1. Effective Semester: Fall 2016

2. College: Science and Engineering
3. Department/School/Program: Ingram School of Engineering

4. Prefix/Subject Number
   M F G E 5 3 9 8 B

5. Course Title:
   Proposed Long Advanced Composite Materials
   Abbreviated (18 characters only including spaces) ADV COM PO MAT L

6. Course Description (complete sentences in 50 words or less): This course examines various aspects of fiber-reinforced polymeric composites. The topics covered include constituent materials (fibers and matrices), mechanics, performance, manufacturing, and introduction to nanocomposites. This course also provides introductory treatments concerning ceramic matrix composites, metal matrix composites, and carbon/carbon composites.

7. Prerequisites (Including Minimum Grade Required): Instructor's approval

8. Co-Requisites (Including Concurrent Enrollment Allowed):

9. Restrictions: Graduate classification; Restricted to students enrolled in MS Engineering, MS Physics, MS Mathematics, MS Computer Science, or MS Technology Management.
**10. Course Data**

<table>
<thead>
<tr>
<th>Instruction Type</th>
<th>Lecture Contact Hours</th>
<th>Lab Contact Hours</th>
<th>Credit Hours</th>
<th>Repeatable for Credit?</th>
<th>Maximum Credit Hours Allowed</th>
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</thead>
<tbody>
<tr>
<td>1-Lecture</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>Yes</td>
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<td>2-Lab</td>
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<td>No</td>
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<td>3-Practicum/Intmshp/Student Teaching</td>
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<td>4-Seminar</td>
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<td>5-Independent Study</td>
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<td>6-Private Lesson</td>
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<td>8-Thesis</td>
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<td>9-Dissertation</td>
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<td>0-Individualized</td>
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<td>C-Clinical</td>
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**Writing Intensive?**
- Yes [ ]
- No [X]

**Topics Course?**
- Yes [X]
- No [ ]

**Valid Grade Mode**
(choose only one)
- Standard Letter [X]
- Credit/ No Credit [ ]
- Leveling/Assistantships/ESL [ ]
- Developmental [ ]

**Course Equivalency(s)**
(Prefix and Number)
- None

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**11. Justification for the course action:**

Degree: Master of Science  
Major: Engineering

Minor: Certificate:

Explain why the new course is needed in the curriculum and how this course may or may not affect the above degree/major/minor/certificate program. If necessary please submit the appropriate Program Addition or Change Form along with this Course Addition Form. Engineering graduate students interested in Manufacturing Engineering and Materials require strong background in advanced composite materials - mechanics, performance and design for modern industrial applications.
12. Course Goals and Objectives:
- Must be specific and unique to each course.
- Must be stated in measurable terms.
- Must have distinct differences between a graduate level course and an undergraduate course (in case of stacked courses).
- Please refer to Bloom's Taxonomy of Measurable Verbs.

**Goals:** Students will have good understanding of different aspects of fiber-reinforced polymeric composites such as constituent materials, mechanics, performance, manufacturing, and design. Students will have an appreciation of vast applications of polymer matrix composites, ceramic matrix composites, metal matrix composites, and carbon/carbon composites in electronics, bio-medical, aerospace, sports, auto, and construction industries.

**Objectives:**
- Compare performance of different fiber reinforcements such as carbon, glass, aramid, and natural fibers.
- Evaluate advantages and disadvantages of different thermoplastics and thermoset polymers as matrix materials.
- Analyze mechanical, thermal, fire, electrical, and morphological properties of fiber-reinforced composites.
- Demonstrate fundamental understanding of basics of mechanics of composites.
- Demonstrate understanding of design methodologies of composites.
- Work in teams to design and conduct experiments and interpret the results.

13. Description of Instructional Methodologies:
- Examples include lecture, discussions, group projects, role playing, simulations, modeling, field-based activities, writing, cooperative learning, inquiry, experimentation, product design, creative activities, case studies, seminars, internship activities, coaching, etc.
- Lectures, Discussions, Group Research Project, and Experimentation in Lab.

14. Assessment of Student Learning:
- Examples include tests, projects, presentations, performances, creative works, papers, etc.
- Above examples of assessment must include percentages of total grade assigned.
- Must have distinct differences between a graduate level course and an undergraduate course (in case of stacked courses).

Homework (20%), Exam (40%) and Project (technical report and oral presentation) (40%)
15. Course Outline:
   - Provide a weekly outline as appropriate for an example semester in which the course will be taught.
   - Must distinguish the course clearly from similar offerings in the same or other programs.
   - Must indicate specific topics.

<table>
<thead>
<tr>
<th>Week 1: Introduction, general characteristics, applications, and material selection</th>
<th>Week 9: Manufacturing of composites</th>
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<tbody>
<tr>
<td>Week 2: Constituent materials - I</td>
<td>Week 10: Laminate design considerations</td>
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<tr>
<td>Week 3: Constituent materials - II</td>
<td>Week 11: Design examples</td>
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<tr>
<td>Week 4: Micromechanics of composite materials</td>
<td>Week 12: Metal matrix composites</td>
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<tr>
<td>Week 5: Mechanics of laminated composites</td>
<td>Week 13: Ceramic matrix composites</td>
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<tr>
<td>Week 6: Static mechanical properties</td>
<td>Week 14: Carbon/carbon composites</td>
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<td>Week 7: Fatigue, impact, and fracture properties</td>
<td>Week 15: Nanocomposites</td>
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<td>Week 8: Other properties such as electrical, thermal, and fire</td>
<td>Week 16 (Finals Week): Group project presentations</td>
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</tbody>
</table>

16. Suggested Textbook(s) and Other Learning Resources:
   - Must list the required and recommended (if any) resources (e.g., relevant textbooks, course packets, websites), with complete bibliographical data (author, title, date and other publication data) in a standard academic format (e.g., CBE, APA, MLA, Chicago, etc.)

17. Bibliography:
- Must include literature other than required textbooks and other learning resources.
- Must demonstrate familiarity with current research. Ordinarily, the bibliography should include scholarship published during the last five years.
- Must conform to a standard academic format (e.g., CBE, APA, MLA, Chicago, etc.) Each bibliography will use only one format.


18. Approvals:

[Signatures and dates]

Date

Date

Date

Date