문제 해결력을 키우는 동역학

Updated : 22.3.22

[1장 답안]

번호	답안
1.1	생략
1.2	❶ 스칼라량 : 질량, 시간, 일, 동력(일률), 회전관성 ❷ 벡터량 : 힘, 위치, 변위, 속도, 가속도, 모멘트, 운동량
1.3	$c = -266i + 15.392j$ 또는 80.194
1.4	$\alpha = 33.685\,°$
1.5	$\mathbf{a} \times \mathbf{b} = 2\mathbf{i} - 8\mathbf{j} + 4\mathbf{k}$
1.6	증명생략
1.7	6
1.8	$\begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 4 & 4 & 2 \\ 3 & -2 & 1 \end{vmatrix} = 8\mathbf{i} + 2\mathbf{j} - 20\mathbf{k}$
1.9	$f'(x) = \dfrac{a\,e^{-ax}}{(1 + e^{-ax})^2}$
1.10	$\displaystyle\int \sqrt{2x+1}\,dx = \dfrac{1}{3}(2x+1)^{3/2} + C$
1.11	$\displaystyle\int_0^a \sqrt{a^2 - x^2}\,dx = \dfrac{\pi}{4}a^2$
1.12	$\displaystyle\int x^2 \sqrt{x^3 + 3}\,dx = \dfrac{2}{9}\sqrt{x^3+3}\,(x^3+3) + C$
1.13	$\dfrac{1}{\rho} = 0.6848 \text{ m}^{-1}$
1.14	(a) $R = m(g-a)$ (하강시) (b) $R = m(g+a)$ (상승시)
1.15	$g_0 = \dfrac{R^2}{(R+h)^2}\,g$
1.16	$t = \dfrac{1}{f} = 2\pi\sqrt{\dfrac{l}{g}}$
1.17	$T = \dfrac{4mg}{3}$
1.18	$N_\mathrm{A} = 147.15 \text{ N}$, $N_\mathrm{B} = 254.88 \text{ N}$
1.19	$N_\mathrm{A} = 1.095 \text{ N}$, $N_\mathrm{B} = 3.008 \text{ N}$
1.20	$T_2 = 276.6 \text{ N}$, $m = 19.998 \text{ kg}$

[2장 답안]

번호	답안
2.1	$a = -1.667 \text{ m/s}^2$
2.2	$v = 700 \text{ m/s}$, $s = 26.67 \text{ km}$
2.3	$v = 5.648 \text{ m/s}$, $s = 11.71 \text{ m}$
2.4	$a = 0.25s$, 그래프 생략
2.5	$v = \sqrt{8s - 400}$ $(100 \le s \le 200 \text{ m})$, 그래프 생략
2.6	$v = \dfrac{1}{2}t^2$ $(0 \le t \le 5 \text{ s})$ $v = 5t - 12.5$ $(5 \le t \le t')$
2.7	$v = 11.18 \text{ m/s}$, $a = 0.25 \text{ m/s}^2$
2.8	$x(0.5) = 0.99 \text{ mm}$ $\dot{x}(0.5) = -1.217 \text{ mm/s}$ $\ddot{x}(0.5) = -24.758 \text{ mm/s}^2$
2.9	$v_1 = 8.292 \text{ m/s}$
2.10	$\beta = \tan^{-1}(1.987) = 63.285°$, $\beta = \tan^{-1}(0.731) = 36.167°$
2.11	$d = \dfrac{u^2}{g\cos\theta}\left[\sin 2\phi - 2\tan\theta\cos^2\phi\right]$
2.12	$R = 6.64 \text{ m}$
2.13	$\beta = 59.475°$
2.14	$s = 285.427 \text{ m}$, $t = 11.98 \text{ s}$
2.15	$v = 32.237 \text{ m/s}$
2.16	(a) $y = -\dfrac{9.81\,x^2}{50} = -0.1962x^2$ (b) $v = 11.012 \text{ m/s}$ (c) $a_t = 9.81\sin(66.99°) = 9.029 \text{ m/s}^2$, $a_n = 9.81\cos(66.99°) = 3.835 \text{ m/s}^2$
2.17	$a = 3.856 \text{ m/s}^2$
2.18	$v = 116.30 \text{ mm/s}$, $a = 5,931.77 \text{ mm/s}^2$
2.19	$v = 5 \text{ m/s}$, $a = 1.031 \text{ m/s}^2$
2.20	$v_B = -1 \text{ m/s} (\uparrow)$
2.21	$v_B = -0.67 \text{ m/s}(\uparrow)$
2.22	$\theta = 7.07°$
2.23	$\mathbf{v}_{A/B} = -9.39\mathbf{i} - 10.61\mathbf{j}$, $\mathbf{a}_{A/B} = -1.763\mathbf{i} - 4.419\mathbf{j}$

