EAMCET ENGINEERING MODEL PAPER

No. of Questions: 160 **Maximum Marks: 160** **Time: 3 Hrs**

MATHS

1. Let $f(x) = \frac{x}{e^x - 1} + \frac{x}{2} + 1$, then f is

1) Odd function 2) Even function

3) Periodic function 4) Constant function

2. The domain of $f(x) = \left(\frac{1}{|x| - 1}\right)^{1/2006}$ is

1) $[-1, 1]$ 2) $R - \{\pm 1\}$ 3) $R - \{1\}$ 4) R

3. If $Z = 1 + i\sqrt{3}$ then $|\text{Arg } Z| + |\text{Arg } \bar{Z}| =$

1) 0 2) $\frac{\pi}{3}$ 3) $\frac{2\pi}{3}$ 4) $\frac{4\pi}{3}$

4. If Z is a complex number of unit modulus and argument θ, then arg $\left(\frac{1+Z}{1+\bar{Z}}\right)$ equals

1) θ 2) $-\theta$ 3) $\pi - \theta$ 4) $\frac{\pi}{2} - \theta$

5. A value of n such that $\left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^n = 1$ is

1) 4 2) 8 3) 12 4) 16

6. If the harmonic mean between the roots of $\left(5 + \sqrt{2}\right)x^2 - bx + \left(8 + 2\sqrt{5}\right) = 0$ is 4, then the value of b

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

7. If one root of $x^2 + px + 1 = 0$ is the cube of the other root, then p =

1) 0 2) 1 3) $0, \pm 2$ 4) $1, \pm 2$

8. The arithmetic mean of the series

$1, 2, 2^2 \ldots\ldots\ldots 2^{n-1}$ is

1) $\frac{2^n - 1}{n}$ 2) $\frac{2^n + 1}{n}$ 3) $\frac{2^n}{n}$ 4) 2^n

9. The median and standard deviation (S.D) of a distribution are 20 and 4 respectively. If each item is increased by 2 then

1) Median & S.D will increase

2) Median will go up by 2 but S.D will remain same

3) Median & S.D will decrease

4) Both are no change

10. $\sin\theta + \cos\theta = m$ and $\sec\theta + \text{cosec}\,\theta = n$ then

1) $n(m^2 - 1) = 2m$ 2) $n(m^2 + 1) = 2m$

3) $2n(m^2 + 1) = m$ 4) $n(m^2 - 1) = m$

11. In an acute angled triangle, $\Sigma \cot A \cdot \cot B$ =

1) −1 2) 0 3) 1 4) 2

12. $\cos^2 A + \cos^2 (120 + A) + \cos^2 (120 - A)$ =

1) $\frac{3}{2}$ 2) $\frac{1}{2}$ 3) $\frac{3}{18}$ 4) $\frac{1}{4}$

13. $\frac{\cos x}{\cos(x - 2y)} = \lambda \Rightarrow \tan (x - y). \tan y$ =

1) $\frac{1 + \lambda}{1 - \lambda}$ 2) $\frac{1 - \lambda}{1 + \lambda}$ 3) $\frac{\lambda}{1 + \lambda}$ 4) $\frac{\lambda}{1 - \lambda}$

14. The period of $\left(\tan \theta - \frac{1}{3} \tan^3\theta\right)\left(\frac{1}{3} - \tan^2 \theta\right)^{-1}$, where $\tan^2 \theta \neq \frac{1}{3}$ is

1) $\frac{\pi}{3}$ 2) $\frac{2\pi}{3}$ 3) π 4) 2π

15. The smallest positive values of x and y which satisfy $\tan(x - y) = 1$, $\sec(x + y) = \frac{2}{\sqrt{3}}$ are

1) $x = \frac{25\pi}{24}$, $y = \frac{19\pi}{24}$ 2) $x = \frac{7\pi}{24}$, $y = \frac{37\pi}{24}$

3) $x = \frac{\pi}{4}$, $y = \frac{\pi}{2}$ 4) $x = \frac{\pi}{3}$, $y = \frac{7\pi}{12}$

16. If $\tan \theta + \tan\left(\frac{\pi}{3} + \theta\right) + \tan\left(\frac{2\pi}{3} + \theta\right) = 3$ then θ =

1) $\frac{n\pi}{3}$; $n \in Z$ 2) $\frac{n\pi}{3} + (-1)^n \cdot \frac{\pi}{6}$; $n \in Z$

3) $\frac{n\pi}{3} + \frac{\pi}{12}$; $n \in Z$ 4) $\frac{2n\pi}{3} \pm \frac{\pi}{9}$; $n \in Z$

17. If $\sin^{-1} x + 4 \cos^{-1} x = \pi$ then x =

1) $\frac{1}{2}$ 2) $\frac{1}{\sqrt{2}}$ 3) $\frac{\sqrt{3}}{2}$ 4) 1

18. If $(\tan^{-1} x)^2 + (\cot^{-1} x)^2 = \frac{5\pi^2}{8}$ then x =

1) −1 2) 1 3) 0 4) 2

19. In ΔABC, if $2R + r = r_2$ then $\angle B$ =

1) $\frac{\pi}{3}$ 2) $\frac{\pi}{4}$ 3) $\frac{\pi}{6}$ 4) $\frac{\pi}{2}$

20. In ΔABC, $\frac{a}{\tan A} + \frac{b}{\tan B} + \frac{c}{\tan C}$ =

1) 2r 2) r + 2R 3) 2r + R 4) 2(r + R)

21. In ΔABC, right angle at A $r_2 + r_3$ =

1) $r_1 - r$ 2) $r_1 + r$ 3) $r - r_1$ 4) R

22. $a = \bar{i} + \bar{j} - 2\bar{k} - \Rightarrow \Sigma [(\bar{a} \times \bar{i}) \times \bar{j}]^2$ =

1) $\sqrt{6}$ 2) 6 3) 36 4) $6\sqrt{6}$

23. If θ is the angle between the unit vectors $\bar{a}$, $\bar{b}$ then $\bar{a} + \bar{b}$ =

1) $\sin\left(\frac{\theta}{2}\right)$ 2) $2\sin\left(\frac{\theta}{2}\right)$ 3) $\cos\left(\frac{\theta}{2}\right)$ 4) $2\cos\left(\frac{\theta}{2}\right)$

24. Three symmetrical dice are thrown. The probability of obtaining a sum of 5 points is

1) $\frac{1}{6}$ 2) $\frac{1}{36}$ 3) $\frac{1}{216}$ 4) $\frac{1}{54}$

25. If A and B are independent events of a random experiment such that $p(A \cap B) = \frac{1}{6}$ and $p(\bar{A} \cap \bar{B}) = \frac{1}{3}$ then p(A) =

1) $\frac{1}{4}$ 2) $\frac{1}{3}$ 3) $\frac{1}{5}$ 4) $\frac{2}{3}$

26. A random variable x takes values 0, 1, 2 its mean is 1.2. If P(x = 0) = 0.3 then p(x = 1) =

1) 0.2 2) 0.3 3) 0.5 4) 0.4

27. If X is a poison variate and p(x = 1) = 2p(x = 2) then p(x = 3)

1) $\frac{e^{-1}}{6}$ 2) $\frac{e^{-2}}{2}$ 3) $\frac{e^{-1}}{2}$ 4) $\frac{e^{-3}}{3}$

28. $\frac{5x+1}{(x+2)(x-1)} = \frac{A}{x+2} + \frac{B}{x-1} \Rightarrow 3B =$

1) A 2) 2A 3) 3A 4) 4A

29. If ${}^{9}p_5 + 5 \cdot {}^{9}p_4 = {}^{10}p_r$. Then r is

1) 5 2) 4 3) 3 4) 7

30. The value of ${}^{14}C_4 + \sum_{j=1}^{4} (18-j)C_j$ is

1) ${}^{18}C_4$ 2) ${}^{18}C_3$ 3) ${}^{17}C_4$ 4) ${}^{17}C_3$

31. The no. of rational terms in $\left[\sqrt[4]{5} + \sqrt[5]{4}\right]^{100}$

1) 50 2) 5 3) 6 4) 51

32. The term independent of x in the expansion of $\left[\sqrt{x} - \frac{2}{\sqrt{x}}\right]^{18}$ is

1) ${}^{18}C_9\,(2^{12})$ 2) ${}^{18}C_6\,(2^6)$ 3) ${}^{18}C_6\,(2^8)$ 4) $-{}^{18}C_6\,(2^9)$

33. The ratio of 3rd and 4th term in $\left[x - \frac{2}{3x^2}\right]^7$ is

1) $\frac{9}{10}x^3$ 2) $\frac{10}{9}x^3$ 3) $\frac{9}{10x^3}$ 4) $\frac{10}{9x^3}$

