# Course Specifications

| | |
|---|---|
| **Course Title:** | **Mechanics of Materials** |
| **Course Code:** | **ME 232** |
| **Program:** | **B.Sc. Mechanical and Industrial Engineering** |
| **Department:** | **Mechanical and Industrial Engineering** |
| **College:** | **Engineering** |
| **Institution:** | **Majmaah University** |

## Table of Contents

## A. Course Identification

| | |
|---|---|
| **1. Credit hours:** | 3(3,1,0) |
| **2. Course type** | |
| **a.** | University [x] College [x] Department [√] Others [x] |
| **b.** | Required [√] Elective [x] |
| **3. Level/year at which this course is offered:** | Level 6th / 6th<br>1440-1441H (2019-2020) First Semester |
| **4. Pre-requisites for this course** (if any)**:** | ME 251 |
| **5. Co-requisites for this course** (if any)**:** | NA |

**6. Mode of Instruction** (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | **Traditional classroom** | 60 | 80 |
| 2 | **Blended** | 05 | 10 |
| 3 | **E-learning** | 05 | 10 |
| 4 | **Correspondence** | 0 | -- |
| 5 | **Other** | 0 | -- |

**7. Actual Learning Hours** (based on academic semester)

| No | Activity | Learning Hours |
|---|---|---|
| **Contact Hours** | | |
| 1 | **Lecture** | 45 |
| 2 | **Laboratory/Studio** | 0 |
| 3 | **Tutorial** | 15 |
| 4 | **Others** (specify) | 0 |
| | **Total** | 60 |
| **Other Learning Hours*** | | |
| 1 | **Study** | 20 |
| 2 | **Assignments** | 20 |
| 3 | **Library** | - |
| 4 | **Projects/Research Essays/Theses** | - |
| 5 | **Others** (specify) | - |
| | **Total** | 40 |

***** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

## B. Course Objectives and Learning Outcomes

### 1. Course Description

Types of loads and stresses. Mechanical behavior of materials. Shearing forces and bending moment diagrams. Shearing stresses in beams. Stresses in compound bars. Bending stresses and deflection. Torsion of bars. Principal stresses, and Mohr's circle. 3-Dimensional stresses. Principal strains and Mohr's circles of strain. Stress-strain relations. Strain energy. Yield criteria. Thin and thick cylinders, fatigue analysis. Lab work.

### 2. Course Main Objective

- Understand Load types, Deformation shapes, Stress and strain, and Material properties,
- Understand; the relations between the loads applied to a body of a given material and the resulting deformation of that body,
- Understand; the relations between the loads applied to a body and the stresses produced in that body,
- Be able to find the required dimensions of a number of specified materials to carry a given load subjected to stated specification of stress and deflection.
- Acquisition of knowledge by learning new theories, concepts, and analytical procedures in basic mechanics of material.
- Cognitive skills through thinking and problem solving.
- Numerical skills through application of knowledge in basic mathematics.
- Student becomes responsible for their own learning through solutions of assignments and time management.

### 3. Course Learning Outcomes

| CLOs | | Aligned PLOs |
|---|---|---|
| 1 | **Knowledge:** | |
| 1.1 | To learn about the types of stress, strain, and load | a(d1) |
| 1.2 | To develop the skills of idealization of Stress and shaft design, | a(d1) |
| 1.3 | Make a full design for beam, | a(d1) |
| 1.4 | Draw bending moment and normal diagrams for shaft and beams, | a(d1) |
| 1.5 | Drawing the stress distribution on the thick cylinder (radial, hoop, and tangential stress), | a(d1) |
| **2** | **Skills :** | |
| 2.1 | Thinking through problems solving, reasoning for each problem solved, | b(b1) |
| 2.2 | Remembering equations and principles, | k(d3) |
| 2.3 | Reasoning in solving a problem step by step. | k(d3) |
| **3** | **Competence:** | |
| 3.1 | Mathematical skills, | a(d1) |
| 3.2 | Asking students to solve problems and explaining to the class the steps and summarize the problem | b(b1) |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | Types of loads and stresses, Mechanical behavior of materials. | 4 |
| 2 | Stresses in compound bars. | 4 |
| 3 | Shearing forces and bending moment diagrams. | 8 |

| | | |
|---|---|---|
| 4 | Shearing stresses in beams. | 4 |
| 5 | Bending stresses in beams | 4 |
| 6 | Principal stresses, and Mohr's circle. | 8 |
| 7 | Stress-strain relations and Yield criteria | 8 |
| 8 | Transformations of stress and strain | 8 |
| 9 | Thin and thick cylinders, | 8 |
| 10 | Deflection of Beams | 4 |
| **Total** | | 60 |

