Mechanical and Industrial Engineering Department
ME-738 Computer Aided Engineering **3 Credits**

NJIT New Jersey's Science & Technology University

COURSE OUTLINE

Prerequisites	ME 635 or Department Approval
Instructor	Dr. Swapnil Moon Office: MEC 324 C Phone: 973-596-5670 E-mail: swapnil.moon@njit.edu
Office Hours	Monday 3:00 – 4:00 & By Appointment
Textbook	Instructor's Lecture Notes
Reference	User's Guide of software packages used in the course Computational Fluid Dynamics by T.J. Chung, Cambridge University Press, 2002 ISBN 0-521-59416-2
Course Description	This is a course introducing various concepts of CAD (Computer Aided Design) and CAE (Computer Aided Engineering) as applied to Mechanical Engineering design problems. Topics include modeling, importing various CAD model formats, assembly, and postprocessing the results of analysis, static modal, nonlinear, contact, impact, failure, thermal, and multi-physics analyses, and computational fluid dynamics for design. The laboratory component involves use of current CAD/CAE software packages.
Software Packages:	Creo Parametric and Simulate by PTC Inc. ANSYS by ANSYS Inc.

Grading Scheme

Lab Work, Assignments, and Class exercises	45%
Projects	40%
Final Exam	15%

1. Homework related to the lectures will be assigned, collected, and graded. The laboratory will have hands-on sessions to cover the topics of the course.
2. Generally, late or missed assignments **will not** be accepted except for legitimate **(pre-approved when possible)** reasons as determined by the instructor. **The method of handling late or missed work is determined by the instructor.**
3. Leaving early will be marked as an absence, if due to any issues you are not able to attend the listed class duration please register for a different section.
4. **ANY FORM OF CHEATING ON ASSIGNMENTS OR EXAMS WILL RESULT IN AN 'F' FOR THE COURSE**. This includes looking at another person's exam or copying another person's work for exams or assignments.

5. NJIT honor code will be used for all situations that involve cheating, copying, misrepresentation of student work, and misrepresentation of student information and any violations will be brought to the immediate attention of the Dean of Students **(visit http://www.njit.edu/academics/honorcode.php).**
6. The **project file** for the assignment is required to be submitted to get credit for the assignment. Non submission of the part file will lead to a loss of grade for the assignment.
7. Weekly assignments are due on the first meeting of the class for the week (Monday or the appropriate first day of class for the section) **BEFORE** the start of Lecture. Assignments turned in after the lecture starts are counted as late.
8. **Assignments that are more than 2 weeks late will not be accepted**.
9. Point deduction – Late Assignments: 1-Week-20%, 2-Weeks-30%
10. **At least 60% of the homework assignment must be submitted for a passing grade.**
11. Not attempting the midterm or the final exams will lead to an 'F' in the course.
12. Attendance, attitude, class participation and effort can and will be used to change borderline grades up or down.
13. For special accommodation student must approach the Office of Accessibility Resources and Services (OARS).
14. For issues regarding access to adequate computing equipment, or high-speed internet access, please contact the Office of the Dean of Students.
15. For any modifications or deviations from the syllabus throughout the course of the semester, instructor will consult with students and the students must agree to.

Course Outline: Lectures

Week #	TOPICS COVERED
1	Software package: Creo Parametric and Simulate Introduction to the course - Computer Aided Engineering. • Stress Concentration Problem - Rectangular Plate with Circular Hole • Large Deflection analysis - Nonlinear analysis of plate. • Tractor Suspension - Linear Static and Large Deflection (Nonlinearity) • THERMAL ANALYSIS: A Steel Cooling Spine
2	Software package: Creo Parametric and Simulate • OPTIMIZATION: Structural static analysis with design sensitivity studies and optimization - bracket. • WELD Analysis: Static Analysis of Spot Weld Assembly • OPTIMIZATION: Food Tray Optimization • 3D CONTACT ANALYSIS: Latch Mechanism