34. A regular polygon of n sides has 170 diagonals. Then n =

1) 12 2) 17 3) 20 4) 25

35. If A is a matrix such that $\begin{bmatrix}2 & 1\\ 3 & 2\end{bmatrix} A \begin{bmatrix}1 & 1\end{bmatrix} = \begin{bmatrix}1 & 1\\ 0 & 0\end{bmatrix}$ then A =

1) $\begin{bmatrix}1 & 1\\ 0 & 0\end{bmatrix}$ 2) [2 1]] 3) $\begin{bmatrix}1 & 0\\ -1 & 0\end{bmatrix}$ 4) $\begin{bmatrix}2\\ -3\end{bmatrix}$

36. If Tr(A) = 2 + i, Tr[(2 − i)A] =

1) 5 2) 4 3) 3 4) −4

37. If $a_k = \frac{1}{k(k+1)}$ for k = 1, 2, 3..... n then $\left[\sum_{k=1}^{n} a_k\right]^2 =$

1) $\frac{n}{n+1}$ 2) $\frac{n^2}{(n+1)^2}$ 3) $\frac{n^4}{(n+1)^4}$ 4) $\frac{n^6}{(n+1)^6}$

38. $\begin{bmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ac & bc & a^2+b^2 \end{bmatrix}$

1) $4a^2b^2c^2$ 2) $a^2b^2c^2$ 3) $2a^2b^2c^2$ 4) $3a^2b^2c^2$

39. If A = (2 − x, 2, 2), B = (2, 2 − y, 2), C = (2, 2, 2 − Z), D = (1, 1, 1) Coplanar then

1) x + y + z = xyz 2) $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$

3) xy + yz + zx = 1 4) x + y + z = 0

40. Let ABCDEF be a regular hexagon, If $\overline{AD} = x\,\overline{BC}$ and $\overline{CF} = y\,\overline{BA}$ then $(x + y)^2 + 8 =$

1) 24 2) −4 3) 2 4) −24

41. The equation $\sqrt{(x-2)^2 + y^2} + \sqrt{(x+2)^2 + y^2} = 4$ represents

1) A pair of lines 2) A parabola 3) A line segment 4) An ellipse

42. The transformed equation of $x^2 + y^2 = r^2$ when the axes are rotated through an angle 36° is

1) $\sqrt{5}\ x^2 - 4xy + y^2 = r^2$ 2) $x^2 + 2xy - \sqrt{5}\ y^2 = r^2$

3) $x^2 - y^2 = r^2$ 4) $x^2 + y^2 = r^2$

43. In an Isosceles triangle OAB, O is the origin and OA = OB = 6. The equation of the side AB is x − y + 1 = 0. Then the area of the triangle is

1) $2\sqrt{21}$ 2) $\sqrt{142}$ 3) $\frac{\sqrt{142}}{2}$ 4) $\frac{\sqrt{71}}{2}$

44. If the lines ax + by + c = 0, bx + cy + a = 0 and cx + ay + b = 0 ($a \neq b \neq c$) are concurrent then the point of concurrency is

1) (0, 0) 2) (1, 1) 3) (2, 2) 4) (−1, −1)

45. If $4a^2 + 9b^2 - c^2 + 12ab = 0$ then the family of straight lines ax + by + c = 0 is concurrent at

1) (2, 3) or (−2, −3) 2) (2, −3) or (−2, 6)

3) (−2, −4) or (−2, 3) 4) (2, 5) or (−1, −5)

46. The difference of the slopes of the lines $(\tan^2\alpha + \cos^2\alpha)\ x^2 - 2xy \tan\alpha - (\sin^2\alpha)\ y^2 = 0$ is

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

47. The equation of the pair of lines passing through (1, −1) and parallel to the pair of lines $x^2 - y^2 = 0$ is

1) $x^2 - y^2 + 2x + 2y = 0$ 2) $x^2 - y^2 - 2x - 2y = 0$

3) $x^2 + y^2 - 2x + 2y = 0$ 4) $x^2 + y^2 + x = 0$

48. The harmonic conjugate of (2, 3, 4) with respect to the points (3, −2, 2) (6, −17, −4) is

1) $\left(\frac{1}{2}, \frac{1}{3}, \frac{1}{4}\right)$ 2) $\left(\frac{18}{5}, -5, \frac{4}{5}\right)$ 3) $\left(\frac{-18}{5}, \frac{5}{4}, \frac{4}{5}\right)$ 4) $\left(\frac{18}{5}, -5, \frac{-4}{5}\right)$

49. If the lines $\frac{x-4}{1} = \frac{y-2}{1} = \frac{z-\lambda}{3}$ and $\frac{x}{1} = \frac{y+2}{2} = \frac{z}{4}$ intersect each other then λ lies in the interval

1) (9, 11) 2) (−5, −3) 3) (13, 15) 4) (11, 13)

50. The distance between the parallel planes $2x + 3y - 6z + 1 = 0$ and $4x + 6y - 12z + 9 = 0$ is

1) 1 2) 2 3) $\frac{1}{2}$ 4) 3

51. $\lim\limits_{x \to 3} \frac{1 - \cos(x^2 - 5x + 6)}{(x-3)^2}$

1) −1 2) $-\frac{1}{2}$ 3) $\frac{1}{4}$ 4) $\frac{1}{2}$

52. Let $f(x) = \frac{\sin(\Pi \cos^2 x)}{x^2}$, $x \neq 0$ the value of f(0) so that 'f' is continuous function is

1) $-\Pi$ 2) Π 3) $\frac{\Pi}{2}$ 4) 1

53. $\frac{d}{dx}\left[\log_e\left\{(e^x + 2) + \sqrt{e^{2x} + 4e^x + 5}\right\}\right] =$

1) $\frac{1}{\sqrt{e^{2x} + 4e^x + 5}}$ 2) $\frac{e^x}{\sqrt{e^{2x} + 4e^x + 5}}$

3) $\frac{e^x}{\sqrt{e^{2x} + 4e^x + 3}}$ 4) $\frac{-e^x}{\sqrt{e^{2x} + 4e^x + 3}}$

54. Let f and g be two differentiable functions satisfying $g'(3) = 7g(3) = 21$ and $g = f^{-1}$ then $f'(21) =$

1) $\frac{1}{3}$ 2) $\frac{1}{21}$ 3) 147 4) $\frac{1}{7}$

55. If $x = at^2$, $y = 2$ at then $y_2 =$

1) $-\frac{1}{2at^3}$ 2) $-\frac{1}{t^2}$ 3) $\frac{1}{2at^3}$ 4) $\frac{1}{t^2}$

56. If a, b, c are the sides of ΔABC inscribed in given circle then $\frac{\delta a}{\cos A} + \frac{\delta b}{\cos B} + \frac{\delta c}{\cos C} =$

1) 0 2) 1 3) Π 4) 2Π

57. $bx + ay = 2ab$ touches the curves $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 2$ at

1) (1, 1) 2) (b, a) 3) (−a, −b) 4) (a, b)

58. The side of a cube increases at a uniform rate of 0.05 cm per sec. The rate of increase in the surface area when the side is 10 cm is

1) 5 sq.cm/sec 2) 6 sq.cm/sec 3) 10 sq.cm/sec 4) 15 sq.cm/sec

59. The shortest distance of the line $y - x - 1 = 0$ from $x = y^2$ is

1) $\frac{3\sqrt{2}}{8}$ 2) $\frac{3\sqrt{2}}{4}$ 3) $\frac{3\sqrt{2}}{2}$ 4) None

60. Rolles theorem holds for the function $x^3 + bx^2 + cx$, $1 \le x \le 2$ at the point $\frac{4}{3}$, the value of b and c are

1) b = 8, c = –5 2) b = –5, c = 8 3) b = 5, c = –8 4) b = –5, c = –8

61. If the line y = x touches the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ at P where $OP = 4\sqrt{2}$ then c =

1) 8 2) 16 3) 32 4) 64

62. A circle touches the x – axis at (2, 0) and has an intercept of 4 units on y – axis. Then the equation of the circle is

1) $x^2 + y^2 - 2x - \sqrt{2}\ y - 8 = 0$

2) $x^2 + y^2 + 4x + 4\sqrt{2}\ y + 3 = 0$

3) $x^2 + y^2 - 4x - 4\sqrt{2}\ y + 2 = 0$

4) $x^2 + y^2 - 4x - 4\sqrt{2}\ y + 4 = 0$

63. If $4l^2 - 5m^2 + 6l + 1 = 0$ and the line $lx + my + 1 = 0$ touches a fixed circle then the radius and centre of the circle

1) $\sqrt{5}$, (3, 0) 2) $\sqrt{5}$, (–3, 0) 3) $\sqrt{3}$, (0, 3) 4) $\sqrt{3}$, (0, –3)