## D. Teaching and Assessment

### 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge** | | |
| 1.1 | To learn about the types of stress, strain, and load | Course delivery by citing real life examples and problems, | Regularly asking questions on different topics and concepts, |
| 1.2 | To develop the skills of idealization of Stress and shaft design, | Emphasis on understanding concepts and illustrating applications to problems, | Interactive problem solving with students, |
| 1.3 | Make a full design for beam, | Solving problems through assignments on each topic, | Placing before the class mind provoking and thinking questions, |
| 1.4 | Draw bending moment and normal diagrams for shaft and beams, | Background materials from the books are provided, | Assignment problems, Exercise / tutorial problems for applications that will force the students to think and apply the knowledge gained, |
| 1.5 | Drawing the stress distribution on the thick cylinder (radial, hoop, and tangential stress), | Extensive interaction with students. | Mid-term and End-semester tests that will force the student to think and apply the knowledge. |
| **2.0** | **Skills** | | |
| 2.1 | Thinking through problems solving, reasoning for each problem solved, | Explaining principles and concepts through real life problems, | Asking students to solve the problem in class, |
| 2.2 | Remembering equations and principles, | Interactive problem solving with students, | Setting assignment problems which will apply principles and concepts, |
| 2.3 | Reasoning in solving a problem step | Asking a student to | Problems in Quiz, |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| | by step. | explain the steps adopted in the problem in Arabic-Summarize, | Mid Term Test and End semester tests which will compel the student to think and apply concepts and principles learnt. |
| **3.0** | **Competence** | | |
| 3.1 | Mathematical skills, | Tutorials review the content of each lecture. Assignments require use of reference textbook from library and websites from internet. | There will be no. of quizzes, homeworks, two midterm examination and one final examination. Examinations are comprehensive, including subjects from all assigned readings, lectures, and classroom demonstrations. Quizzes and homeworks on completion of each topic to measure knowledge items. Tools are Mid Term Exam 1 to measure Knowledge and understanding, Mid Term Exam 2 to measure Knowledge and understanding, Final Exam to measure Knowledge and understanding and Quizzes and Homework to measure Knowledge and understanding. |
| 3.2 | Asking students to solve problems and explaining to the class the steps and summarize the problem in Arabic. | Introductory lecture gives an overview of the content and methods of assessment. | Attendance of lectures and tutorials is a most. |

### 2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| 1 | First Major Exam | 6th week | 20 % |
| 2 | Second Major Exam | 12th week | 20 % |
| 3 | Final Exam | Final exam week | 40 % |
| 4 | Quiz | Continuous | 10 % |
| 5 | Homework assignments | Continuous | 10 % |

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

## E. Student Academic Counseling and Support

**Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :**

Sun. 08.00:09.50,
Mon. 08.00:08.50,
Mon. 09.00:09.50

## F. Learning Resources and Facilities

### 1. Learning Resources

| | |
|---|---|
| **Required Textbooks** | • Mechanics of Materials 6th Beer Johnston (2012)<br>• Mechanics of Materials 7E Hibbler (2006)<br>• Mechanics of Materials 2nd Ed Andrew Pytel (2012)<br>• Handout |
| **Essential References Materials** | • F.P. Beer and E.R. Johnston, "Mechanics of Materials," 5th ed, McGraw-Hill, 2006.<br>• Engineering Fracture Mechanics<br>• Journal of Materials Design and Applications<br>• International Journal of Fracture |
| **Electronic Materials** | Sufficiently of Material available on the net. |
| **Other Learning Materials** | Handouts |

### 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation**<br>(Classrooms, laboratories, demonstration rooms/labs, etc.) | • Lecture room<br>• C03 (Sunday)<br>• A01 (Tuesday) |
| **Technology Resources**<br>(AV, data show, Smart Board, software, etc.) | • Computer and internet<br>• Data show,<br>• Smart board |
| **Other Resources**<br>(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | None |

## G. Course Quality Evaluation

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|---|---|---|
| Effectiveness of Teaching | Students | Indirect Assessment |
| CLOs achievement | Faculty | Direct/Indirect Assessment |
| Learning Resources | Students | Indirect Assessment |
| Course Contents | Students | Indirect Assessment |

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
**Assessment Methods** (Direct, Indirect)

## H. Specification Approval Data

| | |
|---|---|
| **Council / Committee** | Department Council |
| **Reference No.** | 1/34/9767 |
| **Date** | 25/02/1441 H |