location
    d. Having the equal time of travel of surface runoff to the catchment outlet

84. Transmissibility of a confined aquifer having its thickness 15 m and permeability 8×10^{-4} m/s is given by
    a. $1.2 \times 10^{-2} m^2/s$
    b. $12 \times 10^{-2} m^2/s$
    c. $0.12 \times 10^{-2} m^2/s$
    d. $120 \times 10^{-2} m^2/s$

85. The ratio of the total volume of water delivered to a crop to the area on which it has been spread is called
    a. Critical depth
    b. Duty
    c. Delta
    d. Crop-water depth

86. For a irrotational flow, the velocity potential lines and the streamlines are always
    a. Parallel to each other
    b. Coplanar
    c. Orthogonal to each other
    d. Inclined to horizontal

87. The pressure drop of water flowing through a pipe between two points is measured by using a vertical U –tube manometer. Manometer uses a liquid of density 2000 kg/m^3. The difference in height of manometers in two limbs is 10 cm. The pressure drop between the two points is
    a. $98.1 N/m^2$
    b. $981 N/m^2$
    c. $1962 N/m^2$
    d. $19620 N/m^2$

88. The hydraulic efficiency of an impulse turbine is maximum when the velocity is ———— of the jet velocity
    a. One-fourth
    b. Three-fourth
    c. One-half
    d. Double

89. The dimensions of Chezy's coefficient C in [MLT] notation system are
    a. $L^{1/2}\ T^{1/2}$
    b. $L^{-1}\ T^{1/2}$
    c. $L^{-1}\ T^{-1}$
    d. $L^{1/2}\ T^{-1}$

90. The most desirable alignment of an irrigation canal is along
    a. The straight line
    b. The perpendicular line
    c. The valley line
    d. The ridge line

91. The order of B.O.D. reaction is
    a. 0
    b. 1
    c. 2
    d. 0.5

92. Lime and soda are added to water to remove
    a. Pathogens
    b. Iron
    c. Hardness
    d. Nitrates

93. The average BOD removal in the primary sedimentation of sewage is
    a. 30%
    b. 50%
    c. 75%
    d. 80%

94. Bacterial algae symbiosis is associated with
    a. Oxidation pond
    b. Oxidation ditch
    c. Activated sludge process
    d. Rotating biological contactor

95. Ozone is formed in the upper atmosphere by a photochemical reaction with
    a. Ultra violet solar radiation
    b. Infra red radiation
    c. Visible light
    d. All of the above

96. In plane table surveying, the accessory used for sighting the target is
    a. Alidade
    b. Plumbing fork
    c. Trough compass
    d. Sextant

97. The method employed for locating the position of plane table station on drawing sheet is
    a. Radiation
    b. Intersection
    c. Orientation
    d. Resection

98. In levelling, correction for curvature of earth is always
    a. Positive
    b. Zero
    c. Negative
    d. Infinity

99. If the ground is flat, contour interval selected is
    a. Small
    b. Medium
    c. Large
    d. Extra large

100. The formula which calculates the volume of earth work accurately is
    a. Johnson's formula
    b. Kirchoff's formula
    c. Trapezoidal formula
    d. Prismoidal formula

PART III

02 – COMPUTER SCIENCE AND ENGINEERING / INFORMATION TECH.

(Answer ALL questions)

41. Which of the following invokes a function getReg(I)?
    a. Code optimization
    b. Code motion
    c. Code generation algorithm
    d. Intermediate code

42. The identification of common sub-expression and replacement of run-time computations by compile-time computation is
    a. Local optimization
    b. Loop optimization
    c. Constant folding
    d. Data flow analysis

43. Identify the incorrect statement regarding the use of generics and parameterized types in Java?
    a. Generics provide type safety by shifting more type checking responsibilities to the compiler
    b. Generics and parameterized types eliminate the need for down casts when using Java Collections
    c. When designing your own collections class (say, a linked list), generics and parameterized types allow you to achieve type safety with just a single class definition as opposed to defining multiple classes
    d. When designing your own collections class (say, a linked list), generics and parameterized types does not allow you to achieve type safety with just a single class definition as opposed to defining multiple classes

44. What is the if-then-form of the following Conditional statement? "It is time for dinner if it is 6 pm."
    a. If it is time for dinner, then it is 6pm
    b. If you want to eat dinner, then you must eat at 6pm
    c. If it is 6pm, then it is time for dinner
    d. If it is 6 pm , then it is no the time for dinner

45. Consider the following sets of processes, with the length of CPU burst time given in milliseconds:

Process	Burst time	Priority
P_1	8	4
P_2	6	1
P_3	1	2
P_4	9	2
P_5	3	3

    The processes are assumed to have arrived in the order P_1 P_2 P_3 P_4 P_5 all at time 0.Calculate average waiting time of each process by using FCFS.
    a. 13.1 ms
    b. 15.5 ms
    c. 16.4 ms
    d. 12.2 ms

46. Which of the following serves as the root parent process of all the user processes?
    a. root process
    b. parent process
    c. init process
    d. boot process

47. If parent terminated without invoking wait(), process is a
    a. Zombie
    b. Orphan
    c. Parent
    d. Client

48. Which of the following enables indirect communication in IPC?

a. Pipe

b. Shared memory

c. Link

d. Mailbox

49. Which of the following statements is true about the distributed system?

a. All processors are not synchronized

b. It is a collection of processor

c. They do not share memory

d. Both (a) and (c)

50. Which of the following computing models is not an example of distributed computing environment?

a. Cloud computing

b. Parallel computing

c. Cluster computing

d. Peer-to-peer computing

51. Which of the following models is having the most stringent consistency requirement and also called as strongest form of memory coherence?

a. Sequential Consistency

b. Strict Consistency

c. Causal Consistency

d. None of the above

52. When the physical location of the file changed in the distributed file system

a. File name also need to be changed

b. Host name of the file also need to be changed

c. Local name of the file also need to be changed

d. File name need not be changed

53. When inorder traversing a tree resulted ABCDEGFHI and post order traversing a tree resulted ACBEFGIHD; the preorder traversal would return

a. DBCAGEHIF

b. DBACHGEFI

c. DCBAGEFHI

d. IDBACGEHF

54. Consider a binary Max-heap implemented using an array. Which one of the following array represents a binary Max-heap?

a. 20, 18,15,12,10,9,16

b. 20,18,12,10,9,15,16

c. 20,12,18,10,9,15,16

d. 20,12,15,10,9,16,18

55. A B-tree of minimum degree t can have maximum ———————— pointers in a node.

a. $t - 1$

b. $2t - 1$

c. $2t$

d. t

56. The number of trees in a binomial heap with n nodes is

a. $\log n$

b. n

c. $n\log n$

d. $n/2$

57. What is recurrence for worst case of quick sort and what is the time complexity in worst case?

a. Recurrence is T(n) = T(n-2) + O(n) and time complexity is O(n^2)

b. Recurrence is T(n) = T(n-1) + O(n) and time complexity is O(n^2)

c. Recurrence is T(n) = 2T(n/2) + O(n) and time complexity is O(nlog n)

d. Recurrence is T(n) = T(n/10) + T(9n/10) + O(n) and time complexity is O(nlogn)

58. Let S be an NP-complete problem and Q and R be two other problems not known to be in NP. Q is polynomial time reducible to S and S is polynomial-time reducible to R. Which one of the following statements is true?

a. R is NP – complete

b. R is NP – hard

c. Q is NP – complete

d. Q is NP – hard

59. Recursive algorithm like Merge Sort cannot use Dynamic Programming because

a. The sub problems of merge sort are not overlapping in any way

b. Dynamic programming will not handle recursion

c. Dynamic programming takes very long time and will not give optimal solution

d. Sorting cannot be handled by dynamic programming

60. A greedy algorithm is an approach for solving a problem by

a. Decision taken previously will be reversed on finding a best choice

b. Best solution is chosen out of all resultant solutions

c. The solutions of sub-problems are combined in order to achieve the best solution

d. Selecting the best option available at the moment

61. In the absolute addressing mode

a. The operand is inside the instruction

b. The address of the operand is inside the instruction

c. The location of the operand is implicit

d. The register containing the address of the operand is specified

62. The elimination stage of WAR and WAW hazards is often called

a. Anti -dependence

b. Dispatch

c. Data hazards

d. Execution

63. What is the formula for Hit Ratio?

a. Miss/(Hit + Miss)

b. (Hit + Miss)/Miss

c. (Hit + Miss)/Hit

d. Hit/(Hit + Miss)