64. A line '*l*' meets the circle $x^2 + y^2 = 61$ in A, B and P(–5, 6) is such that PA = PB = 10. Then the equation of '*l*' is

1) 5x + 6y + 11 = 0 2) 5x – 6y – 11 = 0

3) 5x – 6y + 11 = 0 4) 5x – 6y + 12 = 0

65. If the circle $x^2 + y^2 + 4x + 22y + c = 0$ bisects the circumference of the circle $x^2 + y^2 - 2x + 8y - d = 0$ then c + d =

1) 60 2) 50 3) 40 4) 30

66. If the joint of ends of the latus rectum of $x^2 = 8y$ subtends an angle θ at the vertex of the parabola then cos θ =

1) $-\frac{4}{5}$ 2) $-\frac{2}{3}$ 3) $-\frac{3}{5}$ 4) $-\frac{1}{5}$

67. The parabola $y^2 = px$ passes through the point of intersection of the lines $\frac{x}{3} + \frac{y}{2} = 1$ and $\frac{x}{2} + \frac{y}{3} = 1$. Its focus is

1) $\left(\frac{3}{10}, 0\right)$ 2) $\left(\frac{3}{5}, 0\right)$ 3) $\left(\frac{3}{7}, 0\right)$ 4) $\left(\frac{6}{7}, 0\right)$

68. L L' is the latusrectum of an ellipse and ΔS'LL' is an equilateral triangle then e =

1) $\frac{1}{\sqrt{2}}$ 2) $\frac{1}{\sqrt{3}}$ 3) $\frac{1}{\sqrt{5}}$ 4) $\sqrt{\frac{2}{3}}$

69. The length of the latusrectum of $9x^2 + 25y^2 - 90x - 150y + 225 = 0$ is

1) $\frac{9}{5}$ 2) $\frac{18}{5}$ 3) $\frac{18}{25}$ 4) $\frac{9}{25}$

70. If the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ and the hyperbola $\frac{x^2}{4} - \frac{y^2}{b^2} = 1$ coincide then b^2 =

1) 4 2) 5 3) 8 4) 9

71. $\int \frac{\cos x + x \sin x}{x\,(x + \cos x)}\,dx =$

1) $\log \left|\frac{x + \cos x}{x}\right| + c$ 2) $\log \left|x\,(x + \cos x)\right| + c$

3) $\log \left|\frac{x}{x + \cos x}\right| + c$ 4) $\log \left|x\,(\cos x + x \sin x)\right| + c$

72. $\int (x^x)^2\,(1 + \log x)\,dx =$

1) $\frac{(x^x)^2}{2} + k$ 2) $x^x + k$ 3) $\frac{x^x}{2} + k$ 4) $\frac{x}{2} + k$

73. If $\int \left[\frac{1}{\log x} - \frac{1}{(\log x)^2}\right] dx =$

1) $x \log x + c$ 2) $\frac{x}{\log x} + c$ 3) $x\,(\log x)^2 + c$ 4) $\frac{x}{(\log x)^2} + c$

74. $\int \frac{\sin^8 x - \cos^8 x}{1 - 2\sin^2 x \cos^2 x}\,dx =$

1) $\frac{1}{2}\cos 2x + c$ 2) $-\frac{1}{2}\cos 2x + c$ 3) $\frac{1}{2}\sin 2x + c$ 4) $-\frac{1}{2}\sin 2x + c$

75. $\int_0^{\Pi/2} \frac{dx}{4\cos^2 x + 9\sin^2 x} =$

1) $\frac{\Pi}{12}$ 2) $\frac{\Pi}{4}$ 3) $\frac{\Pi}{9}$ 4) $\frac{\Pi}{6}$

76. $\int_1^4 \log [x]\,dx =$

1) $\log 4$ 2) $\log 5$ 3) $\log 6$ 4) 0

77. The area bounded by the two parabolas $y^2 = 8x$ and $x^2 = 8y$ is

1) 64 sq.units 2) $\frac{64}{3}$ sq.units 3) $\frac{32}{3}$ sq.units 4) $\frac{1}{3}$ sq.units

78. The solutions of the D.E $ydx - xdy + 3x^2y^2ex^3dx = 0$

1) $x + ex^3 = cy$ 2) $x + yex^3 - cy = 0$

3) $x - yex^3 + c = 0$ 4) $x + yex^3 + cy^2 = 0$

79. The order and degree of $\frac{d^2y}{dx^2} + \sqrt{1 + \left(\frac{dy}{dx}\right)^3} = 0$ is

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

80. The D.E whose solution is $y = ax^2 + bx$ is

1) $x^2 y^2 + 2xy_1 + 2y = 0$ 2) $x^2 y^2 - 2xy_1 + 2y = 0$

3) $x^2 y^2 - 2xy_1 - 2y = 0$ 4) $x^2 y^2 + 2xy_1 - 2y = 0$

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81. If the force is given by $F = at + bt^2$ with 't' at time. The dimensions of a and b are

1) MLT^{-4}, MLT^{-2} 2) MLT^{-3}, MLT^{-4}

3) ML^2T^{-3}, ML^2T^{-2} 4) ML^2T^{-3}, ML^2T^{-4}

82. A freely falling body covers 44.1 m in the last second of its journey. The total distance travelled by the body

1) 88.2 m 2) 66.2 m 3) 108 m 4) 122.5 m

83. An aeroplane is flying horizontally at a height of 490 m with a velocity of 150 ms^{-1}. A bag containing food is to be dropped to the jawans on the ground. How far from them should the bag be dropped so that it directly reaches them?

1) 1000 m 2) 1500 m 3) 750 m 4) 2000 m

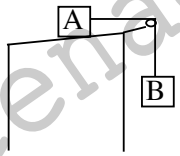
84. The coefficient of static friction between block A of mass 5 kg and the table as shown in the fig. is 0.4. What would be the maximum mass value of block B so that the two blocks do not move? The string and the pulley are assumed to be smooth and massless.

1) 2 kg

2) 4 kg

3) 0.2 kg

4) 0.4 kg



85. A ball of mass m moves towards a wall with a velocity u. The direction of motion making an angle θ with the surface of the wall and rebounds with the same velocity. The change in momentum of the ball during the collision is

1) 2 mu sin θ towards the wall 2) 2 mu sin θ away from the wall

3) 2 mu cos θ towards the wall 4) 2 mu cos θ away from the wall

86. A uniform chain of length L is lying on the horizontal table. If the coefficient of friction between the chain and the table top is μ, what is the maximum length of the chain that can hang over the edge of the table without disturbing the rest of the chain of the table.

1) $\frac{L}{H\mu}$ 2) $\frac{L}{1-\mu}$ 3) $\frac{\mu L}{1-\mu}$ 4) $\frac{\mu L}{1+\mu}$

87. A body of mass 2 kg is at rest. A force of $(4i + 3j - 5k)$ N acts on it and displaces through $(2i + j + 2k)$m. The velocity acquired by the body is

1) 1 ms^{-1} 2) 2 ms^{-1} 3) $\frac{1}{2}$ ms^{-1} 4) 0 ms^{-1}

88. A ball released from a height of 20 m, hits the ground and rebounds to a height of 16 m. The percentage loss of energy during collision is

1) 20% 2) 30% 3) 40% 4) 25%

89. A car is travelling in banked curved road of radius 125 m. If the coefficient of friction between the tyres and road is 0.5 and $g = 10$ m/s^2, the maximum speed to avoid skidding is

1) 10 m/s 2) 20 m/s 3) 25 m/s 4) 50 m/s

90. If the radius of earth shrinks by 0.2% without change in its mass the percentage change in its angular velocity is

1) Decreases by 0.1% 2) Decreases by 0.4%

3) Increases by 0.1% 4) Increases by 0.4%

91. If the length of the second pendulum is increases by 1% how many seconds will it loose in a day?

1) 216 s 2) 432 s 3) 864 s 4) 108 s

92. The period of revolution of Jupiter around the sun is 12 times the period of revolution of the earth around the sun. The distance between the Jupiter and the sun is 'n' times the distance between the earth and sun. Then the value of n is

1) 144 2) $(144)^{3/2}$ 3) $\sqrt[3]{144}$ 4) $\sqrt[4]{144}$

93. Young's modulus of a metal is 15×10^{11} Pa. If its poisson's ratio is 0.4. The bulk modulus of the metal in Pa is

1) 25×10^{11} 2) 2.5×10^{11} 3) 250×10^{11} 4) 0.25×10^{11}

94. Two rain drops reach the earth with different terminal velocities having ratio 9 : 4. The ratio of their volume is

1) 3 : 2 2) 4 : 9 3) 9 : 4 4) 27 : 8

95. A specific gravity bottle contains m grams of liquid of apparent expansion γ_a at 0°C. When it is heated to t°C the mass of liquid expelled is

