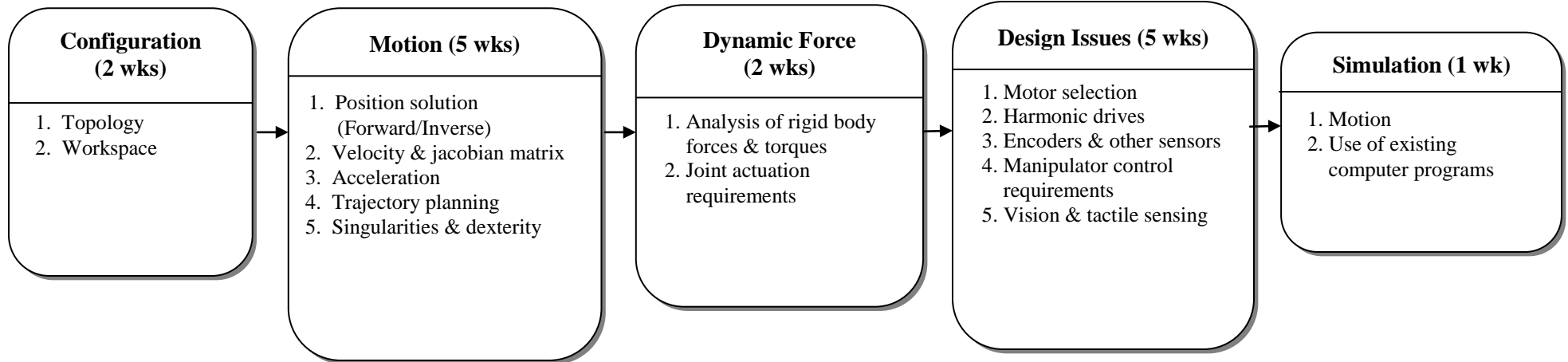## ME 57200
ANALYSIS AND DESIGN
OF ROBOTIC MANIPULATORS

Course Outcomes

1. Analysis of *manipulator motion* and *forces*.
2. *Manipulator design* including actuator, drive, and sensor issues.
3. *Computer simulation* to predict motion and forces.

Configuration (2 wks)

1. Topology
2. Workspace

Motion (5 wks)

1. Position solution (Forward/Inverse)
2. Velocity & jacobian matrix
3. Acceleration
4. Trajectory planning
5. Singularities & dexterity

Dynamic Force (2 wks)

1. Analysis of rigid body forces & torques
2. Joint actuation requirements

Design Issues (5 wks)

1. Motor selection
2. Harmonic drives
3. Encoders & other sensors
4. Manipulator control requirements
5. Vision & tactile sensing

Simulation (1 wk)

1. Motion
2. Use of existing computer programs

Typical Projects

1. Forward position solution for a general manipulator
2. Path planning
3. Modeling and simulation of a manipulator

Revision Date: 7/30/12

1. COURSE NUMBER & NAME: ME 57200 Analysis and Design of Robotic Manipulators	
2. CREDITS AND CONTACT HOURS: 3 credits **a.** Lecture – 3 days per week at 50 minutes for 16 weeks	**6. SPECIFIC GOALS FOR THE COURSE** **a. Course Outcomes:**

2. CREDITS AND CONTACT HOURS: 3 credits
  a. Lecture – 3 days per week at 50 minutes for 16 weeks

3. COURSE COORDINATOR OR INSTRUCTOR:
  R.J. Cipra

4. TEXTBOOK:
  Class Notes

5. SPECIFIC COURSE INFORMATION:

  a. Catalog Description: Introduction to the analysis and design of robotic manipulators. Topics include kinematic configurations, forward and inverse position solution, velocity and acceleration, path planning, workspace analysis, force and torque solutions, rigid body dynamics, motors and actuators, robot design, sensors and controls, computer simulation, and graphical animation. Typically offered in the spring.

  b. Prerequisites:
  ME 35200 – Machine Design I

  c. Status: Elective

6. SPECIFIC GOALS FOR THE COURSE

a. Course Outcomes:

1. Analysis of *manipulator motion* and *forces*.
2. *Manipulator design* including actuator, drive and sensor issues.
3. *Computer simulation* to predict motion and forces.

b. Related ME Program Outcomes:

A1. Engineering Fundamentals;   B3. Prof/Ethical Responsibility;

A2. Analytical Skills;   B4. Contemporary Issues;

A3. Experimental Skills;   B5. Life-Long Learning;

A4. Modern Engr Tools;   C1. Leadership,

A5. Design Skills;   C2. Global Engineering Skills;

A6. Impact of Engr Solns;   C3. Innovation;

B1. Communication Skills;   C4. Entrepreneurship

B2. Teamwork Skills

7. LIST OF TOPICS: See following page.

PREPARED BY: R. J. Cipra   **REVISION DATE:** July 30, 2012