Applied Science

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26. SQUIDS, used to measure voltages associated with brain, chest and cardiac activity, are
(A) Semiconducting rings   (B) Superconducting rings
(C) Soft magnetic materials   (D) Step index optical fibers

27. Galvanisation of iron metal is done by putting a thin coating of _____ metal.
(A) Zinc   (B) Tin   (C) Copper   (D) Chromium

28. Which types of transitions are studied by UV-Vis spectrophotometer?
(A) Electronic   (B) Vibrational   (C) Rotational   (D) Nuclear

29. Which of the following waves has highest frequency?

(A) Radio waves   (B) Micro waves   (C) Gamma rays   (D) X-rays

30. Fullerenes are allotropes of carbon in which carbon atoms have _____ hybridization.
    (A) sp   (B) sp^2 (C) sp^3 (D) sp^4

31. Maximum power will be transmitted through the junction of two media of impedances Z_1 and Z_2 if
    (A) $Z_1 > Z_2$ (B) $Z_1 < Z_2$ (C) $Z_1 = Z_2$ (D) $Z_2 = \infty$

32. The Miller indices of a plane which makes intercepts in the ratio a:b/2:3c on the X-, Y- and Z-axes are
    (A) (3 6 1)   (B) (2 1 3)   (C) (1 2 3)   (D) (3 1 1)

33. In order to measure the roughness of a surface of a nanosystem, the best characterization tool to be used is
    (A) AFM   (B) Raman Spectroscopy
    (C) SEM   (D) XRD

34. In a ferromagnetic substance, the neighbouring atomic magnetic moments are
    (A) Parallel and equal   (B) Parallel and unequal
    (C) Anti parallel and equal   (D) Anti parallel and unequal

35. If a particle executes SHM with a frequency 'ω', then its kinetic energy oscillates with
    (A) Any frequency (B) ω   (C) 2ω   (D) ω/2

36. At a given temperature, the ratio of velocity of sound propagating in hydrogen and oxygen gases is
    (A) 1:8   (B) 1:4   (C) 4:1   (D) 1:1

37. Poynting vector gives
    (A) The amount of energy transfer per unit area per unit time
    (B) Direction of polarization
    (C) The intensity of electric field
    (D) The intensity of magnetic field

38. On replacing monochromatic light with white light in an interference experiment, one gets
    (A) Equally spaced white and black bands on the screen
    (B) Uniformly illuminated screen
    (C) Completely dark screen
    (D) A few coloured bands and then uniform illumination on the screen

39. In a spectrometer with visible and ultraviolet light source, a diffraction grating with _____ lines/cm would be more suitable.
    (A) 10^2 (B) 10^3 (C) 10^4 (D) 10^6

40. The kinetic energy possess by an electron to have de-broglie wavelength of 12 nm is

    (A) 100 eV   (B) 12 eV   (C) 10 eV   (D) 1.2 eV

41. For a reversible adiabatic process, change in entropy is always

    (A) Positive   (B) Negative   (C) Zero   (D) Infinite

42. The density of states for a 2-D nanosystem depends upon energy (E) as

    (A) Varies as E   (B) Does not depend upon E

    (C) Varies as $\sqrt{E}$ (D) Varies as $1/\sqrt{E}$

43. The average energy of the free electrons in a metal at T=0K (Fermi energy of metal= 5 eV) is

    (A) 3 eV   (B) 7.5 eV   (C) 2.5 eV   (D) 1 eV

44. The minimum energy of an electron in one dimensional box of size 1 Å is

    (A) Zero   (B) 6×10^{-18} J   (C) 1.51×10^{-19} J   (D) 2.4×10^{-17} J

45. Which law of thermodynamics introduces the concept of entropy

    (A) Zeroth   (B) First   (C) Second   (D) Third

46. The mobility of charge carriers in terms of Hall Coefficient R_H and conductivity σ is

    (A) R_H/σ (B) $R_H\sigma$ (C) σ/R_H (D) R_H^{σ}

47. Piezoelectric effect can be observed in

    (A) Iron   (B) Quartz   (C) Glass   (D) Mica

48. The electronic polarizability of a monoatomic gas is

    (A) $4\pi\varepsilon_o$ (B) $4\pi\varepsilon_o R$ (C) $4\pi\varepsilon_o R^2$ (D) $4\pi\varepsilon_o R^3$

49. The magnetic susceptibility of a diamagnetic material is

    (A) Positive   (B) Negative   (C) Zero   (D) Infinite

50. The atomic packing factor for a hcp structure is

    (A) 0.52   (B) 0.74   (C) 0.34   (D) 0.68

x-x-x

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26. The escape velocity of a body on earth which is independent of its mass is about _____ km/second.
(A) 3   (B) 7   (C) 11   (D) 15

27. Commercial name of epoxy resin is
(A) Araldite   (B) Teflon   (C) Plexi glass   (D) Novolac

28. A plot of lnk vs. 1/T, where k is the rate constant is known as
(A) Bode diagram   (B) Van't Hoff plot
(C) Arrhenius plot   (D) Heat flow diagram

29. The ratio of momentum diffusivity (ν) to thermal diffusivity (α), is called
(A) Prandtl number   (B) Nusselt number   (C) Biot number   (D) Lewis number

30. Annealing of cast iron
(A) Softens it to facilitate machining   (B) Decreases the free carbon
(C) Increases the strength   (D) Hardens the material

31. The value of integral $\int_1^2 x \, lnx \, dx$ calculated by Trapezoidal rule, using a unit step size is
(A) 0.7298   (B) 0.6931   (C) 0.8232   (D) 0.5401

32. For a steady-state mixed reactor the space time is equivalent to the holding time for
(A) Constant fluid density system
(B) Variable fluid density system
(C) Non-isothermal gas reactions
(D) Gas reactions with changing number of moles

33. Alcohols are not suitable as diesel engine fuel because the cetane number of alcohols is
(A) Very low which prevents their ignition by compression
(B) Very high which prevents their ignition by compression
(C) Zero
(D) Cannot be determined

34. Which one of the following statements about baffles in a shell and tube heat exchanger is false? Baffles
(A) Act as a support to the tube bundle
(B) Reduce the pressure drop on the shell-side
(C) Alter the shell-side flow pattern
(D) Help in increasing the shell-side heat transfer coefficient

35. A metallic ball (ρ= 2700 kg/m^3 and C_p = 0.9 kJ/kg°C) of diameter 7.5 cm is allowed to cool in air at 25°C. When the temperature of the ball is 125°C, it is found to cool at the rate of 4°C/min. If thermal gradients inside the ball are neglected, the heat transfer coefficient (in W/m^2 °C) is
(A) 2.034   (B) 20.34   (C) 81.36   (D) 203.4

36. In a double pipe heat exchanger the ID and OD of the inner pipe are 4 cm and 5 cm, respectively. The ID of the outer pipe is 10 cm with a wall thickness of 1 cm. Then the equivalent diameters (in cm) of the annulus for heat transfer and pressure drop, respectively are
(A) 15, 5   (B) 21, 6   (C) 6, 19   (D) 15, 21

37. A methanol-water vapour liquid system is at equilibrium at 60ºC and 60 kPa. The mole fraction of methanol in liquid is 0.5 and in vapour is 0.8. Vapour pressure of methanol and water at 60ºC are 85 kPa and 20 kPa, respectively. Assuming vapour phase to be an ideal gas mixture, what is the activity coefficient of water in the liquid phase?
(A) 0.3   (B) 1.2   (C) 1.6   (D) 7.5

38. Which of the following conditions are satisfied at the critical point by the p-V-T relation of a real fluid?

(A) $\left(\frac{\partial^2 P}{\partial v^2}\right)_T = \left(\frac{\partial P}{\partial v}\right)_T = 0$ (B) $\left(\frac{\partial^2 P}{\partial v^2}\right)_T > 0, \left(\frac{\partial P}{\partial v}\right)_T = 0$

(C) $\left(\frac{\partial^2 P}{\partial v^2}\right)_T < 0, \left(\frac{\partial P}{\partial v}\right)_T = 0$ (D) $\left(\frac{\partial^2 P}{\partial v^2}\right)_T > 0, \left(\frac{\partial P}{\partial v}\right)_T > 0$

39. An ideal flash vaporization is carried out with a binary mixture at constant temperature and pressure. A process upset leads to an increase in the mole fraction of the heavy component in the feed. The flash vessel continuous to operate at the previous temperature and pressure and still produces liquid and vapour. After the steady state is re-established.
(A) The amount of vapour produced will increase
(B) The amount of liquid produced will decrease
(C) The new equilibrium compositions of the vapour and liquid products will be different
(D) The new equilibrium compositions of the vapour and liquid products will remain as they were before the upset occurred

40. Simultaneous heat and mass transfer are occurring in a fluid flowing over a flat plate. The flow is laminar. The concentration boundary layer will coincide with the thermal boundary layer, when
(A) Sc = Nu   (B) Sh = Nu   (C) Sh = Pr   (D) Sc = Pr

