Electronics, Group D, Model Answers, CET-2018

SECTION I- PHYSICS

Universal Constants: $c = 3 \times 10^8$ m/s; $h = 6.63 \times 10^{-34}$ Js; $k_B = 1.38 \times 10^{-23}$ J/K; $e = 1.6 \times 10^{-19}$ C; Mass of electron= 9.1×10^{-31} kg, 1 amu = 931.5 MeV

1. An electron microscope uses 100 keV electrons for imaging. What will be the wavelength associated with these electrons.

    A. 3.8 nanometer
    B. 3.8 picometer X
    C. 3.8 micrometer
    D. 3.8 mm
    E.   No option is correct

2. When temperature of a semiconductor is increased.

    A. Its resistance increases
    B. No effect of temperature
    C. The conductance increases X
    D. exponential increase in resistance
    E.   No option is correct

3. When a metal rod is heated from one end the, flow of heat from one end to another end, depends on the following (mark the most correct):

    A.   thermal conductivity of the metal rod
    B.   the cross sectional area of the metal rod
    C.   the temperature gradient
    D.   All options are correct X
    E.   No option is correct

4. Give the energy required to convert to convert water of mass m at temperature 30 °C to steam. The specific heat of water is s and latent heat of vaporization is L. Given is boiling temperature of water is 100°C.

    A.   m x s + m x L
    B.   70 x m x s + 100 x m x L
    C.   m x (70 x s + L)   X
    D.   m x s + 70 x m x L
    E.   No option is correct

5. A charged particle with charge q, having velocity $\vec{V}$, passes through a magnetic field $\vec{B}$. The motion of particle is along the magnetic field. The force acting on the particle is

    A. $q \cdot \vec{V} \times \vec{B}$ in direction perpendicular to $\vec{B}$
    B. $q \times \vec{V} + q \times \vec{B}$
    C. $q \times \vec{V} \times \vec{B}$ in direction of $\vec{B}$
    D. Zero   X
    E. No option is correct

6. A ball is dropped from 5 m. At the same time another ball is thrown upwards with a velocity of 10 m/s. At what time and distance they meet each other. Assume the acceleration due to gravity g as 10 m s^{-2}.

    A. in 1 sec at 2.5 m above ground
    B. in 0.5 sec at 2.5 m above ground
    C. in 1 sec above 1.25 m above ground
    D. in 0.5 second 3.75 m above ground   X
    E. No option is correct

7. In a nuclear fission, two fission fragments, alpha particle and neutrons are produced along with release of energy. In the reaction, if the mass deficit is 0.2 a.m.u. in the fission reaction, the energy released is:

    A. independent of mass deficit
    B. 200 MeV
    C. 100 MeV
    D. 186.3 MeV   X
    E. No option is correct

8. In a LC circuit having inductance L /2π, capacitance C /2π, the resonance frequency is given by

    A. independent of frequency of RF
    B. $(LC)^{-0.5}$ X
    C. $2\pi(LC)^{-0.5}$
    D. LC
    E. No option is correct

9. A voltage signal is represented by $V(t) = 10\sin(120\pi t)$. The voltage amplitude and freequency of signal are:

    A. Amplitude is 10 V and frequency is 50 Hz
    B. Amplitude is 20 V and frequency is 60 Hz
    C. Amplitude is 10 V and frequency is 120 Hz
    D. Amplitude is 10 V and frequency is 120 Hz
    E. Amplitude is 10 V and frequency is 60 Hz   X

10. A capillary is dipped in liquid and the liquid rises in capillary up to height h due to surface tension. Radius of capillary is R, acceleration due to gravity is g, surface tension is T, density of liquid is d. The weight of liquid raised in capillary is

  A. 4T
  B. T/(h x g)
  C. 4/3 πR^3 d g T
  D. πR^2 h d g   X
  E. No option is correct

11. In a resistance of 1000 kOhm, a voltage of 1 V is applied. How many electrons flow in resistance in one second.

  A. 1 Ampere
  B. 10^{18}
  C. 6.25 x10^{12} X
  D. 10^2
  E. 6.25 x 10^{15}

12. A ray is incident at an angle of 60 degree on the prism having angle of prism as 60 degree. Find the angle of deviation of incident ray, if the angle of emergence is 40 degree.