[3장 답안]

번호	답안
3.1	$a_x = 1.168\,\text{m/s}^2$
3.2	$a_x = 1.629\,\text{m/s}^2$
3.3	$N_c = 115.33\,\text{N},\ a_y = 2.12\,\text{m/s}^2$
3.4	$t = 6.555\,\text{s}$
3.5	$a_x = 2.173\,\text{m/s}^2,\ x = 9.779\,\text{m}$
3.6	$s_2 = 26.67\,\text{m}$
3.7	$t_x = 43.30\,\text{s},\ t_y = 156.25\,\text{s}$
3.8	$t = 82.24\,\text{s}$
3.9	$a_y = 0.833\,\text{m/s}^2\ (\downarrow),\ T = 4{,}488.5\,\text{N}$
3.10	$C_1 = 180,\ C_2 = 1{,}200,\ C_3 = 12{,}000$
3.11	$v = 57.19\,\text{m/s}$
3.12	$N_c = 38\,\text{N}$
3.13	$\omega_{\max} = 2.971\,\text{rad/s}$
3.14	$v = 31.32\,\text{m/s}$
3.15	(a) $\rho_{\min} = 45.31\,\text{m}$ (b) $\rho_{\min} = 50.82\,\text{m}$
3.16	$\mu_s = 0.029$
3.17	$T = 12.5\,\text{N},\ \ddot{\theta} = 0.02\,\text{rad/s}^2$
3.18	(a) $\dot{\theta} = 3.366\,\text{rad/s}$ (b) $\theta = \cos^{-1}(0.0895) =$
3.19	(a) $F_r = 461.94\,\text{N},\ F_\theta = 353.55\,\text{N}$ (b) $a = 6.937\,\text{m/s}^2$
3.20	$\psi = 84.289\,^\circ,\ a = 5\,\text{m/s}^2$

[4장 답안]

번호	답안
4.1	(a) $U_g = 150\,\text{N·m}$ (b) $\Delta P_E = -150\,\text{N·m}$
4.2	$U_{1-2} = 143.133\,\text{N·m}$
4.3	$v_2 = 5.957\,\text{m/s}$
4.4	$v_2 = 77.46\,\text{m/s}$
4.5	$s = 94.797\,\text{m}$
4.6	$v = 3.069\,\text{m}$
4.7	$d = 8\,\text{m}$
4.8	$s = 1.133\,\text{m}$
4.9	$v = 5.148\,\text{m/s}$
4.10	$v_2 = 1.987\,\text{m/s}$
4.11	$v_2 = 30.345\,\text{m/s}$
4.12	$P_{입력} = 143,125.76\,\text{W}$, $(P_{입력})_{평균} = 71,562.88\,\text{W}$
4.13	$P = 74.997\,\text{kW}$
4.14	$P = 14.067\,t\,\text{MW}$, $P_{\text{output}} = 42.201\,\text{MW}$
4.15	$d = 142.89\,\text{m}$
4.16	$k = 98.88\,\text{N/m}$
4.17	$v_2 = 7.004\,\text{m/s}$
4.18	$d = 1.093\,\text{m}$
4.19	$k = 5.5567 \times 10^5\,\text{N/m}$
4.20	$v = 2.828\,\text{m/s}$, $T = 23.62\,\text{N}$

[5장 답안]