1) $\frac{1+\gamma_a}{\gamma_a\, mt}$ 2) $\frac{\gamma_a\, m}{1+\gamma_a\, t}$ 3) $\frac{\gamma_a\, mt}{1+\gamma_a\, t}$ 4) $\frac{\gamma_a\, mt}{1-\gamma_a\, t}$

96. An ideal heat engine exhausting heat at 77°C is to have a 30% efficiency. It must take heat at

1) 127°C 2) 227°C 3) 327°C 4) 673°C

97. One mole of a monatomic gas is mixed with one mole of a diatomic gas what will be the γ for the mixture

1) 1.5 2) 1.54 3) 1.4 4) 1.45

98. RMS velocity of oxygen molecules at NTP is 0.5 km/s. The RMS velocity for the hydrogen molecule at NTP is

1) 1 km/s 2) 2 km/s 3) 3 km/s 4) 4 km/s

99. At what temperature is the velocity of sound in a gas is twice the velocity of sound in the same gas at 27°C

1) 54°C 2) 627°C 3) 927°C 4) 327°C

100. Two trains are moving towards each other at speeds of 144 km/hr and 54 km/hr relative to the ground. The first train sounds increase in apparent frequency received by observer in second train is

1) 100% 2) 50% 3) 18% 4) 25%

101. The input of A and B for Boolean expression $\overline{(A + B)}.\overline{(A .B)} = 1$

1) 0, 0 2) 0, 1 3) 1, 0 4) 1, 1

102. A carrier wave of peak voltage 12 volt is used to transmit a signal. If the modulation index is 75%. The peak voltage of the modulating signal is

1) 28 V 2) 22 V 3) 16 V 4) 9 V

103. The energy necessary to remove the electron from n = 10 state in hydrogen atom will be

1) 13.6 eV 2) 1.36 eV 3) 0.136 eV 4) 0.0136 eV

104. The ratio of the de Broglie wavelengths for the electron and proton moving with the same velocity is (m_p = mass of proton, m_e = mass of electron)

1) $m_p : m_e$ 2) $m_p^2 : m_e^2$ 3) $m_e : m_p$ 4) $m_e^2 : m_p^2$

105. The work function for a metal is 4 eV. To eject the photo electrons with zero velocity the wavelength of the incident light should be

1) 2700 A° 2) 1700 A° 3) 5900 A° 4) 3100 A°

106. An emf induced in a secondary coil is 10000 V when the current breaks in the primary. The mutual inductance is 5 H and the current reaches to zero in 10^{-4} s in primary. The maximum current in the primary before the break is

1) 0.2 A 2) 0.3 A 3) 0.4 A 4) 0.5 A

107. In a series LCR circuit R = 10 Ω and the impedance Z = 20 Ω. Then the phase difference between the current and the voltage is

1) 60° 2) 30° 3) 45° 4) 90°

108. An electromagnetic wave is travelling in a medium of permeability μ_m and permittivity ε_m. If 'c' is speed of the wave in free space, the refractive index of the medium is

1) $\frac{c}{\sqrt{\mu_m \varepsilon_m}}$ 2) $\frac{1}{c}\sqrt{\frac{\varepsilon_m}{\mu_m}}$ 3) $\sqrt{\frac{\varepsilon_m}{\mu_m}}$ 4) $c\sqrt{\mu_m \varepsilon_m}$

109. When a convex mirror of focal length f produces an image $\left(\frac{1}{n}\right)^{th}$ of the size of the object, then distance of the object from the mirror is

1) nf 2) $\frac{f}{n}$ 3) (n + 1)f 4) (n – 1)f

110. Two coherent sources of intensity ratio 9 : 4 produce interference. The intensity ratio of maxima and minima of the interference pattern is

1) 13 : 5 2) 5 : 1 3) 25 : 1 4) 3 : 2

111. Two positive charges $q_1 = 4 \times 10^{-6}$ C and $q_2 = 9 \times 10^{-6}$ C are placed 10 cm apart in air. The position of a third charge to be placed between them, such that there will be no resultant force on it is

1) 6 cm from q_1 2) 3 cm from q_1

3) 4 cm from q_1 4) 7 cm from q_1

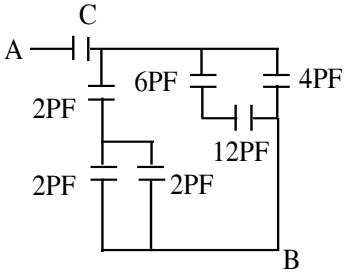
112. A capacitor of 8 micro farad is charged to a potential of 1000 V. The energy stored in the capacitor is

1) 8 J 2) 12 J 3) 2 J 4) 4 J

113. There is 10 units of charge at the centre of a circle of radius 10 m. The work done in moving 1 unit of charge around the circle once is

1) zero 2) 10 units 3) 100 units 4) 1 unit

114. In the given circuit of capacitors, if the effective capacitance between the points A and B is 3 PF, the value of capacitance C is (in pF)

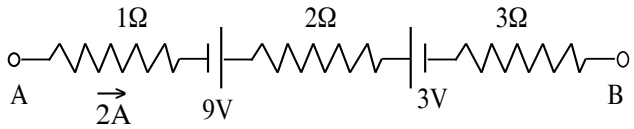


1) $\frac{84}{19}$ 2) $\frac{105}{23}$ 3) $\frac{84}{13}$ 4) $\frac{84}{53}$

115. A wire of resistance 12 ohm is bent in the form of a circle. The effective resistance between the ends of any diameter

1) 3 Ω 2) 6 Ω 3) 4 Ω 4) 24 Ω

116. P.D between A & B in the given branch of circuit is



1) 6 V 2) 12 V 3) 9 V 4) 0 V

117. If the applied emf in the primary circuit of a potentiometer is increased by 3 times, the value of potential gradient will become

1) one third 2) 3 times 3) 6 times 4) 9 times

118. An electron of charge 'e' has a time period of revolution of 'T' in a Bohr orbit of radius 'r'. The dipole moment of the electron is

1) $\pi r^2 eT$ 2) $\pi r^2 e/T$ 3) $\pi r^2 T/e$ 4) $T/\pi r^2 e$

119. A voltmeter of 250 mV range having a resistance of 10 Ω is converted into an ammeter of 250 mA range. The value of necessary shunt is (nearly)

1) 2 Ω 2) 0.1 Ω 3) 1 Ω 4) 10 Ω

120. The percentage of radioactive nuclei that remain undecayed after 5 half lives nearly

1) 20% 2) 3% 3) 5% 4) 10%

CHEMISTRY

121. Wavelength of a radiation is 600 nm. Then its frequency is

1) 2×10^{15} Hz 2) 0.5×10^{15} Hz 3) 1×10^{21} Hz 4) 3×10^{15} Hz

122. Which of the following has highest first ionisation potential?

1) A*l* 2) Si 3) K 4) P

123. The bond energy in halogens decreases in the order.

1) $F_2 > Cl_2 > Br_2 > I_2$ 2) $Cl_2 > Br_2 > F_2 > I_2$

3) $Cl_2 > F_2 > Br_2 > I_2$ 4) $F_2 > Br_2 > Cl_2 > I_2$

124. If the RMS velocity of a gas at 100 K is 10^4 cm/sec. What is the temperature (in °C) at which the RMS velocity will be 3×10^4 cm/sec

1) 900 2) 627 3) 327 4) 217

125. How many litres of oxygen (at STP) are required for complete combustion of 39 gms of liquid benzene?

1) 84 2) 22.4 3) 42 4) 11.2

126. The formula of calgon is

1) $(NaPO_3)_6$ 2) $Mg_3 (PO_4)_2$ 3) $Na_3 PO_4$ 4) $MgSO_4$

127. According to Bohr's theory the angular momentum of an electron in 5^{th} orbit is

1) $\frac{10h}{\pi}$ 2) $\frac{2.5h}{\pi}$ 3) $\frac{25h}{\pi}$ 4) $\frac{h}{\pi}$

128. Which one of the following molecules, ions does not contains unpaired electrons?

1) O_2 2) O_2^{2-} 3) B_2 4) N_2^+

129. The ratio of kinetic energies of 2 gm of H_2 and 4 g of CH_4 at a given temperature is

1) 4 : 1 2) 2 : 32 3) 1 : 4 4) 16 : 2

130. The correct order of stability for the following superoxide's is

1) $KO_2 > RbO_2 > CsO_2$ 2) $RbO_2 > CsO_2 > KO_2$

3) $CsO_2 > RbO_2 > KO_2$ 4) $KO_2 > CsO_2 > RbO_2$

131. One mole of A and 2 moles of B are allowed to react in a 0.5 lit flask. What is the value of Kc if at equilibrium, 0.4 moles of C is formed in the reaction

$A + 2B \rightleftharpoons C + 2D$

1) $\frac{4}{9}$ 2) $\frac{9}{4}$ 3) $\frac{8}{27}$ 4) $\frac{27}{8}$

132. The solubility of CaF_2 is 3×10^{-2} moles/litre. Its solubility product is

1) 108×10^{-6} 2) $2 \times 8 \times 10^{-12}$ 3) $4 \times 8 \times 10^{-12}$ 4) 4×10^{-6}

133. Heat of formation of SiO_2 and MgO are –48.24 and –34.7 KJ respectively. The heat of reaction $2\ Mg + SiO_2 \rightarrow 2\ MgO + Si$ is

1) 21.64 KJ 2) –21.16 KJ 3) –13.62 KJ 4) 13.62 KJ

134. Which of the following reacts with water to give ethane?

1) CH_4 2) C_2H_5MgBr 3) C_2H_4OH 4) $C_2H_5O\ C_2H_5$

135. An Organic compound of structure $CH_3 - CH_2 - CH_2 - CO - CH_3$ shows functional isomerism with another organic compound of structural formula .....

