(EEE)

ELECTRICAL AND ELECTRONICS ENGINEERING
INSTRUCTIONS TO CANDIDATES

1. Candidates should write their Hall Ticket Number only in the space provided at the top left hand corner of this page, on the leaflet attached to this booklet and also in the space provided on the OMR Response Sheet. **BESIDES WRITING, THE CANDIDATE SHOULD ENSURE THAT THE APPROPRIATE CIRCLES PROVIDED FOR THE HALL TICKET NUMBERS ARE SHADED USING H.B. PENCIL ONLY ON THE OMR RESPONSE SHEET. DO NOT WRITE HALL TICKET NUMBER ANY WHERE ELSE.**

2. Immediately on opening this Question Paper Booklet, check:
   (a) Whether **200** multiple choice questions are printed (**50** questions in Mathematics, **25** questions in Physics, **25** questions in Chemistry and **100** questions in Engineering)
   (b) In case of any discrepancy immediately exchange the Question paper Booklet of same code by bringing the error to the notice of invigilator.

3. Use of Calculators, Mathematical Tables and Log books is not permitted.

4. **Candidate must ensure that he/she has received the Correct Question Booklet, corresponding to his/her branch of Engineering.**

5. **Candidate should ensure that the booklet Code and the Booklet Serial Number, as it appears on this page is entered at the appropriate place on the OMR Response Sheet by shading the appropriate circles provided therein using H.B. pencil only. Candidate should note that if they fail to enter the Booklet Serial Number and the Booklet Code on the OMR Response Sheet, their Answer Sheet will not be valued.**

6. **Candidate shall shade one of the circles 1, 2, 3 or 4 corresponding question on the OMR Response Sheet using H.B. Pencil only. Candidate should note that their OMR Response Sheet will be invalidated if the circles against the question are shaded using Black / Blue ink pen / Ball pen / any other pencil other than H.B. Pencil or if more than one circle is shaded against any question.**

7. One mark will be awarded for every correct answer. **There are no negative marks.**

8. The OMR Response Sheet will not be valued if the candidate :
   (a) Writes the Hall Ticket Number in any part of the OMR Response Sheet except in the space provided for the purpose.
   (b) Writes any irrelevant matter including religious symbols, words, prayers or any communication whatsoever in any part of the OMR Response Sheet.
   (c) Adopts any other malpractice.

9. Rough work should be done only in the space provided in the Question Paper Booklet.

10. No loose sheets or papers will be allowed in the examination hall.

11. Timings of Test: 10.00 A.M. to 1.00 P.M.

12. Candidate should ensure that he / she enters his / her name and appends signature on the Question paper booklet, leaflet attached to this question paper booklet and also on the OMR Response Sheet in the space provided. Candidate should ensure that the invigilator puts his signature on this question paper booklet, leaflet attached to the question paper booklet and also on the OMR Response Sheet.

13. Before leaving the examination hall candidate should **return both the OMR Response Sheet and the leaflet attached to this question paper booklet** to the invigilator. Failure to return any of the above shall be construed as malpractice in the examination. **Question paper booklet may be retained by the candidate.**

14. This booklet contains a total of **32** pages including Cover page and the pages for Rough Work.

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Note: (1) *Answer all questions.*
    (2) *Each question carries 1 mark. There are no negative marks.*
    (3) *Answer to the questions must be entered only on OMR Response Sheet provided separately by completely shading with H.B. Pencil, only one of the circles 1, 2, 3 or 4 provided against each question, and which is most appropriate to the question.*
    (4) *The OMR Response Sheet will be invalidated if the circle is shaded using ink / ball pen or if more than one circle is shaded against each question.*

MATHEMATICS

1. If $A+B+C=\pi$, then $\sin 2A + \sin 2B + \sin 2C =$
   (1) $4\cos A \sin B \cos C$
   (2) $4\sin A \cos B \sin C$
   (3) $4\cos A \cos B \cos C$
   (4) $4\sin A \sin B \sin C$

2. The principal solution of $\tan x = 0$ is
   (1) $x = n\pi, n \in Z$
   (2) $x = 0$
   (3) $x = (2n+1)\pi/2, n \in Z$
   (4) $x = n\pi + \alpha, n \in Z$

3. The value of $\tan^{-1}(2) + \tan^{-1}(3)$ is
   (1) $\frac{\pi}{4}$
   (2) $\frac{\pi}{2}$
   (3) $\frac{\pi}{3}$
   (4) $\frac{3\pi}{4}$

4. If the sides of a right angle triangle are in A.P., then the ratio of its sides is
   (1) 1:2:3
   (2) 2:3:4
   (3) 3:4:5
   (4) 4:5:6

5. The value of $r.r_1.r_2.r_3$ is
   (1) Δ^2
   (2) Δ^{-2}
   (3) Δ^{-3}
   (4) Δ^4

6. $\frac{1}{r1}+\frac{1}{r2}+\frac{1}{r3}=$
   (1) $\frac{1}{r}$
   (2) $\frac{1}{2r}$
   (3) $\frac{1}{R}$
   (4) $\frac{1}{\Delta}$

7. If $a=6$, $b=5$, $c=9$, then the value of angle A is

(1) $\cos^{-1}(2/9)$ (2) $\cos^{-1}(2/5)$ (3) $\cos^{-1}(7/9)$ (4) $\cos^{-1}(1/3)$

8. The polar form of complex number $1-i$ is

(1) $\sqrt{2}\,e^{-i\pi/4}$ (2) $\sqrt{2}\,e^{i\pi/4}$ (3) $\sqrt{2}\,e^{i\pi/2}$ (4) $\sqrt{2}\,e^{-i\pi/2}$

