ACME ENGINEERING COLLEGE Sitapaila, Kathmandu Tel: 01-5670924, 5670925, 5382962

2079-4-21 (Set – B) Hints & Solution

Section – I

1.(b) $2x + 1 = 5 \Rightarrow x = 2$
and $8 + y = 0 \Rightarrow y = -8$

2.(a) $x = 1$
But function is undefined at $x = 1$.

3.(b) $\lim_{n \to \infty} \left[\frac{n(n+1)}{2}\right]^2 \times \frac{1}{n^4}$

$= \lim_{n \to \infty} \frac{\left(1 + \frac{1}{n}\right)^2}{4}$

$= \frac{1}{4}$

4.(a) $b^2 = ac$
or, $\log b^2 = \log(ac)$
or, $2\log b = \log a + \log c$

5.(a) $\frac{dy}{dx} = \frac{1}{\sec x} \times \sec x.\tan x$
$= \tan x$

6.(b) $A = \{3, 5, 7, 9, 11\}$
$B = \{1, 4, 7, 10\}$
$B - A = \{1, 4, 10\}$

7.(c) Put $xzy = 1$
or, $(1 + 2 \times 1)^n = 2187$
or, $3^n = 2187$
$3^n = 3^7$
$\therefore$ $n = 7$

8.(a) $\frac{3}{k} = 4$ [$\because$ a = b]
or, $k = \frac{3}{4}$

9.(d) Obvious (By defination)

10.(a) $\tan\theta + \cot\theta = 2\mathrm{cosec}\theta$
or, $\sin^2\theta + \cos^2\theta = 2\cos\theta$
$\cos\theta = \frac{1}{2} = \cos\frac{\pi}{3}$
$\theta = 2n\pi \pm \frac{\pi}{3}$

11.(c)

12.(c) $\cos\beta = \frac{y}{r} = 0$
$\beta = 90°$

13.(c) $z^{-1} = \frac{1}{7 + 24i}$
$= \frac{7 - 24i}{7^2 + 24^2}$
$= \frac{7 - 24i}{625}$

14.(b) $\sin^{-1}x + \sin^{-1}y = \frac{2\pi}{3}$
or, $\frac{\pi}{2} - \cos^{-1}x + \frac{\pi}{2} - \cos^{-1}y = \frac{2\pi}{3}$
or, $\cos^{-1}x + \cos^{-1}y = \frac{\pi}{3}$

15.(a) $\frac{{}^np_r}{{}^nc_r} = \frac{336}{56}$
or, $r! = 6 = 3!$

16.(c) $y = e^x$
$\frac{dy}{dx} = e^x = y$

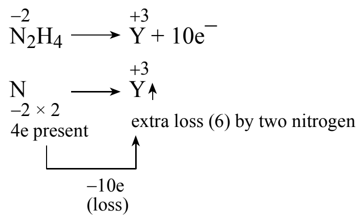
17.(b) $\int a^{f(x)} . f'(x)\, dx$
$= \frac{a^{f(x)}}{\log a} + c$

18.(a) $a \times 1 - 2b + c = 0$
or, $b = \frac{a + c}{2}$

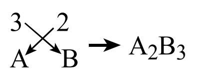
19.(b) $x^2 - 3x + 2 > 0$
or, $(x - 2)(x - 1) > 0$
$x > 2$ or $x < 1$
$\therefore$ $x \in (-\infty, 1) \cup (2, \infty)$

20.(c) $x = \sqrt{2 + x}$
or, $x^2 = 2 + x$
$x^2 - x - 2 = 0$
$x = 2, -1$
$\therefore$ $x = 2$

21.(c)



22.(c)



23.(b) Alkali metal have lowest ionization energy (Na – metal)

24.(c)

25.(a) Weak acid has strong conjugate base.

26.(d)

27.(c)

28.(d)

29.(a) It is an alloy of Fe + C + Mb

30.(b) ${}^2_1H$
$\therefore$ Neutron = At. mass – P
$= 2 - 1 = 1$

31.(d) $Pb(CH_3COO)_2 + H_2S \rightarrow PbS\downarrow + CH_3COOH$
black

32.(c) When body is moving with constant velocity then the speed of body must be constant.