41. Saturated vapor is condensed to saturated liquid in a condenser. The heat capacity ratio is $C_r = \frac{C_{min}}{C_{max}}$. The effectiveness ($\varepsilon$) of the condenser is

(A) $\dfrac{1-\exp[-NTU(1+C_r)]}{1+C_{r)}}$ (B) $\dfrac{1-\exp[-NTU(1-C_r)]}{1-C_r\exp[-NTU(1-C_r)]}$

(C) $\dfrac{NTU}{1+NTU}$ (D) $1 - \exp(-NTU)$

42. A binary mixture has components A and B with vapour pressures of 360mmHg and 355mmHg, respectively? Which type of distillation will you prefer for their separation?
(A) Multi-component distillation   (B) Azeotropic distillation
(C) Reactive distillation   (D) Vacuum distillation

43. In a refinery, petroleum crude is fractionated into gas fraction, light ends, intermediate distillates, heavy distillates, residues and by products. The group of products including gas oil, diesel oil and heavy fuel oil belongs to the fraction

(A) Heavy distillates   (B) Intermediate distillates
(C) Light ends   (D) Residues

44. In Hagen-Poiseuille flow through a cylindrical tube, the radial profile of shear stress is
    (A) Constant   (B) Cubic   (C) Parabolic   (D) Linear

45. The most detrimental impurity in high pressure boiler feed water is
    (A) Suspended salt   (B) Dissolved salt   (C) Silica   (D) Turbidity

46. For a ductile material, toughness is a measure of
    (A) Resistance to scratching
    (B) Ability to absorb energy up to fracture
    (C) Ability to absorb energy till elastic limit
    (D) Resistance to indentation.

47. Chlorine acts as a bleaching agent only in the presence of
    (A) Dry air   (B) Pure oxygen   (C) Moisture   (D) Sunlight

48. High pressure steam is available to concentrate a dilute aqueous solution in an
    evaporator system. Multi effect evaporator will give additional advantage because
    (A)   Total heat transfer area of all the effects is less than that in a single effect
evaporator
        system
    (B) Total amount of vapour produced per kg of feed steam in a multi-effect system is
        much higher than in single effect
    (C) Boiling point elevation in a single effect system is much higher than that in any
effect
        in a multi-effect system
    (D) Heat transfer coefficient in a single effect is much lower than that in any effect in a
        multi-effect system

49. Conversion formula for converting amplitude ratio (AR) into decibels is
    (A) Decibel = 20 $\log_{10} (AR)$ (B) Decibel = 20 $\log_e (AR)$
    (C) Decibel = 20 $\log_{10} (AR)^{0.5}$ (D) Decibel = 20 $\log_e (AR)^{0.5}$

50. Nylon 66 is so named because
    (A) The average degree of polymerization of the polymer is 1966
    (B) The number of carbon atoms between two nitrogen atoms are 6
    (C) The number of nitrogen atoms between two carbon atoms are 6
    (D) The polymer was first synthesized in 1966

x-x-x

CIVIL ENGINEERING

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26. Euler's critical load of following column with both ends pin Joined is

(A) $\dfrac{\pi^2 EI}{L^2}$ (B) $\dfrac{\pi^2 EI}{3l^2}$ (C) $\dfrac{3\pi^2 EI}{L^2}$ (D) $\dfrac{9\pi^2 EI}{L^2}$

27. Poisson's ratio of perfectly incompressible solid is ____
    (A) 0   (B) 0.25   (C) 0.5   (D) 0.3

28. If radial stress is also considered, dilation of thin cylindrical shell increases by ____

    (A) $\dfrac{\mu P}{E}$ (B) $\dfrac{3\mu P}{E}$ (C) $\dfrac{2\mu P}{E}$ (D) $\dfrac{4\mu P}{E}$

29. State of stress about a point is given below, the second invariant of stress is____

$$\sigma = \begin{bmatrix} 10 & 2 & 3 \\ 2 & 5 & 0 \\ 3 & 0 & 1 \end{bmatrix}$$

    (A) 52   (B) 16   (C) 5   (D) 21

30. A hollow shaft and a solid shaft having same polar moment of inertia and made with same material. If $n = \dfrac{d}{D}$, where d = inner diameter of hollow shaft, D = outer diameter of hollow shaft, the ratio of torque carrying capacity of hollow shaft to solid shaft is
    (A) $\left(1-n^4\right)^{1/2}$ (B) $\left(1-n^4\right)^{1/4}$ (C) $\left(1-n^4\right)^{3/4}$ (D) n

31. Support reactions about 'A' are ('B' is articulation/hinged).
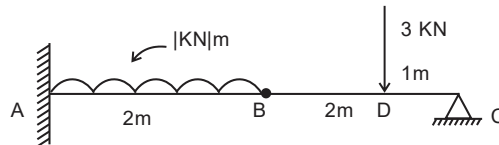
    (A) 3 kN, 2 kNm   (B) 3kN, 4 kNm   (C) 2 kN, 3 kNm   (D) 1 kN, 1 kNm

32. A suspension bridge with a two-hinged stiffening grade is statically
    (A) Determinate   (B) Indeterminate to 1 degree
    (C) Indeterminate to 2 degree   (D) Indeterminate to 3 degree

(4)

33. The Max^m b.m. at the left quarter point of a simple beam due to the crossing of UDL of length shorter than the span in the direction left to right would occur after the load had just crossed the section by
    (A) One fourth of the length   (B) Three fourth of its length
    (C) Half of its length   (D) Its full length

34. Flexibility matrix for a beam element is written in the form.

$$[A] = \frac{L^3}{6EI}\begin{bmatrix} 2 & 5 \\ 5 & 16 \end{bmatrix}$$

    What is corresponding stiffness matrix?

    (A) $\dfrac{6EI}{L^3}\begin{bmatrix} 16 & 5 \\ 5 & 2 \end{bmatrix}$ (B) $\dfrac{6EI}{7L^3}\begin{bmatrix} 16 & -5 \\ 5 & 2 \end{bmatrix}$ (C) $\dfrac{6EI}{7L^3}\begin{bmatrix} 16 & 5 \\ 5 & 2 \end{bmatrix}$ (D) $\dfrac{6EI}{7L^3}\begin{bmatrix} 16 & -5 \\ -5 & 2 \end{bmatrix}$

35. Capillary rise is maximum for
    (A) Course gramed soil   (B) Well-graded soil
    (C) Fine Grained soil   (D) Gap-graded soil

36. In an earthen dam, the phreatic line is
(A) Straight line   (B) Parabolic line   (C) Circular line   (D) Zigzag line

37. In the case of stratified soil layers, the best equation that can be adopted for computing the pressure distribution is
(A) Prandtl   (B) Skempton's   (C) Westergard's   (D) Boussiyesq's

38. What is caused by the addition of coarse particles fine sand or silt to clay
(A) Decrease in liquid limit and increase in plasticity Index
(B) Decrease in liquid limit and no change in plasticity Index.
(C) Decrease in both liquid limit and plasticity Index.
(D) Increase in both liquid limit and plasticity Index.

39. A raft foundation with a basement floor is placed at a depth of 4m below ground level the superstructure imposes a load of 150 kN/m^2 on the raft. The unit wt. of the soil is 20 kN/m^3. What are the values of the grass and net loading pressures on soil, respectively?
(A) 230 kN/m^2, 150 kN/m^2 (B) 150 kN/m^2, 230 kN/m^2
(C) 150 kN/m^2, 70 kN/m^2 (D) 80 kN/m^2, 150 kN/m^2

40. It is required to produce a small-scale map of an area in magnetic zone by directly and checking the work in the field itself. Which of the following surveys will be most appropriate for purpose?
(A) Chain   (B) Theodolite   (C) Plane table   (D) Compass

41. If fore bearing of a line is S49°E the back bearing of the line will be
(A) N49°W   (B) N49°E   (C) S49°W   (D) S49°E

42. Rate of Evaporation increases with increase in
(1) Wind Speed   (2) Atmospheric Pressure
(3) Soluble Salt   (4) Vapour Pressure

(A) 3 and 4   (B) 1 and 4   (C) 1, 3 and 4   (D) Only 2

43. The combined correction of curvature and refraction for distance of 1200m is
(A) 0.153 m   (B) 0.096 m   (C) 0.094 m   (D) 0.021 m

44. In the figure given below, the length P(WCB: 3a) and QR (WCB : 45°) respectively upto three places of decimals
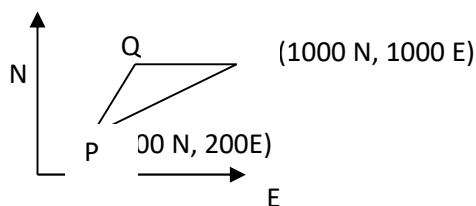
(A) 273.205, 938.186   (B) 273.205, 551.815

(C) 551.815, 557.815 (D) 551.815, 938.186

45. The local mean time at a place located in longitude 90°E when the standard time is 5 hr. and 30 min and standard meridian is 82° 30′E is

(A) 5 hr. (B) 6 hr. (C) 5 hr. 45 min (D) 5 hr. 15 min

46. During a 3-hour rainfall it was observed that the rainfall intensity for 1st, 2nd, and 3rd house are 8.94 mm/hr, 15 mm/hr and 9mm/hr and infiltration follows the curve as $f = 6 + 8 \exp(-t)$ where f in mm/hr and time in hour. What is effective rainfall?

