End Term Examination (December 2019)

School: School of Engineering   **Program:** B.Tech (Biomedical Engineering)

Course: Robotics and Automation in Medicine   **Course Code**: BME401

Semester: VII   **Max Marks:** 40   **Duration (mins) :** 90

Part-A   [10]

1. A robotic arm with a surgical instrument is designed as such that it has 3 links. The first link has a twisting motion with an angle of 30°. The second link attached with the first has linear motion of 1.5 cm. The third link has a rotating motion with the second at an angle of 60°. The link length are 4cm, 5cm, and 2 cm for the first, second, and third respectively. Find the position of the surgical needle as an end effector using forward kinematics.
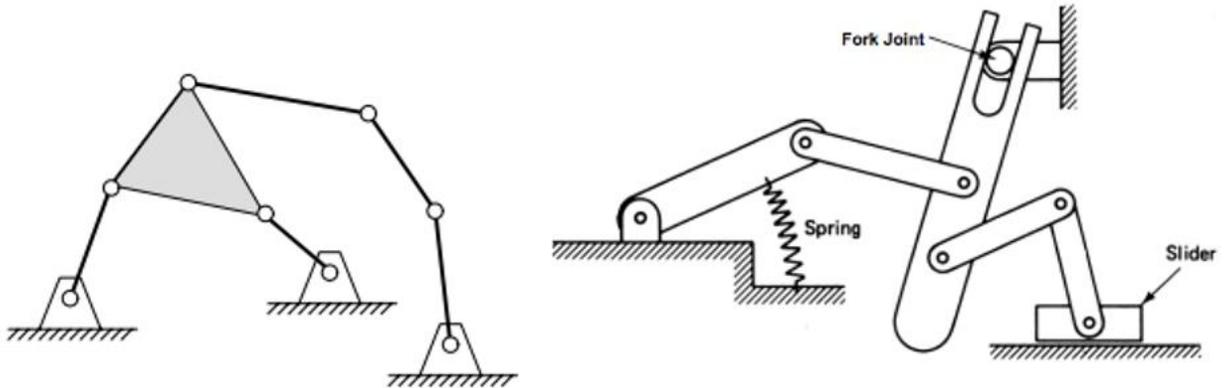
Part-B

Answer any SIX questions   **[30]**

(Each question carries 5 marks)

2. Explain about the articulate robots. What are the basic components of the robots?
3. Calculate the degrees of freedom for the following robots using grubler's criterion.

4. Explain about the different end effectors used by a robot to interact with the environment. Owing to the application of robots, grippers should be designed. From the above statement explain, what kind of grippers can be used in a medically automated robot?

5. Consider an encoder with 15 counts per revolution, how far does the robot wheel travel for 1 encoder count, if we consider the robot has 10 cm wheel diameter. For my 10 cm wheel, how many encoder counts will be there be for 1 metre of travel?

6. Differentiate between model-plan-act approach and behavioural approach control system in robotics.

7. What do you mean by actuators? Mention the advantages and disadvantages of hydraulic and pneumatic actuators.

8. Explain the following: (a) tactile sensors, and (b) PID controllers

9. Explain the following: (a) ultrasonic proximity sensor, and (b) magnetic proximity sensor

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