07) Let $R_0^1 = R_{z,\theta}$

$$R_0^1 = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

$$\det[R_0^1] = \cos\theta[\cos\theta - 0] - (-\sin\theta)[\sin\theta - 0] + 0$$

$$= \cos^2\theta + \sin^2\theta$$

$$\det[R_0^1] = 1$$

Similarly, we can do this for $R_{y,\theta}$ & $R_{x,\theta}$.

QUESTION 2:

1. SCARA(https://www.youtube.com/watch?v=97KX-j8Onu0&ab_channel=ABBRobotics) - A SCARA robot, which stands for Selective Compliance Assembly Robot Arm, is a type of industrial robot known for its horizontal reach and high precision. SCARA robots have a jointed arm structure which works on RRR configuration.
2. PUMA (https://www.youtube.com/watch?v=aHV5oY7viBM&pp=ygUKUFVNQSByb2JvdA%3D%3D)- The Programmable Universal Machine for Assembly (PUMA) robot is a well-known industrial robot. It's characterized by its articulated arm design with multiple rotational joints which works on articulated configuration(RRR).
3. Atlas: A Humanoid Robot (https://www.youtube.com/watch?v=rVlhMGQgDkY&ab_channel=BostonDynamics)- Advanced humanoid robot ATLAS was created by Boston Dynamics. Known for its stunning bipedal shape, ATLAS has a variety of sensors and advanced control systems that enable it to stay balanced and carry out intricate motions.
4. Dragon Runner: Military Robot (https://www.youtube.com/watch?v=TCAc2pYdaeA&t=60s&pp=ygUdZHJhZ29uIHJ1bm5lciAgbWlsaXRhcnkgcm9ib3Q%3D)- A military robot called the Dragon Runner was created to perform reconnaissance and surveillance duties in difficult terrain.This robot gives situational awareness in circumstances where human presence may be dangerous.
5. ATRO: 3 axis Delta Robots (https://www.youtube.com/watch?v=1CDF0jNTCm4&ab_channel=BeckhoffAutomation)- The ATRO 3-axis delta robot is frequently used in fields including packing, assembly, and pick-and-place activities. It excels at quick, repetitive tasks that increase production efficiency and ensure consistent quality in industrial processes.
6. UAV(https://www.youtube.com/watch?v=IgMKiIEbfN8&ab_channel=MAVLabTUDelft) - Unmanned Aerial Vehicle (UAV) robots, commonly known as drones, are autonomous or remotely operated flying robots designed for various applications.
7. AUV Robots (https://www.youtube.com/watch?v=rril44oN63s&ab_channel=KawasakiGroupChannel) - Autonomous Underwater Vehicle (AUV) robots, also known as underwater drones, are self-propelled vehicles designed for exploration and data collection beneath the water's surface.

Question 3-

AC Motors: There are two types of AC motors-

1. Synchronous: The speed of rotor and stator magnetic field are the same. It requires a 3-phase circuit to be used.
2. Asynchronous: The speed of the rotor and stator are not the same.

DC Motors:

1. Brushed Motors: Brushed motors are electric motors that use a mechanical commutator and brushes to direct the current flow through the motor's windings. When voltage is applied, the commutator switches the direction of current, causing the motor to rotate.
2. Brushless Motor:
    a. BLDC- Brushless direct current (BLDC) motor is an electric motor that doesn't use brushes or a commutator to function. As opposed to brushed motors, it employs electronic controllers to alter the current flow in the motor's windings, resulting in more efficiency and less wear.
    b. Stepper Motor- It works similarly as BLDC but there are steps in the rotation of this motor. The motor rotates by a fixed amount of angle so we can easily calculate the rotation.
3. Servo Motor: Servo motor has precise control that runs on feedback signals. To keep precise control over its rotation, it has a closed-loop control system, sometimes comprising a position or speed sensor.