3	Software package: Creo Parametric and Simulate • OPTIMIZATION PROJECT: Belt Clip Optimization • Chip Steady State and Transient Thermal Analysis, also Static Analysis – PROJECT. • BUCKLING Analysis: Buckling of Plate with Ribs as Stiffeners. • FATIGUE ANALYSIS: Fatigue Analysis of Piston – PROJECT • STRUCTURAL ANALYSIS: Engine mount
4	Software package: Creo Parametric and Simulate, ANSYS Classic & Workbench • CYCLIC SYMMETRY STUCTURAL ANALYSIS: Impeller Cyclic Symmetry Analysis – PROJECT • NON-LINEAR ANALYSIS: Plate – ANSYS Mechanical APDL (Classic) • STRUCTURAL STATIC ANALYSIS: Airplane engine mounts • STRUCTURAL STATIC ANALYSIS of Pump Assembly
5	Software packages: ANSYS Discovery, ANSYS Classic & Workbench Static Structural • PLASTICITY: Suspension Bracket – PROJECT • STEADY STATE THERMAL- Pump Housing. • NON-LINEAR CONTACT: Spring and Plate Contact Analysis • STEADY STATE, TRANSIENT AND THERMAL STRESS Analysis of Circuit Board • MULTIPHYSICS: CHT Fluid Solid Thermal
6	Software packages: ANSYS Discovery, ANSYS Workbench: Thermal & Contact • CONTACT: Bolted Joint Assembly - PROJECT • FATIGUE: Fatigue Analysis of Connecting Rod • MODAL ANALYSIS (with and without contact): LIDAR Assembly • RADIATION: Steady State Thermal Analysis of a Spot Light Assembly with Radiation
7	Software packages: ANSYS Discovery, ANSYS Workbench: Contact, Fatigue & Vibration • MODAL and HARMONIC Analysis: AC Unit • STEADY STATE AND THERMAL STRESS: Router assembly • RANDOM Vibration: Random Vibration Analysis of Circuit Board -PROJECT • EXPLICIT DYNAMICS IMPACT: High Speed Impact of a Soda Can - PROJECT • EXPLICIT DYNAMICS IMPACT: Oblique Projectile Impact Of A Bullet
8	Software packages: ANSYS Workbench: Vibration, Explicit Dynamic & Thermal Radiation

9	Software packages: ANSYS Workbench: Non-Linear Material and CFD -Fluid Flow CFX • OPTIMIZATION: Cantilever Support Optimization - PROJECTNON-LINEAR • MATERIAL: Non-Linear Contact of an O-Ring – PROJECT • Porous media- Air filter • COMPUTATIONAL FLUID DYNAMICS (CFD): Simulating Flow in a Cyclone • CFD: Flow Through a Butterfly Valve
10	Software packages: ANSYS Workbench Fluid Flow CFX • FLUID STRUCTURE INTERACTION (FSI): Baffled Tank - FSI • CONJUGATE HEAT TRANSFER AND FSI: T – Junction • CFD: Flow over a wind turbine blade • CFD: Turbulent Flow Over a Drone – PROJECT
11	Software packages: ANSYS Workbench Fluid Flow CFX an Fluent • CFD: Turbulent Flow and Heat Exchanger in Mixing Elbow 3D • CFD: Turbulent Flow in a Compact Heat Exchanger • CFD: Turbulent Flow in Wavy Channel – PROJECT • 2D Flow Analysis over Automobile Project
12	Software packages: ANSYS Workbench Fluid Flow Fluent • FSI: Two-Way FSI for a Hyperelastic Flap • CFD: CHT and Thermal Stress Analysis of Exhaust Manifold • Multiphase VOF and Transient Simulation of Tank Flushing
13	Software packages: ANSYS Workbench Fluid Flow Fluent • CFD: Wind Tunnel Simulation of a Sport Car -PROJECT • CFD: Centrifugal Blower - PROJECT
14	Software packages: ANSYS Workbench Fluid Flow Fluent Review