KANTIPUR ENGINEERING COLLEGE
Dhapakhel, Lalitpur
Model Entrance Test (2073)

Solution Set: I (A)

Section: I

1. (D)	2. (B)	3. (C)	4. (A)	5. (A)
6. (B)	7. (C)	8. (D)	9. (B)	10. (D)
11. (A)	12. (C)	13. (C)	14. (A)	15. (B)

16. (D)

Solution: 1000 ml of 1N = 49 g
1000 ml of 2N = 98 g
200 ml of 2N = 98 / 1000 × 200 = 19.6 g

17. (A)
Solution: pH = - log of N strong acid
= - log 0.2 = 0.69

18. (A)

19. (C)
Solution: $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$
44 g of Propane required 5 × 22.4 L
2.2 g Propane required 5 × 22.4 L / 44 × 2.2 L
= 5.6 L

20. (C)	21. (D)	22. (D)	23. (B)	24. (B)
25. (D)	26. (B)			

27. (C)
Solution: W = Force x Distance = $MLT^{-2} \times L = ML^2T^{-2} = \frac{ML^2}{T^2}$

When the units are doubled, then new unit of work will be,

$$= 2M\,\frac{(2L)^2}{(2T)^2} = 2\,\frac{ML^2}{T^2}$$

28. (A)
Solution: In the absence of gravity, there will be no force to prevent the rise of liquid due to surface tension.

29. (D)
Solution: Change in length is independent of diameter.

30. (D)
Solution: When light passes through one medium to another frequency does not change.

31. (D)
Solution: In interference, the energy remains constant.

32. (A)
Solution: Force between two charges is independent of the presence of another charge near to it.

33. (A)
Solution: At temperature of inversion, the thermo emf in a thermocouple is zero.

34. (A)
Solution: The magnetism of magnet is due to the spin motion of electron, The spining electron posses magnetic dipole moment. This is much greater than that due to orbiting around the nucleus.

35. (C)
Solution: The empty vessel behaves like a closed organ pipe. As it is filled with water, the length of the pipe decreases. Hence frequency increases.

36. (C)
Solution: As cathode rays are stream of electrons and hence they can be deflected by electric field and magnetic field.

37. (C)	38. (B)	39. (B)	40. (B)	41. (B)
42. (A)	43. (C)	44. (D)	45. (D)	46. (A)
47. (C)	48. (B)	49. (B)	50. (D)	

51. (C) obvious

52. (A) let other root be β. Then $\alpha\beta = 1$ so $\beta = \frac{1}{\alpha}$

53. (D) $\operatorname{cosec}^2 x = \operatorname{cosec}^2 \alpha \Rightarrow = x = n\pi \pm \alpha$

54. (B) $A^2 - A + I = 0$

or $I = A - A^2$

or $A^{-1} = A^{-1}A - A^{-1} A \ A$

ie $A^{-1} = I - A$

55. (A) $\lim_{x\to 0} \frac{\text{Sin}2x + \sin 6x}{\text{Sin}5x - \text{Sin}3x} = \lim_{x\to 0} \frac{2\cos 2x + 6\cos 6x}{5\cos 5x - 3\cos 3x} = \frac{2+6}{5-3} = \frac{8}{2} = 4$

56. (C) $f^1(x) = \frac{1}{x^2}$ $f^{11}(x) = \frac{2}{x^3}$ At (1,1), $f^{11}(1) = 2$

57. (C) $\int \frac{dx}{\sqrt{1-x^2}} = \sin^{-1} x + c = \frac{\pi}{2} - \cos^{-1} x + c$ and

58. (B) $\vec{a}x\vec{b}$ and $\vec{b}x\vec{a}$ are both perpendicular to $\vec{a}$ and $\vec{b}$

59. (D) Slope = 0, $-\frac{2-k}{3+k} = 0 \Rightarrow k = 2$

60. (A) 1. (-k) + 2.2+ 3.1 = 0 ie – k + 4 + 3 =0 ⇒ k + 7

Section: II

61. (B)	62. (D)	63. (C)	64. (A)

65. (B)
Solution: HCl is a strong acid and it is completely ionized in aqueous solution

$$\underset{0.001M}{HCl} \longrightarrow \underset{0.001M}{H^+ + Cl^-}$$

For each molecule of HCl there is one H^+. So $[H^+] = [HCl]$

$[H^+] = 0.001M$; pH = $-\log[H^+] = -\log[0.001]$
$= -\log(1 \times 10^{-3}) = -\log 1 + 3\log 10$
$= 0 + 3 \times 1 = 3$

66. (D)
Solution: Total quantity of electricity passed = 0.75× 45 × 60 = 2025 Coulomb
2025 coulomb of electricity deposits 0.6662 g of metal
96500 coulomb of electricity deposits = 0.6662 / 2025×96500 = 31.75 g

67. (A) 68. (C)

69. (A)
Solution: Here $\vec{A}.\vec{B} = 0$. Hence $\vec{A} \perp \vec{B}$.
$\vec{A} \times \vec{C} = 0 \implies \vec{A} \,||\, \vec{C}$
Therefore, B is perpendicular to $\vec{C}$.