(A) 9mm (B) 13.5 mm (C) 0.02 mm (D) 11.5 mm

47. Neglecting uplift pressure, the base width of an elementary profile of a gravity dam shall be taken as

(A) $\dfrac{H}{\sqrt{G}}$

(B) $\dfrac{H}{\mu G}$

(C) lesser of $\dfrac{H}{\sqrt{G}}$ and $\dfrac{H}{\mu G}$

(D) greater of $\dfrac{H}{\sqrt{G}}$ and $\dfrac{H}{\mu G}$

48. The maximum rainfall depth of 300mm in 24 hours has a return period of 100 years .The probability of 24 hours rainfall equal to or greater than 300mm occurring at least once in 10 years is given by

(A) $(0.99)^{10}$ (B) $1-(0.99)^{10}$ (C) $(0.9)^{100}$ (D) $1-(0.9)^{100}$

49. Select the correct relationship between porosity (N), specify yield (γ) and specify retention (R)

(A) $N=\gamma+R$ (B) $\gamma=N+R$ (C) $R=N+\gamma$ (D) $R>(N+\gamma)$

50. A metal block weighing 20kgf rests on a horizontal surface, whose coefficient of friction is 0.22. The horizontal force necessary to just move the block is to be predicted

(A) 0.22 kgf (B) 2.20 kgf (C) 4.40 kgf (D) 8.80 kgf

x-x-x

Computer Science & Engineering

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   (A) Allows theory to emerge out of the data
   (B) Involves testing an explicitly defined hypothesis
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2. Which of the following is not a data-collection method?
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3. A population N is divided into three strata so that $N_1 = 5000$, $N_2 = 2000$ and $N_3 = 3000$. Respective standard deviations are: $\sigma_1 = 15$, $\sigma_2 = 18$, and $\sigma_3 = 5$. How should a sample of size $n = 84$ be allocated to the three strata, if we want optimum allocation using disproportionate sampling design?
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4. An appropriate measure of central tendency for an ordinal scale variable is :
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   (A) Experimental research   (B) Library research
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7. Nine years old children are taller than 7 years old ones. It is an example of :
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26.   For merging two sorted lists of sizes m and n into a sorted list of size m+n, we require comparisons of

     A.   O(m)

     B.   O(n)

     C.   O(m+n)

     D.   O(log (mn))

27.   For finding a minimum spanning tree in an undirected graph with positive integer edge weights, which of following technique is more suitable

     A.   Greedy approach

     B.   Backtracking

     C.   Branch & Bound

     D.   Dynamic Programming

28. Which of the characteristic is common to traps, subroutine calls and supervisor calls but different in interrupts?

    A.   Interrupts calls are synchronous and others are asynchronous
    B.   Interrupts calls are asynchronous and others are synchronous
    C.   Only Interrupt calls are caused due to hardware errors
    D.   Only Interrupt calls change the execution mode to kernel mode.

29. Which of the following statements is false?

    A.   Every NFA can be converted to an equivalent DFA.
    B.   Every non-deterministic Turing machine can be converted to an equivalent deterministic Turing machine.
    C.   Every regular language is also a context-free language.
    D.   Every subset of a recursively enumerable set is recursive.

30. Given an arbitrary non – deterministic finite automation (NFA) with N states, the maximum number of states in an equivalent minimized DFA is at least

    A. N^2
    B. 2^N
    C.   2 N
    D.   N!

31. What can be the maximum size of stage -1 boot program at the beginning of a hard disk, assuming a 4 bytes bootstrap magic bit pattern, 64 bytes of for partition table and 512 bytes of sector size.

    A.   448 bytes
    B.   508 bytes
    C.   444 bytes
    D.   512 bytes

32. The mathematical model of push-down automaton is represented as a

    A.   quadruple
    B.   quintuple
    C.   hextuple
    D.   septuple

33. The capacity of a memory unit is defined by the number of words multiplied by the number of bits/ word. How many separate address and data lines are needed for a memory of 4K *16?

    A.   10 address,16 data lines
    B.   11 address,8 data lines
    C.   12 address,16 data lines

D.   12 address,12 data lines

34.   In a binary max heap containing n numbers, the smallest element can be found in time

A.   O(n)

B.   O(logn)

C.   O(loglogn)

D.   O(1)

35.   A context free grammar is said to be in Chomsky normal form if productions has

A.   only one terminal on its RHS

B.   only two no-terminals on its RHS

C.   string on non-terminals on its RHS

D.   both a. and b.

36.   Consider a B+-tree in which the maximum number of keys in a node is 5. What is the minimum number of keys in any non-root node?

A.   1

B.   2

C.   3

D.   4

37.   Program Counter always keeps the address of an instruction

A.   Which is being executed

B.   To be executed next

C.   Which has been executed

D.   Base address of first instruction

38.   Evaluation of an expression involving && operator

   I.   Takes place from left to right

   II.   Takes place from right to left

   III.   Stops when one of the operand evaluates to true.

   IV.   Stops when one of the operand evaluates to false.

A.   I and III

B.   II Only

C.   I and IV

D.   IV

39.   Which of the following function does not manipulate the value of a position indicator

A.   fputc

B.   fseek

C.   ftell

D.   fgetc

40. In C++ language, Sequence of execution of constructor in following derivation
Class III: public I, virtual II

A.   III, II, I

B.   III, I, II

C.   I, II, III

D.   II, I, III

41. The time complexity to sort elements of binary search tree is

A. $O(n)$

B. $O(nlogn)$

C. $O(n^2)$

D. $O(n^2 logn)$

42. The solution of the recurrence relation $T(n) = 4T\left(\frac{n}{2}\right) + \Theta(n^2)$ is

A. $\Theta(nlogn)$

B. $\Theta(n^2)$

C. $\Theta(n^2 logn)$

D. $\Theta((nlogn)^2)$

43. If a graph $G = (V, E)$ is represented using an adjacency list, what is the time complexity of finding breadth-first traversal of graph G?

A. $O(|V|^2)$

B. $O(|V||E|)$

C. $O(|V|^2|E|)$

D. $O(|V| + |E|)$

44. Suppose that a certain software product has a mean time between failures of 10,000 hours and has a mean time to repair of 20 hours. If the product is used by 100 customers, what is its availability?

A.   80%

B.   90%

C.   98%

D.   99.8%

45. Given an empty hash table with m slots. What is the expected time taken by any sequence of n INSERT, SEARCH and DELETE operations if the number of insert operations are $O(m)$, collisions are resolved by chaining and universal hashing is assumed?

A. $\Theta(1)$

B. $\Theta(n)$

C. $\Theta(1 + logn)$

D. $\Theta(logm)$

46. Let P_1 be the problem of determining if there exists a Hamiltonian cycle in a graph, and let P_2 is the problem of finding Hamiltonian cycle in a graph. Which one the following is TRUE?

A. Both P_1 and P_2 are NP-hard

B. P_1 is NP-hard but P_2 is not

C. P_2 is NP-hard but P_1 is not

D. Neither P_1 nor P_2 is NP-hard

47. Which of the following is the most appropriate sequence of testing

A. Unit – Integration – System – Acceptance

B. Unit – Integration – Acceptance – System

C. Acceptance – System – Integration – Unit

D. System – Acceptance – Integration – Unit

48. What is the state of the system during busy- wait loop?

A. Remains busy in executing system programs

B. Execute in idle loop state and wait for an interrupt

C. Remains busy in executing user programs

D. System hangs and need to be restarted.

49. If a relation is in 3NF, which of the following dependency should be removed to convert it into BCNF

A. Transitive dependency

B. Multi valued dependency

C. Partial dependency

D. Join dependency

50. A CPU generates 30-bit virtual addresses. The page size is 2 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 64 page table entries and is 4-way set associative. The minimum size of the TLB tag is

A. 9 bits

B. 10 bits

C. 11 bits

D. 12 bits

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(A) Using PostScript or Metafont fonts
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26. Three equal resistances are connected in star. If this star is converted into equivalent delta, then
(A) The resistance of the delta network will be smaller than that of the star network
(B) The resistance of both the network will be equal
(C) The resistance of the delta network will be larger than that of the star network
(D) None

27. When the frequency of applied voltage in a series RC circuit increases, what happens to the capacitive reactance?
(A) Decreases   (B) Remains the same
(C) Increases   (D) Becomes zero