33.(b) The position of centre of mass of body depends on mass and its distribution.

34.(c) % increase in diameter

$= \frac{\Delta d}{d} \times 100\%$

$\Delta\theta \times 100\%$ i.e. depends on nature & change in temperature.

35.(c) $f_0 = \frac{v}{4l} = \frac{336}{4 \times 1.05} = 80$ Hz

First overtone $= 3f_0 = 3 \times 80 = 240$ Hz

36.(b)

37.(d) $v = \omega\sqrt{r^2 - y^2}$

$v = \frac{v_{max}}{r}\sqrt{r^2 - y^2}$

or, $8\sqrt{3} = \frac{16}{4}\sqrt{r^2 - y^2}$

or, $12 = 16 - y^2$

$y = 2$ cm

38.(a) $E = -L\frac{dI}{dt}$

$L = \frac{0.4}{1 - 0.2} \times 10 = 5H$

39.(c) $E = \frac{Q}{4\pi\varepsilon_0 r^2} = \frac{\sigma}{\varepsilon_0}$

40.(b) $\delta = (\mu - 1)A$

and $\mu = A + \frac{B}{\lambda^2}$

Here λ_b is least, so δ will be maximum.

41.(b) In 1st case $T = 2\pi\sqrt{\frac{m}{k}}$

If spring is cuts in 4 equal parts k' = 4k

$T' = 2\pi\sqrt{\frac{m}{k'}} = 2\pi\sqrt{\frac{m}{4k}}$

$T' = \frac{T}{2}$

42.(c) $Y = \frac{stress}{strain} = \frac{\frac{F}{A}}{strain}$

$A = \frac{F}{Y \times strain} = \frac{10^4 \times 100}{7 \times 10^9 \times 0.2}$

$= 7.1 \times 10^{-4}\ m^2$

43.(c) $y = \frac{1}{2}at^2 = \frac{1}{2}\frac{eE}{m}\frac{x^2}{v^2}$

$= \frac{Eex^2}{4\ K.E}$

$\therefore$ Path will be equally curved.

44.(c) $R = \frac{\Delta V}{\Delta I} = \frac{20 - 10}{(50 - 25) \times 10^{-6}} = 400\ K\Omega$

45.(c) $\frac{v_H}{v_{He}} = \sqrt{\frac{\gamma_H M_{He}}{M_H \gamma_{He}}}$

$= \sqrt{\frac{7 \times 3 \times 4}{5 \times 2 \times 5}} = \frac{\sqrt{42}}{5}$

46.(b) $B = \frac{\mu_0 I}{2\pi r}$ i.e. $B \propto \frac{1}{r}$

47.(b) $eV = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2eV}{m}}$

$= 2.3 \times 10^7$ m/s

48.(b) $v = 760$ m/s

$f = \frac{1800}{60} = 30$ Hz

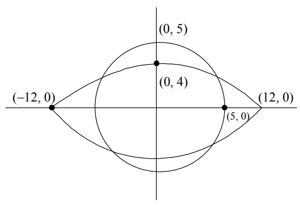
$v = f \times \lambda$

$\lambda = \frac{760}{30} = 25.3$ m

49.(b)	50.(a)	51.(b)	52.(b)	53.(c)	54.(b)
55.(d)	56.(a)	57.(c)	58.(c)	59.(c)	60.(d)

Section – II

61.(c)



From figure
4 points
(inter section)

62.(b) $I = \int |x|\ dx$

$I = |x|\int 1.dx - \int\left[\frac{d|x|}{dx}\int 1.dx\right]dx$

$I = x|x| - \int\frac{x}{|x|}.\ x\ dx \quad [\because x^2 = |x|^2]$

$= x|x| - \int |x|\ dx$

$I = \frac{x|x|}{2}$

63.(c) $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{2e^t \sin t}{2e^t \cos t} = \tan t$

64.(c) $4^{\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+......}$

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

Check option using calculator.
Roots of (c) are 4 and 1.

