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

Solution Set: I (B)

Section: I

1. (B) W = Force x Distance = MLT^{-2} x L = ML^2T^{-2} = $\frac{ML^2}{T^2}$

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

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

2. (C) In the absence of gravity, there will be no force to prevent the rise of liquid due to surface tension
3. (A) Change in length is independent of diameter.
4. (D) When light passes through one medium to another frequency does not change.
5. (D) In interference, the energy remains constant.
6. (D) Force between two charges is independent of the presence of another charge near to it.
7. (A) At temperature of inversion, the thermo emf in a thermocouple is zero.
8. (A) 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.
9. (A) The empty vessel behaves like a closed organ pipe. As it is filled with water, the length of the pipe decreases. Hence frequency increases.
10. (A) As cathode rays are stream of electrons and hence they can be deflected by electric field and magnetic field.

11. (C)	12. (C)	13. (B)	14. (B)	15. (B)	16. (B)
17. (A)	18. (C)	19. (D)	20. (D)	21. (A)	22. (C)
23. (B)	24. (B)	25.			

26. (C) **Solution:** 1000 ml of 1N = 49 g
1000 ml of 2N = 98 g
200 ml of 2N = 98 / 1000 × 200 = 19.6 g

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

28. (D)

29. (B) **Solution:** $C_3H_8 + 5O_2 3CO_2 + 4H_2O \longrightarrow$ 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

30. (A)	31. (C)	32. (C)	33. (B)	34. (D)	35. (A)
36. (B)					

37. (D) obvious

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

39. (A) $\text{cosec}^2 x = \text{cosec}^2 \alpha \Rightarrow = x = n\pi \pm \alpha$

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

or $I = A - A^2$
or $A^{-1} = A^{-1}A - A^{-1} A \; A$
ie $A^{-1} = I - A$

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

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

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

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

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

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

47. (B)	48. (C)	49. (B)	50. (D)	51. (D)
52. (B)	53. (C)	54. (A) and (B)	55. (A)	56. (B)
57. (C)	58. (D)	59. (B)	60. (D)	

Section: II

61. (A) Here $\vec{A}.\vec{B} = 0.$ Hence $\vec{A} \perp \vec{B}$.
$\vec{A} x \vec{C} = 0 \implies \vec{A} \,||\, \vec{C}$
Therefore, B is perpendicular to $\vec{C}$.

62. (C) Here $S = 12t+3t^2-2t^3$
Differentiating with respect to t, we get,
$\frac{ds}{dt} = 12 + 6t - 6t^2$
∴ v = 12 + 0 - 0 = 12 m/s [∵ at start t = 0]

63. (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) $\implies \mu = \frac{a}{g} = \frac{\frac{6}{10}}{10} = 0.06$

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

65. (B) Volume of big drop = Volume of small drop x 1000

$$\frac{4}{3}\pi R^3 = \frac{4}{3}\pi r^3 \text{ x } 1000 \Rightarrow r = \frac{R}{10}$$

66. (D) $R_t = R_0(1 + \alpha t)$

t = 300k = 27°C and α = 0.00125 /°C

$1 = R_0(1 + 0.00125 \text{ x } 27) \ldots\ldots\ldots (i)$

$2 = R_0(1 + 0.00125 \text{ x } t) \ldots\ldots\ldots (ii)$

Solving (i) and (ii), we get, t = 854°C

$\therefore t = 854 + 273 = 1127 \text{ K}$

67. (A) Since $Q \propto T_1^4$

$16\ Q \propto T_2^4$

$$\Rightarrow 16 = \left(\frac{T_2}{T_1}\right)^4$$

$$\therefore \frac{T_2}{T_1} = 2 \Rightarrow T_2 = 2T_1$$

68. (A) Velocity (v) = $\frac{1000}{5} = 200 \text{ m/s}$

$$\lambda = \frac{v}{f} = \frac{200}{500} = \frac{2}{5}$$

No. of waves = $\frac{1000}{\lambda} = \frac{1000}{2} \text{ x } 5 = 2500$

69. (C) 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,

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

70. (C) $\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)} \Rightarrow \sqrt{2} = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{60^o}{2}\right)}$

Solving, i = 45°

71. (D)

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

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

72. (D) Here, q_1= 10 x 50 = 500 μC

C_1 = 10 μF, C_2=? and q_2=0

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

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

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

74. (B) The change in stopping potential

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

75. (D)

Here $\frac{N}{N_o} = \frac{1}{4}$

$\therefore \frac{1}{4} = \left(\frac{1}{2}\right)^{\frac{t}{T}} \Rightarrow \frac{t}{T} = 2$

$\therefore t = 2T = 2 \times 4 = 8$ months

76. (D)

77. (B)

78. (C) **Solution**: HCl is a strong acid and it is completely ionized in aqueous solution

$$HCl \longrightarrow H^+ + Cl^-$$
$$0.001M \qquad 0.001M$$

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

$[H^+] = 0.001M$; pH = $-\log [H^+] = -\log [0.001]$

$= -\log (1 \times 10^{-3}) = -\log 1 + 3 \log 10$

$= 0 + 3 \times 1 = 3$

79. (A) **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

80. (A) 81. (B)

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

83. (D)

$$\frac{1}{\sqrt{A_1}} + \frac{1}{\sqrt{A_2}} = \frac{1}{\sqrt{A_3}} \qquad = \frac{1}{\sqrt{\pi\gamma_2{}^2}} + \frac{1}{\sqrt{\pi\gamma_3{}^2}}$$

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

$$= \frac{1}{\sqrt{\gamma}} \frac{1}{\gamma} \qquad = \frac{1}{\sqrt{\pi\gamma^2}} \quad = \frac{1}{\sqrt{A}}$$

84. (B)

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

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

85. (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

86. (A)

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

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

$$= 2\cos n\theta$$

87. (C)

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

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

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

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

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

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

$$= e^{-1}$$

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

88. (C)

$$|\vec{a}\times\vec{b}| = \vec{a}.\vec{b}$$

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

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

89. (A) $m_1 + m_2 = 2 \ m_1m_2$

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

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

91. (D) $x^2 - 2x + 8y = 7$

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

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

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

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

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

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

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

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

$$= \sqrt{61}$$

93. (A) $y = x^y \Rightarrow \log y = \log x$

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

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

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

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

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

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

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

$$= \tan xe^x + C$$

96. (D) Solving $y = x^3$ and $y = x$ we get

$x = 0, 1$

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

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

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

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

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

Read the passage and answer the questions from 97 to 100.

97. (D)
98. (B)
99. (B)
100. (D)

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