번호	답안
5.1	$(v_x)_2 = 8.66\,\text{m/s}$, $\quad N_c = 734.8\,\text{N}$
5.2	$T = 135.15\,\text{N}$, $\mu_{\text{k}} = 0.903$
5.3	$\mu_k = 0.34$
5.4	$\displaystyle \int F\,dt = 57.296\,\text{N·s}$
5.5	$(v_x)_2 = 12.2\,\text{m/s}$
5.6	$v_2 = 6.21\,\text{m/s}$, $\theta_x = 14.88\,°$
5.7	$(v_b)_2 = 90\,\text{m/s}$
5.8	$v = 13.098\,\text{m/s}$, $\theta = 49.105\,°$
5.9	$d = 7.5265\,\text{m}$
5.10	$x = 1\,\text{m} \;\rightarrow\;$ 우측으로 이동
5.11	$v_1{'} = -1\,\text{km/h} \;\rightarrow\;$ 우측방향
5.12	$v = \dfrac{(m+M)}{m}\sqrt{2gh}$, $v{'} = \sqrt{2gh}$
5.13	$(v_{\text{B}})_2 = 1.5\,\text{m/s}$, $(v_{\text{A}})_2 = 0.5\,\text{m/s}$ $\Delta T = 1.5\,\text{J}$
5.14	$(v_{\text{A}})_2 = -2\,\text{m/s}$, $e = 0.5$
5.15	$(v{'}_{\text{C}})_2 = 1.125\,\text{m/s}$, $(v{'}_{\text{B}})_2 = 0.375\,\text{m/s}$
5.16	$(v_{\text{A}})_2 = 6.933\,\text{m/s}$, $(v_{\text{B}})_2 = 4.808\,\text{m/s}$
5.17	(a) $e = 0.774$, $(v_p)_2 = 4.573\,\text{m/s}\downarrow$ (b) $\Delta T = 7{,}864.23\,\text{J}$
5.18	$v = 7.107\,\text{m/s}$
5.19	$v{'} = 2v$
5.20	$v_1 = v_{\text{Q}} = 7{,}712\,\text{m/s}$, $v_{\text{P}} = 4{,}630.52\,\text{m/s}$

[6장 답안]

번호	답안
6.1	$v_{A/B} = v_A - v_B = (-80i - 80j)\,\text{m/s}$
6.2	$V_A = \omega r = 5.6\,\text{m/s}$ (점 A의 속도) $a_A = \sqrt{8^2 + 39.2^2} = 40\,\text{m/s}^2$ (점 A의 가속도)
6.3	북서쪽으로 $70.1\,^\circ$, $2.41\,\text{m/s}$
6.4	$v_{A/B} = (-3.18i + 4.14j)\,\text{m/s}$
6.5	(a) $v_B = 13.1\,e_t\,\text{m/s}$ (b) $v_B = (-9.26i - 9.26j)\,\text{m/s}$
6.6	(a) $\theta = 3\,^\circ$ 일 때 , $h = 1.81\,\text{m}$, 스트라이크존 내에 공이 들어오지 않는다. (b) $\theta = 5\,^\circ$ 일 때 , $h = 2.43\,\text{m}$, 스트라이크존 내에 공이 들어오지 않는다.
6.7	(a) $t = 1\,\text{s}$ (b) $t = 3\,\text{s}$ (c) $\theta = 4583.6\,^\circ$
6.8	$v = (28\,m/s)e_t$ (수직방향 속도) $a = (4\,m/s^2)e_t + (980 m/s^2)e_n$ (수직 및 수평방향 가속도)
6.9	$a_B = 21.16\,\text{m/s}^2$
6.10	$\omega_B = 52.751\,\text{rad/s}$
6.11	$\omega_{AB} = 5\,\text{rad/s}$ (링크 AB의 각속도) $V_P = -2.5\,\text{m/s}\,i + 0.875\,\text{m/s}\,j$ (점 P의 속도)
6.12	$\omega_{CB} = 6.65\,\text{rad/s},\ \omega_{CD} = 20.2\,\text{rad/s}$
6.13	$V_C = L(\cos 60\,^\circ)(-\omega) - L(\cos 60\,^\circ)(\omega) = -L\omega,\ a_c = -0.577 L\omega^2$
6.14	$\dot{\theta} = 1.95\,\text{rad/s}$
6.15	$\omega_{AB} = 2.00\,\text{rad/s}$
6.16	$\omega = 3.111\,\text{rad/s}$ (기어의 각속도) $v_O = 0.667\,\text{m/s}$ (중심 O의 속도)
6.17	$\omega_{BC} = 8.65\,\text{rad/s}$ (봉 BC의 각속도) $\omega_{AB} = 4.99\,\text{rad/s}$ (봉 AB의 각속도)
6.18	$v_B = \dfrac{v_A}{\sin 60\,^\circ} \times \sin 30\,^\circ = 3.35\,\text{m/s}$
6.19	$\omega_A = \omega_{AB} = \dfrac{v_B}{r_{G'B}} = 1.67$ (점 A에서의 각속도) $\alpha_A = \alpha_{AB} = \dfrac{a_B}{r_{G'B}} = \dfrac{10}{3} = 3.33\,\text{s}^{-2}$ (봉AB의 회전각가속도)
6.20	$\omega_{AB} = 1.255\,\text{rad/s}$ (A의 각속도) $v_A = 4.549\,\text{m/s}$ (A의 속도)