9. If $1, \omega, \omega^2$ be the cube roots of unity, then the value of $2^{\omega^3}.2^{\omega^5}.2^{\omega}$ is

(1) ω (2) ω^2 (3) 1 (4) 0

10. The intercept made on X-axis by the circle $x^2+y^2+2gx+2fy+c = 0$ is

(1) $\sqrt{g^2-c}$ (2) $\sqrt{f^2-c}$ (3) $2.\sqrt{g^2-c}$ (4) $2.\sqrt{f^2-c}$

11. If one end of the diameter of the circle $x^2+y^2-5x-8y+13 = 0$ is $(2, 7)$, then the other end of the diameter is

(1) $(3, 1)$ (2) $(1, 3)$ (3) $(-3, -1)$ (4) $(-1, -3)$

12. The radius of the circle $\sqrt{1+m^2}(x^2+y^2)-2cx-2mcy = 0$ is

(1) $2c$ (2) $4c$ (3) $c/2$ (4) c

13. The parametric equations of the ellipse $\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2}=1$ are

(1) $x = a\sec\theta, y = b\tan\theta$ (2) $x = b\sin\theta, y = a\cos\theta$

(3) $x = a\cos\theta, y = b\sin\theta$ (4) $x = a\csc\theta, y = b\cot\theta$

14. The equation of the directrix of the parabola $2x^2 = -7y$ is

(1) $8y+7=0$ (2) $8y-7=0$ (3) $7y+8=0$ (4) $8x-7=0$

15. The condition for a straight line $y = mx+c$ to be a tangent to the hyperbola $\dfrac{x^2}{a^2}-\dfrac{y^2}{b^2}=1$ is

(1) $c = a/m$ (2) $c^2 = a^2m^2 - b^2$ (3) $c^2 = a^2m^2 + b^2$ (4) $c^2 = a/m$

16. $\underset{x\to1}{Lt}\ \dfrac{\sqrt{5x-4}-\sqrt{x}}{x-1}$ is

    (1) 3   (2) 2   (3) 4   (4) 1

17. $\log i =$
    (1) $\pi/2$ (2) $\pi/4$ (3) $i\pi/2$ (4) $i\pi/4$

18. $\dfrac{d}{dx}\left[\log_7 X\right]=$

    (1) $\dfrac{1}{x}$ (2) $X\log_7^e$ (3) $\dfrac{1}{x}\log_e^7$ (4) $\dfrac{1}{x}\log_7^e$

19. $\dfrac{d}{dx}\left[2\cosh x\right]=$

    (1) $\dfrac{e^x+e^{-x}}{2}$ (2) $\dfrac{e^x-e^{-x}}{2}$ (3) e^x+e^{-x} (4) e^x-e^{-x}

20. $\dfrac{d}{dx}\left[\cos^{-1}\left(\dfrac{1-x^2}{1+x^2}\right)\right]=$

    (1) $\dfrac{1}{1+x^2}$ (2) $\dfrac{-1}{1+x^2}$ (3) $\dfrac{2}{1+x^2}$ (4) $\dfrac{-2}{1+x^2}$

21. If $x=at^2, y=2at$, then $\dfrac{dy}{dx}=$

    (1) $\sqrt{\dfrac{y}{x}}$ (2) $\sqrt{\dfrac{x}{a}}$ (3) $\sqrt{\dfrac{a}{x}}$ (4) $\sqrt{\dfrac{x}{y}}$

22. The derivative of e^x with respect to $\sqrt{x}$ is

    (1) $\dfrac{2\sqrt{x}}{e^x}$ (2) $2\sqrt{x}\,e^x$ (3) $\dfrac{e^x}{2\sqrt{x}}$ (4) $\sqrt{x}\cdot e^x$

23. The equation of the normal to the curve $y = 5x^4$ at the point $(1, 5)$ is

    (1) $x + 20y = 99$ (2) $x + 20y = 101$ (3) $x - 20y = 99$ (4) $x - 20y = 101$

24. The angle between the curves $y^2 = 4x$ and $x^2 + y^2 = 5$ is

    (1) $\dfrac{\pi}{4}$ (2) $\tan^{-1}(2)$ (3) $\tan^{-1}(3)$ (4) $\tan^{-1}(4)$

25. If $u = x^3 y^3$ then $\dfrac{\partial^3 u}{\partial x^3} + \dfrac{\partial^3 u}{\partial y^3} =$

    (1) $6\,(x^3 + y^3)$ (2) $6\,x^3 y^3$ (3) $6x^3$ (4) $6y^3$

26. $\int \operatorname{cosec} x \, dx =$

    (1) $\log\,(\operatorname{cosec} x + \cot x) + C$ (2) $\log\,(\cot x/2) + C$

    (3) $\log\,(\tan x/2) + C$ (4) $-\operatorname{cosec} x . \cot x + C$

27. $\displaystyle\int_0^{\frac{\pi}{2}} \cos^{11} x \, dx =$

    (1) $\dfrac{256}{693}$ (2) $\dfrac{256\pi}{693}$ (3) $\dfrac{\pi}{4}$ (4) $\dfrac{128}{693}$

28. $\int f'(x) [f(x)]^n \, dx =$

    (1) $\dfrac{[f(x)]^{n-1}}{n-1} + C$ (2) $\dfrac{[f(x)]^{n+1}}{n+1} + C$ (3) $n[f(x)]^{n-1} + C$ (4) $(n+1)[f(x)]^{n+1} + C$

29. $\displaystyle\int \dfrac{dx}{(x+7)\sqrt{x+6}} =$

    (1) $Tan^{-1}(\sqrt{x+6}) + C$ (2) $2Tan^{-1}(\sqrt{x+6}) + C$

    (3) $Tan^{-1}(x+7) + C$ (4) $2Tan^{-1}(x+7) + C$

30. $\int \tan^{-1} x \, dx =$

(1) $x.Tan^{-1}x + \dfrac{1}{2}\log(1+x^2)+C$

(2) $\dfrac{1}{1+x^2}+C$

(3) $x^2.Tan^{-1}x + C$

(4) $x.Tan^{-1}x - \log\sqrt{1+x^2}+C$

31. $\int \dfrac{dx}{1+e^{-x}} =$

(1) $\log(1+e^{-x})+C$

(2) $\log(1+e^x)+C$

(3) $e^{-x}+C$

(4) e^x+C

32. $\displaystyle\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \sin|x| \, dx =$

