THE HONG KONG POLYTECHNIC UNIVERSITY

HONG KONG COMMUNITY COLLEGE

Subject Title : Physics I **Subject Code** : CCN1049

Session : Semester One, 2018/19

Numerical Answers

Question B1

(a) $\overrightarrow{R1} = 0\hat{\imath} - 10\hat{\jmath} + 5\hat{k} = -10\hat{\jmath} + 5\hat{k}$

$\overrightarrow{R2} = 2\hat{\imath} + 0\hat{\jmath} - 2\hat{k} = 2\hat{\imath} - 2\hat{k}$

$\overrightarrow{R3} = -15\hat{\imath} + 15\hat{\jmath} + 10\hat{k}$

$\overrightarrow{R4} = 4\hat{\imath} - 8\hat{\jmath} + 12\hat{k}$

(b) $\overrightarrow{R3} - \overrightarrow{R1} = -15\hat{\imath} + 25\hat{\jmath} + 5\hat{k}$

(c) θ = 33.21091° (33.2°)

(d)(i) $\frac{1}{4}\overrightarrow{R1} \times \left(\overrightarrow{R4} - \overrightarrow{R2}\right) = \frac{1}{4}\begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 0 & -10 & 5 \\ 2 & -8 & 14 \end{vmatrix} = -25\hat{\imath} + 2.5\hat{\jmath} + 5\hat{k}$

(d)(ii) $\frac{1}{4}\overrightarrow{R1} \bullet \left(\overrightarrow{R4} \times \overrightarrow{R3}\right) = 475$

Question B2

(a) $\omega = 2.379994435\ rad/s$

$v = (1)\omega = 2.379994435$ m/s (2.38 m/s)

(b) T = 2.83190307 N (2.83N)

(c) D = 1.177191341 m (1.18 m)

Question B3

(a) x = 0.2481 m (0.248 m)

(b) v =1 m/s

(c) $\Delta E_{th} = -\Delta K$ = 4 J

=> d_2 = 0.20387 m (0.204 m)

Question B4

(a) 123762.5 J (124000 J)

(b) 3474 J (3470 J)

(c) T = 1197 K (1200 K)

or T = 924 °C

Question C1

(b) $(10)(9.81) - (0.2)(3)(9.81) - (2)(9.81)(\sin 60) = 15a$

→ $a = 5.014838772$ m/s^2 (5.01 m/s^2)

→ $T_1 = 47.95161228$ N (48.0 N)

→ $T_2 = 27.02109597$ N (27.0 N)

Question C2

(a) 78.48 J (78.5 J)

(b) $\frac{1}{2}I\omega^2 + \frac{1}{2}mv^2 = 1.5\, v_1^2$

(c) $v_1 = 7.233$ m/s (7.23 m/s)

(d) $\omega_1 = v_1/R = 36.165$ rad/s (36.2 rad/s)

(e) $\alpha = 18.0825$ rad/s^2 (18.1 rad/s^2)

(f) $v_2 = 6.2641$ m/s (6.26 m/s)

Question C3

(a)(i) $I = 0.14$ kg m^2

(a)(ii) $h_{cm} = 0.2$ m

(b)(i) $I = 0.64125$ kg m^2 (0.641 kg m^2)

(b)(ii) $h_{cm} = 0.3\ m$

(b)(iii) $\omega = 5.247556$ rad/s

(b)(iv) $T = \frac{2\pi}{\omega} = 1.197355$ s

Question C4

(a)(i) $\lambda = 2\pi / 6 = 1.047$ m (1.05 m)

(a)(ii) $T = 2\pi / 12 = 0.5236$ s (0.524 s)

(a)(iii) $v = 2$ m/s

(a)(iv) $u_m = 26.4$ m/s

(a)(v) $\Phi' = \frac{\pi}{6} = 0.5236$ rad or 30°

$y_m' = 3.8105$ m

(a)(vi) $y'(x,t) = (4.4\cos\frac{\pi}{6})\sin(6x - 12t + \frac{\pi}{6})$ m

(b) $f' = 1626$ Hz (1630 Hz)