Week-7:

1. Why is robotic assistance necessary in percutaneous needling interventions?
   a) To improve the target reaching accuracy
   b) To aid the physician
   c) To avoid anatomical obstacles
   d) All of the above
2. Needle insertion by MIRAB robotic system developed in Thomas Jefferson University is
   a) Manual
   b) Autonomous
   c) Semi-Autonomous
   d) None of the above
3. What are the imaging feedback modalities used in robot-assisted percutaneous interventions?
   a) CT
   b) MRI
   c) US
   d) All of the above
4. How many DOF, the active needle (Design-2) has
   a) 4
   b) 5
   c) 6
   d) 7
5. The expression of the control law used for closed-loop inverse kinematics (CLIK) is given by $\dot{\theta} = J^{-1}(\dot{x}_d + Ke)$
6. During designing of the linear sliding surface, the chosen sliding parameter in equation below must be

$$S = c_1 x_1 + c_2 x_2$$

   a) $c_1 > 0, c_2 < 0$
   b) $c_1 > 0, c_2 > 0$
   c) $c_1 < 0, c_2 > 0$
   d) $c_1 > 0, c_2 > 0$
7. Choose True or False
   Statement 1: The rigorous approach through the Lyapunov stability analysis not only analyzes the stability but also used to design the controller. True
8. In order to successfully design the controller in conventional sliding mode control, the sliding variable must have the relative degree.
   a) One
   b) Two
9. Choose True or False
   Statement 2: The first derivative of sliding variable must be a function of control input in order to design the controller in conventional sliding mode control successfully. True
10. The disturbances given in our research study while controlling the SMA actuated active needle are
    a) Disturbance from tissue heterogeneity and cooling
    b) SMA hysteresis and non-linearity
    c) Air blown disturbance to the SMA actuator and Load at the tip
    d) None of the above