1) $CH_3 - CH_2 - CO - CH_2 - CH_3$ 2) $CH_3 - CH_2 - CH_2 - CH_2 - CHO$

3) $CH_3 - CH = CH - CH_2 - CH_2OH$ 4) Both 2 and 3

136. $C_6H_6 + 3O_3 \rightarrow A \xrightarrow{Zn/H_2O} 3B.$

What is B in above reaction?

1) Benzene triozonide 2) Glyoxal

3) Ethylene glycol 4) Glycerol

137. The number of σ and π bonds present in 'borazole' respectively are

1) 12, 6 2) 6, 6 3) 6, 12 4) 12, 3

138. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence

1) $PbX_2 < SnX_2 < GeX_2 < SiX_2$ 2) $GeX_2 < SiX_2 < SnX_2 < PbX_2$

3) $SiX_2 < GeX_2 < PbX_2 < SnX_2$ 4) $SiX_2 < GeX_2 < SnX_2 < PbX_2$

139. A spontaneous change is one in which the system suffers

1) An increase in internal energy 2) Lowering in entropy

3) Lowering in free energy 4) No energy change

140. The relative lowering of vapour pressure of a solution containing 34.2 g of sucrose (M.wt = 342) in 900 g of water is

1) $\frac{1}{50}$ 2) $\frac{1}{51}$ 3) $\frac{1}{500}$ 4) $\frac{1}{501}$

141. The packing efficiency in a body centered cubic cell system of crystals is

1) 52% 2) 68% 3) 74% 4) 88%

142. For a cell the cell reaction is $Mg(s) + Cu_{(aq)}^{+2} \rightarrow Cu_{(s)} + Mg_{(aq)}^{+2}$

If the S.R.P values of Mg and Cu are – 2.37 V and +0.34 V respectively, the e.m.f of the cell is

1) + 2.03 V 2) –2.03 V 3) +2.71 V 4) –2.71 V

143. Which one of the following equations is correct for the reaction.

$\underset{(g)}{N_2} + \underset{(g)}{3H_2} \rightarrow \underset{(g)}{2\,NH_3}$

1) $3\frac{d[NH_3]}{dt} = 2\frac{d[H_2]}{dt}$ 2) $3\frac{d[NH_3]}{dt} = 3\frac{d[H_2]}{dt}$

3) $2\frac{d[NH_3]}{dt} = -3\frac{d[H_2]}{dt}$ 4) $3\frac{d[NH_3]}{dt} = -2\frac{d[H_2]}{dt}$

144. Micelle is

1) A single +ve ion 2) A single –ve ion

3) An aggregate of many soap ions 4) An individual molecule

145. How many P – H and O – H bonds respectively, are present in $H_4P_2O_7$ molecule?

1) 1, 3 2) 0, 4 3) 4, 0 4) 2, 3

146. The order of basic strength of

ClO^-, ClO_2^- , ClO_3^- , ClO_4^- is

1) $ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$

2) $ClO_4^- > ClO_2^- > ClO^- > ClO_3^-$

3) $ClO^- > ClO_2^- > ClO_3^- > ClO_4^-$

4) $ClO^- > ClO_4^- > ClO_3^- > ClO_2^-$

147. The gas used in beacon lights is

1) Helium 2) Argon 3) Neon 4) Krypton

148. Which of the metal can be obtained directly during the roasting of its sulphide ore

1) Cu 2) Zn 3) Fe 4) Ca

149. Which of the following complex is an outer orbital complex?

1) $[Ni(NH_3)_6]^{2+}$ 2) $[Mn(CN)_6]^{4-}$ 3) $[Co(NH_3)_6]^{3+}$ 4) $[Fe(CN)_6]^{4-}$

150. Among the following sets of reactants which one produces anisole?

1) CH_3CHO, RMgx

2) C_6H_5OH, NaOH, CH_3I

3) C_6H_5OH, neutral $FeCl_3$

4) $C_6H_5CH_3$, CH_3COCl, $AlCl_3$

151. In the reaction $C_6H_5NH_2 \xrightarrow[0^\circ C]{NaNO_2 + HCl} x \xrightarrow[warm]{H_2O} y$. Then y is

1) C_6H_5Cl 2) C_6H_6 3) C_6H_5OH 4) C_6H_5CHO

152. What reagent is used in Rosenmunds's reduction?

1) H_2/Pd – $BaSO_4$

2) Li$Al$$H_4$

3) NH_2 – NH_2/KOH/CH_2OH – CH_2 – OH

4) Zn – Hg/HCl

153. CH_3 – COOH → CH_3 – COCl. Here the reagent is

1) Cl_2 2) Red P + Cl_2 3) CHCl_3 4) PCl_5

154. The order of basicity of amines in gaseous state is

1) $1^\circ > 2^\circ > 3^\circ > NH_3$ 2) $3^\circ > 2^\circ > 1^\circ > NH_3$

3) $3^\circ > 2^\circ > NH_3 > 1^\circ$ 4) $NH_3 > 1^\circ > 2^\circ > 3^\circ$

155. Caprolactum is used for the manufacture of

1) Teflon 2) Terylene 3) Nylon 6, 6 4) Nylon 6

156. The reagent which forms crystalline osazone derivative when reacted with glucose is

1) Fehling solution 2) Phenyl hydrazine

3) Benedict solution 4) Hydroxylamine

157. Which of the following is a non-narcotic analgesic?

1) Morphine 2) Codeine 3) Heroin 4) Aspirin

158. On Ozonolysis 2 – methyl – 2 – butene gives

1) 2 mole of CH_3CHO

2) 2 mole of CH_3COCH_3

3) CH_3CHO and CH_3COCH_3

4) CH_3CHO and HCHO

159. Molarity of 1 m aqueous NaOH solution is [density of the solution is 1.0 2 g/ml].

1) 1 M 2) 1.02 M 3) 1.2 M 4) 0.98 M

160. When electricity is passed through a solution of AlCl_3, 13.5g of Al is discharged. The amount of charge passed is

1) 1.5 F 2) 0.5 F 3) 1 F 4) 2 F

KEY

1-2; 2-2; 3-3; 4-1; 5-3; 6-4; 7-3; 8-1; 9-2; 10-1; 11-3; 12-1; 13-2; 14-1; 15-1; 16-3; 17-3; 18-1; 19-4; 20-4; 21-1; 22-2; 23-4; 24-4; 25-2; 26-1; 27-1; 28-2; 29-1; 30-1; 31-3; 32-4; 33-3; 34-3; 35-4; 36-1; 37-2; 38-1; 39-2; 40-1; 41-3; 42-4; 43-4; 44-2; 45-1; 46-2; 47-2; 48-2; 49-4; 50-3; 51-4; 52-2; 53-2; 54-4; 55-1; 56-1; 57-4; 58-2; 59-1; 60-2; 61-3; 62-4; 63-1; 64-3; 65-2; 66-3; 67-1; 68-2; 69-2; 70-2; 71-3; 72-1; 73-2; 74-4; 75-1; 76-3; 77-2; 78-2; 79-1; 80-2; 81-2; 82-4; 83-2; 84-1; 85-2; 86-4; 87-1; 88-1; 89-3; 90-4; 91-2; 92-3; 93-1; 94-4; 95-3; 96-2; 97-1; 98-2; 99-3; 100-3; 101-1; 102-4; 103-3; 104-1; 105-4; 106-1; 107-1; 108-4; 109-4; 110-3; 111-3; 112-4; 113-1; 114-1; 115-1; 116-1; 117-2; 118-2; 119-3; 120-2; 121-2; 122-4; 123-2; 124-2; 125-1; 126-1; 127-2; 128-2; 129-1; 130-3; 131-3; 132-1; 133-2; 134-2; 135-4; 136-2; 137-4; 138-4; 139-3; 140-3; 141-2; 142-3; 143-4; 144-3; 145-2; 146-3; 147-3; 148-1; 149-1; 150-2; 151-3; 152-1; 153-4; 154-2; 155-4; 156-2; 157-4; 158-3; 159-4; 160-1.