64. The Sun micro systems processors usually follow ———— architecture.

a. CISC

b. RISC

c. ISA

d. SPARC

65. The number of additions required to compute N-point DFT using radix-2 FFT is given by

a. $N \log_2 N$

b. $(N-1)\log_2 N$

c. $(N/2)\log_2 N$

d. $4N \log_2 N$

66. The transfer function of a Butterworth filter is given by

a. $H(j\Omega)\dfrac{6}{1+\left(\dfrac{1}{\Omega_c}\right)^N}$

b. $H(j\Omega)=\dfrac{1}{1+j\left(\dfrac{2\Omega}{\Omega_c}\right)^N}$

c. $H(j\Omega)=\dfrac{1}{1+j\left(\dfrac{\Omega}{\Omega_c}\right)^N}$

d. $H(j\Omega)=\dfrac{N}{1+\left(\dfrac{\Omega}{2\Omega_c}\right)^N}$

67. Fast Fourier Transform algorithms exploit

a. Four basic properties of phase factor

b. Complex multiplications

c. Indexing and addressing operations

d. Symmetry and periodicity

68. Low pass butterworth filters are

a. All-zero filters

b. Pole-pole filters

c. All-pole filters

d. Pole-zero filters

69. What is the maximum size of data that the application layer can pass on to the TCP layer below?

a. Any size

b. 1024 bytes - size of TCP header

c. 1400 bytes

d. 4500 bytes

70. A channel has B=4 KHz, what is the channel capacity having the signal-to-noise ratio of 20 dB?

a. 24.6 kbits/s

b. 26.6 kbits/s

c. 39.8 kbits/s

d. 20.2 kbits/s

71. A bit-stuffing based framing protocol uses an 8-bit delimiter pattern of 01111110. If the output bit-string after stuffing is 01111100101, then the input bit-string is

a. 0111110100

b. 0111110101

c. 0111111101

d. 0111111111

72. If 5 TCP segments of 100 byte MSS are sent consecutively, starting with sequence number 101,201,301,401, and 501, and if the First segment is lost, the ACKs returned will have ACK numbers as

a. 101,101,101,101

b. 201,301,401,501

c. 201,201,201,201

d. 101,201,301,401

73. The CREATE TRIGGER statement is used to create the trigger. THE ———— clause specifies the table name on which the trigger is to be attached. The ———— specifies that this is an AFTER INSERT trigger.

a. for insert, on

b. on, for insert

c. for, insert

d. for, for insert

74. Which of the following is a semi join?

a. Only the joining attributes are sent from one site to another and then all of the rows are returned

b. All of the attributes are sent from one site to another and then only the required rows are returned

c. Only the joining attributes are sent from one site to another and then only the required rows are returned

d. All of the attributes are sent from one site to another and then only the required rows are returned

75. Which of the following is not a clustering method?

a. K-nearest neighbourhood method

b. Agglomerative method

c. K-means method

d. Linear search method

76. Which of the following is the characteristics of RAID -5?

a. Dedicated Parity

b. Distributed Parity

c. Double Parity

d. Single Parity

77. All activities lying on critical path have slack time equal to

a. 0

b. 1

c. 2

d. – 1

78. If P is risk probability, L is loss, then Risk Exposure (RE) is computed as

a. RE = P/L

b. RE = P + L

c. RE = P*L

d. RE = 2* P *L

79. For a function of two variables, boundary value analysis yields

a. $4n + 3$ test cases

b. $4n + 1$ test cases

c. $n + 4$ test cases

d. $n + 1$ test cases

80. Which test refers to the retesting of a unit, integration and system after modification, in order to ascertain that the changes have not introduced new faults?

a. Regression Test

b. Smoke Test

c. Alpha Test

d. Beta Test

81. The number of levels used in defining a knowledge-based agent is

a. 2

b. 3

c. 4

d. 5

82. The reason for the uncertainty in the Wumpus World Problem is that the agent's sensor provides only the following information.

a. partial and global

b. partial and local

c. full and global

d. full and local

83. Which one of the following is the ability to represent all kinds of knowledge that are needed in that domain?

a. Inferential Adequacy

b. Representation Adequacy

c. Inferential Efficiency

d. Acquisitional Efficiency

84. Which one of the following is about a specific attribute that is guaranteed to take a unique value?

a. Inverses

b. Existence in an is a hierarchy

c. Techniques for reasoning about values

d. Single valued attributes

85. Which one of the following multiplexing techniques cannot be used for analog signals?

a. Frequency Division Multiplexing

b. Wavelength Division Multiplexing

c. Time Division Multiplexing

d. All of the above

86. In a wireless network, an extended service set is considered to be a set of

a. Access Points

b. Basic service sets

c. Mobile stations

d. None of the above

87. The radius within which the receiver receives the signals with an error rate low enough to be able to communicate and can also act as a sender is

a. Transmission range

b. Detection range

c. Interference range

d. Propagation range

88. Delay spread in signal propagation is due to
    a. Guidance of waves through a single path
    b. Signals arriving at the receiver at different times
    c. Transmission of signals through wires
    d. Signals travelling along a straight line

89. Which of the following methods provides a one-time session key for two parties?
    a. Diffie-Hellman
    b. RSA
    c. DES
    d. AES

90. The most widely used ensemble method is
    a. pruning
    b. boosting
    c. bagging
    d. regret learning

91. Which one of the following options contains the list of escape character in HTML escape function?
    a. &, <, >, *, "
    b. &, (,), ", *
    c. &, <, >, ", '
    d. &,', (,), ;

92. Consider the following systems of three equations (congruences): x ≡ 2 (mod 3), x ≡ 3 (mod 5) and x ≡ 2 (mod 7). Find *x*?
    a. 33
    b. 23
    c. 42
    d. 51

93. The probability density function of a continuous random variable X is given by $f(x) = k(x-1)^3, 1 \le x \le 3$. The value of "$k$" is
    a. 1/4
    b. 1/2
    c. 2
    d. 4

94. If the random process is such that, "Future behavior of the process depends only on the present state and not on the past", then it is a
    a. Poisson Process
    b. Binomial Process
    c. Markov Process
    d. Stationary Process

95. The stability condition for the multi-server queueing model with "c" servers is given by
    a. $\lambda < \mu$
    b. $\lambda > \mu$
    c. $\lambda < c\mu$
    d. $\lambda > c\mu$

96. Which of the following is not a component of the ANOVA table?
    a. F ratio
    b. Sum of Squares
    c. Degree of Freedom
    d. Correction Term

97. Regular expression for all strings starting with "ab" and ending with "ba" is:
    a. aba^*b^*ba
    b. $ab(ab)^*ba$
    c. $ab(a+b)^*ba$
    d. $abba$

98. The regular expression of the language {0,01,011,0111,.....} is given by
    a. $(0+1)^*$
    b. $(01)^*$
    c. $(0)(1)^*$
    d. $01^* + 0$

99. The number of states required to accept the string ending with 010 is
    a. 2
    b. 3
    c. 1
    d. 4

100. The chromatic number of a wheel graph on n vertices denoted by W_n is
    a. n
    b. 3 when n is even and 4 when n is odd
    c. $n-1$
    d. 3 when n is odd and 4 when n is even

PART III

03 – ELECTRICAL AND ELECTRONICS ENGINEERING

(Answer ALL questions)

41. The resultant magnetic flux generated in the closed surface will be
    a. Zero
    b. Continuous
    c. Constant
    d. Unity

42. The motion of electrons in a CRTs is due to
    a. Charge density
    b. Columbic Force
    c. Lorentz Force
    d. Electron Gun

43. H in the region $0 \le l \le a$ for an infinitely long co-axial transmission line is
    a. $H = Il/2\pi a^2$
    b. $H = I/\pi a^2$
    c. $H = 0$
    d. $H = Il^3/\pi a^2$

44. The direction of current flow in the circuit is such that the induced magnetic field produced by the induced current will oppose the original magnetic field. This is
    a. Faraday's Law
    b. Lenz's Law
    c. Biot - Savart Law
    d. Gauss Law

45. The electromagnetic wave propagates in free space with a speed of
    a. 1.9×10^6 m/s
    b. 3×10^8 m/s
    c. 2.12×10^2 m/s
    d. 3.8×10^4 m/s

46. Energy stored in the capacitor is
    a. $\frac{1}{2} CI^3$
    b. $\frac{1}{2} CV^3$
    c. $\frac{1}{2} CV^2$
    d. $\frac{1}{2} CI^2$

47. 200 V, 50 Hz inductive circuit takes a current of 10 A lagging the voltage by 30^o. Calculate inductance of the circuit
    a. 31.85 mH
    b. 51.85 mH
    c. 21.85 mH
    d. 11.85 mH

48. Which of the following motors is expected to have maximum full-load efficiency
    a. 1 kW
    b. 5 kW
    c. 30 kW
    d. 100 kW