  A. 20 degree
  B. 10 degree
  C. 40 degree   X
  D. 20 degree
  E. 120 degree

13. What will be the energy of photon of light with wavelength of 500 nanometer. Where 1 nanometer is 10^{-9} meter.

  A. 5.0 eV
  B. 2.0 eV
  C. 1.24 eV
  D. 2.48 eV   X
  E. No option is correct

14. A capillary of radius r is dipped in liquid and the liquid of density d, rises in capillary up to height h due to surface tension T. The upward force due to surface tension is

  A. 4T
  B. T/(h x g)
  C. 4/3 πr^3 d g T
  D. 2 π rT   X
  E. No option is correct

15. An electron microscope uses 200 keV electrons for imaging. What will be the wavelength associated with these electrons?

    A.   2.7 nanometer
    B.   2.7 picometer   X
    C.   2.7 micrometer
    D.   2.7 mm
    E.   No option is correct

16. A p-n junction has a depletion layer at the interface. Choose the best option among following statements.

A. There is always little voltage across the depletion layer
B. The depletion layer has negatively charged acceptor ions
C. The depletion layer has positively charged donor ions
D. All options are correct   X
E. No option is correct

17. A charge particle moving in linear path enters a magnetic field at angle 45 degree with respect to the direction of magnetic field. What will be the path of the electron?

    A.   The electron will follow a circular path
    B.   The electron will move unaffected
    C.   The electron will be bent by another 45 degree
    D.   The electron will follow a helical path   X
    E.   The electron will moved away from the magnetic field

18. A doubly ionized alpha particle of mass 4 amu is attracted by voltage of 1 kV. The energy gained by alpha particle is

    A. 1 keV
    B. Zero
    C. 2 keV   X
    D. 4 keV
    E. No option is correct

19. In a nuclear fusion reaction, two light nuclei fuse together to form a bigger nucles. If the mass deficit is ΔM in fusion reaction and the velocity of light is c, the energy released in fusion is:

    A. independent of M
    B. $2 \Delta Mc^2$
    C. $\Delta Mc^2/2$
    D. ΔMc^2 X
    E. No option is correct

20. In a LC circuit having inductance L, capacitance C, and a RF source. It is observed that the current in circuit is maximum, when the frequency of RF is

    A. independent of frequency of Rf
    B. $2\pi (LC)^{0.5}$
    C. $2\pi (LC)$
    D. $2\pi (LC)^{-1}$
    E. $(2\pi)^{-1} (LC)^{-0.5}$ X

21. In a circuit the resistance R, an inductance L and a capacitor of capacitance C are connected to a RF source. Choose the most correct option in following.

A. At resonance, the impedance of circuit will be R
B. At resonance the impedance offered by capacitor and inductor cancel each other
C. Quality factor Q of the circuit depends on resistance R
D. Lower the value of resistance, higher is the quality factor Q
E. All options are correct   X

22. In a sound experiment, the difference between first and second resonance in water column with a tuning fork, is 50 cm. If the velocity of light is 332 m/s, the frequency of tuning fork is

A. 664 Hz
B. 6.64 Hz
C. 332 Hz   X
D. 3.32 Hz
E. 83 Hz

23. In a resistance of 1 k Ohm, a voltage of 1 V is applied. How many electrons flow in resistance in one second.

A. 1.6×10^{14}
B. 1.6×10^{15}
C. 6.2×10^{14}
D. 10^{15}
E. 6.2×10^{15} X

24. A ball A is thrown at an angle of 30 degree with respect to the horizontal axis, with a velocity of 50 m/s. At the same time another ball B is thrown at an angle of 45 degree with respect to horizontal axis, with a velocity of $25\sqrt{2}$ m/s. Which of the following is true?