SOLUTIONS

1. $f(-x) = f(x)$ satisfied

$\therefore$ function is even function

2. $|x| - 1 \neq 0 \Rightarrow |x| \neq 1$

$\Rightarrow |x| \neq \pm 1$

3. $\text{Arg}\,(1 + i\sqrt{3}) = \frac{\Pi}{3}$

$\text{Arg}\,\bar{z} = (1 - i\sqrt{3}) = -\frac{\Pi}{3}$

$\therefore \quad |\text{Arg}\, z| + |\text{Arg}\,\bar{z}| = \frac{\Pi}{3} + \frac{\Pi}{3} = \frac{2\Pi}{3}$

4. $\frac{1}{z} = \frac{\bar{z}}{z\bar{z}} = \frac{\bar{z}}{|\bar{z}|^2} = \bar{z}$

Now $\frac{1+z}{1+\bar{z}} = \frac{1+z}{1+\frac{1}{z}} = \frac{1+z}{\left(\frac{z+1}{z}\right)} = z$

$\Rightarrow \arg\left(\frac{1+z}{1+\bar{z}}\right)$

$= \arg z = \theta$

5. $\left(\frac{\sqrt{3}+i}{2}\right)^n = \left(\text{cis}\,\frac{\Pi}{6}\right)^n = 1$

$\Rightarrow \cos\frac{n\Pi}{6} + i\sin\frac{n\Pi}{6} = 1$

Least value of $n = 12$

6. Given harmonic mean of α, β is 4

$\Rightarrow \frac{2\alpha\beta}{\alpha+\beta} = 4$

$\Rightarrow \frac{\frac{2(8+2\sqrt{5})}{\sqrt{2}+5}}{\frac{b}{5+\sqrt{2}}} = 4$

$\Rightarrow 2(8 + 2\sqrt{5}) = 4b$

$\Rightarrow b = 4 + \sqrt{5}$

7. Let α, α^3 be the roots of $x^2 + px + 1 = 0$

$\therefore \alpha + \alpha^3 = -p, \ \therefore \alpha.\alpha^3 = 1$

$\Rightarrow \alpha + \alpha^3 = -p, \ \alpha^4 = 1$

$\Rightarrow \alpha = 1, -1, i, -i$

$\therefore p = -(\alpha + \alpha^3) \Rightarrow p = 0, 2, -2$

8. A.M $= \frac{1 + 2 + 2n + ... + 2n - 1}{n} = \frac{1}{n}\left[\frac{2^n - 1}{2 - 1}\right]$

$= \frac{2^n - 1}{n}$

9. Median will go up by 2 and S.D will remains same

10. Given $\sin\theta + \cos\theta = m$;

$\sec\theta + \text{cosec}\,\theta = n$

$\Rightarrow \frac{\sin\theta + \cos\theta}{\sin\theta.\cos\theta} = n$

$\Rightarrow \frac{m}{n} = \sin\theta.\cos\theta$

We have

$(\sin\theta + \cos\theta)^2 = 1 + 2\sin\theta.\cos\theta$

$\Rightarrow m^2 = 1 + \frac{2m}{n}$

$\Rightarrow m^2 n = n + 2m$

$\Rightarrow n(m^2 - 1) = 2m$

11. Synopsis if $A + B + C = 180^\circ$ then

$\Sigma\cot A.\cot B = 1$

12. Put $A = 0 \Rightarrow \cos^2 0 + \cos^2 120 + \cos^2 120$

$= 1 + \frac{1}{4} + \frac{1}{4} = \frac{3}{2}$

13. Apply componendo & dividendo method

14. $\left(\tan\theta - \frac{1}{3}\tan^3\theta\right)\left(\frac{1}{3} - \tan^2\theta\right)^{-1}$

$= \frac{3\tan\theta - \tan^3\theta}{1 - 3\tan^2 q}$

$= \tan 3\theta \Rightarrow \text{period} = \frac{\pi}{3}$

15. $\tan(x - y) = 1 \Rightarrow (x - y) = \frac{\pi}{4}$ .....(1)

$\text{Sec}(x + y) = \frac{2}{\sqrt{3}}$ $1x + y = 2\pi - \frac{\pi}{6}$ .....(2)

From (1) & (2)

$x = \frac{25\pi}{24}$, $y = \frac{19\pi}{24}$

16. W.K .T $\tan\theta + \tan(60 + \theta) + \tan(120 + \theta) = 3\tan 3\theta$

Given $\tan\theta + \tan(60 + \theta) + \tan(120 + \theta) = 3$ & $3\tan 3\theta = 3 \Rightarrow \tan 3\theta = 1 = \tan\frac{\pi}{4}$

Solution set in $3\theta = n\pi + \frac{\pi}{4}$

$\Rightarrow \theta = \frac{n\pi}{3} + \frac{\pi}{12}$; $n \in Z$

17. Given $\sin^{-1} x + 4 \cos^{-1} x = \pi$

$(\sin^{-1} x + 4 \cos^{-1} x) + 3\cos^{-1} x = \pi \Rightarrow 3 \cos^{-1} x$

$= \pi - \frac{\pi}{2} = \frac{\pi}{2}$

$\cos^{-1} x = \frac{\pi}{6} \Rightarrow x = \cos\frac{\pi}{6} \Rightarrow x = \frac{\sqrt{3}}{2}$

18. Put $x = -1$

given equation is satisfied

19. Given $2R + r = r_2 \Rightarrow 2R = r_2 - r$

$2R = 4R \sin^2 \frac{B}{2} \Rightarrow \sin^2 \frac{B}{2} = \frac{1}{2}$

$= \left(\frac{1}{\sqrt{2}}\right)^2 = \sin^2 \frac{\pi}{4}$

$\frac{B}{2} = 45^\circ \Rightarrow B = 90^\circ$

20. W.K.T $\cos A + \cos B + \cos C = 1 + \frac{r}{R}$

Given

$\Sigma\ a \cdot \cot A = \Sigma\ 2R \cdot \sin A \cdot \frac{\cos A}{\sin A}$

$= 2R \Sigma \cos A$

$2R\left[1 + \frac{r}{R}\right] = 2(R + r)$

21. W.K.T

$r_2 + r_3 + r - r_1 = 4R \cos A \Rightarrow \angle A = 90^\circ$

22. $\Sigma[(a \times i) \times j]^2 = \Sigma[(a \cdot i) j]^2$

$= |a|^2 = |i - j - 2k|^2 = 6$

23. $(\bar{a} + \bar{b})^2 = |a|^2 + |b|^2 + 2|a||b| \cos\theta$ and simplify

24. Requested probability $= \frac{(r-1)(r-2)}{2 \times 6^3}$

where $r = 5$

25. $p(A)\ p(B) = \frac{1}{6}$; $p(\bar{A})\ p(\bar{B}) = \frac{1}{3}$;

26. $\Sigma\ P(X = x_i) = 1$; $\Sigma\ x_i P(X = x_i) = 1.2$

27. $p(X = 1) = 2p(X = 2)$

$\Rightarrow \frac{e^{-\lambda}\lambda^1}{1!} = \frac{2e^{-\lambda}\lambda^2}{2!} \Rightarrow \lambda = 1$

28. $5x + 1 = A(x - 1) + B(x + 2)$ solving

29. ${}_{n}p_{r} + r.np_{r-1} = {}_{n+1}p_{r}$

30. ${}_{n}C_{r} + r.nc_{r-1} = {}_{n+1}c_{r}$

31. $\left[\frac{100}{l\text{cm of } (4, 5)}\right] + 1$

32. $T_{r+1} = T_{9+1} = {}^{18}C_9 (-2)^9$

33. $\frac{t_3}{t_4} = \frac{t_{2+1}}{t_{3+1}}$

34. No.of diagonals $\frac{n(n-3)}{2} = 170$

35. Let $A = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$

$\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} [1 \quad 1] = \begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$

$2x_1 + x_2 = 1$ and $3x_1 + 2x_2 = 0$ solving

$x_1 = 2; x_2 = -3$

36. $Tr[(2 - i)A] = (2 - i)Tr(A) = (2 - i)(2 + i) = 5$

37. $ak = \frac{1}{k} - \frac{1}{k+1}$

$\sum a_k = 1 - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} \ldots\ldots\ldots + \frac{1}{n} - \frac{1}{n+1}$

