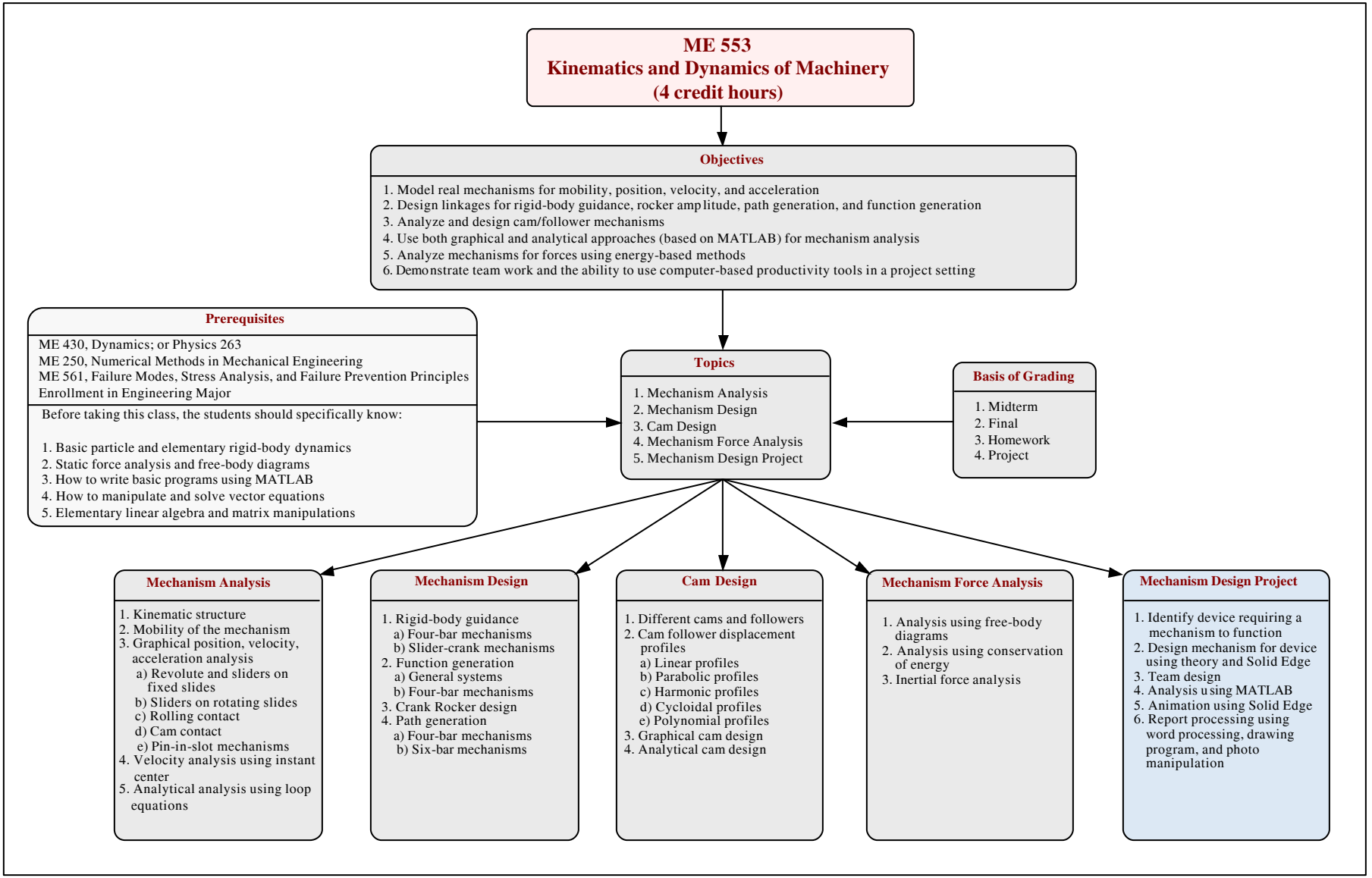
ME 553
Kinematics and Dynamics of Machinery
(4 credit hours)
Objectives
1. Model real mechanisms for mobility, position, velocity, and acceleration
2. Design linkages for rigid-body guidance, rocker amplitude, path generation, and function generation
3. Analyze and design cam/follower mechanisms
4. Use both graphical and analytical approaches (based on MATLAB) for mechanism analysis
5. Analyze mechanisms for forces using energy-based methods
6. Demonstrate team work and the ability to use computer-based productivity tools in a project setting
Prerequisites
ME 430, Dynamics; or Physics 263
ME 250, Numerical Methods in Mechanical Engineering
ME 561, Failure Modes, Stress Analysis, and Failure Prevention Principles
Enrollment in Engineering Major
Before taking this class, the students should specifically know:
1. Basic particle and elementary rigid-body dynamics
2. Static force analysis and free-body diagrams
3. How to write basic programs using MATLAB
4. How to manipulate and solve vector equations
5. Elementary linear algebra and matrix manipulations
Topics
1. Mechanism Analysis
2. Mechanism Design
3. Cam Design
4. Mechanism Force Analysis
5. Mechanism Design Project
Basis of Grading
1. Midterm
2. Final
3. Homework
4. Project
Mechanism Analysis
1. Kinematic structure
2. Mobility of the mechanism
3. Graphical position, velocity, acceleration analysis
a) Revolute and sliders on fixed slides
b) Sliders on rotating slides
c) Rolling contact
d) Cam contact
e) Pin-in-slot mechanisms
4. Velocity analysis using instant center
5. Analytical analysis using loop equations
Mechanism Design
1. Rigid-body guidance
a) Four-bar mechanisms
b) Slider-crank mechanisms
2. Function generation
a) General systems
b) Four-bar mechanisms
3. Crank Rocker design
4. Path generation
a) Four-bar mechanisms
b) Six-bar mechanisms
Cam Design
1. Different cams and followers
2. Cam follower displacement profiles
a) Linear profiles
b) Parabolic profiles
c) Harmonic profiles
d) Cycloidal profiles
e) Polynomial profiles
3. Graphical cam design
4. Analytical cam design
Mechanism Force Analysis
1. Analysis using free-body diagrams
2. Analysis using conservation of energy
3. Inertial force analysis
Mechanism Design Project
1. Identify device requiring a mechanism to function
2. Design mechanism for device using theory and Solid Edge
3. Team design
4. Analysis using MATLAB
5. Animation using Solid Edge
6. Report processing using word processing, drawing program, and photo manipulation