28. In a certain series RLC circuit, $V_R = 24$ V, $V_L = 15$ V, $V_C = 45$ V, what is the source voltage?
(A) 38.42 V   (B) 45 V   (C) 15 V   (D) 24 V

29. W_1 and W_2 are the readings of two wattmeters used to measure power of a three phase balanced load. The reactive power drawn by the load is

(A) W_1+W_2　　　　(B) W_1-W_2　　　　(C)$\sqrt{3}(W_1-W_2)$　　　(D) $\sqrt{3}(W_1+W_2)$

30. Interpoles are provided in dc machines to

(A) Neutralize the cross magnetizing component of armature reaction
(B) Neutralize the demagnetizing component of armature reaction
(C) Reduce iron loss
(D) Reduce copper loss

31. A 200 V DC machine has an armature resistance of 0.5. if the full load armature current is 30 A. the induced emf when the machine run (i) as a generator and (ii) as a motor will be

(A) 230 V, 170 V　　　　　　　　　(B) 225 V, 175 V
(C) 185 V, 215 V　　　　　　　　　(D) 215 V, 185 V

32. What is the condition to obtain the maximum starting torque?

(A) $r^2 = x^2$　　　　(B) $2r^2 = x^2$　　　　(C) $r^2 = 3x^2$　　　　(D) $r^2 = 4x^2$

33. Calculate the value of resistance R for the following cases:

(i) A Voltmeter V of 2000 Ω resistance connected across R reads 200 V, while the total current supplied to V and R is 0.5 A.
(ii) A voltage of 10 V is applied to R in series with an ammeter A of 0.1 Ω resistance, while A reads 50 A.

(A) 400 Ω, 0.2Ω　　　(B) 500 Ω, 0.1 Ω　　　(C) 300 Ω, 0.3 Ω　　　(D) 500 Ω, 0.2 Ω

34. An alternating current of frequency 50 Hz and RMS value of 70.7 A is given as

(A) I = 100sin639t　　　　　　　　(B) I = 141.4sin157t
(C) I = 141.4sin314t　　　　　　　(D) I = 100sin314t

35. For the circuit given below, obtain R_N of the equivalent Norton circuit between terminals AB and find the load current I_L
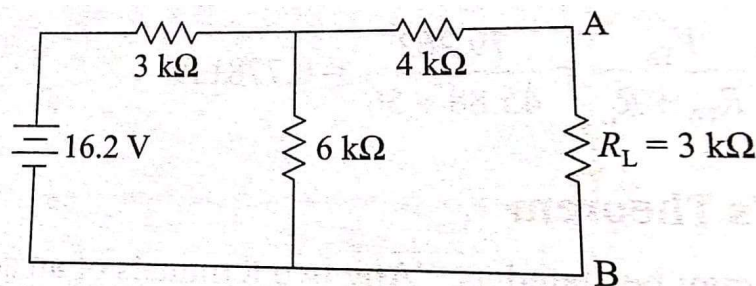
(A) R_N = 5 kΩ, I_L = 1.2 mA　　　　　(B) R_N = 6 kΩ, I_L = 1.2 mA
(C) R_N = 4 kΩ, I_L = 1.5 mA　　　　　(D) R_N = 4 kΩ, I_L = 1.2 mA

36. In a thyristor, the forward breakover voltage

(A) Is constant
(B) May be constant or may depend on gate current
(C) Decreases as gate current is increased
(D) Increases as gate current is increased

37. Thyristor circuit is feeding an RL load. The turn on time can be reduced by
(A) Decreasing R
(B) Decreasing L
(C) Increasing L
(D) Decreasing R and L together

38. The condition for underdamped oscillations in a series RLC circuit is
(A) $R < L/C$
(B) $R^2 < 4L/C$
(C) $R^2 < 2L/C$
(D) $R < \sqrt{L/C}$

39. In Pulse width modulation of Chopper
(A) T is kept constant and T_{on} is varied
(B) T_{on} is kept constant and T is varied
(C) Both T and T_{on} are varied
(D) Either T or T_{on} is varied

40. A single phase full wave regulator feeds R-L load. The best gating signal is
(A) Short duration pulses
(B) Long duration pulses
(C) Pulse train
(D) Either (A) or (B)

41. A 3 phase, 6 pole induction machine having 50 Hz frequency running at 920 rpm. Find the output frequency at the rotor?
(A) 4 Hz
(B) 2 Hz
(C) 6 Hz
(D) 8 Hz

42. The Z matrix of a 2 port network as given by

$$\begin{bmatrix} 0.9 & 0.2 \\ 0.2 & 0.6 \end{bmatrix}$$

The element Y_{22} of the corresponding Y matrix of the same network is given by
(A) 1.2
(B) 0.4
(C) -0.4
(D) 1.8

(5)

43. If a two port network is reciprocal, then we have, with the usual notation, the followingrelationship
(A) $h_{12} = h_{21}$
(B) $h_{12} = -h_{21}$
(C) $h_{11} = h_{22}$
(D) $h_{11}h_{22} - h_{12}h_{21}$

$= 1$

44. Power factor of a synchronous motor can be varied by varying.
(A) Excitation
(B) Supply frequency
(C) Applied voltage
(D) Load

45. Bundled conductors are mainly used in High voltage overhead transmission lines to
(A) Reduce transmission line losses
(B) Increase mechanical strength of the line
(C) Reduce corona
(D) Reduce sag

46. For a fixed value of complex power flow in a transmission line having a sending end voltage V, the real power loss will be proportional to
(A) V
(B) V^2
(C) $1/V^2$
(D) $1/V$

47. Series capacitive compensation in EHV transmission lines is used to
(A) Reduce the line leading
(B) Improve the stability of the system

(C) Reduce the voltage profile   (D) Improve the protection of line

48. The incremental cost characteristic of two generators delivering 200 MW are as follows.

$$\frac{dF_1}{dP_1} = 20 + 0.1P_1$$

$$\frac{dF_2}{dP_2} = 16 + 0.1P_2$$

For economic operation, the generation P_1 and P_2 should be
(A) $P_1 = P_2 = 100$ MW   (B) $P_1 = 80$ MW, $P_2 = 120$ MW
(C) $P_1 = 200$ MW, $P_2 = 0$ MW   (D) $P_1 = 120$ MW, $P_2 = 80$ MW

49. The sequence components of the fault currents are as follows: $I_{positive} = j1.5$ pu, $I_{negative} = -j0.5$ pu, $I_{zero} = -j1$ pu. The type of fault in the system is
(A) LG   (B) LL   (C) LLG   (D) LLLG

50. A negative sequence relay is commonly used to protect
(A) An alternator   (B) A transformer
(C) A transmission line   (D) A bus bar

x-x-x

Electronics & Communication Engineering

1. A deductive theory is one which
   (A) Allows theory to emerge out of the data
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4. An appropriate measure of central tendency for an ordinal scale variable is :
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26. The minimum eigen value of the following matrix is
$$\begin{bmatrix} 3 & 5 & 2 \\ 5 & 12 & 17 \\ 2 & 7 & 5 \end{bmatrix}$$

(A) 0   (B) 1   (C) 2   (D) 3

27. The system of equations
$x + y + z = 6$
$x + 4y + 6z = 20$
$x + 4y + \lambda z = \mu$
has NO solution for values of λ and μ given by

(A) $\lambda = 6$, $\mu = 20$ (B) $\lambda = 6$, $\mu \neq 20$
(C) $\lambda \neq 6$, $\mu = 20$ (D) $\lambda \neq 6$, $\mu \neq 20$

28. A fair coin is tossed independently four times. The probability of the event " the number of time heads shown up is more than the number of times tail shown up"
    (A) 1/16   (B) 1/3   (C) ¼   (D) 5/16

29. The equation $\sin(z) = 10$ has
    (A) no real or complex solution
    (B) Exactly two distinct complex solutions
    (C) A unique solution
    (D) An infinite number of complex solutions

30. Which one of the following functions is strictly bounded?
    (A) $1/x^2$ (B) e^x (C) x^2 (D) e^{-x^2}

31. Three companies X, Y, Z supply computers to a university. The percentage of computers supplied by them and the probability of those being defective are tabulated below:

Company	% of Computer Supplied	Probability of being supplied defective
X	60%	0.01
Y	30%	0.02
Z	10%	0.03

Given that a computer is defective, the probability that was supplied by Y is
    (A) 0.1   (B) 0.2   (C) 0.3   (D) 0.4

32. The current i_b through the base of a silicon *npn* transistor is $1 + 0.1 \cos(10000\pi t)$ mA At 300 K, the r_π in the small signal model of the transistor is