38. Put a = 1, b = 2, c = 3 then verify

39. $[\overline{AB}\ \overline{AC}\ \overline{AD}] = 0$

40. $\overline{AD} = 2\overline{BC} \Rightarrow x = 2$

$\overline{CF} = 2\overline{BA} \Rightarrow y = 2 \Rightarrow (x + y)^2 + 8 = 24$

41. P (x, y) A (2, 0) B (–2, 0)

PA + PB = 4

42. $x = X\cos\theta - Y\sin\theta$, $y = X\sin\theta + Y\cos\theta$ and $\theta = 36^\circ$ then substitute x, y in the G.E

43. $h = \frac{1}{\sqrt{2}}$

$36 = k^2 + \frac{1}{2}$

Area $= \frac{1}{2}$ (base) height

44. Verify the point p (1, 1) in the given lines.

45. $(2a + 3b)2 - c^2 = 0$

$2a + 3b + c = 0, \quad -2a - 3b + c = 0,$

compare these with $ax + by + c = 0$

46. Put $\alpha = 45^\circ$ in G.E then the equation

$3x^2 - 4xy + y^2 = 0$

$$|m_1 - m_2| = \frac{2\sqrt{h_2 - ab}}{|b|}$$

47. Put $x = x - 1,\ y = y + 1$ in the

G.E $\Rightarrow (x - 1)^2 - (y + 1)^2 = 0$

48. (2, 3, 4) divides A (3, –2, 2) and

B (6, –17, –4) in the ratio = $x_1 - x : x - x_2$

$= 1 : -4$

The harmonic conjugate at (2, 3, 4) divide

$\overline{AB}$ in the ratio = 1 : 4

Point

$$= \left(\frac{mx_2 + nx_1}{m + n}, \frac{my_2 + ny_1}{m + n}, \frac{mz_2 + nz_1}{m + n}\right)$$

49. $\begin{vmatrix} 4 & 2 & \lambda \\ 1 & 1 & 3 \\ 1 & 2 & 4 \end{vmatrix} = 0$ or

$$\begin{vmatrix} x_2 - x & y_2 - y & z_2 - z \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix} \Rightarrow \lambda = 12$$

50. $$\left|\frac{d_1 - d_2}{\sqrt{a^2 + b^2 + c^2}}\right|$$

51. $$\lim_{x \to 3} \frac{1 - \cos(x - 2)(x - 3)}{(x - 3)^2}$$

$$\lim_{x \to 3} \frac{1 - \cos(x - 2)(x - 3)}{[(x - 2)(x - 3)]^2} \times (x - 2)^2$$

$$= \frac{1}{2}(1)^2 = \frac{1}{2}$$

52. $$\lim_{x \to 0} \frac{\sin(\Pi \cos^2 x)}{x^2} = f(0)$$

Use 'L' hospital rule

$$-\lim_{x \to 0} \frac{\cos(\Pi \cos^2 x)\ \Pi \sin 2x}{2x} = f(0)$$

$$-\Pi \lim_{x \to 0} \cos(\Pi \cos^2 x) \cdot \lim_{x \to 0} \frac{\sin 2x}{2x} = f(0)$$

$-\Pi\ (-1)(1) = f(0)$

$f(0) = \Pi$

53. $\frac{d}{dx}\left[\log_e\{(e^x+2)+\sqrt{(e^x+2)^2+1}\}\right]$

$\frac{d}{dx}[\sin h^{-1}(e^x+2)]$

54. $g = f^{-1}$; gof = I

$f\{g(x)\} = I(x) = x$

d.w.r.to x

$f'(g(x))\, g'(x) = 1$

$f'(g(3))\, g'(3) = 1$

$\Rightarrow f'(21) = \frac{1}{7}$

55. Differentiate two times

56. $a = 2R\sin A \quad b = 2R\sin B \quad c = 2R\sin C$

$\frac{\delta a}{\cos A} + \frac{\delta b}{\cos B} + \frac{\delta c}{\cos C} = 0$

57. $bx + ay = 2ab$

$\frac{x}{a} + \frac{y}{b} = 2$ verify the option (4)

(a, b)

$\Rightarrow \frac{a}{a} + \frac{b}{b} = 2 \Rightarrow 2 = 2$

58. $s = 6x^2 \frac{dx}{dt} = 0.05 \quad x = 10$

59. $y = x + 1; \quad x = y^2$

Let $d = \frac{|x - y + 1|}{\sqrt{2}} = \frac{|y^2 - y + 1|}{\sqrt{2}}$

d has maxima (or) minima $d' = 0$

$d' = \frac{2y - 1}{\sqrt{2}} = 0$

$y = \frac{1}{2}, \quad x = \frac{1}{4}$

60. $c = \frac{4}{3}$, $f'(c) = 0$, $f(1) = f(2)$

61. op = length of tangent from '0' to circle

$= \sqrt{S_{11}}$

$\sqrt{S_{11}} = \sqrt{c} = 4\sqrt{2}$

C = 32

62. $4 + 4g + c = 0$

$g^2 = c \quad g = -2 \quad c = 4 \quad f = \pm 2\sqrt{2}$

63. $4l^2 + 6l + 1 = 5m^2$

$9l^2 + 6m + 1 = 5\,(l^2 + m^2)$

$$\frac{(3l + 1)^2}{l^2 + m^2} = 5$$

$$\Rightarrow \frac{3(l) + 0(m) + 1}{\sqrt{l^2} + m^2} = \sqrt{5}$$

64. $p(-5, 6) \quad r = 10$

$(x + 5)^2 + (y - 6)^2 = 100$

$x^2 + y^2 + 10x - 12y + 61 - 100 = 0$

$S = x^2 + y^2 + 10x - 12y - 39 = 0$

$S' = x^2 + y^2 - 61 = 0$

$S' - S = 0 \Rightarrow 5x - 6y + 11 = 0$

65. Radical axis is diameter of the second circle

66. Find the equation of $\overline{OL}$ and $\overline{OL'}$ then find $\cos\theta$

67. Point of intersection of

$$\frac{x}{a} + \frac{y}{b} = 1, \ \frac{x}{b} + \frac{y}{a} = 1$$

Is , $\left(\frac{ab}{a + b}, \frac{ab}{a + b}\right)$

$$s = \left(\frac{p}{4}, 0\right) = \left(\frac{3}{10}, 0\right)$$

68. $\tan 30° = \frac{b^2}{2a^2e}$

$\sqrt{3}e^2 + 2e - \sqrt{3} = 0$

$e \neq \sqrt{3}, \quad e = \frac{1}{\sqrt{3}}$

69. $\frac{(x - 5)^2}{25} + \frac{(y - 3)^2}{9} = 1$

$L.L.R = \frac{2b^2}{a}$

70. $e = \frac{3}{5} \quad ae = 3$

$3 = 2\sqrt{\frac{4 + b^2}{4}}$

$3 = \sqrt{4 + b^2} \Rightarrow 9 = 4 + b^2 \Rightarrow b^2 = 5$

71. $\int \frac{x + \cos x + x\sin x - x}{x(x + \cos x)}\,dx$

$$\int \frac{x + \cos x}{x(x + \cos x)}\, dx + \int \frac{x(\sin x - 1)}{x + \cos x}\, dx$$

$$\int \frac{1}{x}\, dx + \int \frac{1 - \sin x}{x + \cos x}\, dx$$

$$\log|x| - \log|x + \cos x| = \log\left|\frac{x}{x + \cos x}\right| + c$$

72. Put $x^x = t$ then integrate

73. Put $\log x = t \Rightarrow x = e^t \Rightarrow dx = e^t\, dt$

$$\int\left(\frac{1}{t} - \frac{1}{t^2}\right) e^t\, dt = e^t\left(\frac{1}{t}\right) + c$$

$$= \frac{x}{\log x} + c$$

74. $\sin^8 x - \cos^8 x = (\sin^4 x)^2 - (\cos^4 x)^2$

$= (\sin^4 x - \cos^4 x)(\sin^4 x + \cos^4 x)$

$= (1 - 2\sin^2 x \cos^2 x)(-\cos 2x)$

75. $\int_0^{\Pi/2} \frac{1}{a^2 \sin^2 x + b^2 \cos^2 x}\, dx = \frac{\Pi}{2ab}$