49. Dynamic braking is very effective for
    a. DC series motor
    b. DC shunt motor
    c. Separately excited DC motor
    d. Cumulatively compound DC motor

50. A transformer steps up the voltage by a factor of 100. The ratio of current in the primary to that in the secondary is
    a. 1
    b. 100
    c. 0.01
    d. 0.1

51. Power factor of a power transformer on no load will be about
    a. 1
    b. 0.75
    c. 0.5
    d. 0.35

52. To eliminate 5th harmonic voltage from the phase voltage of and alternator, the coils should be short pitched by an electrical angle of

a. 30 degree

b. 36 degree

c. 72 degree

d. 18 degree

53. The flux set up by the armature current, which does not cross the air gap and takes a different path is called as

a. Leakage flux

b. Main flux

c. Cross-magnetizing flux

d. Demagnetizing flux

54. AC machines should have proper ———— in order to limit the operating temperature

a. Voltage rating

b. Current rating

c. Speed

d. kW rating

55. The nuclear plants are suitable for

a. Peak load

b. Intermediate loads

c. Base load

d. Both base and peak loads

56. Corona loss increases with

a. Decrease in conductor size and increase in supply frequency

b. Increase in conductor size and decrease in supply frequency

c. Increase in both conductor size and supply frequency

d. Decrease in both conductor size and supply frequency

57. Which of the following matrices reveals the topology of the power system network?

a. Bus incidence matrix

b. Primitive impedance matrix

c. Primitive admittance matrix

d. Bus admittance matrix

58. Four identical alternators each rated for 20 MVA, 11 kV having a sub-transient reactance of 16% are working in parallel. The short circuit level at the bus bars is

a. 700 MVA

b. 500 MVA

c. 300 MVA

d. 200 MVA

59. Magnetizing inrush current is rich in

a. 3rd harmonics

b. 5th harmonics

c. 7th harmonics

d. 2nd harmonics

60. Negative phase sequence current in an alternator produces

a. Over speed

b. Over voltage

c. Rotor heating

d. Under frequency

61. SVC is basically

a. A FACTS controller connected to transmission line by series insertion transformer only

b. A compensator used to exchange real power at fundamental frequency

c. A series connected FACTS controller

d. A shunt connected FACTS controller

62. The Impulse Response of an initially relaxed linear system is $e^{-2t}u(t)$. To produce a response of $te^{-2t}u(t)$, the input should be

a. $2e^{-t}u(t)$

b. $0.5\,e^{-2t}u(t)$

c. $e^{-2t}u(t)$

d. $e^{-t}u(t)$

63. The steady state error due to unit acceleration input for a type 2 system is

a. Zero

b. Infinity

c. $1/K_a$

d. $1/K_v$

64. A system has two zeros and four poles. Then two asymptotes in the root loci plane move towards infinity along

a. ± 60 degree

b. ± 90 degree

c. ± 45 degree

d. ± 30 degree

65. A closed loop system has the characteristic equation given by $s^3 + ks^2 + (k + 2)\, s + 3 = 0$. For the system to be stable the value of k is

a. $k > 1$

b. $0.5 < k < 1$

c. $0 < k < 1$

d. $0 < k < 0.5$

66. Loop transfer function of a feedback system is $G(s)\, H(s) = \frac{10}{(s-2)}$. Assume the Nyquist contour in the clockwise direction. Then the Nyquist plot of G(s) encircles –1 + j0

a. once in clockwise direction

b. twice in clockwise direction

c. once in anti-clockwise direction

d. twice in anti-clockwise direction

67. The transfer function of a first order controller is given as $G_c(s) = K\,(s + a) / (s + b)$, where K, a, b are positive real numbers. The condition for this controller to act as a phase lag compensator is

a. $a < b$

b. $a > b$

c. $K < ab$

d. $K > ab$

68. The state variable description of a system is $\dot{X} = AX + BU$; $A = \begin{bmatrix} 0 & 3 \\ 3 & 0 \end{bmatrix}$. The poles of the system are located at

a. $s = \pm 2$

b. $s = \pm j2$

c. $s = \pm j3$

d. $s = \pm 3$

69. In a single phase semi-converter without freewheeling diode, for discontinuous conduction and extinction angle $\beta > \pi$, each SCR conducts for the period

a. $\pi - \alpha$

b. $\beta - \alpha$

c. α

d. β

70. For a single phase full wave uncontrolled rectifier with purely R load, the form factor is

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

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

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

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

71. A single-phase inverter has square wave output voltage. The percentage of the fifth harmonic component in relation to the fundamental component is

a. 10

b. 20

c. 30

d. 40

72. The RMS output voltage at fundamental frequency of a single phase, full bridge inverter with input voltage of 48V DC, feeding a load of 2.4 Ω is

a. $\frac{4\times 48}{\sqrt{2}\,\pi}V$

b. $\frac{48}{2\sqrt{2}\,\pi}V$

c. $\frac{\sqrt{2}\times 48}{\pi}V$

d. $\frac{4\times 48}{\pi}V$

73. When the MOSFET is in the ON state, the channel of the device behaves like

a. Constant resistance

b. Inductance

c. Capacitance

d. Resistance and Inductance

74. The duty cycle value of buck converter when the switching frequency is 250 kHz and the ON time is 2μs is

a. 0.4

b. 0.8

c. 0.5

d. 0.2

75. Which load torque will be used in regenerative braking?

a. Fan hype load torque

b. Frictional load torque

c. Passive load torque

d. Archive load torque

76. Assuming 3 MHz clock frequency, the execution time taken by the delay subroutine is :

```
Delay :  MVI C, 9Ah
Loop  :  DCR C
         JNZ  Loop
         RET
```

a. 0.723 msec

b. 7.23 msec

c. 0.07231 msec

d. 72.34 μsec.

77. The output of the following program is :

```
LXI  H, 1234h
MVI C, 05h
MVI B, 67h
DCR  C
DAD  B
SHLD Result
HLT.
```

a. 1234 h

b. 7938 h

c. 7939 h

d. 129 Bh

78. On execution of the program segment,

```
MVI A, 0Ah
SIM
....
```

a. RST 6.5 is disabled, but other interrupts are enabled

b. RST 7.5 is disabled, but other interrupts are enabled.

c. RST 5.5 is disabled, but other interrupts are enabled.

d. Both RST 5.5 and RST 6.5 are disabled, but other interrupts are enabled.

79. The 8051 program segment, which performs 'software polling' to check if the timer-0 counting has completed, is:

a. JNB TF0, 0FEh

b. JB TF0, 0FEh

c. JB TF1, 0FEh

d. JNB TF1, 0FEh

80. The output of the following 8051 Assembly code is,

```
MOV A, #10
MOV 01H, A
MOV A, #20
MOV @R1, A
```

a. A = 10
b. [01] = 20
c. [10] = 20
d. [20] = 10

81. What is the operation carried out by the 8051 instruction: 'SETB 0D3'?
a. It disables all of the interrupts temporarily
b. It doubles the baud rate of the serial communication
c. It switches to bank1 from the default bank0
d. It makes the timer-0 run in mode-3

82. If all the poles of H(z) are outside the unit circle, then the system is said to be
a. Only causal
b. Only BIBO stable
c. BIBO stable and causal
d. None of the above

83. Which of the following is true regarding the number of computations required to compute N-point DFT
a. N^2 complex multiplications and N(N–1) complex additions
b. N^2 Complex additions and N(N–1) complex multiplications
c. N^2 complex multiplications and N(n+1) complex additions
d. N^2 complex additions and N(N+1) complex multiplications

84. Which of the following justifies the linearity property of z-transform? [x(n) ↔ X(z)].
a. x(n) + y(n) ↔ X(z)Y(z)
b. x(n) + y(n) ↔ X(z) + Y(z)
c. x(n) y(n) ↔ X(z) + Y(z)
d. x(n) y(n) ↔ X(z)Y(z)

85. What is the width of the main lobe of the frequency response of a rectangular window of length M-1?
a. π/M
b. $2\pi/M$
c. $4\pi/M$
d. $8\pi/M$

86. With reference to the Fast Fourier Transform if $W_4^1 = W_x^2$, then what is the value of x ?
a. 2
b. 4
c. 8
d. 16

87. Which of the following defines the FIR filter for length M, input x(n) and output y(n)?
a. $y(n) = \sum_{K=0}^{M} b_k\, x(n-k)$
b. $y(n) = \sum_{K=0}^{M+1} b_k\, x(n+k)$
c. $y(n) = \sum_{K=0}^{M-1} b_k\, x(n-k)$
d. $y(n) = \sum_{K=0}^{M} b_k x(n+k)$