[7장 답안]

번호	답안
7.1	(a) $a = 0.940 \, \text{m/s}^2$ (b) $N_A = 910.7 \, \text{N}$, $N_B = 289.3 \, \text{N}$
7.2	(a) $d = 8.22 \, \text{m}$ (b) $N_A = 1190 \, \text{N}$, $N_B = 1910 \, \text{N}$
7.3	(a) $a = 0.981 \, \text{m/s}^2$ (b) $A = 371.43 \, \text{N}$, $B = 628.57 \, \text{N}$
7.4	(a) $\alpha = 2 \, \text{rad/s}^2$ (b) $\omega = 76.4 \, \text{rpm}$
7.5	$\omega = 4.43 \, \text{rad/s}$
7.6	$\alpha_A = 259.3 \, \text{rad/s}^2$, $\alpha_B = 172.8 \, \text{rad/s}^2$, $\alpha_C = 57.6 \, \text{rad/s}^2$
7.7	$O = 376.73 \, \text{N}$
7.8	$a_A = 65.67 \, \text{cm/s}^2 \uparrow$, $a_B = 32.84 \, \text{cm/s}^2 \downarrow$
7.9	$M = 5.17 \, \text{N} \cdot \text{m}$, $\alpha = 38.3 \, \text{rad/s}^2$
7.10	(a) $a_G = (2.747 \text{m/s}^2)j$ (b) $a_A = (23.75 \, \text{m/s}^2)j$
7.11	$\alpha = 4.91 \, \text{rad/s}^2$, $O_y = 196.15 \, \text{N}$
7.12	$\omega = 0.213 \, \text{rad/s}$
7.13	$a = 0.19 \, \text{m/s}^2$ (질량이 있는 경우 강체의 가속도) $a = 2.51 \, \text{m/s}^2$ (질량이 없는 경우 강체의 가속도)
7.14	$v = 149.64 \, \text{cm/s}$
7.15	$P = 1020.2 \, \text{N}$
7.16	(a) $t = 0.05194 \, \text{s}$ (b) $\bar{a} = 46.04 \, \text{m/s}^2$
7.17	$a = 0.3 \, \text{m/s}^2$
7.18	$\alpha = 2.4525 \, rad/s^2 = 2.45 \, \text{rad/s}^2$ (막대의 각가속도) $N_A = 33.3 \, \text{N}$ (A와 B의 반발력)
7.19	$V = 0 \, \text{N}$ (중심에서 전단력) $M = 72198.74 \, \text{N}$ (중심에서 모멘트)
7.20	$\alpha = 10.42 \, \text{rad/s}^2$
7.21	(a) $a = 8.72 \, \text{m/s}^2$ (b) $\mu_s = 0.444$
7.22	$\alpha = 3 \, \text{rad/s}^2$