A.   A will hit ground first
B.   Both A and B will hit ground at the same time   X
C.   B will hit the ground first
D.   No option is correct
E.   Difficult to say

25. For given principal quantum number of 3, the other quantum numbers are:

A. Angular quantum number L can be 0, 1 and 2. Magnetic quantum numbers m can be -2,-1,0, 1 and 2   X

B. Angular quantum number L can be 1 and 2. Magnetic quantum numbers m can be -2,-1,0, 1 and 2

C. Angular quantum number L can be 0, 1 and 2. Magnetic quantum numbers m can be -2,-1,0

D. Angular quantum number L can be 0, 1 and 2. Magnetic quantum numbers m can be 0, 1 and 2

E. Angular quantum number L can be 1 and 2. Magnetic quantum numbers m can be -2,-1,0, 1 and 2

SECTION II- MATHEMATICS

26. Let G be an eulerian graph. Then which of the following statements is false?

A. G is an edge-disjoint union of cycles
B. Degree of every vertex is even
C. G is connected
D. G has a cycle passing through every vertex   X
E. G has a path containing evey vertex

27. An analytic function is

A. continuous but not differentiable
B. infinitely differentiable   X
C. finitely differentiable
D. not differentiable
E. two times differentiable

28. The function f(z) = | z |^2 of complex variable is.

A. nowhere analytic   X
B. every where analytic
C. analytic at z = 0
D. not differentiable at z = 0
E. differtiable at every positive real number

29. A function f(x + iy) = u + iv is said to be harmonic if

A. $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 v}{\partial x^2} = 0$

B. $\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 v}{\partial y^2} = 0$

C. $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$ X

D. $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$

E. $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$

30. The fixed points of the mapping w = $\frac{5z+4}{z+5}$ of complex variables are

A. 2, 2
B. -2,-2
C. 2,-2   X
D. 1,-1
E. -4/5 , 5

31. The mapping w = z^2 - 2z - 3 is

A. conformal within $| z | = 1$
B. not conformal at z = 1   X
C. not conformal at z = -1 and z = 3
D. conformal everywhere
E. nowhere conformal

32. Which one of the following is true for functions of domain R?

A. Every Riemann integrable function is Lebesgue integrable   X
B. Every Riemann integrable function is a continuous function
C. A constant function is Riemann integrable
D. A bounded function is Riemann integrable
E. Every Lebesgue integrable function is Riemann integrable

33. Which of the following is false?

A. Every compact metric space is separable
B. Every totally bounded metric space is separable
C. Every separable metric space is totally bounded   X
D. The real line R is separable
E. The metric space l_2 is separable

34. Which of the following subspaces of R is not complete with respect to the standard metric?

A. R
B. Z
C. Q   X
D. {0, 1, 1/2, 1/3, ...}
E. [0, 1]

35. The integral $\int_0^\infty \sin x \, dx$

A. exists and equal to π
B. exists and equal to zero

C. exists and equal to one
D. exists and equal to two
E. does not exist   X

36. $\lim\limits_{x \to 0}$ $\dfrac{2x - \sin 2x}{x^2 \sin x}$ is

A. 0
B. 2/3
C. 4/3   X
D. 1
E. 2

37. Which of the following series is divergent?

A. $\sum_{1}^{\infty} \dfrac{1}{n!}$

B. $\sum_{2}^{\infty} \dfrac{1}{\log n}$ X

C. $\sum_{1}^{\infty} \dfrac{1}{n^2}$

D. $\sum_{1}^{\infty} \dfrac{(-1)^n}{n}$

E. $\sum_{1}^{\infty} e^{-n^2}$

38. The sequence $x_n = 1 + \dfrac{1}{2} + \dfrac{1}{2^2} + \cdots + \dfrac{1}{2^{(n-1)}}$ is

A. increasing and not bounded
B. decreasing and not bounded
C. increasing and bounded   X
D. decreasing and bounded
E. neither increasing nor decreasing

39. The integral $\int_{-\infty}^{\infty} \dfrac{dx}{1+x^2}$ is

A. $\dfrac{\pi}{2}$

B. 0

C. 1

D. $\dfrac{-\pi}{2}$

E. π   X

40. The set of the linearly independent solutions of differential equation $\frac{d^4y}{dx^4} - \frac{d^2y}{dx^2} = 0$

A. 1, x, e^x, e^{-x}
B. 1, x, e^x, xe^x X
C. 1, x, e^{-x}, xe^{-x}
D. 1, x, e^{-x}, e^{-x}
E. 1, x, e^{-x}, xe^x

41. Which of the following statements is not true?

A. A tree is a bipartitie graph
B. K5, the complete graph on 5 vertices is a planar graph   X
C. Every connected graph contains a spanning tree
D. The number of vertices of odd degree in a graph is always even
E. Every edge of a tree is a cut-edge