88. Surge impedance of loss less transmission line is (if L =inductance/m C = capacitance/m)
a. $\sqrt{C/L}$
b. $\sqrt{L/C}$
c. $1/\sqrt{LC}$
d. $\sqrt{LC}$

89. Time lag for breakdown is
a. time required for gas to breakdown under pulse application
b. time taken for the voltage to rise before breakdown occurs
c. time difference between instant of applied voltage and occurrence of breakdown
d. time required for ionization

90. In impulse testing of transformers fault location is usually done by
a. neutral current oscillogram
b. chopped wave oscillogram
c. observing for noise or smoke
d. scanning method

91. The breakdown strength of air for small gaps (1 mm) under uniform field condition and standard atmospheric conditions will be

a. 50 kV/cm

b. 43.45 kV/cm

c. 25.58 kV/cm

d. 40.59 kV/cm

92. Optimum number of stages for Cockcroft Walton voltage multiplier circuit are

a. $\sqrt{V_{max}/If\ C}$

b. $\sqrt{If\ C/V_{max}}$

c. $\sqrt{V_{max}f/IC}$

d. $\sqrt{V_{max}fC/I}$

93. The most important test to assert the proper functions of a surge diverter is

a. 100% impulse withstand test

b. Front of wave spark over and residual voltage tests

c. Impulse current test

d. Pollution tests

94. An R-C voltage divider has an HV arm capacitance, C_1 = 600 pf, resistance = 400 Ω and equivalent ground capacitance C_g = 240 pF. The effective time constant of the divider in nanoseconds is

a. 32

b. 100

c. 67

d. 25

95. Electric traction uses power supply of

a. 25 kV, AC, 50Hz

b. 25kV, DC

c. 50kV, AC, 50Hz

d. 50kV, DC

96. Filament lamps operate normally at a power factor of

a. 0.6 lagging

b. 0.6 leading

c. Zero power factor

d. Unity power factor

97. Candela is the unit of

a. Luminous flux

b. Luminous intensity

c. Light

d. Brightness

98. A slab of insulating material 130 cm^2 in area and 1 cm thick is to be heated by dielectric heating. The power required is 380 W at 30 MHz. The material has a relative permittivity of 5 and power factor of 0.05. Determine the necessary voltage

a. 837 kV

b. 837 V

c. 652 V

d. 552 V

99. Spot welding is used for

a. Thin metal sheets

b. Thick metal rods

c. Thick Square sections

d. Rough and irregular surfaces

100. Material used for solar cell is

a. Germanium

b. Silicon

c. Silica gel

d. Mercury

PART III

04 - ELECTRONICS AND COMMUNICATION ENGINEERING

(Answer ALL questions)

41. Transfer characteristics of JFET is drawn between
    a. V_{DS} and I_D
    b. V_{DS} and I_G
    c. V_{GD} and I_D
    d. V_{GS} and I_D

42. ———————— capacitance affects high frequency response of CE amplifier.
    a. C_{ce}
    b. C_{be}
    c. C_{gd}
    d. C_{bc}

43. Forward current of 75mA passes through a diode for a forward drop of 0.6V. Find the forward resistance of the diode.
    a. 7Ω
    b. 8Ω
    c. $9.3\,k\Omega$
    d. $10.7\,k\Omega$

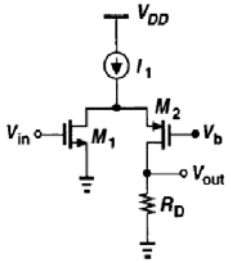
44. Early effect in bipolar transistor is caused by
    a. Fast turn on
    b. Fast turn off
    c. Large collector base reverse bias
    d. Large emitter base forward bias

45. Find the operating region of N-channel MOSFET with V_{GS} = 1.4V, V_{TN} = 0.5V, V_{DS} = 1.8V
    a. Linear
    b. Cut-off
    c. Triode
    d. Saturation

46. High frequency response of CS amplifier has a Miller multiplier equal to
    a. $1+g_mR_L'$
    b. $-g_mR_L'$
    c. $1/g_mR_L'$
    d. $1/g_m$

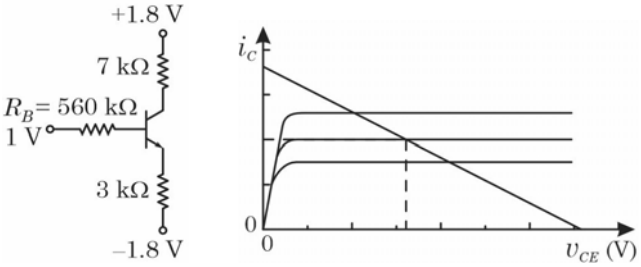
47. Find the differential mode gain of differential amplifier with CMRR of 5200 and common mode gain of 0.015V/V
    a. 0.012V/V
    b. 120V/V
    c. 7.8V/V
    d. 78V/V

48. Amplifier configuration shown in the below Figure is with MOSFETS M1, M2 connected respectively in a configuration given by



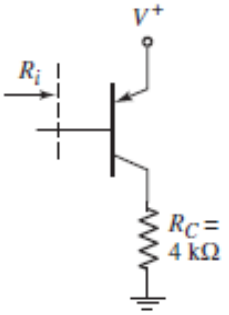
    a. Common Source and Common Drain
    b. Common Gate and Common Drain
    c. Common Source and Common Gate
    d. Common Gate and Common Source

49. Consider the circuit shown in the below Figure and its load line characteristic. The x-intercept of the load line is



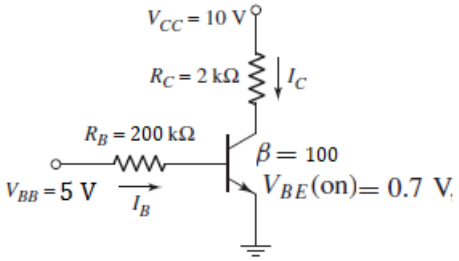
    a. 3.6V
    b. 0
    c. 1.8V
    d. 1V

50. Parameters of the transistor shown in the circuit below are $\beta = 100$, I_{CQ} = 1mA. Input resistance R_i of the circuit is



    a. $5\,k\Omega$
    b. $2.6\,k\Omega$
    c. $400\,k\Omega$
    d. $3\,k\Omega$

51. For the circuit shown in the Figure below, g_m of the transistor is



a. 0.0635A/V
b. 0.0827A/V
c. 0.026A/V
d. 0.071A/V

52. How many AND gates are required to construct a 4 – bit parallel multiplier if four 4 – bit parallel binary adders are given?
a. Sixteen 2 – input AND gates
b. Eight 2 – input AND gates
c. Four 2 – input AND gates
d. Two 2 – input AND gates

53. Which of these error-detecting codes enables to find double errors in Digital Electronic devices?
a. Bit generation method
b. Odd-Even method
c. Parity method
d. Check sum method

54. In order to check the CLR function of a counter
a. Connect the CLR input to Vcc and check to see if all of the Q outputs are HIGH
b. Ground the CLR input and check to be sure that all of the Q outputs are LOW
c. Apply the active level to the CLR input and check all of the Q outputs to see if they are all in their reset state
d. Connect the CLR to its correct active level while clocking the counter; check to make sure that all of the Q outputs are toggling

55. Why the feedback circuit is said to be negative for voltage series feedback amplifier?
a. Input voltage is 180° out of phase with respect to feedback voltage
b. Feedback voltage is 180° out of phase with respect to input voltage
c. Input voltage is in same phase with respect to feedback voltage
d. Feedback voltage is in same phase with respect to input voltage

56. A linear, bilateral, electrical network produces 2A current through a load when the network was energized by a 20V source. If the network is energized by 40V source, the current through the load will be
a. 8 A
b. 6 A
c. 4 A
d. 2 A

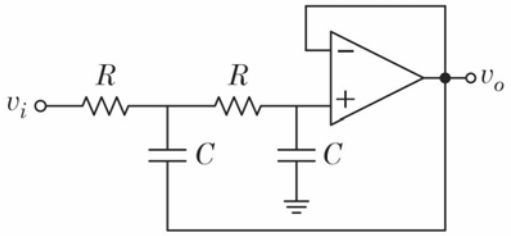
57. Choose the minimum number of op-amps required to implement the given expression.

$$V_o = \left[1 + \frac{R_2}{R_1}\right] V_1 - \frac{R_2}{R_1} V_2$$

a. Two
b. Four
c. Three
d. One

58. Calculate the value of LSB and MSB of a 12-bit DAC for 10V.
a. LSB = 2.4 mV; MSB = 5 V
b. LSB = 2.4 mV; MSB = 10 V
c. LSB = 4.8 mV; MSB = 5 V
d. LSB = 4.8 mV; MSB = 10 V

