Week-9 - Assignment 9 - Solutions

1. (d) Two roots must be at 1 and third root between 1 and infinity.

2. (a) $w_2^2 \geq \frac{4mglI_1}{I_3^3}$

3. (c) scleronomic

4. (a) In any virtual displacement, the total work done by the force of constraint is zero.

5. (b) A single, coupled equation of motion

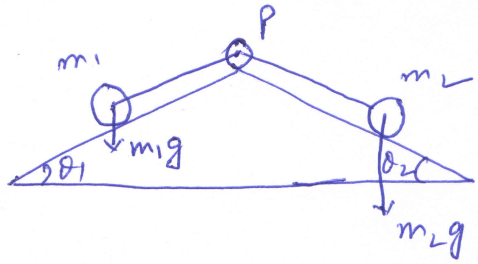
6. (d) A set of generalised co-ordinates is a unique set of co-ordinates to describe the configuration of the system.

7. (e) θ

8. (a) $(x_1, y_1) = (l_1 \cos\theta_1, l_1 \sin\theta_1)$

$(x_2, y_2) = (l_1 \cos\theta_1 + l_2 \cos\theta_2), (l_1 \sin \sin\theta + l_2 \sin\theta_2)$

9.



from the principal of virtual work, we can write,

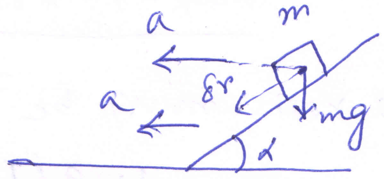
$$m_1\vec{g}\cdot\delta\vec{r_1} + m_2\vec{g}\cdot\delta\vec{r_2} = 0$$

$$\Rightarrow m_1 g \sin\theta_1 \delta r_1 + m_2 g \sin\theta_2 \delta r_2 = 0$$

Here, δr_1 and δr_2 are two virtual displacement of m_1 and m_2 along the inclined plane in the downward directions respectively. $\therefore \delta r_1 = -\delta r_2$

$\therefore$ $\boxed{m_1 \sin\theta = m_2 \sin\theta_2}$ $\Rightarrow$ Cond^n of equ^m.

(10) The body is accelerating ($\vec{a}$) horizontally towards left w.r.t incline, w.r.t an observer on earth. The virtual displacement $\delta\vec{r}$ can only be along the incline.



$\therefore$ from D'Alembert's principal,

$$(m\vec{g} - m\vec{a}) \cdot \delta\vec{r} = 0$$

$$\Rightarrow mg\sin\alpha\,\delta r - ma\cos\alpha\,\delta r = 0$$

$$\Rightarrow \boxed{a = g\tan\alpha}.$$