42. Suppose that n+1 objects are put into n boxes. Then which one of the following statements is true?

A. no box contains more than one object
B. exactly one box contains two objects
C. at most one box contains two or more objects
D. at least one box contains two or more objects   X
E. exactly one box is empty

43. The Taylor series for sinx about 0 is

A. $1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \cdots$

B. $x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots$ X

C. $x - \frac{x^3}{3} + \frac{x^5}{5} - \cdots$

D. $x - \frac{x^2}{2!} + \frac{x^3}{3!} - \cdots$

E. $1 + \frac{x^3}{3!} - \frac{x^5}{5!} + \cdots$

44. The order of convergence in Newton-Raphson methode is

A. 0
B. 1
C. 2   X
D. 3
E. does not converge

45. let A be a set and P(A) be the set of all subset of A. Then

A. there is no injective map from A to P(A)
B. there is no surjective map from A to P(A)   X
C. there is injective A to P(A) is surjective
D. there is surjective P(A) to A is injective
E. every map from P(A) to A is surjective

46. If $P(A \mid B) = P(A \mid B^c)$ then

A. $A \subseteq B$
B. the events A and B are mutually exclusive events
C. the events A and B are independent events   X
D. the events A and B are exhaustive events
E. $P(A) = P(B)$

47. The differential equation of all circles touching X-axis at the origin is

A. $(x^2 + y^2) \frac{dy}{dx} - 2xy = 0$

B. $(x^2 - y^2) \frac{dy}{dx} + 2xy = 0$

C. $(x^2 - y^2) \frac{dy}{dx} - xy = 0$

D. $(x^2 + y^2) \frac{dy}{dx} + xy = 0$

E. $(x^2 - y^2) \frac{dy}{dx} - 2xy = 0$ X

48. The set $B = \{(x_1, x_2) : x_1^2 + x_2^2 < 4\}$ is

A. a convex set   X
B. a concave set
C. an unbounded set
D. a concave and convex set
E. neither concave nor convex set

49. Minimal polynomial of the matrix:

$$A = \begin{bmatrix} 1 & 3 & -2 \\ 0 & 4 & -2 \\ 2 & 3 & -1 \end{bmatrix}$$

Is

A. $(x - 1)(x - 2)^2$
B. $(x - 1)^2(x - 2)$
C. $(x - 1)(x - 2)$　　　X
D. $(x - 1)^2$
E. $(x - 2)^2$

50. The partial differential equation obtained by eleminating arbitrary constant a and b from
u = a.e^{bx}sinby is

A. $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 v}{\partial x^2} = 0$

B. $\dfrac{\partial^2 u}{\partial x^2} - \dfrac{\partial^2 v}{\partial y^2} = 0$

C. $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} = 0$　　　X

D. $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} = 0$

E. $\dfrac{\partial u}{\partial x} + \dfrac{\partial v}{\partial y} = 0$

SECTION-III
ELECTRONICS

51. A Hartley oscillator is used for the generation of

    A. Very low frequencies
    B. Microwave frequencies
    C. Radio frequencies   X
    D. Audio frequencies
    E. Extremely low frequencies

52. The essential blocks of a Phase Locked Loop (PLL) are phase detector, amplifier,

    A. High pass filter and crystal controlled oscillator
    B. Low pass filter and crystal controlled oscillator
    C. High pass filter and voltage controlled oscillator
    D. Low pass filter and voltage controlled oscillator   X
    E. Low pass filter and high pass filter

53. The ideal characteristics of a stabilizer are constant

    A. Output voltage with low internal resistance   X
    B. Output current with low internal resistance
    C. Output voltage with high internal resistance
    D. Internal resistance with variable output voltage
    E. Internal resistance with variable output current

54. In a transistor amplifier, the reverse saturation current I_{CO}

    A. reduces to half of its value for every 10°C rise in temperature
    B. doubles for every 1°C rise in temperature
    C. linearly increases with temperature
    D. doubles for every 5°C rise in temperature
    E. doubles for every 10°C rise in temperature   X