    (A) 250 Ω   (B) 27.5 Ω   (C) 25 Ω   (D) 22.5 Ω
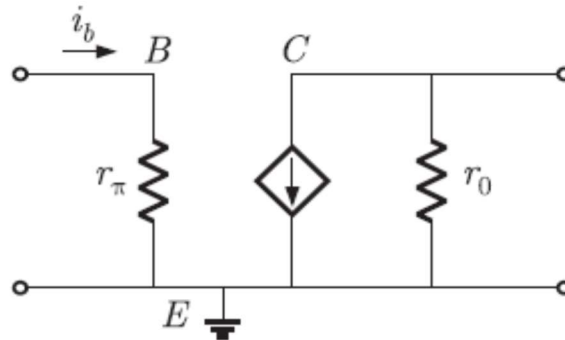
33. For a BJT, the common base current gain $\alpha = 0.98$ and the collector base junction reverse bias saturation current $I_{CO} = 0.6$ μA. This BJT is connected in the common emitter mode and operated in the active region with a base drive current $I_B = 20$ μA. The collector current I_C for this mode of operation is
    (A) 0.98 mA   (B) 0.99 mA   (C) 1.0 mA   (D) 1.01 mA

34. For small increase in V_G beyond 1V, which of the following gives the correct description of the region of operation of each MOSFET
    (A) Both the MOSFETs are in saturation region
    (B) Both the MOSFETs are in triode region

(C) n-MOSFETs is in triode and p -MOSFET is in saturation region
(D) n- MOSFET is in saturation and p -MOSFET is in triode region

35. The first dominant pole encountered in the frequency response of a compensated op-amp is approximately at
    (A) 5Hz   (B) 10 kHz   (C) 1MHz   (D) 100 MHz

36. Consider the following two statements:
    Statement 1 :
    A stable multi vibrator can be used for generating square wave.
    Statement 2:
    Bistable multi vibrator can be used for storing binary information.
    (A) Only statement 1 is correct
    (B) Only statement 2 is correct
    (C) Both the statements 1 and 2 are correct
    (D) Both the statements 1 and 2 are incorrect

37. For an npn transistor connected as shown in figure $V_{BE} = 0.7$ volts. Given that reverse saturation current of the junction at room temperature 300 K is 10^{-13} A, the emitter current is
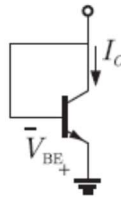
    (A) 30 mA   (B) 39 mA   (C) 49 mA   (D) 20 mA

38. In a baseband communications link, frequencies up to 3500 Hz are used for signaling. Using a raised cosine pulse with 75% excess bandwidth and for no inter-symbol interference, the maximum possible signaling rate in symbols per second is
    (A) 1750   (B) 2625   (C) 4000   (D) 5250

39. Assuming high SNR and that all signals are equally probable, the additional average transmitted signal energy required by the 8-PSK signal to achieve the same error probability as the 4-PSK signal is
   (A) 11.90 dB   (B) 8.73 dB   (C) 6.79 dB   (D) 5.33 dB

40. A communication channel with AWGN operating at a signal to noise ration $SNR \gg 1$ and bandwidth B has capacity $C1$. If the SNR is doubled keeping constant, the resulting capacity $C2$ is given by
    (A) $C2 \approx 2C1$ (B) $C2 \approx C1 + B$
   (C) $C2 \approx C1 + 2B$ (D) $C2 \approx C1 + 0.3B$

41. A memory less source emits n symbols each with a probability p. The entropy of the source as a function of n
    (A) Increases as $\log n$ (B) Decreases as $\log(1/n)$
   (C) Increases as n (D) Increases as $n \log n$

42. A zero-mean white Gaussian noise is passes through an ideal lowpass filter of bandwidth 10 kHz. The output is then uniformly sampled with sampling period $t_s = 0.03$ msec. The samples so obtained would be
(A) Correlated   (B) Statistically independent
(C) Uncorrelated   (D) Orthogonal

43. In a PCM system, if the code word length is increased from 6 to 8 bits, the signal to quantization noise ratio improves by the factor
(A) 8/6   (B) 12   (C) 16   (D) 8

44. A video transmission system transmits 625 picture frames per second. Each frame consists of a 400x400 pixel grid with 64 intensity levels per pixel. The data rate of the system is
(A) 16 Mbps   (B) 100 Mbps   (C) 600 Mbps   (D) 6.4 Gbps

45. The feedback system shown below oscillates at 2 rad/s when
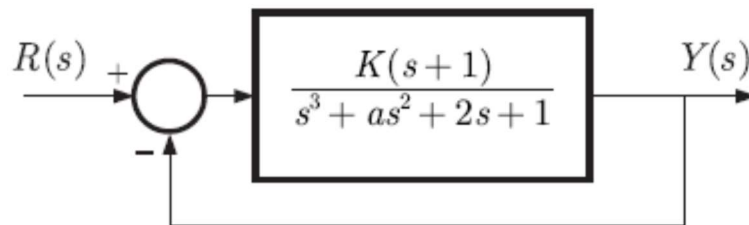
(A) $K = 2$ and $a = 0.75$ (B) $K = 3$ and $a = 0.75$
(C) $K = 4$ and $a = 0.5$ (D) $K = 2$ and $a = 0.5$

46. The pole-zero given below correspond to a
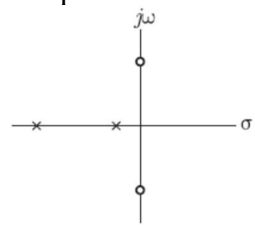
(A) Low pass filter   (B) High pass filter
(C) Band filter   (D) Notch filter

47. A control system with PD controller is shown in the figure. If the velocity error constant $K_V = 1000$ and the damping ratio $\zeta = 0.5$, then the value of K_P and K_D are
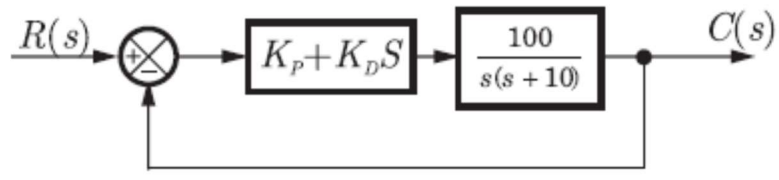
(A) $K_P = 100, K_D = 0.09$ (B) $K_P = 100, K_D = 0.9$
(C) $K_P = 10, K_D = 0.09$ (D) $K_P = 10, K_D = 0.9$

48. Despite the presence of negative feedback, control systems still have problems of instability because the

(A) Components used have non-linearities
(B) Dynamic equations of the subsystem are not known exactly.
(C) Mathematical analysis involves approximations.
(D) System has large negative phase angle at high frequencies.

49. A PD controller is used to compensate a system. Compared to the uncompensated system, the compensated system has
(A) a higher type number   (B) reduced damping
(C) higher noise amplification   (D) larger transient overshoot

50. The characteristic polynomial of a system is
$q(s) = 2s^5 + s^4 + 4s^3 + 2s^2 + 2s + 1$
The system is
(A) Stable   (B) Marginally stable   (C) Unstable   (D) Oscillatory

x-x-x

Food Technology

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26. Which of the following factor(s) affect the growth of microorganisms?
(A) Water activity   (B) pH   (C) O-R Potential   (D) All of these

27. The enzymatic reaction rate is reduced to half by decreasing temperature by
(A) 10°C   (B) 20°C   (C) 50°C   (D) None of these

28. Hedonic test pertains to:
(A) Sensory evaluation   (B) Total solids evaluation
(C) Total soluble solids evaluation   (D) Total deformation evaluation

29. Which of the following enzymes is responsible for off-flavor development in cream & butter
(A) Lipase   (B) Protease   (C) Peroxidase   (D) None of these

30. Which of the following is a milk sugar
(A) Lactose (B) Fructose (C) Glocose (D) None of these

31. Which of the following nutrient if not used is converted into fat in the body
(A) Fat (B) Carbohydrate (C) Protein (D) Vitamins

32. Bread dough is ------------ in nature.
(A) Viscous (B) Elastic (C) Visco-elastic (D) Solid

33. The most heat resistant microorganism is
(A) Clostridium botulinum (B) C. burnetti
(C) Saccharomyces cerevase (D) Lactobacillus bulgaricus

34. Salt is a better preservative than sugar, because it
(A) Has lower molecular weight
(B) Lowers the vapor pressure of food water by a large extent
(C) Kills microorganisms better
(D) Reduces pH

35. The food fiber that produces necessary dietary roughage is largely
(A) Cellulose (B) Hemicelluloses (C) Dextrin (D) Pectin

36. Pectin and gums are added to food as
(A) Thickeners and stabilizers (B) Emulsifier
(C) Humactant (D) Colorant

37. The manometer is used to measure:
(A) Fluid velocity (B) Fluid density (C) Fluid pressure (D) Fluid viscosity

38. Lecithins are structurally like fats but contain
(A) Oxalic acid (B) Citric acid (C) Phosphoric acid (D) Capric acid

39. Which of the following metals are strong promoters of oxidation
(A) Na and Fe (B) Na and Al (C) Al and Cu (D) Cu and Fe

(4)