(1) 0   (2) 1   (3) 2   (4) -1

33. Area under the curve $f(x) = \sin x$ in $[0; \pi]$ is

(1) 4 sq. units   (2) 2 sq. units   (3) 6 sq. units   (4) 8 sq. units

34. The order of $x^3 \dfrac{d^3y}{dx^3} + 2x^2\dfrac{d^2y}{dx^2} - 3y = x$ is

(1) 1   (2) 4   (3) 3   (4) 2

35. The degree of $\left[\dfrac{d^2y}{dx^2}+\left(\dfrac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = a\dfrac{d^2y}{dx^2}$ is

(1) 4   (2) 2   (3) 1   (4) 3

36. The family of straight lines passing through the origin is represented by the differential equation

(1) $ydx + xdy = 0$ (2) $xdy - ydx = 0$ (3) $xdx + ydy = 0$ (4) $xdx - ydy = 0$

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37. The differential equitation $\dfrac{dy}{dx} + \dfrac{ax+hy+g}{hx+by+f} = 0$ is called

   (1) Homogeneous   (2) Exact   (3) Linear   (4) Legender

38. The solution of differential equation $\dfrac{dy}{dx} = e^{-x^2} - 2xy$ is

   (1) $y.e^{-x^2} = x+c$ (2) $ye^x = x+c$ (3) $ye^{x^2} = x+c$ (4) $y = x+c$

39. The complementary function of $(D^3+D^2+D+1)\,y = 10$ is

   (1) $C_1\cos x + C_2\sin x + C_3 e^{-x}$ (2) $C_1\cos x + C_2\sin x + C_3 e^x$

   (3) $C_1 + C_2\cos x + C_3\sin x$ (4) $(C_1 + C_2 x + C_3 x^2)\,e^x$

40. Particular Integral of $(D-1)^4 y = e^x$ is

   (1) $x^4 e^x$ (2) $\dfrac{x^4}{24} e^{-x}$ (3) $\dfrac{x^4}{12} e^x$ (4) $\dfrac{x^4}{24} e^x$

41. If $A = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then $A^4 =$

   (1) $3I$ (2) $9I$ (3) $27I$ (4) $81I$

42. If $A = \begin{bmatrix} 0 & 2 & 1 \\ -2 & 0 & -2 \\ -1 & x & 0 \end{bmatrix}$ is a skew symmetric matrix, then the value of x is

   (1) 1   (2) 2   (3) 3   (4) 4

43. What is the number of all possible matrices with each entry as 0 or 1 if the order of matrices is 3×3

   (1) 64   (2) 268   (3) 512   (4) 256

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44. If $A = \begin{bmatrix} 1 & i & -i \\ i & -i & 1 \\ -i & 1 & i \end{bmatrix}$, then $|A| =$

   (1) 1 .   (2) 2   (3) 3   (4) 4

45. The solution of a system of linear equations $2x - y + 3z = 9, x + y + z = 6, x - y + z = 2$ is

   (1) $x = -1, y = -2, z = -3$ (2) $x = 3, y = 2, z = 1$

   (3) $x = 2, y = 1, z = 3$ (4) $x = 1, y = 2, z = 3$

46. If $\dfrac{1}{x^2 + a^2} = \dfrac{A}{x + ai} + \dfrac{B}{x - ai}$ then A = _____ , B = _____ .

   (1) $\dfrac{1}{2ai}, -\dfrac{1}{2ai}$ (2) $-\dfrac{1}{2ai}, \dfrac{1}{2ai}$ (3) $\dfrac{1}{ai}, -\dfrac{1}{ai}$ (4) $-\dfrac{1}{ai}, \dfrac{1}{ai}$

47. If $\dfrac{2x + 4}{(x-1)^3} = \dfrac{A_1}{(x-1)} + \dfrac{A_2}{(x-1)^2} + \dfrac{A_3}{(x-1)^3}$ then $\sum\limits_{i=1}^{3} A_i$ is equal to

   (1) A_2 (2) $2A_2$ (3) $4A_2$ (4) $4A_1$

48. The period of the function $f(x) = |\sin x|$ is

   (1) π (2) 2π (3) 3π (4) 4π

49. If $A + B = 45°$, then $(1 - \cot A) \cdot (1 - \cot B)$ is

   (1) 1   (2) 0   (3) 2   (4) -1

50. The value of $\sin 78° + \cos 132°$ is

   (1) $\dfrac{\sqrt{5}+1}{4}$ (2) $\dfrac{\sqrt{5}+1}{2}$ (3) $\dfrac{\sqrt{5}-1}{2}$ (4) $\dfrac{\sqrt{5}-1}{4}$

PHYSICS

51. The linear momentum of a particle varies with time t as $p = a + bt + ct^2$ which of the following is correct?
    (1) Force varies with time in a quadratic manner.
    (2) Force is time-dependent.
    (3) The velocity of the particle is proportional to time.
    (4) The displacement of the particle is proportional to t.

52. A shell of mass m moving with a velocity v suddenly explodes into two pieces. One part of mass $m/4$ remains stationary. The velocity of the other part is
    (1) v　　　　(2) $2v$　　　　(3) $3v/4$　　　　(4) $4v/3$

53. The velocity of a freely falling body after 2s is
    (1) 9.8 ms^{-1}　　(2) 10.2 ms^{-1}　　(3) 18.6 ms^{-1}　　(4) 19.6 ms^{-1}

54. A large number of bullets are fired in all directions with the same speed u. The maximum area on the ground on which these bullets will spread is
    (1) $\dfrac{\pi u^2}{g^2}$　　　(2) $\dfrac{\pi u^4}{g^2}$　　　(3) $\dfrac{\pi u^2}{g^4}$　　　(4) $\dfrac{\pi u}{g^4}$

