ASSUMPTION UNIVERSITY

VINCENT MARY SCHOOL OF ENGINEERING

FINAL EXAMINATION 1 / 2020 (Part 2)

SUBJECT : **MCE4101-Introduction to Robotics**

LECTURER : **Asst. Prof. Dr. Narong Aphiratsakun (narongphr@au.edu)**

DATE :

TIME : **50 Min**

NAME ……	**SURNAME ……**	**ID.NO. ……**	**SEC……**

Make sure you have all the questions.

- Total examination paper: **1** question, **1** page (not including cover page).

Instructions:

1. This examination is worth a total of **50** points. This examination will contribute to **17% of your final grade**.
2. **Open books Examination**.
3. Answer in the provided booklet.
4. **Any** calculator can be used.
5. The University's examination regulations are on the reverse page. Students are expected to read and strictly observe them while the examination is in progress. Failure to do so would subject students to the terms of punishments.

This is to inform that

- Students are NOT allowed to use Smart Watches in examinations. Should they be brought into examination rooms, they are required to be placed on the floor under students' desk or chair.
- Violators will be subjected to the terms of punishment for violating examination regulations and/or cheating in the examination.

Other pertinent University's examination regulations are on the reverse page.
Students are expected to read and strictly observe them while the examination is in progress.
Failure to do so would subject students to the terms of punishments for violating examination regulations and/or cheating in the examination.

NAME …… SURNAME …… ID.NO. …… SEC……

2. (50 minutes). The iVMEbot, RPP Robot with 1DOF wrist is given as in Figure 2. Where d_1 and d_3 are robot links' offset and d_5 is 1DOF wrists' offset. Given $d_1 = 2$ and $d_3 = 1.5$ and $d_5 = 0.5$.

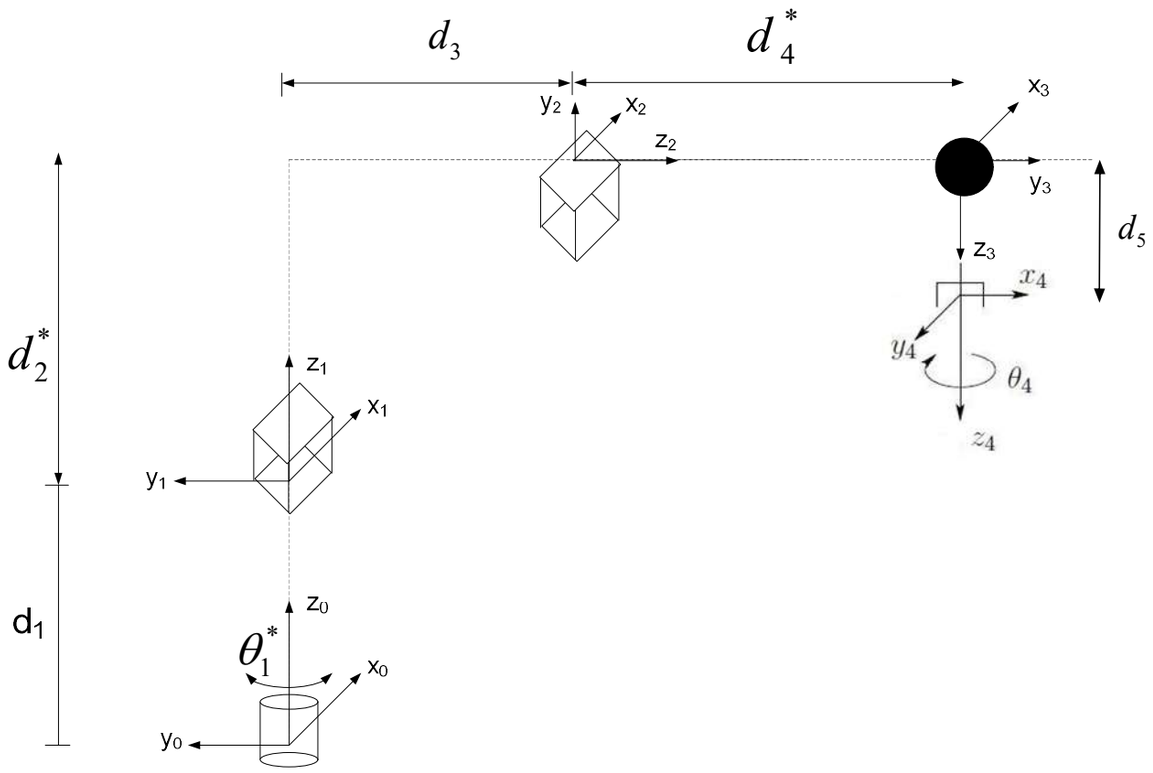

Figure 2: iVMEbot, RPP Robot with 1DOF wrist.

a) (10 marks) Obtain o_i and z_i with variables $\theta_1^*, d_2^*, d_4^*, \theta_4^*$.

b) (25 marks) Determine the **Jacobian matrix <u>equation</u>** for the iVMEbot with variables $\theta_1^*, d_2^*, d_4^*, \theta_4^*$.

c) (5 marks) Compute the Jacobian matrix value **<u>from b)</u>** when $\theta_1^* = 0°, d_2^* = 3, d_4^* = 1.5, \theta_4^* = 0°$.

d) (2.5 marks) Compute the Jacobian matrix value **<u>by "Jacobian function" with MATLAB toolbox</u>** when $\theta_1^* = 0°, d_2^* = 3, d_4^* = 1.5, \theta_4^* = 0°$.

e) (5 marks) Compute the Jacobian matrix value **<u>from b)</u>** when $\theta_1^* = 90°, d_2^* = 3, d_4^* = 1.5, \theta_4^* = 0°$.

f) (2.5 marks) Compute the Jacobian matrix value **<u>by "Jacobian function" with MATLAB toolbox</u>** when $\theta_1^* = 90°, d_2^* = 3, d_4^* = 1.5, \theta_4^* = 0°$.

<u>Total 50 Marks</u>

%%%%%%%%%%%%%%%%%%Enjoy Robotics, End of Questions2%%%%%%%%%%%%%%%%%%