[8장 답안]

번호	답안
8.1	$v = 2.36\,\text{m/s}$
8.2	(a) $U = 9.79 \times 10^5\,\text{N} \cdot \text{m}$ (b) $F = 3916\,\text{N}$
8.3	$d = 137.04\,\text{m}$
8.4	$v = 102.6\,\text{m/s}$
8.5	$y_{\max} = 9.8\,\text{m}$
8.6	(a) $v_2 = 7.67\,\text{m/s}$ (위치 2에서의 공의 속도 크기) (b) $v_2 = 9.40\,\text{m/s}$ (위치 2에서의 공의 속도 크기)
8.7	(a) $U_{12} = -10\,\text{N} \cdot \text{cm}$ (b) $v = 3.62\,\text{m/s}$
8.8	$s = 4.32\,\text{m}$
8.9	$v_2 = 2.41\,\text{m/s}$
8.10	$\rho = 12.16\,\text{m}$
8.11	(a) $\omega = 14.3\,\text{rad/s}$ (b) $17.54\,\text{hp}$
8.12	$\omega = 1.91\,\text{rad/s}$
8.13	$\omega = 6.97\,\text{rad/s}$
8.14	$A_x = 111.2\,\text{N}$, $A_y = 125.9\,\text{N}$
8.15	$W = 16.24\,\text{N}$
8.16	(a) $\omega_f = 11.13\,\text{rad/s}$ (b) $k = 201.84\,\text{N/m}$
8.17	(a) $U_{12} = 26\,N \cdot m$ (b) $v = 2.94\,\text{m/s}$
8.18	$S = 0.29\,\text{m}$
8.19	$\omega = 4.49\,\text{rad/s}$
8.20	$\omega = 22.03\,\text{rad/s}$
8.21	$s = 18.02\,\text{m}$
8.22	$\omega_A = 147.19\,\text{rad/s}$
8.23	$P = 22.57\,\text{W}$

[9장 답안]

번호	답안
9.1	(a) $\omega_1 = 1.65\,\mathrm{rad/s}$ (b) $\omega_1 = 1.45\,\mathrm{rad/s}$ (회전 방향과 같은 방향으로 점프한 경우) 　　$\omega_1 = 1.86\,\mathrm{rad/s}$ (회전 방향의 반대 방향으로 점프한 경우)
9.2	$v = 4.3\,\mathrm{m/s}$
9.3	$t = 2.83\,\mathrm{s}$
9.4	$\omega = 40.03\,\mathrm{rad/s}\circlearrowleft$ 시계방향
9.5	$(\omega_A)_2 = 29.44\,\mathrm{rad/s}$
9.6	$t = 1.45\,\mathrm{s}$
9.7	$v_a = 9.07\,\mathrm{m/s}$ (y+ 상승 방향)
9.8	경사 아래 방향으로 $1.49\,\mathrm{m}$ ($\swarrow +$)
9.9	$t = 0.589\,\mathrm{s}$
9.10	$\omega = 4.69\,\mathrm{rad/s}$
9.11	(a) $\omega_2 = 0.768\,\mathrm{rad/s}\circlearrowleft$ (b) $\bar{F} = 5.76/0.0005 = 11.52\,\mathrm{kN}$
9.12	(a) $2.4\,\mathrm{rad/s}$　　(b) $8420\,\mathrm{N}$　　(c) $0.08\,\mathrm{m}$
9.13	$\dot{\theta}_2 = v_2/49l$
9.14	$\omega'_b = -1.98\,\mathrm{ras/s}$
9.15	$\omega = 8.85\,\mathrm{rad/s}$
9.16	$h = 45.85\,\mathrm{mm}$
9.17	$\theta = 72.75\,°$
9.18	$(v_b)_2 = 1.28\,\mathrm{m/s}\rightarrow$
9.19	$\theta = 48.3\,°$
9.20	$v_{c2} = +1.76\,\mathrm{m/s}$