

$$m_2 = 3 \text{ kg}$$

$$\vec{r}_2 = 2\hat{i} - 5\hat{j} + \hat{k} \text{ m}$$

$$m_3 = 5 \text{ kg}$$

$$\vec{r}_3 = 3\hat{i} - 2\hat{j} + 5\hat{k} \text{ m}$$

$$(1, -2, 3) \text{ m}$$

$$(2, -5, 1) \text{ m}$$

$$(3, -2, 5) \text{ m}$$

$$\vec{r}_{cm} = \frac{m_1 \vec{r}_1 + m_2 \vec{r}_2 + m_3 \vec{r}_3}{m_1 + m_2 + m_3} = \frac{2(\hat{i} - 2\hat{j} + 3\hat{k}) + 3(2\hat{i} - 5\hat{j} + \hat{k}) + 5(3\hat{i} - 2\hat{j} + 5\hat{k})}{2+3+5}$$

$$\vec{r}_{cm} = \frac{1}{10} \{ 2\hat{i} - 4\hat{j} + 6\hat{k} + 6\hat{i} - 15\hat{j} + 3\hat{k} + 15\hat{i} - 10\hat{j} + 25\hat{k} \}$$

$$= \frac{1}{10} \{ 23\hat{i} - 29\hat{j} + 34\hat{k} \}$$

$$\vec{r}_{cm} = 2.3\hat{i} - 2.9\hat{j} + 3.4\hat{k}$$

$$x_{cm} = 2.3 \text{ m}$$

$$y_{cm} = -2.9 \text{ m}$$

$$z_{cm} = 3.4 \text{ m}$$

Ex 3:

$$1 \text{ kg}, 2 \text{ kg}, 3 \text{ kg}, 4 \text{ kg}$$

$$O, A, B, C$$

$O \rightarrow \text{origin}$, $OA \rightarrow x\text{-axis}$

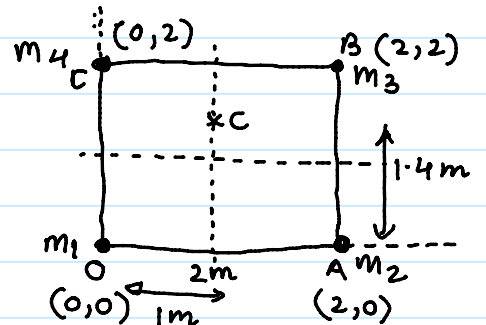
$$x_{cm} = \frac{m_1 x_1 + m_2 x_2 + m_3 x_3 + m_4 x_4}{m_1 + m_2 + m_3 + m_4}$$

$$x_{cm} = \frac{1 \times 0 + 2 \times 2 + 3 \times 2 + 4 \times 0}{1 + 2 + 3 + 4} = \frac{4 + 6}{10} = 1 \text{ m}$$

$$y_{cm} = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3 + m_4 y_4}{m_1 + m_2 + m_3 + m_4} = \frac{1 \times 0 + 2 \times 0 + 3 \times 2 + 4 \times 2}{1 + 2 + 3 + 4}$$

$$y_{cm} = \frac{6 + 8}{10} = \frac{14}{10} \Rightarrow y_{cm} = 1.4 \text{ m}$$

$$CM \equiv (1 \text{ m}, 1.4 \text{ m})$$



Ex 4: Example 6
Nootan Phy. 407

$$m_1, m_2, m_3$$

$$m_4, (x_4, y_4, z_4)$$

$$x_{cm} = 1 \text{ m}, y_{cm} = 1 \text{ m}, z_{cm} = 1 \text{ m}$$

$$m = m_1 + m_2 + m_3 = 1 + 2 + 3 = 6 \text{ kg}$$

$$(3, 3, 3) \text{ m}, m'_1 = m, m'_2 = m_4$$

$$x_{cm} = \frac{m'_1 \times 3 + m'_2 \times x_4}{m'_1 + m'_2}$$

$$\begin{cases} m'_1 = m = 6 \text{ kg} \\ m'_2 = m_4 = 4 \text{ kg} \end{cases}$$

$$x_{cm} = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$$

$$1 = \frac{6 \times 3 + 4 \times x_4}{6 + 4}$$

$$1 = \frac{18 + 4x_4}{10}$$