59. Which type of filter is shown in the figure?



a. Low Pass Filter
b. High Pass Filter
c. Band Pass Filter
d. Band Reject Filter

60. The output voltage of phase detector is
a. Phase voltage
b. Free running voltage
c. Error voltage
d. None of the above

61. Which characteristic of PLL is defined as the range of frequencies over which PLL can acquire lock with the input signal?
a. Free-running state
b. Pull-in time
c. Lock-in range
d. Capture range

62. In 8085 microprocessor, unfortunately, 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

63. It is desired to mask the higher order bits (D_7-D_4) of the data bytes in register C. consider the following set of 8085 instruction,

(i)
```
MOV  A, C
ANI  F0H
MOV  C, A
HLT
```
(ii)
```
MOV  A, C
MVI  B, F0H
ANA  B
MOV  C, A
HLT
```
(iii)
```
MOV  A, C
MVI  B, 0FH
ANA  B
MOV  C, A
HLT
```
(iv)
```
MOV  A, C
ANI  0FH
MOV  C, A
HLT
```

The instruction set, which execute the desired operation is

a. (i) and (ii)
b. (iii) and (iv)
c. Only (i)
d. Only (iv)

64. 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

65. For the given 8086 microprocessor instructions below, which is an invalid instruction?

a. MOV BX, [0301 H]
b. MOV CX, 037AH
c. MOV AL,BL
d. MOV DS, 4100H

66. Match the following: For 8086 microprocessor,

A. Program memory	1. It can be located at odd memory addresses
B. Data memory	2. Jump and call instructions can be used for short jumps within selected 64 KB code segment
C. Stack memory	3. The size of the data accessible memory is limited to 256 KB
D. Cache memory	4. Storage device placed in between processor and main memory

a. A-3, B-4, C-2, D-1
b. A-2, B-1, C-3, D-4
c. A-2, B-3, C-1, D-4
d. A-2, B-3, C-4, D-1

67. Moist soil has a conductivity of $\sigma = 10^{-3}$ S/m and Cr = 2.5. Find conduction current Jc. Given, $E = 6 \times 10^{-6} \sin 9 \times 10^{9}t$ V/m

a. $6 \times 10^{-9} \sin 9 \times 10^{9}t$ A/m²
b. $46 \times 10^{-3} \sin 9 \times 10^{3}t$ A/m²
c. $6.67 \times 10^{-4} \sin 9 \times 10^{4}t$ A/m²
d. $0.065 \times 10^{-2} \sin 9 \times 10^{7}t$ A/m²

68. A wave is incident at an angle of 30°, from air to Teflon. Find the angle of transmission. Given, Cr = 2.1, $\mu_1 = \mu_2$

a. 60.19°
b. 39.47°
c. 30°
d. 20.18°

69. Calculate the propagation constant Y for a conducting medium in which σ = 58 MS/m, μ_r=1 and f = 100 MHz.

a. 2.14×10^{6} angle 90° m^{-1}
b. 2.14×10^{2} angle 60° m^{-1}
c. 2.14×10^{9} angle 15° m^{-1}
d. 2.14×10^{5} angle 45° m^{-1}

70. On a radio frequency transmission line, the velocity of signals at a frequency of 125 MHz is 2.1×10^8 m/sec. What is the wavelength of the signal on the line?
a. 1.32 m
b. 1.16 m
c. 1.68 m
d. 1.93 m

71. When an arbitrary length of any general transmission line, is terminated in an open circuit or a short circuit, its input impedance is determined completely by
a. the propagation factors, the characteristic impedance and line length
b. the propagation factors and line length
c. the characteristic impedance and line length
d. the propagation factors alone

72. A mode is a combination of a voltage V and current I, which propagate along z according to the common propagation factor of
a. $\exp(j\omega t - yz)$ and which, maintains a constant relationship between V and I
b. $\exp(j\omega t + yz)$ and which, maintains a constant relationship between α and β
c. $\exp(j\omega t)$ and which, maintains a constant relationship between α and β
d. $\exp(yz\ t)$ and which, maintains a constant relationship between V and I

73. In the absence of attenuation on the line $(\alpha = 0)$, the Voltage Standing Wave Ratio (VSWR) is
a. The same everywhere on a uniform, source free section of line
b. Infinity on a uniform, source free section of line
c. Zero on a uniform, source free section of line
d. –1 on a uniform, source free section of line

74. Consider an air filled rectangular waveguide with a cross – section of 5 cm × 3 cm. For this waveguide, the cut off frequency (in MHz) of TE_{21} mode is
a. 7810 MHz
b. 7.81 MHz
c. 78.1 MHz
d. 781 MHz

75. The far field of an antenna varies with distance r as
a. $1/r$
b. $1/r^2$
c. $1/r^3$
d. $1/\sqrt{r}$

76. What is the nature of radiation pattern of an isotropic antenna?
a. Spherical
b. Dough-nut
c. Elliptical
d. Hyperbolic

77. The modulation index of amplitude modulation system is limited to unity because of
a. transmission requires higher power for higher values of modulation index
b. modulated signal bandwidth is higher for higher values of modulation index
c. demodulated signal is distorted while coherent receiver is used
d. demodulated signal is distorted while envelop detector is used as receiver

78. A 4×1 multiplexer is used to multiplex 3 signals $\{A, B, C\}$ with highest frequency components $\{250\,\text{Hz}, 100\text{Hz}, 600\,\text{Hz}\}$ respectively. Each channel is uniformly sampled at constant rate with the help channel selector clock (F_{sel}). The input channels $\{I_1, I_2, I_3, I_4\}$ of the multiplexers are connected to the signals as $\{A, C, B, C\}$ respectively. What is the minimum value F_{sel} in order to recover the signals from their samples?
a. 100 Hz
b. 500 Hz
c. 600 Hz
d. 1200 Hz

79. NRZ and QPSK are ———— respectively.
a. Baseband and baseband signaling schemes
b. Baseband and pass band signaling schemes
c. Pass band and pass band signaling schemes
d. Error control and source coding schemes

80. Let an error control system uses (16, 3) block codes. The coding efficiency of the system will be
   a. 3 bits
   b. 16 bits
   c. 48
   d. 3/16

81. A direct sequence spread spectrum technique uses 10 flip-flop linear feedback shift register as PN code generator. The jamming margin produced by the system will be
   a. 10 dB
   b. 20 dB
   c. 30 dB
   d. 40 dB

82. Which of the following statements is true about error detection techniques used on communications link?
   a. Cyclic Redundancy Check (CRC) sequence can detect as well as correct errors
   b. Error detection alone cannot be used on simplex links
   c. (7, 4) Hamming code can detect up to 3-bit errors
   d. All of the above

83. Which of the following Light source is popularly used in optical communication?
   a. Visible light
   b. Ultraviolet
   c. Infrared
   d. Radio frequency

84. The Numerical aperture of a fiber describes the ———————— characteristics.
   a. Light scattering
   b. Light collection
   c. Light dispersion
   d. Light polarisation

85. When mean optical power launched into an 8 km length of fiber is 12 μW, the mean optical power at the fiber output is 3 μW. Find the overall signal attenuation in dB
   a. 15 dB
   b. 16 dB
   c. 10 dB
   d. 12 dB

86. The orthogonal signals S_1 and S_2 satisfy the following relation.
   a. $\int_0^T s_1(t)s_2(t)dt = 0$
   b. $\int_0^T s_1(t)s_2(t)dt = 1$
   c. $\int_0^T s_1(t)s_2(t)dt = \infty$
   d. Both (b) and (c)

87. In a PCM system, speech signal bandlimited to 4 kHz is sampled at 1.5 time Nyquist rate and quantized using 256 levels. The bit rate required to transmit the signal will be
   a. 64 kbps
   b. 96 kbps
   c. 128 kbps
   d. 160 kbps

88. If the data rate of delta modulator output is 43.2 kbps, for the input signal of 3.6 kHz, then the sampling rate used is equal to,
   a. 4 times the Nyquist rate
   b. 6 times the Nyquist rate
   c. 12 times the Nyquist rate
   d. 3 times the Nyquist rate

89. An AM modulator develops an unmodulated power output of 400W across a 50Ω resistive load. The carrier is modulated by a single tone with a modulation index of 0.6. If this AM signal is transmitted, the power developed across the load is,
   a. 428 W
   b. 432 W
   c. 472 W
   d. 418 W

90. The Modulating frequency in narrow band frequency modulation is increased from 10 kHz to 20 kHz. The bandwidth is
   a. Doubled
   b. Halved
   c. Increased by 10 kHz
   d. Decreased by 10 kHz