40. Which one is not a thermal processing equipment?
(A) Blancher (B) Pasteurizer (C) Crystallizer (D) Evaporator

41. Carotene gives
(A) Orange color (B) Red color (C) Green color (D) Purple color

42. Fat soluble vitamins are
(A) A, D, E, & K (B) A, D, C, & K (C) A, C, E, & K (D) A, B, E, & K

43. Water which cannot be removed by drying is called
(A) Bound water (B) Free water (C) Unbound water (D) Frozen water

44. Which is the body's primary source of energy?
(A) Fructose (B) Sucrose (C) Glycogen (D) Glucose

45. Anabolic process of converting extra glucose into glycogen is called
 (A) Catharisis   (B) Metabolism   (C) Anabolism   (D) Glycogenesis

46. An enzyme which acts only in acidic medium is
 (A) Pepsin   (B) Trypsin   (C) Rennin   (D) Amylase

47. The Reynolds number for turbulent fluid flow in a pipe is:
 (A) Less than 2100   (B) Greater than 2100
 (C) Greater than 4000   (D) Greater than 10,000

48. Which of the following is most concentrated source of energy
 (A) Fats   (B) Proteins   (C) Carbohydrates   (D) All of these

49. Lactic acid is formed in milk on fermentation of
 (A) Lactose   (B) Sucrose   (C) Fructose   (D) None of these

50. What causes potato slice to turn brown
 (A) Carmelization   (B) Staling
 (C) Protein degradation   (D) Enzymatic activity

x-x-x

INDUSTRIAL CHEMISTRY

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26. **A shopkeeper purchases 15 mangoes for Rs. 10 and sells them at 10 mangoes for Rs. 15. Thus, he earns a profit of**
(A) 50%   (B) 75%   (C) 80%   (D) 125%

27. **A line which cuts a pair of parallel lines is called**
(A) Tangent   (B) Chord   (C) Traversal   (D) Intersector

28. **Which of the following is the formula for hydrosulfuric acid?**
(A) H_2S (B) H_2SO_3 (C) H_2SO_4 (D) HSO_4

29. **99.9% pure copper can be achieved through?**
(A) Dialysis   (B) Electrolysis   (C) Hydrolysis   (D) Pyrolysis

30. **HCL, H_2SO_4 and HNO_3 are considered as?**

(A) Strong solvents (B) Strong acids (C) Weak acids (D) Basic in nature

31. **The relative atomic mass of an element is the result of comparing mass of one atom of the element to the .... of the mass of carbon atom?**
(A) 1/12 (B) 1/10 (C) 1/16 (D) 1/14

32. **The relative strengths of acids and alkalis can be determined with the help of a?**
(A) Litmus paper (B) Methyl orange (C) pH paper (D) Phenolphthalein

33. **The chemical used for the sterilization of drinking water and swimming pool water is?**
(A) Iodine (B) Chlorine (C) Ammonia (D) Calcium

34. **All of the following is used as raw materials in the production of cement, except?**
(A) Hydrochloric acid (B) Clay (C) Sand (D) Dolomite

35. **Alums purify muddy water by:**
(A) Dialysis (B) Adsorption (C) Coagulation (D) Forming a true solution

36. **The first use of quantum theory to explain the structure of atom was made by:**
(A) Heisenberg (B) Bohr (C) Planck (D) Einstein

37. **The formula of Prussian blue is:**
(A) $Fe_3[Fe(CN)_6]_2$ (B) $Fe_2[Fe(CN)_6]_3$ (C) $Fe_4[Fe(CN)_6]_3$ (D) $Fe_3[Fe(CN)_6]_4$

38. **If a particle moves in a circle, describing equal angles in equal intervals, the velocity vector**
(A) Remains constant (B) Changes in direction
(C) Changes in magnitude (D) Changes both in magnitude and direction

39. **If the radius of earth were to shrink by 1 %, its mass remaining the same, the acceleration due to gravity on the earth's surface would**
(A) Decrease by 9.8% (B) Decrease
(C) Increase (D) Remain unchanged

40. **Young's Modulus of material of a wire is defined as**
(A) Ratio of linear strain to normal stress
(B) Ratio of normal stress to linear strain
(C) Product of linear strain to normal stress
(D) Square root of the ratio between normal stress and linear strain

41. **The profile of advancing liquid through a tube is**
(A) Hyperbola (B) Straight line (C) Semicircle (D) Parabola

42. **The focus of a convex mirror is:**
(A) At the pole (B) Real (C) Virtual (D) Undefined

43. According to Charles Law
    (A) PV = Constant   (B) P/V = (-) K   (C) V/T = Constant   (D) VT = K_0

44. Objects float in liquid denser than themselves due to
    (A) Bernoulli's law   (B) Drag Theory
    (C) Archimedes Principle   (D) Pascal's Law

45. What type of electric charge would a glass rod develop, when it is rubbed with silk?
    (A) Negative charge   (B) Positive charge
    (C) May be positive or negative   (D) No electricity at all

46. The unit of Resistivity is:
    (A) Ohm – m   (B) Ohm/m   (C) Ohm   (D) m/Ohm

47. Chemical equations involve
    (A) The breaking of bonds   (B) The making of bonds
    (C) The breaking and making of bonds   (D) The shifting of bonds

48. The decomposition of vegetable matter into compost is
    (A) An exothermic reaction   (B) A combination reaction
    (C) Both (A) and (B)   (D) Not possible

49. Respiration is
    (A) An exothermic reaction   (B) A combination reaction
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50. Following is used in whitewashing
    (A) MgO   (B) CaO   (C) MnO   (D) FeO

x-x-x

Information & Technology Engineering

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26. The NAND gate output will be low if the two inputs are

(A) 00   (B) 01   (C) 10   (D) 11

27. What is the binary equivalent of the decimal number 368

(A) 101110000   (B) 110110000   (C) 111010000   (D) 111100000

28. The simplification of the Boolean expression $(ABC) + (ABC)$ is

(A) 0   (B) 1   (C) A   (D) BC

29. The number of control lines for a 8 : 1 multiplexer is

(A) 2   (B) 3   (C) 4   (D) 5

30. EPROM contents can be erased by exposing it to

(A) Ultraviolet rays   (B) Infrared rays.
(C) Burst of microwaves   (D) Intense heat radiations

31. The hexadecimal number 'A0' has the decimal value equivalent to
    (A) 80   (B) 256   (C) 100   (D) 160

32. The Boolean expression $\bar{A}B + A\bar{B} + AB$
    (A) A + B   (B) $\bar{A}B$ (C) $\overline{A + B}$ (D) $A\bar{B}$

33. The 2's complement of the number 1101101 is
    (A) 0101110   (B) 0111110   (C) 0110010   (D) 0010011

34. When simplified with Boolean Algebra (x + y)(x + z) simplifies to
    (A) x   (B) x + x(y + z)   (C) x(1 + yz)   (D) x + yz

35. The code where all successive numbers differ from their preceding number by single bit
is
    (A) Binary code   (B) BCD   (C) Excess – 3   (D) Gray

36. RTL stands for
    (A) Register transfer language   (B) Random transfer language
    (C) Receiver transmitter logic   (D) Register transfer logic

37. The register that includes address of the memory unit is termed as
    (A) PC   (B) MAR   (C) IR   (D) AC

38. Which register is used to store hexadecimal code of the instruction?
    (A) SP   (B) MAR   (C) IR   (D) PC

39. Which operation puts data in the data register?
    (A) Input output read   (B) input output write
    (C) Memory read   (D) Memory write

40. In arithmetic operation addition is performed at
    (A) PC   (B) MAR   (C) IR   (D) ALU

41. HDL stands for
    (A) Human Description Language   (B) Hardware description language
    (C) Hardware description land   (D) Human Description logic

42. IDE stands for
    (A) Input device electronics   (B) Integrated development environment
    (C) Input device environment   (D) Input development electronics

43. SDRAM stands for
    (A) System dynamic random access memory
    (B) Synchronous dynamic random access memory
    (C) Synchronous description random access memory
    (D) System description random access memory

44. Shift left is equivalent to
     (A) Multiply by 2   (B) Divide by 2 (C) Addition with 2 (D) Subtraction from 2

45. Two important fields of an instruction are
     (A) Oprand   (B) Opcode   (C) Opcode & Oprand (D) Hex code

46. _____ is the step during which new instruction is read from the memory
     (A) Opcode fetch   (B) Decode   (C) Execute   (D) Machine

     operation

47. The contents of the program counter represent
     (A) Data   (B) Address   (C) Opcode   (D) Operand

48. Which code is used to represent character, numeric, symbols and punctuation marks?
     (A) ASCII   (B) BCD   (C) Gray code   (D) Excess 3

49. What is a Firewall in Computer Network?
     (A) The physical boundary of Network
     (B) An operating System of Computer Network
     (C) A system designed to prevent unauthorized access
     (D) A web browsing Software