55. The minimum stopping distance for a car of mass m, moving with a speed v along a level road, if the coefficient of friction between the tyres and the road is μ, will be
    (1) $\dfrac{v^2}{2\mu g}$　　　(2) $\dfrac{v^2}{\mu g}$　　　(3) $\dfrac{v^2}{4\mu g}$　　　(4) $\dfrac{v}{2\mu g}$

56. When a bicycle is in motion, the force of friction excreted by the ground on the two wheels is such that it acts
    (1) In the backward direction on the front wheel and in the forward direction on the rear wheel
    (2) In the forward direction on the front wheel and in the backward direction on the rear wheel
    (3) In the backward direction on both the front and the rear wheels
    (4) In the forward direction on both the front and the rear wheels

57. In a perfectly inelastic collision, the two bodies
    (1) strike and explode
    (2) explode without striking
    (3) implode and explode
    (4) combine and move together

58. Under the action of a constant force, a particle is experiencing a constant acceleration, then the power is
    (1) zero
    (2) positive
    (3) negative
    (4) increasing uniformly with time

59. Consider the following two statements:
    A: Linear momentum of a system of particles is zero.
    B: Kinetic energy of a system of particles is zero.
    Then
    (1) A implies B & B implies A
    (2) A does not imply B & B does not imply A
    (3) A implies B but B does not imply A
    (4) A does not imply B but B implies A

60. An engine develops 10 kW of power. How much time will it take to lift a mass of 200 kg to a height of 40 m? (Given g = 10 ms^{-2})
    (1) 4s
    (2) 5s
    (3) 8s
    (4) 10s

61. If a spring has time period T, and is cut into n equal parts, then the time period will be
    (1) $T\sqrt{n}$
    (2) $\frac{T}{\sqrt{n}}$
    (3) nT
    (4) T

62. When temperature increases, the frequency of a tuning fork
    (1) increases
    (2) decreases
    (3) remains same
    (4) increases or decreases depending on the materials

63. If a simple harmonic motion is represented by $\dfrac{d^2x}{dy^2} + \alpha x = 0$, its time period is

   (1) $2\pi\sqrt{\alpha}$ (2) $2\pi\alpha$ (3) $\dfrac{2\pi}{\sqrt{\alpha}}$ (4) $\dfrac{2\pi}{\alpha}$

64. A cinema hall has volume of 7500 m³. It is required to have reverberation time of 1.5 seconds. The total absorption in the hall should be

   (1) 850 w-m²   (2) 82.50 w-m²

   (3) 8.250 w-m²   (4) 0.825 w-m²

65. To absorb the sound in a hall which of the following are used

   (1) Glasses, stores   (2) Carpets, curtains

   (3) Polished surfaces   (4) Platforms

66. If N represents avagadro's number, then the number of molecules in 6 gm of hydrogen at NTP is

   (1) 2N   (2) 3N   (3) N   (4) N/6

67. The mean translational kinetic energy of a perfect gas molecule at the temperature T K is

   (1) $\dfrac{1}{2}kT$ (2) kT (3) $\dfrac{3}{2}kT$ (4) $2kT$

68. The amount of heat given to a body which raises its temperature by 1°C

   (1) water equivalent   (2) thermal heat capacity

   (3) specific heat   (4) temperature gradient

69. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio Cp/Cv for gas is

   (1) $\dfrac{3}{2}$ (2) $\dfrac{4}{3}$ (3) 2   (4) $\dfrac{5}{3}$

70. Cladding in the optical fiber is mainly used to
    (1) to protect the fiber from mechanical stresses
    (2) to protect the fiber from corrosion
    (3) to protect the fiber from mechanical strength
    (4) to protect the fiber from electromagnetic guidance

71. Two quantities A and B are related by the relation A/B = m where m is linear mass density and A is force. The dimensions of B will be
    (1) same as that of latent heat
    (2) same as that of pressure
    (3) same as that of work
    (4) same as that of momentum

72. The dimensional formula of capacitance in terms of M, L, T and I is
    (1) $[ML^2T^2I^2]$ (2) $[ML^{-2}T^4I^2]$ (3) $[M^1L^3T^3I]$ (4) $[M^{-1}L^{-2}T^4I^2]$

73. If l, m and n are the direction cosines of a vector, then

    (1) $l + m + n = 1$ (2) $l^2 + m^2 + n^2 = 1$ (3) $\dfrac{1}{l} + \dfrac{1}{m} + \dfrac{1}{n} = 1$ (4) $lmn = 1$

74. The angle between i+j and j+k is
    (1) 0°   (2) 90°   (3) 45°   (4) 60°

75. A particle is moving eastwards with a velocity of 5 ms^{-1}. In 10 seconds the velocity changes to 5 ms^{-1} northwards. The average acceleration in this time is

    (1) $\dfrac{1}{\sqrt{2}}$ ms^{-2} towards north-west   (2) zero

    (3) $\dfrac{1}{2}$ ms^{-2} towards north   (4) $\dfrac{1}{\sqrt{2}}$ ms^{-2} towards north-east

CHEMISTRY

76. Potassium metal and potassium ions
    - (1) both react with water
    - (2) have the same number of protons
    - (3) both react with chlorine gas
    - (4) have the same electronic configuration

77. 5.85 gms of sodium chloride were dissolved in water and the solution made upto 100 ml in a standard flask. 10 ml of this solution were pipetted out into another flask and made up with distilled water into 100 ml of solution. The concentration of the sodium chloride solution now is
    - (1) 0.1 M
    - (2) 1.0 M
    - (3) 0.5 M
    - (4) 0.25 M

78. Concentration of a 1.0 M solution of phosphoric acid in water is
    - (1) 0.33 N
    - (2) 1.0 N
    - (3) 2.0 N
    - (4) 3.0 N

79. Which of the following is a Lewis acid?
    - (1) Ammonia
    - (2) Berylium chloride
    - (3) Boron trifluoride
    - (4) Magnesium oxide

80. Which of the following constitutes the components of a buffer solution?
    - (1) Potassium chloride and potassium hydroxide
    - (2) Sodium acetate and acetic acid
    - (3) Magnesium sulphate and sulphuric acid
    - (4) Calcium chloride and calcium acetate

