Department of Electronic and Telecommunication Engineering
University of Moratuwa

Tutorial 1 – Co-ordinate Transformation

- Write your name and index number at the top right hand corner of the front page
- Drop your answer script into the drop box labeled EN3562

(1) Derive basic rotation matrices $R_x(\theta), R_y(\beta)$, and $R_z(\gamma)$ using vector component (scalar product) method. [5 marks]

(2) {A} and {B} are two coincident frames.. Frame {B} rotates 30^0 about $\mathbf{z_A}$, 45^0 about $\mathbf{x_A}$, and then translates to (3,2,1) w.r.t frame {A}.

(a) Determine ${}^A_B R$, ${}^A P_{Borg}$, and ${}^A_B T$ [5 marks]

(b) A vector ${}^B P = \{1, 1.5, -3\}$ is attached to frame{B}. Determine ${}^A P$ the position coordinates of P w.r.t. {A}. [5 marks]

(c) Determine ${}^B_A T$ without using inverse matrix transformation [5 marks]

(d) A vector ^{A}Q = [1.5, 0, -2] is attached to frame {A}. Determine ^{B}Q. [5 marks]

(3) Write Matlab m-code and verify your answers in (2). [5 marks]

P.T.O

(4). A manufacturing work cell with a robot arm is shown in Fig.1

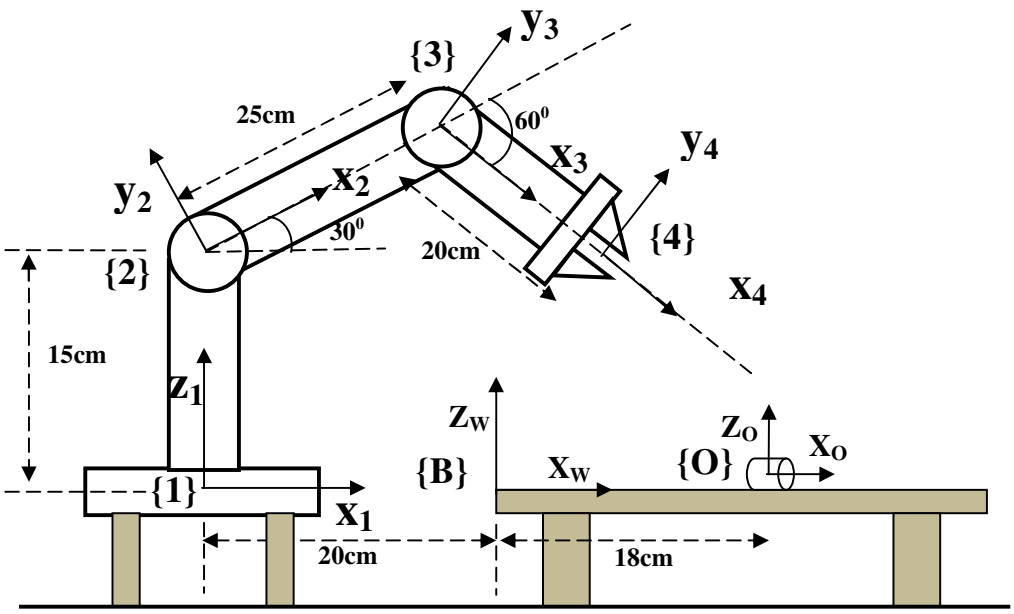

Fig.1 Manufacturing work cell with a robot arm

(a) Determine ${}^{1}_{2}R$, ${}^{2}_{3}R$, ${}^{3}_{4}R$, ${}^{1}P_{2org}$, ${}^{2}P_{3org}$, ${}^{3}P_{4org}$, and ${}^{1}_{4}T$ [5 marks]

(b) Determine the position and orientation of the object on the work table {O} with respect to reference co-ordinate frame $\{W\} \equiv \{1\}$ [5 marks]

(c) Calculate position and orientation of the object {O} as it is seen by the robot gripper {4}. [5 marks]