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)

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

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

   h. **prerequisites or co-requisites**  
      Math 245: Elementary Differential Equations & Linear Algebra, and  
      Engr 309: Mechanics of Solids

   i. **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**  
   g. **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.

h. 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