81. Which of the following is an electrolyte?
    - (1) Acetic acid
    - (2) Glucose
    - (3) Urea
    - (4) Pyridine

82. Calculate the Standard emf of the cell, $Cd/Cd^{+2}//Cu^{+2}/Cu$ given that E^0 Cd/Cd^{+2} = 0.44V and E^0 Cu/Cu^{+2} = (–) 0.34 V.
    - (1) (–) 1.0 V
    - (2) 1.0 V
    - (3) (–) 0.78 V
    - (4) 0.78 V

83. A solution of nickel chloride was electrolysed using Platinum electrodes. After electrolysis,
    - (1) nickel will be deposited on the anode
    - (2) Cl_2 gas will be liberated at the cathode
    - (3) H_2 gas will be liberated at the anode
    - (4) nickel will be deposited on the cathode

84. Which of the following metals will undergo oxidation fastest?

    (1) Cu   (2) Li   (3) Zinc   (4) Iron

85. Which of the following cannot be used for the sterilization of drinking water?

    (1) Ozone   (2) Calcium Oxychloride

    (3) Potassium Chloride   (4) Chlorine water

86. A water sample showed it to contain 1.20 mg/litre of magnesium sulphate. Then, its hardness in terms of calcium carbonate equivalent is

    (1) 1.0 ppm   (2) 1.20 ppm   (3) 0.60 ppm   (4) 2.40 ppm

87. Soda used in the L-S process for softening of water is, Chemically.

    (1) sodium bicarbonate   (2) sodium carbonate decahydrate

    (3) sodium carbonate   (4) sodium hydroxide (40%)

88. The process of cementation with zinc powder is known as

    (1) sherardizing   (2) zincing   (3) metal cladding (4) electroplating

89. Carrosion of a metal is fastest in

    (1) rain-water   (2) acidulated water (3) distilled water (4) de-ionised water

90. Which of the following is a thermoset polymer?

    (1) Polystyrene   (2) PVC

    (3) Polythene   (4) Urea-formaldehyde resin

91. Chemically, neoprene is

    (1) polyvinyl benzene   (2) polyacetylene

    (3) polychloroprene   (4) poly-1,3-butadiene

92. Vulcanization involves heating of raw rubber with

    (1) selenium element   (2) elemental sulphur

    (3) a mixture of Se and elemental sulphur (4) a mixture of selenium and sulphur dioxide

93. Petrol largely contains
    (1) a mixture of unsaturated hydrocarbons $C_5 - C_8$
    (2) a mixture of benzene, toluene and xylene
    (3) a mixture of saturated hydrocarbons $C_{12} - C_{14.}$
    (4) a mixture of saturated hydrocarbons $C_6 - C_8$

94. Which of the following gases is largely responsible for acid-rain?
    (1) SO_2 & NO_2 (2) CO_2 & water vapour
    (3) CO_2 & N_2 (4) N_2 & CO_2

95. BOD stands for
    (1) Biogenetic Oxygen Demand   (2) Biometric Oxygen Demand
    (3) Biological Oxygen Demand   (4) Biospecific Oxygen Demand

96. The valency electronic configuration of Phosphorous atom (At.No. 15) is
    (1) $3s^2 3p^3$ (2) $3s^1 3p^3 3d^1$ (3) $3s^2 3p^2 3d^1$ (4) $3s^1 3p^2 3d^2$

97. An element 'A' of At.No.12 combines with an element 'B' of At.No.17. The compound formed is
    (1) covalent AB   (2) ionic AB_2 (3) covalent AB_2 (4) ionic AB

98. The number of neutrons present in the atom of $_{56}Ba^{137}$ is
    (1) 56   (2) 137   (3) 193   (4) 81

99. Hydrogen bonding in water molecule is responsible for
    (1) decrease in its freezing point   (2) increase in its degree of ionization
    (3) increase in its boiling point   (4) decrease in its boiling point

100. In the HCl molecule, the bonding between hydrogen and chlorine is
    (1) purely covalent   (2) purely ionic   (3) polar covalent   (4) complex coordinate
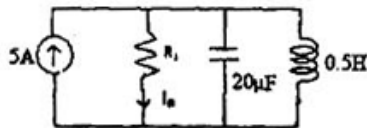
ELECTRICAL AND ELECTRONICS ENGINEERING

101. In a given below circuit, at resonance I_R is equal to
    (1) 0 A
    (2) 10 A
    (3) 5 A
    (4) 0.5 A

102. An alternating current has a peak value of 2A. If its Peak Factor is $\sqrt{2}$ and its form factor is $\dfrac{\pi}{2\sqrt{2}}$, then its average value is

    (1) $\dfrac{8}{\pi}$ A   (2) $\dfrac{4}{\pi}$ A   (3) $\dfrac{\pi}{2}$ A   (4) $\dfrac{\pi}{4}$ A

103. The power factor of an incandescent bulb is
    (1) 0.8 lagging   (2) 0.8 leading   (3) unity   (4) zero

104. The power factor of a circuit comprising resistance R and reactance X in series is

    (1) $\dfrac{R}{\sqrt{R^2 + X^2}}$ (2) $\dfrac{X}{\sqrt{R^2 + X^2}}$ (3) $\dfrac{R}{R^2 + X^2}$ (4) $\dfrac{X}{R^2 + X^2}$

105. The working principle of a Transformer is
    (1) Electromagnetism   (2) Conduction
    (3) Energy transfer   (4) Mutual induction

106. The equivalent resistance of a transformer having transformation ratio (K) = 5 and R1 = 0.1 Ω when referred to secondary is
    (1) 150 Ω (2) 0.02 Ω (3) 0.004 Ω (4) 2.5 Ω

107. What is load at which maximum efficiency occurs in case of a 100 kVA transformer with iron loss of 1 kW and full load copper loss of 2 kW
    (1) 100 kVA   (2) 70.7 kVA   (3) 50.5 kVA   (4) 25.2 kVA