91. Which of the following causal analog transfer functions is used to design causal IIR digital filter with transfer function?

$$H(z)=\frac{0.05z}{z-e^{-0.42}}+\frac{0.05z}{z-e^{-0.2}}$$

Assume impulse invariance transformation with T = 0.1s.

a. $H(S)=\frac{0.5}{S+4.2}+\frac{0.5}{S+2}$

b. $H(S)=\frac{0.5}{S+2.1}+\frac{0.5}{S+4}$

c. $H(S)=\frac{0.5}{S-2.1}+\frac{0.5}{S-4}$

d. $H(S)=\frac{0.5}{S-4.2}+\frac{0.5}{S-2}$

92. The shape of the rectangular window function is changed to other function such as Hamming and Blackman window functions so that

a. the sidelobe amplitude decreases while decreasing transition band width
b. the sidelobe amplitude increases while increasing transition band width
c. the sidelobe amplitude decreases while increasing transition band width
d. the sidelobe amplitude increases while decreasing transition band width

93. Window function used in FIR realization,

a. truncates the impulse response
b. minimize power leakage in side lobes
c. increases main lobe width
d. does all

94. The new pole locations due to truncation of coefficient to 4 bit including sign bit in the cascade realization

$$H(z)=\frac{1}{\left(1-0.95z^{-1}\right)\left(1-0.25z^{-1}\right)}$$

a. 0.5, 0.25
b. 0.875, 0.25
c. 0.95, 0.5
d. 0.75, 0.125

95. The number 110000000.010…..000 represented in IEEE single precision format corresponds to the decimal number

a. –2.5
b. –1.25
c. –2.15
d. –2.75

96. The transfer function of first order high pass digital Butterworth filter that has 3dB cut off frequency $\omega_c=0.15\,\pi$ using bilinear transformation with T = 1s

a. $H(z)=\frac{1}{1-0.24\left[\frac{z+1}{z-1}\right]}$

b. $H(z)=\frac{1}{1+0.15\left[\frac{z+1}{z-1}\right]}$

c. $H(z)=\frac{1}{1+0.24\left[\frac{z-1}{z+1}\right]}$

d. $H(z)=\frac{1}{1+0.48\left[\frac{z+1}{z-1}\right]}$

97. The signal to quantization noise ratio of an analog to digital converter having full scale range of ±1 volt for seven bit word length is 42dB. The approximate value of signal to quantization noise ratio for 9 bit word length is

a. 44 dB
b. 24 dB
c. 54 dB
d. 75 dB

98. A digital filter with impulse response $h[n]=2^n u[n]$ will have transfer function with region of convergence

a. includes unit circle
b. excludes unit circle
c. bounded by rings with circles of radius 0.5 and 2
d. entire z-plane excluding origin and infinite

99. The number of multipliers and delay elements required in direct form II realization of $H(z)=\frac{1+0.5z^{-1}-2z^{-2}}{1+z^{-1}-z^{-2}}$

a. 5, 2
b. 3, 4
c. 6, 4
d. 3, 2

100. The output noise variance due to 8 bit ADC of first order filter with $H(z)=\frac{1}{1-0.25z^{-1}}$ for the input signal with noise variance σ^2 is

a. $1.5\sigma^2$
b. $1.06\sigma^2$
c. $0.25\sigma^2$
d. $1.25\sigma^2$

PART III

05 - MECHANICAL ENGINEERING

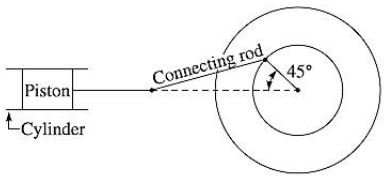
(Answer ALL questions)

41. A bullet is fired upwards at an angle of 30° to the horizontal from a point P on a hill, and it strikes a target which is 80 m lower than P. The initial velocity of the bullet is 100 m/s. Calculate the maximum height to which the bullet will rise above the horizontal. Assume $g = 9.81\ m/s^2$.
    a. 150.8 m
    b. 100.5 m
    c. 140.2 m
    d. 127.6 m

42. The condition for a screw jack to be self-locking is that
    a. Its efficiency should be the maximum possible
    b. Its efficiency should be the minimum possible
    c. It should not unwind to lower the load if left to itself
    d. Its efficiency should be more than 50%

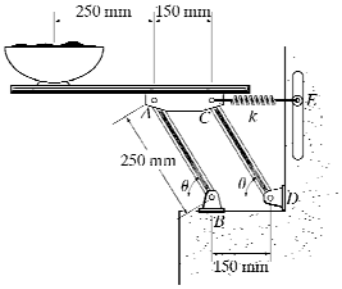
43. The first moment of area of a semicircular area about its diameter 'd' is given by
    a. $d^3/36$
    b. $d^3/12$
    c. $d^3/24$
    d. $d^3/6$

44. A reciprocating pump driven by a driving wheel is shown in the below figure. If crank is 80 mm long and connecting rod 200 mm, determine the velocity of the piston in the position shown. The driving wheel rotates at 2000 rpm in anticlockwise direction.



    a. 15.34 m/s
    b. 30.61 m/s
    c. 31.45 m/s
    d. 72.82 m/s

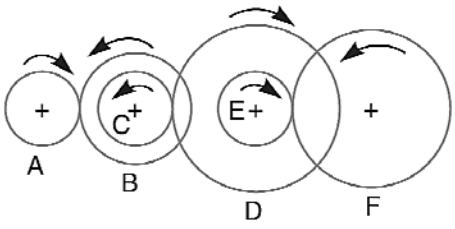
45. A 5-kg uniform serving table is supported on each side by two pairs of identical links, AB and CD, and springs CE as shown in the below figure. If the bowl has a mass of 1 kg and is in equilibrium when θ = 45°, determine the stiffness k of each spring. The springs are upstretched when θ= 90°. Neglect the mass of the links.



    a. 88 N/m
    b. 166 N/m
    c. 194 N/m
    d. 138 N/m

46. Calculate the power transmitted through belt drive (in kW) if tension on tight and slack sides are 200 N and 50 N, respectively. The linear velocity of belt speed is 10 m/s.
    a. 2.5 kW
    b. 1 kW
    c. 2 kW
    d. 1.5 kW

47. The gearing of a machine tool is shown in the below figure. The motor shaft is connected to gear A and rotates at 975 rpm. The gear wheels B, C, D and E are fixed to parallel shafts rotating together. The final gear F is fixed on the output shaft. What is the speed of gear F? The number of teeth on each gear are as follows: A=20; B=50; C=25; D=75; E=26 and F=65.

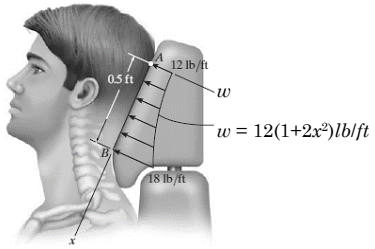


    a. 78
    b. 104
    c. 52
    d. 98

48. When the rotor rotates in the anticlockwise direction and viewed from the stern while the ship is steering to the left, then the effect of reactive gyroscopic couple will be

a. To lower the bow and lower the stern
b. To raise the bow and lower the stern
c. To raise the bow and raise the stern
d. To lower the bow and raise the stern

49. Currently eighty-five percent of all neck injuries are caused by rear-end car collisions. To alleviate this problem, an automobile seat restraint has been developed that provides additional pressure contact with the cranium. During dynamic tests the distribution of load on the cranium has been plotted and shown to be parabolic. Determine the equivalent resultant force and its location, measured from point A.



a. $F_R = 7\,lb$ and $\bar{x} = 0.268\,ft$
b. $F_R = 5\,lb$ and $\bar{x} = 0.223\,ft$
c. $F_R = 12\,lb$ and $\bar{x} = 0.718\,ft$
d. $F_R = 4\,lb$ and $\bar{x} = 0.482\,ft$

50. For a flywheel, if I = mass moment of inertia of flywheel, w_{av} = average rotational speed, K_s= coefficient of fluctuation of speed given by $(w_{max} - w_{min})/w_{av}$. Then, find the maximum fluctuation of energy during a cycle.

a. $I\,K_s(w^2_{max} - w^2_{min})$
b. $0.5 \mid w_{av}(w_{max} - w_{min}).KS$
c. $0.5 \mid K_s w^2_{av}$
d. $\mid K_s w^2_{av}$