65.(a) $\cos c = \frac{a^2 + b^2 - c^2}{2ab}$

Since, side C is greatest

Angle c is greatest

$\cos C = \frac{3^2 + 5^2 - 7^2}{2 \times 3 \times 5}$

$= 120° > 90°$

66.(b) $\text{Max} = \frac{1}{\text{min value}}$

$= \frac{1}{-\sqrt{3^2 + 4^2} + 7}$

$= \frac{1}{-5 + 7}$

$= \frac{1}{2}$

67.(d) $\log_a ab = x$

$\log_a a + \log_a b = x$

or, $1 + \log_a b = x$

$\log_a b = x - 1$ .... (i)

or, $\log_b ab = \log_b a + \log_b b$

$= \log_b a + 1$

$= \frac{1}{x - 1} + 1 = \frac{1 + x - 1}{x - 1} = \frac{x}{x - 1}$

68.(d) $\{1 + x + x^3(1 + x)\}^{10}$

$= (1 + x)^{10} (1 + x^3)^{10}$

$= ({}^{10}c_0 + {}^{10}c_1 x + {}^{10}c_2 x^2 + {}^{10}c_3 x^3 + {}^{10}c_4 x^4 + ...)$

$({}^{10}c_0 + {}^{10}c_1 x^3 + ...)$

Coeff. of $x^4 = {}^{10}c_1 \times {}^{10}c_1 + {}^{10}c_4 \times {}^{10}c_0$

$= 10 \times 10 + 210 = 310$

69.(b) $z = (i + \sqrt{2})^{10}$

$|z| = |i + \sqrt{2}|^{10}$

$= (\sqrt{1 + 2})^{10}$

$= (\sqrt{3})^{10}$

70.(a) Eq^n of plane parallel to $3x - 4y + 5z = 0$ is $3x - 4y + 5z + k = 0$

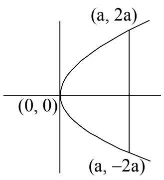
Pass point (1, 2, 3)

$k = -10$

71.(c) $A = 2\int_0^a y\, dx$

$= 2\int_0^a \sqrt{4ax}\, dx$

$= \frac{8}{3} a^2$



72.(b) $\frac{\text{Projection of } \vec{a} \text{ on } \vec{b}}{\text{Projection of } \vec{b} \text{ on } \vec{a}} = \frac{|\vec{a}|}{|\vec{b}|}$

73.(b) $r = 4R\sin\frac{A}{2}.\sin\frac{B}{2}.\sin\frac{C}{2}$

Put A = B = C = 60°

74.(a)

(4)	(6)
Gentleman	Ladies
3	2
4	1

${}^4c_3 \times {}^6c_2 + {}^4c_4 \times {}^6c_1$

75.(b) $D_1 = x(x^2 - ab) - b(ax - ab) + b(a^2 - ax)$

$= x^3 - 3abx + ab^2 + ba^2$

$\frac{d(D_1)}{dx} = 3x^2 - 3ab$

$= 3(x^2 - ab)$

& $D_2 = x^2 - ab$

$\therefore \frac{d(D_1)}{dx} = 3D_2$

76.(b) 6 mole of e = 6F = 1 mole Cr = 52 gm

$\therefore$ 6 × 96500 C = 52gm Cr

$36000\text{ C} = \frac{52 \times 36000}{6 \times 96500} = 3.23\text{g}$

77.(a) Acid Base

$N_{salt} = \frac{200 \times 0.4 - 200 \times 0.2}{400}$

(Na_2SO_4)

$= \frac{40}{400} = \frac{1}{10} = 0.1$ N

$M_{Na_2SO_4} = \frac{N_{Na_2SO_4}}{\text{Charge}} = \frac{0.1}{2} = 0.05$ M

78.(b) pH = 4, So $\frac{H^+ = 10^{-4}}{1000} = 10^{-7}$

No neutral < 7 so 6.69

79.(c) $0.16 \times 60\text{gm } CO_3^{--} = 9.6\text{gm}$

80.(d) $C = \frac{80}{12} = 6.66$ | $\frac{6.66}{6.66} = 1$

$H = \frac{20}{1} = 20$ | $\frac{20}{6.66} = 3$

$CH_3 \Rightarrow C_2H_6$

81.(b) $Cr_{(24)} - 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$

$\Downarrow$

6 unpaired electrons

82.(b) HBr is dried by passing through anhydrous $CaCl_2$.