70. (A)
Solution: Here $S = 12t+3t^2-2t^3$
Differentiating with respect to t, we get,
$\frac{ds}{dt} = 12 + 6t - 6t^2$
$\therefore v = 12 + 0 - 0 = 12$ m/s [$\because$ at start t = 0]

71. (C) Retardation of block is given by
v=u+at
$\implies 0 = 6 + a \times 10 \implies a = -6/10$
Now, F = μh
or, ma = μ (mg) $\implies \mu = \frac{a}{g} = \frac{\frac{6}{10}}{10} = 0.06$

72. (B) The torque is defined as
$\tau = \frac{dL}{dt} = \frac{5L-2L}{3} = L$

73. (C) Volume of big drop = Volume of small drop x 1000
$\frac{4}{3}\pi R^3 = \frac{4}{3}\pi r^3 \times 1000$
$\implies r = \frac{R}{10}$

74. (B) $R_t = R_0(1 + \alpha t)$
t = 300k = 27°C and α = 0.00125 /°C
$1 = R_0(1 + 0.00125 \times 27) \ldots\ldots\ldots$ (i)
$2 = R_0(1 + 0.00125 \times t) \ldots\ldots\ldots$ (ii)
Solving (i) and (ii), we get, t = 854°C
$\therefore t = 854 + 273 = 1127$ K

75. (D) Since $Q \propto T_1^4$
$16\,Q \propto T_2^4$
$\implies 16 = \left(\frac{T_2}{T_1}\right)^4$ $\therefore \frac{T_2}{T_1} = 2 \implies T_2 = 2T_1$

76. (D) Velocity (v) = $\frac{1000}{5} = 200$ m/s
$\lambda = \frac{v}{f} = \frac{200}{500} = \frac{2}{5}$
No. of waves = $\frac{1000}{\lambda} = \frac{1000}{2} \times 5 = 2500$

77. (D) In displacement method, the magnifications in two positions are: $\frac{D+d}{D-d}$ and $\frac{D-d}{D+d}$. So the ratio of two magification is,

$$\frac{D+d}{D-d} \text{ x } \frac{D+d}{D-d} = \left(\frac{D+d}{D-d}\right)^2$$

78. (A) $\mu = \frac{\sin(\frac{A+\delta_m}{2})}{\sin(\frac{A}{2})} \Longrightarrow \sqrt{2} = \frac{\sin(\frac{A+\delta_m}{2})}{\sin(\frac{60^o}{2})}$

Solving, i = 45^o

79.(C)

$$\frac{M_1}{M_2} = \frac{T_2^2}{T_1^2} = \left(\frac{1}{2}\right)^2$$

$$\therefore \frac{M_1}{M_2} = \frac{1}{4}$$

80. (B) Here, q_1= 10 x 50 = 500 μC

C_1 = 10 μF, C_2=? and q_2=0

$$\text{Now, } v = \frac{q_1 + q_2}{C_1 + C_2} = \frac{500 + 0}{C_1 + C_2}$$

$$\Longrightarrow C_1 + C_2 = \frac{500}{20} = 25\mu F \quad \therefore C_2 = 25 - 10 = 15\mu F$$

81. (B) Transformer is an ac device. This does not work on dc. Hence, output voltage is zero.

82. (D) The change in stopping potential

$$= \frac{h_c}{e}\left[\frac{1}{\lambda_2} - \frac{1}{\lambda_1}\right] = \frac{6.6\text{x}10^{-34}\text{x}3\text{x}10^8}{1.6\text{x}10^{-19}}\left(\frac{10^{10}}{3000} - \frac{10^{10}}{4000}\right) = 1.03 \text{ V}$$

83 (C) Here $\frac{N}{N_o} = \frac{1}{4}$

$$\therefore \frac{1}{4} = \left(\frac{1}{2}\right)^{\frac{t}{T}} \Longrightarrow \frac{t}{T} = 2 \quad \therefore t = 2T = 2 \text{ x } 4 = 8 \text{ months}$$

84 (A)

85 (A)

86 (D) $f(x) = f^{-1}(x)$ ie. $1 + \alpha x = \frac{x-1}{\alpha}$ which is true for $\alpha = -1$

87. (B) $\frac{1}{\sqrt{A_1}} + \frac{1}{\sqrt{A_2}} = \frac{1}{\sqrt{A_3}} = \frac{1}{\sqrt{\pi\gamma_2{}^2}} + \frac{1}{\sqrt{\pi\gamma_3{}^2}}$

$$= \frac{1}{\sqrt{\pi}}\left(\frac{1}{\sqrt{\gamma 1}} + \frac{1}{\gamma 2} + \frac{1}{\gamma 3}\right) = \frac{1}{\sqrt{\gamma}} \quad \frac{1}{\gamma} = \frac{1}{\sqrt{\pi\gamma^2}} = \frac{1}{\sqrt{A}}$$

