1. **Course number and name**
   
   ENGR 441: Fundamentals of Composite Materials

2. **Credits and contact hours**
   
   3 credit hours: two 75-minute lecture sessions/week

3. **Instructor’s or course coordinator’s name**
   
   Instructor: Kwok Siong Teh, Associate Professor of Mechanical Engineering
   
   Course coordinator: Kwok Siong Teh, Associate Professor of Mechanical Engineering

4. **Text book, title, author, and year**
   
   (No textbook)

   a. **other supplemental materials**
      
      (none)

5. **Specific course information**
   
   a. **brief description of the content of the course (catalog description)**
      

   b. **prerequisites or co-requisites**
      

   c. **indicate whether a required, elective, or selected elective course in the program**
      
      Upper Division Technical Elective for Civil Engineering and Mechanical Engineering

6. **Specific goals for the course**
   
   a. **specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**
      
      • The student will demonstrate an ability to describe and solve problems on atomic arrangements, geometry of imperfections, and atomic diffusion in solids.
      
      • The student will demonstrate an ability to describe and solve problems on mechanical and electrical behavior of materials.
      
      • The student will demonstrate an ability to submit homework solutions in proper engineering format.
      
      • The student will demonstrate an ability to describe and solve problems on the distinguishing properties of metals, plastics and ceramics.
      
      • The student will demonstrate a familiarity with the effects of thermal, mechanical, and chemical treatments on properties.
      
      • The student will demonstrate an ability to experimentally determine mechanical and electrical properties of materials.
The student will demonstrate an ability to make oral presentations and write a technical report.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Course addresses ABET Student Outcome(s): a, b, c, d, e, g, h, i, j, k.

7. Brief list of topics to be covered

- Introduction to composites: nomenclature, definitions, advantages, applications.
- Fiber Materials (polymer, metal, ceramic, carbon)
- Matrix Materials (polymer, metal, ceramic, carbon)
- Stress-Strain Tensors and Transformation
- Long Fiber-Reinforced Lamina: Mechanical Properties
- Long Fiber-Reinforced Laminate Plate Theory and Design
- Strength Theories
- Manufacturing Processes
- Test Methods
- Aligned and Non-Aligned Short Fiber-Reinforced Composites
- Failure Modes - Fracture, Fatigue, Delamination
- Thermomechanical Properties
- Sandwich Panels
- Particle-Reinforced Composites
- Metal and Ceramic Matrix Composites
- Nanocomposites
- Case Studies and Applications