76. $\int_1^2 \log[x]\, dx + \int_2^3 \log[x]\, dx + \int_3^4 \log[x]\, dx$

$= 0 + \log 2 + \log 3 = \log 6$

77. The area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is $\frac{16a^2}{3}$

78. Dividing with y^2

$$\frac{ydx - xdx}{y^2} + 3x^2 e x^3\, dx = 0$$

$$d\left(\frac{x}{y}\right) + d(ex^3) = 0$$

79. $\left(\frac{d^2 y}{dx^2}\right) = -\sqrt{1 + \left(\frac{dy}{dx}\right)^3}$

squaring on both sides

$$\left(\frac{d^2 y}{dx^2}\right)^2 = 1 + \left(\frac{dy}{dx}\right)^3$$

80. The D.E of $y = A_1 x^m + A_2 x^n$ is

$x^2 y_2 - (m + n - 1)xy_1 + mny = 0$

PHYSICS

81. $F = Kgms^{-1}$

$a = F/t = kgms^{-1}\, MLT^{-3}$

$b = F/t^2 = kgms^{-1}\, MLT^{-4}$

82. $Sn = u + \frac{a}{2}(2n - 1)$

$44.1 = 0 + \frac{9.8}{2}(2n - 1)$

$44.1 = 4.9\ (2n - 1) = 2n - 1 \Rightarrow 9 = 2n - 1$

$n = 5$

$s = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2}(9.8)\ (5)^2$

$s = 4.9\ (25) = 122.5$ m

83. $R = u\sqrt{\frac{2h}{g}}$

$R = 150\sqrt{\frac{2 \times 490}{9.8}}$

$= 150\sqrt{\frac{980}{9.8}} = 150 \times 10 \Rightarrow 1500$ m

84. $\mu m_A\ g = m_B\ g$

$(0.4)\ (5) = m_B$

$2 = m_B$

85. mu sin θ + mu sin θ away

86. $\mu \frac{m}{L}(L - x) = \frac{m}{L}x$

87. $F.s = \frac{1}{2}mv^2$

$\frac{1}{2}2v^2 = 1$

$v = 1$ m/sec

88. $\%\ \text{loss} = \frac{h_1 - h_2}{h_1} \times 100 = \frac{20 - 16}{20} \times 100$

$4 \times ,5 = 20\%$

89. $\frac{mv^2}{r} = \mu\ m\ g$

$v = \sqrt{\mu}\ gr$

$v = \sqrt{0.5\ (10)\ 125} = 25$

90. $\omega \alpha r^{-2}$

$\frac{\Delta\omega}{\omega} = -\left(\frac{\Delta r}{r} \times 100\right) = -2(-0.2)$

$= 0.4$ increases

91. $\frac{\Delta T}{T} = \frac{1}{2} \times \Delta T 86400 = \frac{1}{2}\ \frac{\Delta l}{l}\ 86400$

$$\frac{\Delta T}{T} = \frac{1}{2} \times \Delta T86400 = \frac{1}{2}\ \frac{1}{100}\ 86400$$

$$= 432 \text{ s}$$

92. $T^2 \propto R^3$

93. $Y = 3K(1 - 2\sigma)$

94. $V \propto r^{2/3}$

95. $\gamma_a = \dfrac{\text{mass expelled}}{\text{Remaining mass} \times \text{rise in temperature}}$

96. $n = 1 - \dfrac{T_2}{T_1}$

97. $\dfrac{n_1 + n_2}{\gamma_m - 1} = \dfrac{n_1}{\gamma_1 - 1} + \dfrac{n_2}{\gamma_2 - 1}$

98. $V = \sqrt{\dfrac{3RT}{M}}$

$$V = \frac{1}{\sqrt{M}}$$

99. $V \propto \sqrt{T}$

100. $n' = \left(\dfrac{v + v_0}{v - v_s}\right)^n$

101. Use true table of NAND and NOR gates.

102. $\mu = \dfrac{V_m}{V_C} = \dfrac{75}{100} = V_m$

$$\frac{3}{4} = \frac{V_m}{12} \Rightarrow 9 = V_m$$

103. $\dfrac{13.6}{n^2}$

104. $\lambda = \dfrac{h}{mv}$

105. $\dfrac{12400}{W} = \lambda$

106. $e = -L\dfrac{di}{dt}$

$$e = -L = \frac{(i_2 - i_1)}{dt} = 10^4 = -5\ \frac{(0 - i)}{10^{-4}}$$

$$i = 0.2 \text{ A}$$

107. $\cos\phi = \dfrac{R}{Z}$

108. $\mu = \dfrac{C}{C_m}$, $C_m = \dfrac{1}{\sqrt{\in_m \mu_m}}$

109. $\frac{1}{f} = -\frac{1}{u} + \frac{n}{u}$

110. $\frac{I_{max}}{I_{min}} = \left[\frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}}\right]^2 = \left[\frac{3+2}{3-2}\right]^2 = \frac{25}{1}$

111. Null point x $= \frac{d}{\sqrt{\frac{q_2}{q_1}} + 1}$

112. $E = 1/2\ CV^2$

113. Conceptual

114. Series and Parallel combination of Capacitors.

115. Resistance of one semi circular part = 6 Ω

116. $V_A - 2 + 9 - 4 - 3 - 6 - V_B = 0$

117. $x \propto E$

118. $M = niA = \frac{\Pi r^2 e}{T}$

119. $S = \frac{G}{n-1}$

120. $\frac{N}{N_0} \times 100 = \frac{1}{2^n} \times 100$

CHEMISTRY

121. $\vartheta = \frac{c}{\lambda} = \frac{3 \times 10^{10}}{600 \times 10^{-7}} = 0.5 \times 10^{15}$

122. Conceptual

123. Conceptual

124. $\frac{C_1}{C_2} = \sqrt{\frac{T_1}{T_2}}$

125. 156 g of Benzene requires (22.4×15) *l* of O_2

39 g of Benzene .....?

126. Conceptual

127. $mvr = \frac{nh}{2\Pi} = \frac{5h}{2\Pi} = \frac{2.5h}{\Pi}$

128. Conceptual

129. $\frac{KE_1}{KE_2} = \frac{n_1}{n_2}$

130. Conceptual

131.

	$A + 2B \rightleftharpoons C + 2D$			
Initial	1	2	0	0
At equilibrium	0.6	1.2	0.4	0.8

$$K_C = \frac{[C][D]^2}{[A]\,[B]^2}$$

132. $CaF_2 \rightleftharpoons Ca^{+2} + 2F^-$

S 2S

$K_{SP} = [Ca^{+2}]\,[F^-]2$

$= (S)\,(2S)^2 = 4S^3$

$4(3 \times 10^{-2})^3 = 108 \times 10^{-6}$

133. $\Delta H = \Delta H_P - \Delta H_R$

$2Mg + SiO_2 \rightarrow 2\,MgO + Si$

$\Delta H = 2(-34.7) - (-48.24) = -\,21.16$ KJ

134. $C_2H_5 - MgBr + H_2O \rightarrow C_2H_6 + Mg(OH)Br$

135. Conceptual

136. $C_6H_6 + 3O_3 \rightarrow$ Benzenetriozonide $\xrightarrow{Zn/\,H_2O}$ 3

CH O
|
CH O

137. Conceptual

138. Conceptual

139. Conceptual

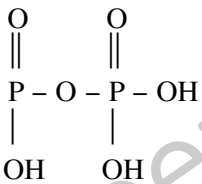
140. $\frac{P_0 - P_s}{P_0} = \frac{n_s}{n_0}$

141. Packing efficiency in B.B.C = $\frac{\Pi\sqrt{3}}{8} = 68\%$

142. $E_{cell} = E^{cathode}_{R.P} - E^{Anode}_{R.P}$

143. Conceptual

144. Conceptual

145.


146. Conceptual

147. Conceptual

148. Conceptual

149. Conceptual

150. $C_6H_5OH + NaOH \xrightarrow[H_2O]{} C_6H_5ONa$

$C_6H_5ONa + CH_3\,I \xrightarrow{\Delta} C_6H_5OCH_3 + NaI$

151. $C_6H_5NH_2 \xrightarrow[0^\circ C]{NaNO_2, HCl} C_6H_5N_2Cl \xrightarrow{H_2O, \text{ warm}} C_6H_5OH$

152. Conceptual

153. $CH_3COOH \xrightarrow{PCl_5} CH_3COCl + POCl_3 + HCl$

154. Conceptual

155. Conceptual

156. Conceptual

157. Conceptual

158. $CH_3 - CH = \underset{\displaystyle CH_3}{\overset{|}{C}} - CH_3 \xrightarrow{O_3} CH_3CHO + CH_3 - \underset{\displaystyle O}{\overset{\|}{C}} - CH_3$

159. $\frac{1}{m} = \frac{d}{M} - \frac{Mw}{1000}$

160. $w = \frac{\text{At. wt}}{\text{valency} \times 96500} \times c.t$

This model paper was prepared by subject experts of

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