<table>
<tr><td>COURSE NUMBER</td><td>ME 425</td></tr>
<tr><td>COURSE TITLE</td><td>Finite Element Method in Mechanical Engineering</td></tr>
<tr><td>COURSE STRUCTURE</td><td>(3-0-3) (lecture hr/wk - lab hr/wk – course credits)</td></tr>
<tr><td>COURSE COORDINATOR</td><td>Rong-Yaw Chen</td></tr>
<tr><td>COURSE DESCRIPTION</td><td>Introduction to central ideas underlying the finite element method in mechanical engineering and its computer implementation. Fundamental concepts such as interpolation functions for one- and two –dimensional elements, bar element method, Galerkin’s method, discretization of a model, methods of assembling global matrices, and the final solution techniques for obtaining nodal values. Specific applications to mechanical engineering problems in trusses, beams, torsion, heat transfer, fluid flow, plane stress, and plane strain.</td></tr>
<tr><td>PREREQUISITE(S)</td><td>CIS 101 – Computer Programming and Problem Solving
Math 222 – Differential Equations
MECH 237 Strength of Materials</td></tr>
<tr><td>REQUIRED ELECTIVE, ELECTIVE</td><td>Elective</td></tr>
<tr><td>COREQUISITE(S)</td><td>None</td></tr>
<tr><td>REQUIRED MATERIALS</td><td>Introduction to Finite Element Analysis and Design
By Nam-Ho Kim and Bhavani V. Sankar
Publisher: John Wiley & Sons, Inc. 2009</td></tr>
<tr><td>Other supplemental materials</td><td>Hand out lecture note with examples</td></tr>
<tr><td>COMPUTER USAGE</td><td>ANSYS software is used to solve projects.</td></tr>
<tr><td>COURSE LEARNING OUTCOMES/ EXPECTED PERFORMANCE CRITERIA:</td><td>
<table>
<tr><th>Course Learning Outcomes</th><th>SOs*</th><th>Expected Performance Criteria</th></tr>
<tr><td>1 derive 1-D element matrix equation for bar under tension and heat transfer type problem</td><td>a,e,g,k</td><td>Homework (80% o the students will earn a grade of 70% or better)</td></tr>
<tr><td>2. apply the steps required for FEM solution to variety of physical systems and obtain engineering design quantities</td><td>a,b,c,d,e, f,k</td><td>Homework, Project (80% o the students will earn a grade of 75% or better)</td></tr>
<tr><td>3. use existing software (available from ME CAD room) such as ANSYS to work on projects</td><td>a,b,c,e,g,i ,k</td><td>Project (80% o the students will earn a grade of 70% or better)</td></tr>
<tr><td>4. select engineering design quantities (force, stress or heat flux) for truss, beam, plane stress or heat transfer problems</td><td>a,b,c,e,h, k</td><td>Homework, Project (80% o the students will earn a grade of 70% or better)</td></tr>
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<tr><td>CLASS TOPICS</td><td>1. Introduction, spring and bar elements, element and global matrix equations, solution.
2. Interpolation functions, potential energy, residual integral.</td></tr>
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	3. Matrix algebra. 4. Truss element formulation, element stiffness, assembled and condensed matrices. 5. ANSYS – truss structure. 6. Heat transfer in a fin, axial deformation of a bar using 3-node element. 7. Beam and Frame elements, Hermite Interp. Functions. 8. ANSYS – frame structure. 9. Gaussian quadrature. 10. 2-D elements, triangular and rectangular elements, isoparametric transformation. 11. ANSYS – 2-D heat transfer. 12. Potential flow and torsion of a solid bar. 13. Plane elastic problems. 14. 1-D time dependent problems. 15. ANSYS – plane stress analysis.
STUDENT OUTCOMES (SCALE: 1-3)	a b c d e f g h i j k 3 2 3 1 3 1 3 1 2 1 2 3 – Strongly supported 2 – Supported 1 – Minimally supported

* Student Outcomes