88. (C)

$$10_{c_3} - n_{c_3} = 110$$

or, $120 - n_{c_3} = 110$ ie. $n_{c_3} = 10 \Rightarrow n = 5$

89. (D) a, 4, b are in AP ⇒ $4 = \frac{a+b}{2}$

A, 2, b are in GP ⇒ 4 = ab

so $ab = \frac{a + b}{2}$

$\Rightarrow 1 = \frac{2ab}{a+b} \Rightarrow$ a, 1, b are in HP

90. (D)

$z^n + \frac{1}{z^n} = \cos n\theta + i\sin n\theta + \frac{1}{\cos n\theta + i\sin n\theta}$

$= \cos n\theta + i\sin n\theta + \cos n\theta - i\sin n\theta$

$= 2\cos n\theta$

91. (C)

$a = \sum_{n=1}^{\infty} \frac{2n}{(2n-1)!} = \sum_{n=1}^{\infty}\left[\frac{2n-1+1}{(2n-1)!}\right]$

$= \sum_{n=1}^{\infty}\left[\frac{2n-1}{(2n-1)!} + \frac{1}{(2n-1)!}\right]$

$= \sum_{n=1}^{\infty}\left[\frac{1}{(2n-2)!} + \frac{1}{(2n-1)!}\right] = c$

$b = \sum_{n=1}^{\infty} \frac{2n}{(2n+1)!} = \sum_{n=1}^{\infty}\left[\frac{2n+1-1}{(2n+1)!}\right]$

$= \sum_{n=1}^{\infty}\left[\frac{2n+1}{(2n+1)!} - \frac{1}{(2n+1)!}\right]$

$= \sum_{n=1}^{\infty}\left[\frac{1}{2n!} - \frac{1}{(2n+1)!}\right]$

$= e^{-1}$

$ab = e \quad e^{-1} = 1$

92. (B) $|\vec{a} x \vec{b}| = \vec{a}.\vec{b}$

$|\vec{a}||\vec{b}| sin\theta = |\vec{a}||5| cos\theta$

$\sin\theta \cos\theta \Rightarrow \tan\theta = 1 \Rightarrow \theta \frac{\pi}{4}$

93. (B) $m_1 + m_2 = 2 \; m_1 m_2$

ie. $-\frac{\lambda}{-3} = 2.\frac{1}{-3} \Rightarrow \lambda = -2$

94. (A) $\pm\frac{l.0 + m.\ 0 - 1}{\sqrt{l^2 + m^2}} = a \Rightarrow -\frac{1}{\sqrt{l^2 + m^2}} + a \Rightarrow l^2 + m^2 \; \frac{1}{a^2}$

95. (C) $x^2 - 2x + 8y = 7$

$x^2 - 2x + 1 = -8y + 8$

$(x-1)^2 = -8(y-1)$

Eq^n. of directrix : y = 1 – 2 = 0 ie. y = 3

96. (A) Plane is 6x + 4y + 3z = 12

ie. $\frac{x}{2}+\frac{4}{3}+\frac{z}{4}=1$

Area of $\Delta ABC=\frac{1}{2}\sqrt{a^2\ b^2+b^2\ c^2+c^2\ a^2}$

$=\frac{1}{2}\sqrt{4.9+9.16+4.16}$

$=\frac{1}{2}\sqrt{244}$

$=\sqrt{61}$

97. (D) $y=x^y \Rightarrow \log y=\log x$

$\frac{1}{y}\frac{dy}{dx}=\frac{y}{x}+\log x\ \frac{dy}{dx}$

$\left(\frac{1-y\log^x}{y}\right)\frac{dy}{dx}=\frac{y}{x}$

ie. $\frac{dy}{dx}=\frac{y^2}{a(1-y\log x)}$

98. (B) $\frac{dv}{dt}=\frac{dr}{dt}\Rightarrow\frac{\theta}{3}\pi.\frac{dr^3}{dt}=\frac{dr}{dt}$

$=\frac{\theta}{3}\pi\ 3r^2\ \frac{dr}{dt}=\frac{dr}{dt}\Rightarrow r=\frac{1}{2\sqrt{\pi}}$

99. (C) Put $y=xe^x$ $\therefore$ $dy=(e^x+xe^x)\,dx$

Then $\int\frac{(x+11\,e^x\,dx}{\cos^2(xe^x)}=\int\frac{dy}{\cos^2 y}=\int\sec 2y\ dy=\tan\ y+C$

$=\tan xe^x+C$

100. (A) Solving $y=x^3$ and $y=x$ we get

$x=0,1$

$\therefore$ R.A. $=\int_0^1 (y_1\ 4_2)dx$

$=\int_0^1 (x3-x)dx$

$=\left[\frac{x4}{4}-\frac{x^2}{2}\right]_0^1$

$=\frac{1}{4}-\frac{1}{2}$

$=\frac{1-2}{4}=\frac{1}{4}$

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