55. Which one of the following power amplifiers has the maximum efficiency?

    A. Class A
    B. Class B
    C. Class AB
    D. Class C   X
    E. Class AC

56. SCR turns OFF from conducting state to blocking state on

   A. reducing gate current
   B. reversing gate voltage
   C. reducing anode current below holding current value   X
   D. applying AC to the gate
   E. increasing gate current

57. CE configuration is the most preferred transistor configuration when used as a switch because it

   A. requires only power supply
   B. requires help of CB configuration   X
   C. requires no power supply
   D. requires high voltage or current
   E. requires low voltage or current

58. The number of 4 line to line decoders required to make an 8 line to 256 line decoder is

   A. 16
   B. 17
   C. 32
   D. 64
   E. 68   X

59. A relaxation oscillator

   A. produces non sinusoidal input   X
   B. oscillates continuously
   C. relaxes indefinitely
   D. has two stable states
   E. never relaxes

60. The race around condition occurs in a JK flip flop when

   A. J = 0, K = 1
   B. J = 1, K = 0
   C. J = 0, K = 0
   D. J = 1, K = 1   X
   E. J = X, K = 0

61. In the negative logic system,

   A. the more negative logic of the two logic levels represents a logic '1' state   X
   B. the more negative logic of the two logic levels represents a logic '0' state

C. all input and output voltage levels are negative

D. the output is always complement of the intended logic function

E. all input and output voltage levels are positive

62. TTL circuits with active pull up are preferred because of their suitability for

A. wired AND operation

B. bus operated system

C. wired logic system

D. wireless logic system

E. reasonable dissipation and speed of operation   X

63. While obtaining minimal sum of products expression,

A. all don't cares are treated as logic ones

B. only such don't cares that aid minimisation are treated as logic ones   X

C. all don't cares are treated as logic zeroes

D. all don't cares are ignored

E. only such don't cares that aid minimisation are treated as logic zeros

64. In digital circuit, Schottky transistors are preferred over normal transistors because of their

A. lower power dissipation

B. higher propagation delay

C. lower propagation delay   X

D. higher power dissipation

E. no power dissipation

65. If two numbers in excess-3 code are added and the result is less than 9, then to get equivalent binary

A. 0011 is subtracted

B. 0011 is added

C. 0110 is subtracted   X

D. 0110 is added

E.   0110 is multiplied

66. If the various logic families are arranged in the ascending of their fan-out capabilities, the sequence will be

A. TTL, ECL, IIL, CMOS

B. IIL, TTL, ECL, CMOS   X

C. ECL, TTL, IIL, CMOS

D. TTL, ECL, CMOS, IIL

E.   ECL, IIL, TTL, CMOS

67. A ring counter consisting of five flip-flops will have

   A. 5 states   X
   B. 10 states
   C. 32 states
   D. 64 states
   E. infinite states

68. Double integration of unit step function would lead to

   A. an impulse
   B. a doublet
   C. a ramp
   D. a parabola   X
   E. a triangular function

69. The impulse response of an R-L circuit is a

   A. rising exponential function
   B. hyperbolic function
   C. step function
   D. parabolic function
   E. decaying exponential function   X

70. If the numerator of a second-order transfer function F(s) is a constant, then the filter is a

   A. band-pass filter
   B. band-stop filter
   C. high-pass filter
   D. low-pass filter   X
   E. notch filter

71. Which of the following theorems is a manifestation of the Law of conservation of energy?

   A. Tellegen's theorem   X
   B. Reciprocity theorem
   C. Thevenin's theorem
   D. Norton's theorem
   E. Fourier series

72. In an optical fibre, the refractive index of the cladding material should be

   A. nearly unity
   B. very low
   C. equal to unity
   D. more than that of the core
   E. less than that of the core   X

73. The power spectral density of white noise

    A. Varies as square root of frequency
    B. Varies as inverse of frequency
    C. remains constant with frequency   X
    D. Varies as square of frequency
    E. is unity

74. The rate at which information can be passed through a telecommunication channel depends on the

    A. carrier frequency
    B. bandwidth   X
    C. transmission loss
    D. transmitter power
    E. transmission width

75. If a carrier modulated by a digital bit stream had one of the possible phases of 0, 90, 180 and 270 degrees, then the modulation is called

    A. BPSK
    B. QPSK   X
    C. QAM
    D. MSK
    E. 8-PSK