51. A beam with a span of 4.5 meter carries a point load of 30 kN at 3 meter from the left support. If for the section, $I_{xx} = 54.97 \times 10^{-6} m^4$ and E=200 GN/m², then the deflection under the load is

a. 7.11 mm
b. 4.09 mm
c. 3.27 mm
d. 5.92 mm

52. A wire of length L and radius r is rigidly clamped from one end and other end is pulled by force F. It is found that wire elongates by 5 cm. Another wire of same material but 4L length and 4r radius is pulled by 4F forces under identical conditions, then what will be the final length of wire?

a. 16 cm
b. 1/16 cm
c. 5 cm
d. 4 cm

53. A slender pin ended aluminium column 1.8 m long and of circular cross-section is to have an outside diameter of 50 mm. Calculate the necessary internal diameter to prevent failure by buckling if the actual load applied is 13.6 kN and the critical load applied is twice the actual load. Take E for aluminium as E=70 GN/m².

a. 39.4 mm
b. 47.2 mm
c. 43.7 mm
d. 42.8 mm

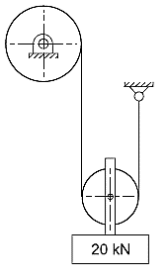
54. A boiler drum consists of a cylindrical portion 4 m long, 1.5 m in diameter and 2.25 cm thick. It is closed by hemispherical ends. In a hydraulic test to 6 MN/m², how many liters of additional water will be pumped in after initial filling at atmospheric pressure? The hoop strain at the junction of the cylinder and hemisphere may be assumed to be the same for both. Consider, E=200 GN/m²; for water, K= 2.13 GN/m² and 1/m=0.3.

a. 45.3
b. 42.8
c. 52.7
d. 61.9

55. A hollow rectangular column has external and internal dimensions as $2.4\,m \times 1.8\,m$ and $1.2\,m \times 1.2\,m$ respectively. Calculate the safe load that can be placed at an eccentricity of 0.5 m on a plane bisecting the longer side, if the maximum compressive stress is not to exceed 5 MN/m².

a. 72 kN
b. 270 kN
c. 720 kN
d. 27 kN

56. $A6\times19$ wire rope with fiber core and tensile designation of 1570 is used to raise the load of 20 kN as shown in the below figure. The nominal diameter of the wire rope is 12 mm, and the sheave has 500 mm pitch diameter. Determine the expected life of the rope in years assuming 500 bends per week.



a. 92.61
b. 19.12
c. 26.91
d. 12.69

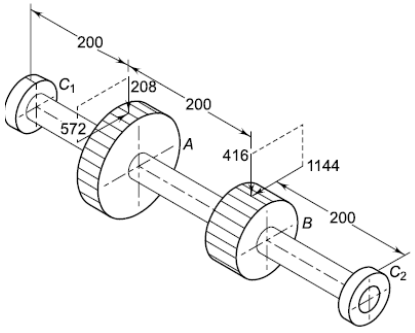
57. A riveting machine is driven by a constant torque 3 kW motor. The moving parts including the flywheel are equivalent to 150 kg at 0.6 m radius. One riveting operation takes 1 second and absorbs 10000 N-m of energy. The speed of the flywheel is 300 r.p.m. before riveting. Find the speed immediately after riveting. How many rivets can be closed per minute?

a. 260 rpm and 18
b. 290 rpm and 36
c. 360 rpm and 9
d. 390 rpm and 200

58. The following are the selection characteristics considered while choosing a material for brake lining. Identify the incorrect characteristic.

a. It should have low wear rate
b. It should have low coefficient of friction with maximum fading
c. It should have high heat dissipation capacity
d. It should not be affected by moisture and oil

59. An intermediate shaft of a gearbox, supporting two spur gears A and B and mounted between two bearings C_1 and C_2, is shown in the below figure. The pitch circle diameters of gears A and B are 500 and 250 mm respectively. The shaft is made of alloy steel 20MnCr5. *(S_{ut} = 620 and S_{yt} = 480 N/mm^2).* The factors k_b and k_t of the ASME code are 2 and 1.5 respectively. The gears are keyed to the shaft. Determine the shaft diameter using the ASME code.



a. 44.52 mm
b. 59.36 mm
c. 27.15 mm
d. 38.87 mm

60. The maximum pull in the tie rods of a turnbuckle used in the roof truss is 4.5kN. The tie rods are made of steel 40C8 $(S_{yt} = 380\,N/mm^2)$ and the factor of safety is 5. Determine the nominal diameter of the threads on the tie rod on the basis of maximum principal stress theory. Assume $d_c = 0.8d$.

a. 21.91 mm
b. 11.92 mm
c. 12.91 mm
d. 19.21 mm

61. Which of the following is not a principal classification model representing the 3D geometric modelling?

a. Line
b. Surface
c. Primitives
d. Volume

62. For maintaining records, _____ cards contain information on the (a) type of part, (b) location where the card was issued, (c) part number, and (d) number of items in the container.

a. Production and conveyance
b. Routing
c. Scheduling
d. Follow-Up

63. Calculate the matrix product $C = AB$, where

$$A = \begin{bmatrix} 5 & 3 & 1 \\ 4 & 6 & 2 \\ 10 & 3 & 4 \end{bmatrix}; \; B = \begin{bmatrix} 1 & 5 \\ 2 & 4 \\ 3 & 2 \end{bmatrix}$$

a. $\begin{bmatrix} 14 & 38 \\ 22 & 48 \\ 28 & 70 \end{bmatrix}$

b. $\begin{bmatrix} 14 & 39 \\ 22 & 48 \\ 29 & 70 \end{bmatrix}$

c. $\begin{bmatrix} 14 & 39 \\ 22 & 48 \\ 28 & 70 \end{bmatrix}$

d. $\begin{bmatrix} 14 & 39 \\ 22 & 49 \\ 28 & 70 \end{bmatrix}$

64. According to ———————— equation "for most metals, yield strength depends on average grain diameter"

a. Young
b. Bragg's law
c. Nernst
d. Hall–Petch

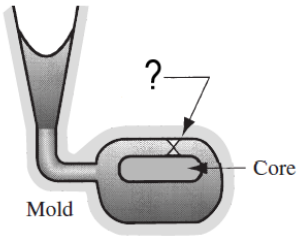
65. Which of the statements is not true for Bainite, which is a micro constituent in Iron–Carbon Alloys?

a. The phases present in Bainite are α-Ferrite + Fe_3C
b. Hardness and strength is less than fine Pearlite
c. Hardness is less than Martensite
d. Ductility is greater than Martensite

66. Having a eutectoid composition ———————— is a microstructural product of an iron–carbon alloy consisting of alternating layers of ferrite and cementite.

a. Austenite
b. Delta-ferrite
c. Martensite
d. Pearlite

67. Identify the correct type of defect for casting shown below:



a. Cold shut
b. Cold shots
c. Hot tearing
d. Shrinkage cavity

68. Cracks appear in weld and base metal when the localized stresses exceed the ———————— strength of a metal.

a. Shear
b. Compressive
c. Ultimate
d. Yield

69. In a machining operation that approximates orthogonal cutting, the cutting tool has a rake angle of 10°. The chip thickness before the cut $t_o = 0.50\,mm$ and the chip thickness after the cut $t_c = 1.125\,mm$. The shear plane angle ϕ is ————————. Assuming $\sin 10^\circ = 0.173$ and $\cos 10^\circ = 0.984$.

a. 0.008°
b. 25.4°
c. 50.4°
d. 20.5°

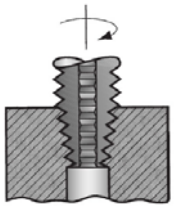
70. The term "bulk" in bulk deformation processes describes the work parts that have ———————— ratio.

a. Low area-to-volume
b. High area-to-volume
c. Low modulus-to-strength
d. High modulus-to-strength

71. Identify the operation which cannot be performed using a conventional lathe.

a. Contour turning
b. Chamfering
c. Planning
d. Facing

72. Identify the operation related to drilling which is illustrated in Figure below.



a. Reaming
b. Tapping
c. Counter boring
d. Center drilling

73. The application for which a point to point numerical control system can be employed is a
a. Hobbling machine
b. Cutting machine
c. Lathe machine
d. Punching Machine

74. In laser beam welding, ———————— are associated with the evolution of vapor from the surface of the material to produce a needle-like, vapor-filled cavity or keyhole in the work piece through which the beam can penetrate.
a. Magnetic forces
b. Tensile forces
c. Compressive forces
d. Recoil forces

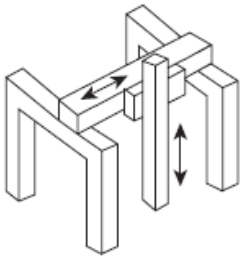
75. Which of the following is an incorrect operation in relation to the finishing processes employed for gear teeth?
a. Gear trimming
b. Gear shaving
c. Gear grinding
d. Burnishing