108. In high frequency transformers, the material used for core is
   (1) Ferrite   (2) Iron   (3) Cast iron   (4) Silica

109. Buchholz relay is used to
   (1) identify faults
   (2) rectify the fault
   (3) trip-off connections when fault exists
   (4) clears the fault

110. Distribution transformers are designed to keep core losses minimum and copper losses are relatively less important because
   (1) The primary of such transformers are energized for all the 24 hours in a day and core loss occur throughout the day while copper loss occur only when the secondary is supplying the load
   (2) To ensure maximum All-day efficiency
   (3) Greater core losses my destroy in insulation
   (4) Greater core losses will heat up the oil of the transformer rapidly

111. Which one of the following methods gives more accurate result for determination of voltage regulation of an alternator
   (1) MMF method   (2) Synchronous impedance method
   (3) Potier triangle method   (4) ASA method

112. Hydrogen is used in large alternators mainly to
   (1) reduce distortion of waveform   (2) cool the machine
   (3) strengthen the magnetic field   (4) reduce eddy current losses

113. The frequency of emf generated in an 8-pole alternator running at 900 rpm is
   (1) 50 Hz   (2) 120 Hz   (3) 90 Hz   (4) 60 Hz

114. The angle between synchronously rotating stator flux and rotor poles of a synchronous motor is called _____ angle.
   (1) Synchronizing   (2) Slip   (3) Power factor   (4) Torque

(EEE)

115. If θ_e be the electrical angle and θ_m be the mechanical angle and P be the number of poles of a synchronous motor, then which one of the following relation is true?

   (1) $\theta_e = P \times \theta_m$ (2) $\theta_e = (P/2) \times \theta_m$

   (3) $\theta_e = \theta_m/P$ (4) $\theta_e = P/\theta_m$

116. The essential condition for parallel operation of two single phase transformers is that they should have same

   (1) Polarity   (2) KVA rating   (3) Voltage ratio   (4) Percentage impedance

117. The V-curve of a synchronous motor is a plot of

   (1) State current versus stator power factor

   (2) Stator current versus rotor current at all loads

   (3) Stator current versus rotor currents when power delivered is constant

   (4) Stator current versus power delivered

118. A wound rotor induction motor runs with a slip of 0.03 when developing full load torque. Its rotor resistance is 0.25 ohm per phase. If an external resistance 0.50 ohm per phase is connected across the slip rings, what is the slip for full load torque?

   (1) 0.03   (2) 0.06   (3) 0.09   (4) 0.1

119. The torque developed in a three phase induction motor depends on

   (1) Stator flux and rotor current   (2) stator flux and stator current

   (3) stator current and rotor flux   (4) rotor current and rotor flux

120. A single phase ac induction motor is not self starting because it has

   (1) No slip   (2) rotor is short circuited

   (3) high intertia   (4) absence of rotating magnetic field

121. A single phase winding in a single phase motor produces

   (1) an alternating magnetic field   (2) a stationary magnetic field

   (3) a rotating magnetic field   (4) a steady magnetic field

122. Under no-load conditions, power factor of an induction motor is about
   (1) 0.2 lag   (2) 0.9 lag   (3) Unity   (4) 0.5 lead

123. Of all the plants, minimum quantity of fuel used is required in .... plant.
   (1) Diesel power   (2) Steam   (3) Hydro-electric (4) Nuclear

124. The overall efficiency (η) of a Thermal Power Station is
   (1) η_{boiler} (2) $\eta_{boiler} \times \eta_{generator}$ (3) $\eta_{generator} \times \eta_{turbine}$ (4) $\eta_{turbine} \times \eta_{boiler}$

125. The effect of water hammer can be minimized by using
   (1) Spill way   (2) Anvil   (3) Surge Tank   (4) Draft tube

126. In a diesel power plant suspended impurities in the fuel are removed by
   (1) Cyclone separators   (2) Electrostatic separators
   (3) Fabric filters   (4) Strainer

127. The rupturing capacity of a circuit breaker is measured in
   (1) Ampere   (2) Volt-Ampere (3) Watt   (4) Volt

128. A circuit breaker is essentially
   (1) An arc extinguisher
   (2) A current interrupting device
   (3) A power factor correcting device
   (4) A device for neutralizing the effect of transients

129. Mho relay normally is used for protection of
   (1) Long transmission lines
   (2) Medium Transmission lines
   (3) Short transmission lines
   (4) No length criterion

(EEE)

130. The scheme adopted for bus-bar protection is
    (1) spilt-phase protection
    (2) differential protection
    (3) over current protection
    (4) reverse power protection

131. Due to the ferrari effect on long overhead lines _____
    (1) receiving end voltage is less than sending voltage
    (2) receiving end voltage is more than sending voltage
    (3) receiving end voltage is equal to sending voltage
    (4) receiving end voltage is not effected

132. Corona occurs between two transmission lines when they are
    (1) closely spaced
    (2) widely spaced
    (3) having high potential difference
    (4) carrying DC power

133. Surge impedence of a transmission line is given by
    (1) $\sqrt{(L/C)}$
    (2) $\sqrt{(C/L)}$
    (3) $\sqrt{LC}$
    (4) $1\sqrt{LC}$

134. The general distance for short transmission line is _____
    (1) less than 80 km
    (2) 80 km-250 km
    (3) more than 250 km
    (4) 150 km-300 km

135. The resistance of the line
    (1) increases with increase in frequency
    (2) decreases with increase in frequency
    (3) is independent of frequency
    (4) increases with decrease in frequency

136. In HVDC Transmission System AC is converted to DC using
    (1) Rectifier
    (2) Inverter
    (3) Chopper
    (4) Cycloconverter

137. Suspension type insulators are used for voltages beyond
    (1) 220 V
    (2) 400 V
    (3) 11 KV
    (4) 33 KV

(EEE)

138. Power Factor of Industrial loads is generally

    (1) Unity   (2) Leading   (3) Lagging   (4) Zero

139. Pole mounted transformer stations are meant for

    (1) Primary transmission   (2) Primary distribution

    (3) Secondary transmission   (4) Secondary distribution

140. Transmission lines are transposed to

    (1) Reduce copper loss

    (2) Reduce skin effect

    (3) Prevent interference with communication lines

    (4) Present short circuit between conductors

141. The units for specific energy consumption related to traction is _____

    (1) $\dfrac{\text{Watt - Hour}}{\text{Tonne - km}}$ (2) $\dfrac{\text{Watt - Hour}}{\text{km}}$ (3) Joules/Sec   (4) Watt

142. In Kando system of track electrification_____ is converted into _____

    (1) single phase, dc   (2) dc, single phase

    (3) single phase, three phase   (4) three phase, single phase

143. A train has a scheduled speed of 60 kmph between the stops which are 6 km apart. The actual run time is _____ if the duration of stop is 60 sec.