83.(c) $\frac{T_1}{T_2} = \frac{m(g + a)}{m(g - a)} = \frac{10 + 5}{10 - 5} = 3:1$

84.(b) Change in K.E. = workdone against friction.

$\frac{p^2}{2m} = F \times s$

$\frac{p^2}{2m} = \mu mgs$

$\therefore s = \frac{p^2}{2\mu m^2 g}$

85.(b) v = volume inside water

V = total vol. of iceberg

$V\gamma g = v\sigma g$

$\frac{v}{V} = \frac{\rho}{\sigma} = \frac{0.92}{1.03} = \frac{92}{103}$

Fraction of volume outside

$= 1 - \frac{v}{V} = 1 - \frac{92}{103} = \frac{11}{103}$

% outside $= \frac{11}{103} \times 100\% = 11\%$

86.(c) $\frac{50}{100} \times \frac{1}{2} mv^2 = ms\Delta\theta$

$\Delta\theta = \frac{1}{4}\frac{v^2}{s} = \frac{300^2}{4 \times 150} = 150°C$

87.(b) $\sin 60° = \frac{h}{vt}$

$h = vt \sin 60° = 330 \times \sin 60°$

88.(d) $\frac{f'}{f} = \frac{v}{v - v_s} = \frac{v}{v - \frac{v}{10}} = \frac{10}{9}$

89.(b) Each arm of resistor has resistance 2Ω and 4Ω are in parallel

$R_{eq} = \frac{2 \times 4}{2 + 4} = 1.3\ \Omega$

90.(c) $\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mE}}$

$E = \frac{(6.62 \times 10^{-34})^2}{2 \times 9.1 \times 10^{-31} \times (1.224 \times 10^{-10})^2}$

$= 1.61 \times 10^{-17}$ J

$= \frac{1.6 \times 10^{-17}}{1.6 \times 10^{-19}} = 100$ eV

91.(a) $\frac{N}{N_0}\left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}} = \left(\frac{1}{2}\right)^{\frac{5T_{1/2}}{T_{1/2}}} = \frac{1}{32}$

$\frac{N}{N_0} \times 100\% = \frac{1}{32} \times 100 = 3\%$

92.(b) NP = 50 cm

u = 25 cm v = –50 cm

$f = \frac{uv}{u + v} = \frac{25\,(-50)}{25 - 50} = 50$ cm = 0.5 m

$P = \frac{1}{f} = \frac{1}{0.5} = +2D$

93.(b) $E_1t_1 = E_2t_2$

or, $\frac{I}{r_1^2} t_1 = \frac{I}{r_2^2} \times t_2$

or, $t_2 = \left(\frac{r_2}{r_1}\right)^2 t_1 = \left(\frac{25 + 15}{25}\right)^2 \times 5 = 12.8s$

94.(c) 1st case, $mg = 6\pi\eta r v_0$ ... (i)

2nd case $QE = mg$ .... (ii)

Again, $mg + 6\pi\eta r v_0 = E(Q + 3q)$ .... (iii)

Now $2mg = E(Q + 3q)$ .... (iv)

Dividing (iv) by (ii)

$\frac{2mg}{mg} = \frac{E(Q + 3q)}{EQ}$

or, $2Q = Q + 3q$

$Q = 3q$

95.(b) $\theta = \frac{\beta}{D} = \frac{D\lambda}{d.D} = \frac{\lambda}{d}$

$= \frac{6.5 \times 10^{-7}}{10^{-3}}$

$= 6.5 \times 10^{-4}$ rad

96.(d) $B = \frac{\mu_0 N I_1}{2r_1} - \frac{\mu_0 N I_2}{2r_2}$

$= 5\mu_0\left(1 - \frac{3}{4}\right) = \frac{5}{4}\mu_0$

97.(a) 98.(a) 99.(c) 100.(c)

…The End…