76. Which of the following options does not belong to a special purpose lathe?
a. Wheel lathe
b. Gap bed lathe
c. Crank shaft lathe
d. Rear edge lathe

77. What structure is formed in the heat affected zone of a medium carbon steel weld due to rapid cooling?
a. Pearlite
b. Ferrite
c. Martensite
d. Austenite

78. Inside size of slots or holes can be measured by
a. Tachometer
b. Hammer gauge
c. Telescopic gauge
d. Telegraphic gauge

79. Which is the correct type of configuration of a CMM from the figure presented below?



a. Column type
b. Gantry type
c. Moving bridge
d. Moving lever cantilever arm

80. Which of the following provides a quick-fix means of conducting an initial investigation before attempting a major investigation of surface quality?
a. Tomlinson surface meter
b. Taylor–Hobson talysurf
c. Light interference microscope
d. Profilometer

81. The following options represent the work done (W) and heat transfer (Q) relations for the various thermodynamic process. Identify the INCORRECT option. [Consider c_v, c_p - Specific heats at constant volume and constant pressure respectively, p- pressure, v, v_1, v_2 – Specific volumes of working fluid, T_1, T_2 – Temperature at starting and end of the process.)
a. Isochoric process
$\rightarrow W = 0, Q = c_v(T_2 - T_1)$
b. Isobaric process
$\rightarrow W = p(v_2 - v_1), Q = c_p(T_2 - T_1)$
c. Throttling process $\rightarrow W = Q = 0$
d. Isothermal Process
$W = 0, Q = p_1 v_1 \log_e\left(\frac{T_1}{T_2}\right)$

82. All of the following options describe the availability and unavailable energy of a system EXCEPT:

a. Availability depends on the system and the surroundings

b. Availability is defined as the maximum work output obtainable from a certain heat input in a cyclic heat engine

c. Unavailable energy is defined as minimum energy that has to be rejected to the sink by the second law

d. When heat is transferred through the finite temperature difference, the available energy transferred remains constant

83. Air enters the compressor at 100 kPa and 25°C having the volume of 1.8 m^3/kg and compressed to 5 bar isothermally. The change in internal energy during the process is

a. 0 kJ

b. 37 kJ

c. 1 kJ

d. 73 kJ

84. $\left(\frac{\partial P}{\partial V}\right)_T\left(\frac{\partial V}{\partial T}\right)_P\left(\frac{\partial T}{\partial P}\right)_V$ is equal to the value of

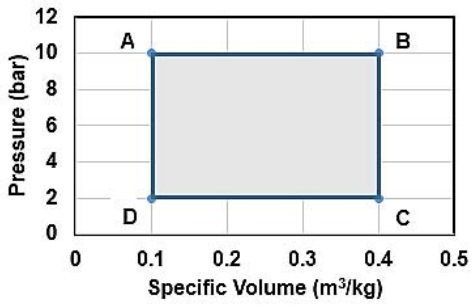
a. Zero

b. 1

c. –1

d. Infinity

85. Consider the indicator diagram for the heat engine as shown in the following figure. If the heat rejected by the engine to a heat sink is 1250 kJ/kg, the thermal efficiency (by considering one decimal place) of the engine is:



a. 8 %

b. 16 %

c. 24 %

d. 32 %

86. For a balanced counter flow heat exchanger where $\dot{m}_h Cp_h = \dot{m}_c Cp_c$, the logarithmic mean temperature difference (LMTD) and temperature profile is:

a. ΔT at any section = Constant, parallel, linear

b. 0, parallel, linear

c. ΔT at any section = Constant, parallel, non-linear

d. 0, parallel, non-linear

87. A slab of 250 mm thick is made up of material 'X' and its thermal conductivity is $500\frac{W}{m-K}$. The one of the surface is kept at $100^\circ C$ and another surface is maintained at $25^\circ C$. The net heat flux across the surface is

a. 150 kW/m^2

b. 250 kW/m^2

c. 100 kW/m^2

d. 200 kW/m^2

88. The characteristics of Planks black body radiation distribution is given in the options. Which of the following is NOT a characteristic of Planks black body radiation distribution?

a. As temperature increases, peak of the curve shift towards higher wavelength

b. Spectral emissive power varies continuously with change in wavelength

c. At a given wavelength, as temperature increases, emissive power also increases

d. Total emissive power is proportional to T^4

89. If Stanton number is 0.5, Reynolds number is 39 and Nusselt number is 390, then the Prandtl number is

a. 1

b. 10

c. 2

d. 20

90. Consider the following statements regarding Mass Transfer. Identify the INCORRECT statement.

a. Mass transfer refers to mass in transit due to a species concentration gradient in a mixture

b. Only one species is sufficient for mass transfer to occur

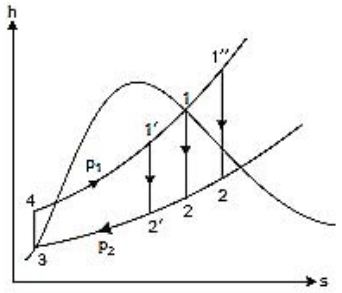
c. The species concentration gradient is the driving potential for mass transfer

d. Mass transfer by diffusion is analogous to heat transfer by conduction

91. For the same maximum pressure and same heat input in the air standard cycles, which of the following option is CORRECT?
   a. Diesel cycle is less efficient than Otto cycle
   b. Otto cycle is less efficient than Diesel cycle
   c. Otto and Diesel cycles have equal efficiency
   d. Carnot cycle is less efficient than Otto cycle

92. In a Vapour Compression Refrigeration System (VCRS), if throttle valve is replaced with expansion cylinder, the COP will
   a. Increase
   b. Decrease
   c. Remain Same
   d. Not be predictable unless refrigerant used is known

93. Consider the h-s diagram for the Rankine Cycle as shown in Figure. According to the h-s diagram, which of the following steady flow devices is responsible for process 3-4?



   a. Boiler
   b. Container
   c. Condenser
   d. Feed pump

94. A heat pump operates on Carnot cycle pumps heat from a reservoir at 27 °C to 327 °C. The Coefficient of performance is
   a. 1.5
   b. 0.5
   c. 2
   d. 1

95. If SH, LH represents Sensible Heat and Latent Heat respectively, then identify the CORRECT relation for Sensible Heat Factor (SHF) from the given options.
   a. $SHF = \frac{LH}{(SH + LH)}$
   b. $SHF = \frac{LH}{(SH - LH)}$
   c. $SHF = \frac{SH}{(SH + LH)}$
   d. $SHF = \frac{SH}{(SH - LH)}$

96. A pool is filled with water and the pool has a maximum depth of 100 m. If the atmospheric pressure 101 kPa, the absolute pressure at 100 mm depth of the pool is
   a. 900 kPa
   b. 1082 kPa
   c. 678 kPa
   d. 881 kPa

97. If k is the average height of irregularities and δ is the thickness of laminar sub layer, then the boundary is known to be hydro dynamically rough when
   a. $(k/\delta) > 6$
   b. $2.5 < (k/\delta) < 6$
   c. $(k/\delta) = 0$
   d. $(k/\mathrm{R}) < 0$

98. In a hydraulic system, the point of intersection of the line of action of the resultant hydrostatic force and the corresponding surface is known as
   a. Centre of pressure
   b. Centre of locust
   c. Centre of velocity
   d. Centre of momentum

99. If V is velocity of fluid flow, V_1 and V_2 are velocity at inlet and outlet of the pipe, respectively and k is the value of the coefficient depending on the fittings, then which of the following options has the correct match of case and loss of head?

	Case		Loss of head, h
(i)	Sudden enlargement	(a)	$\frac{V_2^2}{2g}$
(ii)	Entrance of the pipe	(b)	$\frac{(V_1 - V_2)^2}{2g}$
(iii)	Exit of the pipe	(c)	$\frac{0.5V^2}{2g}$
(iv)	Pipe fittings	(d)	$\frac{kV^2}{2g}$

   a. (i) – (b), (ii) – (c), (iii) – (d), (iv) – (a)
   b. (i) – (c) , (ii) – (d) , (iii) – (b) , (iv) – (a)
   c. (i) – (a) , (ii) – (c) , (iii) – (b) , (iv) – (d)
   d. (i) – (b), (ii) – (c) , (iii) – (a) , (iv) – (d)

100. A fluid jet discharges from 100 mm diameter nozzle and vena contracta formed has a diameter of 90 mm. If the coefficient of velocity is 0.95, then the coefficient of discharge of the Nozzle is
   a. 0.77
   b. 0.81
   c. 0.90
   d. 0.86

FOR ROUGH WORK

FOR ROUGH WORK

FOR ROUGH WORK

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