Kingdom of Saudi Arabia Ministry of Higher Education **Qassim University** College of Engineering		**المملكة العربية السعودية** وزارة التعليم العالي **جامعة القصيم** **كليه الهندسه**

Advanced Mechanics of Materials

College: **College of Engineering (Qassim University)**

Department: **Mechanical Engineering Department**

First: Course Definition

1- Course Code: **ME 632**

2- Units: 3 credit hrs

3– Semester:

4 -Prerequisite:ME 351
(This course covers advanced subjects in mechanics of materials. A first course in mechanics of material such as ME 351 or similar to it is required before attempting this course)

5- Co-requisite: **None**

6- Location (if not on main Campus):

Second: Course Objectives

1) To give students an understanding of solution techniques to obtain useful approximations to solid mechanics problems as opposed to approximation techniques such as finite element analysis and other computer solutions.

2) To give students an understanding of the applicability of these approximations to mechanics of material problems in design as well as their reliability in design.

3) To make students familiar with common failure mechanisms, familiar with procedures to conduct analysis for potential failures in design and familiar with procedures to obtain designs that are reasonably safe.

Third: Course Specifications

1-Topics to be covered

Subject	No of Weeks	Units
1) Theories of stress & Strain -Stress at a point, Notation -Stress transformation, principle stress, Plane stress, Mohrs Circle 2D, 3D. -Stain theory, transformation, principle strain -Small displacement theory	**2**	**6**
2) Stress-Strain-Temperature Relations -Hooke's law: anisotropic, isotropic elasticity. -Equ. of thermo-elasticity (isotropic material)	**1**	**3**
3) Failure Theories (Inelastic material behavior) - Yield criteria - Yield of Ductile metals - Alternative yield criteria	**1**	**3**
4) Energy Methods - Catigliano's theorem on deflection. - Deflection of statically determinate structures - Statically indeterminate structures	**2**	**6**
5) Torsion - Intro: Circular cross-section - Noncircular cross-section	**2**	**6**
6) Bending of Straight Beams - Symmetrical bending - Nonsymmetrical bending - Deflection	**2**	**6**
7) Shear Center for Thin-Wall Beam Cross-sections	**1**	**3**
8) Bending of Curved Beams	**1**	**3**
9) Thick-Wall Cylinder	**2**	**6**
10) Stress Concentrations	**1**	**3**

2- Course components (Total hrs in the Semester)

Lecture	Exercise or lab	Other
45	**--**	

3- Intended Learning Outcomes of the Course (ILO's)

a. *Knowledge*

i) Description of the knowledge to be acquired:

- Defined important terms associated with the course (e.g. Stress, strain, principle stress, principle strain, multi-axial state of stress, elasticity, yielding, anisotropic, isotropic, strain energy, shear center etc.)
- Recall the various failure criterions and their appropriate application
- List the various assumptions associated with the derived equations

ii) Teaching strategies to be used to develop that knowledge

- Lectures
- Class discussions
- Reading assignments and research (internet or books)

iii) Methods of assessment of knowledge acquired

-Home assignments

- Quizzes
- Exams

b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

-Discuss the usefulness and limitation of the derived formulae for real life problems

- Conduct stress analysis on a component with the aid of calculators as well as conduct failure analysis to determine the safety of a structure.
- Transformation of a physical problem into a mathematical problem to enable estimations of stress as well as safety assessment.
- Combining strength of material analysis together with failure theory in order to design a safe structure.

ii) Teaching strategies to be used to develop these cognitive skills

- Lectures
- Case studies
- Class discussions
- Reading and research assignments

iii) Methods of assessment of students cognitive skills

-Home assignments

- Quizzes
- Exams

- **Projects**

c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be developed

-Team work
- **Sharing of ideas with colleagues**
- **Time management**
- **Keeping of deadlines**

ii) Teaching strategies to be used to develop these skills

- **Class discussions**
- **Team projects**
- **Home assignments**

iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

-Peer-peer assessments in projects
- **Project (with specified and enforced deadlines)**
- **Home assignments (with specified and enforced deadlines)**

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

-Conveying ideas in a clear manner
- **Report writing**
- **Use of internet**
-

ii) Teaching strategies to be used to develop these skills

-Class discussion
- **Home assignments**
- **Project assignments**
-

iii) Methods of assessment of students numerical and communication skills

-Project reports
- 10-15 min presentations
-

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required
-N/A

ii) Teaching strategies to be used to develop these skills-
- N/A

iii) Methods of assessment of student's psychomotor skills
-N/A

4- Student Assessment Schedule

Serial	*Assessment tool (test, group project, examination etc.)*	*Week due*	*Weight (%)*
1	Homework	Every 2 weeks	5
2	Quizzes	Distributed Through Semester	10
3	Midterm 1	6	15
4	Midterm 2	12	15
5	Project report	15	3
6	Attendance and Class Participation	1-15	2
7	Final Exam	16-18	50
Total			100

5- Student Support

Office hours: 4hrs a week

6- Learning Resources

i) Essential Books (References)

- **Arthur P. Boresi and Richard J. Schmidt Advanced Mechanics of Materials, 6th Ed., Wiley, 2002**

ii) Course Notes

- **Notes provided by instructor as needed**

iii) Recommended Books

-Robert Cook and Warren Young, Advanced Mechanics of Materials, 2nd Ed., Prentice Hall, 1998.

iv)Electronic Books & Web Sites:

-Course website (Course material, recommended articles, homework, project details, announcements etc)

v) Periodicals

- ----------

7-Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- **Student questioners at the end of the course (input about course for future improvement)**
- **Instructors solicitation of anonymous feedback (instructors effort to improve current course on minor issues)**

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- **Use of anonymousquestioners at the end of the semester to assess the instructor**

iii) Processes for Improvement of Teaching

- **Acting on the results of the surveys and questioners**
- **Staying up-to-date with new teaching strategies and teaching technologies such as the smart board**
- **Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.**

iv) Processes for verifying standards of student achievement (e.g. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)

-Check marking of a sample of student work by an independent faculty member

- **Annual statistical analysis of students performance and education progress (detailed in the annual report)**

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

-Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university)

- **Consequently, actions are to be taken to improve the course delivery when necessary**
- **Review of the course objectives, outcomes and curriculum periodically**