50. Which data communication method is used to transmit the data over a serial communication
     link?
     (A) Simplex   (B) Half-duplex   (C) Full duplex   (D) All of these

x-x-x

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26. The volume and temperature of air (assumed to be an ideal gas) in a closed vessel is 2.87 m^3 and 300K, respectively. The gauge pressure indicated by a manometer fitted to the wall of the vessel is 0.5 bar. If the gas constant of air is R = 287 J/kg. K and the atmospheric pressure is 1 bar, the mass of air (in kg) in the vessel is.
(A) 1.67   (B) 3.33   (C) 5.00   (D) 6.66

27. During a non-flow thermodynamic process (1-2) executed by a perfect gas, the heat interaction is equal to the work interaction ($Q_{1-2}=W_{1-2}$) when the process is
(A) Adiabatic   (B) Polytropic   (C) Isothermal   (D) Isentropic

28. A gas expands in a frictionless piston-cylinder arrangement. The expansion process is very slow, and is resisted by an ambient pressure of 100 kPa. During the expansion process, the pressure of the system (gas) remains constant at 300 kPa. The change in

volume of the gas is 0.01m^3. The maximum amount of work that could be utilized from the above process is

(A) 0 kJ   (B) 2 kJ   (C) 1 kJ   (D) 3 kJ

29. For an ideal gas with constant values of specific heats, for calculation of the specific enthalpy,
   (A) It is sufficient to know only the temperature
   (B) Both temperature and pressure are required to be known
   (C) Both temperature and volume are required to be known
   (D) Both temperature and mass are required to be known

30. The internal energy of an ideal gas is a function of
   (A) Temperature and pressure   (B) Volume and pressure
   (C) Entropy and pressure   (D) Temperature only

31. An industrial heat pump operates between the temperatures of 27°C and –13°C. The rates of heat addition and heat rejection are 750 W and 1000 W, respectively. The COP for the heat pump is
   (A) 7.5   (B) 6.5   (C) 4.0   (D) 3.0

32. A mass 35 kg is suspended from a weight less bar AB which is supported by a cable CB and a pin at A as shown in figure. The pin reactions at A on the bar AB are

   (A) Rx = 343.4N, Ry = 755.4N   (B) Rx = 343.4N, Ry = 0
   (C) Rx = 755.4N, Ry = 343.4N   (D) Rx = 755.4N, Ry = 0

33. If a system is in equilibrium and the position of the system depends upon many independent variable the principle of virtual work states that the partial derivatives of its total potential energy with respect to each of the independent variable must be
   (A) -1.0   (B) 0   (C) 1.0   (D) ∞

34. In a statically determinate plane truss, the number of joints (j) and the number of members (m) are related by
   (A) $j = 2m - 3$ (B) $m = 2j + 1$ (C) $m = 2j - 3$ (D) $m = 2j - 1$

35. A steel wheel of 600mm diameter on a horizontal steel rail. It carries a load of 500N. The coefficient of rolling resistance is 0.3. The force in Newton, necessary to roll the wheel along the rail is
   (A) 0.5   (B) 5   (C) 1.5   (D) 150

36. A mass m_1 of 100 kg travelling with a uniform velocity of 5 m/s along a line collides with a stationary mass m_2 of 1000 kg. After the collision, both the masses travel together with the same velocity. The coefficient of restitution is
    (A) 0.6   (B) 0.1   (C) 0.01   (D) 0

37. The SI unit of kinematic viscosity (v) is:
    (A) m^2/sec (B) kg/m-sec   (C) m/sec^2 (D) m^3/sec^2

38. For the stability of a floating body, under the influence of gravity alone, which of the following is TRUE?
    (A) Metacentre should be below centre of gravity
    (B) Metacentre should be above centre of gravity
    (C) Metacentre and centre of gravity must lie on the same horizontal line
    (D) Metacentre and centre of gravity must lie on the same vertical line

39. A two-dimensional flow filed has velocities along the x and y directions given by u = x^2t and v = $-2xyt$ respectively, where t is time. The equation of streamlines is
    (A) x^2y = constant   (B) $x\,y^2$ = constant
    (C) $x\,y$ = constant   (D) Not possible to determine

40. Which combination of the following statements about steady incompressible forced vortex flow is correct?
    P: Shear stress is zero at all points in the flow.
    Q: Vorticity is zero at all points in the flow.
    R: Velocity is directly proportional to the radius from the centre of the vortex.
    S: Total mechanical energy per unit mass is constant in the entire flow field.
    (A) P and Q   (B) R and S   (C) P and R   (D) P and S

41. A venturimeter of 20 mm throat diameter is used to measure the velocity of water in a horizontal pipe of 40 mm diameter. If the pressure difference between the pipe and throat sections is found to be 30 KPa then, neglecting frictional losses, the flow velocity is
    (A) 0.2 m/s   (B) 1 m/s   (C) 1.4 m/s   (D) 2.0 m/s

42. Two pipes of uniform section but different diameters carry water at the same volumetric flow rate. Water properties are the same in the two pipes. The Reynolds number, based on the pipe diameter,
    (A) is the same in the both pipes   (B) is large in the narrow pipe
    (C) is smaller in the narrower pipe   (D) depends on the pipe material

43. With an increase in the thickness of insulation around a circular pipe, heat loss to surroundings due to
    (A) Convection increases, while that due to conduction decreases
    (B) Convection decreases, while that due to conduction increases
    (C) Convection and conduction decreases
    (D) Convection and conduction increases

44. Which one of the following configurations has the highest fin effectiveness?
    (A) Thin, closely spaced fins   (B) Thin, widely spaced fins
    (C) Thick, widely spaced fins   (D) Thick, closely spaced fins

45. Match List-I with List-II and select the correct answer using the codes given below:
          List-I   List-II

A. Compressible flow	1. Renolds number
B. Free surface flow	2. Nussult number
C. Boundary layer flow	3. Weber number
D. Pipe flow	4. Froude number
E. Heat convection	5. Mach number
	6. Skin friction coefficient

Codes:	A B C D E		A B C D E
(A)	1 4 2 6 3	(B)	3 4 6 1 2
(C)	5 3 6 1 4	(D)	5 3 6 1 2

46. The emissive power of a blackbody if P. If its absolute temperature is doubled, the emissive power becomes.
(A) 2P   (B) 4P   (C) 8P   (D) 16P

47. A diesel engine is usually more efficient than a spark ignition engine because
(A) Diesel being a heavier hydrocarbon, releases more heat per kg than gasoline
(B) The air standard efficiency of diesel cycle is higher than the Otto cycle, at a fixed compression ratio
(C) The compression ratio of a diesel engine is higher than that of an SI engine
(D) Self ignition temperature of diesel is higher than that of gasoline

48. For a gas turbine power plant, identify the correct pair of statements.
P. Smaller in size compared to steam power plant for same power output
Q. Starts quickly compared to steam power plant
R. Works on the principle of Rankine cycle
S. Good compatibility with solid fuel
(A) P, Q   (B) R, S   (C) Q, R   (D) P, S

49. Which one of the following modifications of the simple ideal Rankine cycle increases the thermal efficiency and reduces the moisture content of the steam at the turbine outlet?
(A) Increasing the turbine inlet temperature

(B) Decreasing the condenser pressure

(C) Increasing the boiler pressure

(D) Decreasing the boiler pressure

50. Consider an ideal vapor compression refrigeration cycle. If the throttling process is replaced by an isentropic expansion process, keeping all the other processes unchanged, which one of the following statements is true for the modified cycle?
(A) Coefficient of performance is higher than that of the original cycle
(B) Coefficient of performance is the same as that of the original cycle
(C) Coefficient of performance is lower is lower than that of the original cycle
(D) Refrigerating effect is lower than that of the original cycle

x-x-x

Biotechnology Engineering

1. A deductive theory is one which
   (A) Allows theory to emerge out of the data
   (B) Involves testing an explicitly defined hypothesis
   (C) Allows for findings to feed back into the stock of knowledge
   (D) Uses qualitative methods whenever possible

2. Which of the following is not a data-collection method?
   (A) Research questions
   (B) Unstructured interviewing
   (D) Postal survey questionnaires
   (D) Participant observation

3. A population N is divided into three strata so that $N_1 = 5000$, $N_2 = 2000$ and $N_3 = 3000$. Respective standard deviations are: $\sigma_1 = 15$, $\sigma_2 = 18$, and $\sigma_3 = 5$. How should a sample of size $n = 84$ be allocated to the three strata, if we want optimum allocation using disproportionate sampling design?
   (A) $n_1 = 50$, $n_2 = 10$ and $n_3 = 24$
   (B) $n_1 = 28$, $n_2 = 28$ and $n_3 = 28$
   (C) $n_1 = 50$, $n_2 = 24$ and $n_3 = 10$
   (D) $n_1 = 54$, $n_2 = 10$ and $n_3 = 20$

4. An appropriate measure of central tendency for an ordinal scale variable is:
   (A) Median   (B) Mode   (C) Arithmetic Mean   (D) Geometric Mean