    (1) 60 sec   (2) 360 sec   (3) 240 sec   (4) 300 sec

144. Average speed of a train is dependent on

    (1) Distance between two stops & run time

    (2) Run time & stop time

    (3) Stop time & acceleration

    (4) Acceleration & deceleration

145. The electric motor used for traction work should have _____
    (1) Low starting torque
    (2) High starting torque
    (3) Rise in speed with increase in load
    (4) No braking capability

146. Tractive effort of an electric locomotive can be increased by
    (1) Increasing the supply voltage
    (2) Increasing the speed
    (3) Increasing the dead weight over the driving axles
    (4) Using high rating motors

147. Tractive effort required for a train going down from an upgradiant is
    (1) less than tractive effort on level track
    (2) more than tractive effort on level track
    (3) equal to the tractive effort on level track
    (4) independent of mass of the train

148. The area under speed-time curve of a train represents
    (1) average speed
    (2) average acceleration
    (3) distance travelled
    (4) average velocity

149. As the number of wire guage increases the cross sectional area of wire _____
    (1) increases
    (2) remains same
    (3) becomes neglible
    (4) decreases

150. Which of the following wiring is not visible outside?
    (1) conduit wiring
    (2) cleat wiring
    (3) casing and capping wiring
    (4) concealed wiring

151. Resistance of earth system of power stations should not exceed the limit of -----
    (1) 0.5 ohms
    (2) 2 ohms
    (3) 1 ohms
    (4) 5 ohms

(EEE)

152. In electrical installations the fuse is always connected in _____ wire.

    (1) earth   (2) neutral   (3) phase   (4) ground

153. The transistor used in amplifier circuits operates in

    (1) Active region   (2) Saturation region

    (3) Cut off region   (4) Reverse region

154. The gain of an amplifier is given by the following formula

    (1) $G(dB) = 10 \log (p_{in}/p_{out})$ (2) $G(dB) = 10 \log (p_{out})$

    (3) $G(dB) = 10 \log (p_{out}/p_{in})$ (4) $G(dB) = 10 \log (p_{in})$

155. The number of diodes that are used in half wave rectifier and full wave bridge rectifier are

    (1) 1,2   (2) 1,4   (3) 2,4   (4) 2,1

156. The average voltage of a full wave rectifier fed from an ac source of peak voltage, V_m and frequency 50Hz is

    (1) V_m/π (2) $2V_m/\pi$ (3) $V_m/\sqrt{2}$ (4) $V_m/2$

157. In a transistor which of the following layer is lightly doped

    (1) Emitter   (2) Collector   (3) Drain   (4) Base

158. Zener diode regulates

    (1) Voltage   (2) Current   (3) Resistance   (4) Power

159. The frequency of oscillation of wein bridge oscillator in Hz is

    (1) $1/2\pi RC$ (2) $2\pi RC$ (3) $1/RC$ (4) R/C

160. $XYZ + (\overline{X} + \overline{YZ})XYZ + \overline{XYZ}$

    (1) $X\dot{Y}Z$ (2) X   (3) Z   (4) 0

161. The 2's complement of the number 1001 1100 is

    (1) 0110 0011   (2) 0110 0100   (3) 1001 1100   (4) 1001 1101

162. The bolean expression for NOR gate with inputs A and B is

    (1) A+B   (2) A.B   (3) A+B   (4) $\overline{A+B}$

163. A DAC with 8 input bits has _____ resolution compared with DAC with 4 input bits.

    (1) High   (2) Same   (3) Low   (4) Infinite

164. The power electronic device, Silicon Controlled Rectifier has

    (1) Two junctions and three layers   (2) Three junctions and three layers

    (3) Three junctions and four layers   (4) Two junctions and two layers

165. Which one of the following is a bidirectional Controlled switch

    (1) Thyristor   (2) Triac   (3) GTO   (4) Diac

166. If the gate current of an SCR is increased, its forward break over voltage V_{BO} will

    (1) Increase   (2) Decrease   (3) Not be affected (4) Be infinity

167. In an UJT triggering circuit for SCR, pulses are generated at _____ of UJT.

    (1) Emitter (E)   (2) Base 1 (B1)   (3) Base 2(B2)   (4) B1-B2

168. In a half wave controlled rectifier feeding R-L load, the range of firing angle of thyristor is

    (1) $0 \leq \alpha \leq 180°$ (2) $90 \leq \alpha \leq 180°$ (3) $0 \leq \alpha \leq 90°$ (4) $0 \leq \alpha \leq 360°$

169. The DC output voltage, V_o of a basic chopper circuit with input voltage, V_{in} and duty cycle, δ is given by _____

    (1) $V_o = V_{in} \times \delta$ (2) $V_o = V_{in}/\delta$ (3) $V_o = V_{in}/(1-\delta)$ (4) $V_o = V_{in}$

170. An AC regulator provides
    (1) Variable frequency, fixed magnitude AC
    (2) Fixed frequency, variable magnitude AC
    (3) Fixed frequency, fixed magnitude AC
    (4) Variable frequency, variable magnitude AC

171. The output voltage of a single phase bridge inverter is
    (1) Square wave   (2) Sinusoidal wave
    (3) Constant dc   (4) Triangular wave