5. The research antagonistic to ex-post facto research is
   (A) Experimental research
   (B) Library research
   (C) Normative research
   (D) Descriptive research

6. Standardising the conditions under which the measurement of variables takes place will improve which characteristic of the measuring instrument:
   (A) Validity   (B) Reliability   (C) Equivalence   (D) Accuracy

7. Nine years old children are taller than 7 years old ones. It is an example of :
   (A) Longitudinal studies
   (B) Cross-sectional studies
   (C) Experimental studies
   (D) Case studies

8. A researcher divides the populations into PG, graduates and 10+2 students and using the random digit table he selects some of them from each. This is technically called
   (A) Stratified sampling
   (B) Stratified random sampling
   (C) Representative sampling
   (D) None of these

9. In an experimental testing hypothesis research, the group that is subjected to usual conditions is known as :
   (A) Control group
   (B) Experimental group
   (C) Extraneous group
   (D) Treatment group

10. A statistical measure based upon the entire population is called parameter while measure based upon a sample is known as :
    (A) Sample parameter (B) Inference   (C) Statistic   (D) None of these

11. The case study method does which of the following:
    (A) Attempts to capture a population's characteristic from a sample's characteristics
    (B) Emphasizes a full contextual analysis of a few events or conditions and their interrelations

(C) Provides repeated measures over an extended period of time

(D) Reveals why or how one variable changes another

12. All of the following are types of non probability based sampling techniques except :
(A) Purposive sampling
(B) Quota sampling
(C) Random sampling
(D) Snowball sampling

13. During testing of Hypothesis, a researcher is said to have committed Type I error when:
(A) When he rejects a null hypothesis which is actually true
(B) When he accepts a null hypothesis which is actually false
(C) Both the null and alternate hypothesis are rejected
(D) None of the above

14. The probability of making a Type II error can be reduced by :
(A) Increasing sample size
(B) Decreasing the power of the statistical test
(C) Using a lower α value
(D) Choosing a different statistical test

15. Review articles in academic journals that summarize existing research on a given topic can be considered as:
(A) Primary sources
(B) Secondary sources
(C) Tertiary sources
(D) Direct sources

16. Which of the following is NOT true about the standard error of a statistic?
(A) The standard error measures, roughly, the average difference between the statistic and the population parameter.
(B) The standard error is the estimated standard deviation of the sampling distribution for
the statistic.
(C) The standard error can never be a negative number.
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26. A segment of DNA about 84 bp long with closed circular topology will be termed as;
(A) Relaxed with eight helical turns and strained with seven helical turns
(B) Relaxed with seven helical turns and strained with eight helical turns
(C) Relaxed with eight helical turns and strained with nine helical turns
(D) Relaxed with nine helical turns and strained with eight helical turns

27. A mutation in sigma factor of RNA polymerase that does not allow it to get separated from core enzyme will lead to which of the following effect;
(A) Slowing down of gene transcription
(B) Very quick gene transcription process
(C) No effect on the gene transcription process
(D) Multiple round of gene transcription process

28. In proteome analysis by two dimensional gel electrophoresis techniques which of the following statements is true;
(A) First dimension is isoelectric focussing followed by Native polyacrylamide gel electrophoresis
(B) First dimension is isoelectric focussing followed by SDS polyacrylamide gel electrophoresis
(C) First dimension is Native polyacrylamide gel electrophoresis followed by isoelectric focussing
(D) First dimension is SDS polyacrylamide gel electrophoresis followed by isoelectric focussing

29. A single strand of DNA having 35 nucleotides would have how many phosphodiester bonds when present as covalently closed circle and as linear chain;

(A) 35 and 34, respectively   (B) 34 and 33, respectively
(C) 34 and 34, respectively   (D) 33 and 33, respectively

30. The inflammatory response against extracellular bacterial infections is characterized by all of following, except;
(A) Complement system activation
(B) Degranulation of histamine releasing cells
(C) Phagocytosis by macrophages
(D) Dimerization of Ig E antibodies

31. From each pair of the following antigen which one is more antigenic when injected in rabbit;
(A) BSA in Freund's complete adjuvant & Freund's incomplete adjuvant
(B) Hen elastin and Egg white lysozyme
(C) Natural BSA and heat denatured BSA
(D) Proteins with molecular weight of 20,000 and 100, 000

32. The Bacmid are the shuttle vectors that can propogate in which of the following species;

(A) In bacteria and mammalian cells   (B) In bacteria and yeast
(C) In bacteria and plant cells   (D) In bacteria and insect cells

33. During solid-liquid separation via centrifugation, the Sigma-factor increases as;
(A) $(RPM)^2$ (B) $(RPM)^{1/2}$ (C) $(RPM)^{-1}$ (D) Independent of RPM

34. The fermentation of genetically modified microorganisms comes under which of the following category of intellectual property activity ;
(A) Process patent   (B) Product patent
(C) Copyright   (D) Geographic indicator

35. The first genome sequence project was accomplished in which of the following species;
(A) *Drosophila melanogaster*   (B) *Saccharomyces cerevisae*
(C) *Arabidopsis thaliana*   (D) *Haemophilus influenzae*

36. For the growth-associated product formation, the specific rate of product formation increases as;
(A) μ (B) $1/\mu$ (C) x (D) $Y_{p/x}$

37. If a pilot sterilization were carried out in a 100-dm^3 vessel with a medium containing 10^6
organisms cm^{-3} requiring a probability of contamination of 1 in 1000, the Del factor would be;
(A) 34.5 (B) 32.23 (C) 20.72 (D) 25.32

38. A pneumatic proportional controller is used to control temperature within the range of 60 to 100^0F. The controller is adjusted so that the output pressure goes from 3 psi (valve fully open) to 15 psi (valve fully closed) as the measured temperature goes from 71 to 75^0F with the set-point held constant. Find the gain (psi/$^{\circ}$F);

(A) 0.3 (B) 3.0 (C) 0.25 (D) 0.2

39. A pseudo-plastic fluid is the one in which the viscosity ;
(A) Is constant regardless of the stirrer speed or mixing time
(B) Changes during mixing but returns to its original state after mixing
(C) Increases with increasing stirrer speed
(D) Decreases with increasing stirrer speed

40. Trypan blue was added to the cell suspension for cell counting. The dye penetrated some of the cells while others did not acquire color. The viability index (% viability) of cells can be calculated by which of the following formula;
(A) Total Cells minus Colored Cells x 100
(B) Total Cells minus non colored cells x 100
(C) Number of colored cells /total no. of cells x 100
(D) Number of non-colored cells /total no. of cells x 100

41. The X_{90} value for a filtration system is;
(A) The time required to reduce microbial population by 90%
(B) The time required to traverse survivor curve by one log cycle
(C) The depth of the filter required to reduce population by 90%
(D) The depth of the filter required to reduce population by 99%

42. The flow in the real packed bed can be approximated as;
(A) Mixed flow (B) Plug flow
(C) Dispersed plug flow (D) Tanks in series model

43. Space time for a plug flow reactor (n=1) is;
(A) K lnC/C_o (B) $1/K$ ln C_o/C (C) $1/K$ C_o/C (D) K ln C_o/C

44. Let S be the fractional change in volume of the reactor system between no conversion and complete conversion of reactant A. What is the value of 'S' for a reaction A$\rightarrow$ 3B, starting with 50% inerts;
(A) 2 (B) 1 (C) 3 (D) 0

45. How many numbers of protein bands would you observe when a dimeric protein of 50 kd each is resolved using Native-PAGE and SDS-PAGE, respectively;
(A) One in Native and one in SDS-PAGE
(B) One in Native and two SDS-PAGE
(C) Two in Native and one in SDS-PAGE
(D) Three in Native and none in SDS-PAGE

46. You were asked to engineer a single stranded DNA to be used as a probe for identifying the target gene. For this you required cloning your gene of interest in which of the following vector;

(A) pUC8/9 Vector   (B) Phagemid   (C) YAC Vector   (D) Lambda Phage

47. Which of the following structures is a supersecondary structure;
(A) Alpha helices   (B) Beta -strands   (C) Loops   (D) Coiled coils

48. Which of the following features is not true for *Shine –Dalgarno* sequences;

(A) It is a stretch of purine –rich sequences.
(B) It is complementary to 16S rRNA .
(C) It is a ribosomal binding site.
(D) It is always located down stream to coding region.

49. Which of the following *p*-value represents sequences that will possibly have distant homology?
(A) *p*- value is smaller than 10^{-100}
(B) *p*-value is equal to 10^{-100}
(C) *p*-value is in the range of 10^{-50} to 10^{-100}
(D) *p*-value is smaller than 10^{-1} to 10^{-5} .

50. Which of the following does not represent a gene finding program in prokaryotes?
(A) Glimmer   (B) RBS finder   (C) Gene Mark   (D) Phylip

x-x-x