172. Two quadrant operation of dc motor can be obtained if it is fed from a
    (1) Uncontrolled convertor   (2) Half controlled convertor
    (3) Half wave convertor   (4) Fully controlled convertor

173. For controlling the speed of a 3 phase induction motor V/f ratio is maintained constant for
    (1) Constant air gap flux   (2) Constant reactance
    (3) Varying the air gap flux   (4) Variable resistance

174. 8051 microcontroller has _____ data lines and _____ address lines.
    (1) 16, 8   (2) 8, 8   (3) 8, 16   (4) 16, 20

175. Which of the following instruction is not a data transfer instruction?
    (1) XCH   (2) PUSH   (3) ADD   (4) MOV

176. Internal memory of 8051 micro controller consists of
    (1) 128 bytes of RAM, 2 K bytes of ROM
    (2) 4 K bytes of RAM, 128 bytes of ROM
    (3) 2 K bytes of RAM, 128 bytes of ROM
    (4) 128 bytes of RAM, 4 K bytes of ROM

(EEE)

177. The highest priority interrupt is

    (1) TF1   (2) IE1   (3) TF0   (4) IE0

178. Percentage Voltage regulation of a transmission line is given by _____

    (1) $(E_s - E_r)/E_r * 100$ (2) $(E_r - E_s)/E_r * 100$

    (3) $(E_s - E_r)/E_s * 100$ (4) $(E_r - E_s)/E_s * 100$

179. In a main line service of electric traction system _____

    (1) Distance between two stops is very small

    (2) Acceleration and retardation periods are small

    (3) Free running and coasting periods are short

    (4) Acceleration and retardation periods are long

180. For SCR, dv/dt protection is achieved by connecting _____

    (1) L in series with SCR   (2) RL in series with SCR

    (3) RC in series with SCR   (4) RC in parallel with SCR

181. The effective resistance between terminals A and B in the below figure is

    (1) r

    (2) 2r

    (3) 3r

    (4) 4r
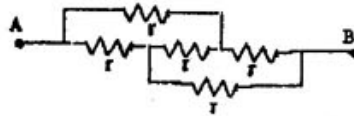
182. If I be the current, C be the capacitance and V be the potential differences, the I/CV will have the unit of

    (1) Time   (2) Power   (3) Frequency   (4) Reactive Power

183. In a series R-C circuit excited by a DC voltage E, the initial current is

    (1) $\dfrac{E}{R}$ (2) 0   (3) $\dfrac{E}{C}$ (4) $\dfrac{C}{E}$

184. The strength of electromagnet can be increased by
    (1) Decreasing the length of the conductor (2) Increasing the length of the conductor
    (3) Increasing the number of turns   (4) Decreasing the number of turns

185. Tesla is a unit of
    (1) Flux   (2) Field strength (3) Current   (4) Flux density

186. According to joule's law heat produced by an electric current is proportional to
    (1) square of the resistance   (2) square of the current
    (3) potential difference   (4) square of the time

187. The Thevenin's equivalent resistance R_{th} for given below network is
    (1) 1 Ω
    (2) 2 Ω
    (3) 4 Ω
    (4) Infinity
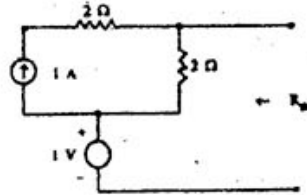
188. In a differential compound generator, the series field turns are provided on
    (1) Armature   (2) Commutator   (3) Interpole   (4) Main pole

189. The function of the commutator in a dc machine is
    (1) to change alternating current to direct current
    (2) to improve commutation
    (3) for easy speed control
    (4) to change alternating voltage to direct voltage

190. If N is the speed and P is number of poles, then the frequency of induced e.m.f in DC generator will be
    (1) $\dfrac{NP}{60}$ (2) $\dfrac{NP}{120}$ (3) $\dfrac{NP}{2}$ (4) NP

191. The demagnetizing flux in dc generator
    (1) Increases e.m.f
    (2) Decreases e.m.f
    (3) Increases speed
    (4) Decreases speed

192. If T_a be the torque and I_a the armature current for a dc series motor, then which of the following relation is valid before saturation
    (1) $T_a \alpha I_a$
    (2) $T_a \alpha (1/I_a)$
    (3) $T_a \alpha (I_a^2)$
    (4) $T_a \alpha (1/I_a)^2)$

193. What will happen if the back e.m.f of a DC motor vanishes suddenly
    (1) The motor will stop
    (2) The motor will continue to run
    (3) The armature may burn
    (4) The motor will run noisy

194. The mechanical power developed by a DC motor is equal to
    (1) Power input + losses
    (2) Back e.m.f × armature current
    (3) Power output × losses
    (4) Power output × efficiency

195. Neglecting saturation, if current taken by a series motor is increased from 10A to 12A, the percentage increase in its torque is
    (1) 20%
    (2) 44%
    (3) 30.5%
    (4) 16.6%

196. Dynamometer type instrument have
    (1) Cramped scale at the beginning
    (2) Cramped at the end
    (3) Cramped at the middle
    (4) Uniform scale

197. To measure a signal of 10 mV at 75 Hz, which one of the following instrument can be used
    (1) cathode ray oscilloscope
    (2) VTVM
    (3) Moving Iron voltmeter
    (4) digital multimeter

198. Which one of the following a passive transducer
    (1) piezolectric
    (2) thermocouple
    (3) photovoltaic cell
    (4) LVDT

(EEE)

199. The voltage coil of a single phase house energy meter

    (1)   is highly resistive

    (2)   is highly inductive

    (3)   is highly capacitive

    (4)   has a phase angle equal to load power factor angle

200. The effective value of a triangular wave is

    (1)   Max. value

    (2) $\sqrt{3}$(Max. value)

    (3) $\dfrac{\sqrt{3}}{\text{Max. value}}$

    (4) $\dfrac{\text{Max. value}}{\sqrt{3}}$