REGULAR COURSE SYLLABUS

College of: Professional Studies
Department: Engineering Technology
Prefix & Course Number: IND 3260  Crosslisted With*: MET 3260
Course Title: Direct Digital Manufacturing
Banner Course Title (30 characters): Direct Digital Manufacturing

Check All That Apply:  Required for Major: _____  Required for Minor: _____  Specified Elective: _____
Required for Concentration: _____  Elective: X  Service Course: _____

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

**Federal Credit Hour Definition:** A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:

1. One hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or
2. At least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward the award of credit hours. 34CFR 600.2 (11/1/2010)

Credit Hours: 3 (2+2)

Face-to-Face or Equivalent Hours per course:
Lecture 30  Lab 30  Internship _____  Practicum _____  Other (please specify type and hours): _____

Additional Student Work Hours per course: 90

Schedule Type: L  Grade Mode: L

Variable topics umbrella course: No X  Yes _____  If yes, number of credits/repeats allowed _____

Specified repeatable course: No X  Yes _____  If yes, number of credits/repeats allowed _____

Prerequisite(s): MET 1210 or IND 3660 with grades of "C" or better
Corequisite(s): _____
Prerequisite(s) or Corequisite(s): _____

APPROVED:

Department Chair OR Program Director  Date

Dean OR Associate Dean  Date

Associate VP, Academic and Student Affairs  Date

*If crosslisted, attach completed Course Crosslisting Agreement Form
Prefix and Course Number: IND 3260

Banner Enforced Coding:
Prerequisite(s): IND 3660 or MET 1210 with grades of “C” or better
Corequisite(s): —
Prerequisite(s) or Corequisite(s): —

Registration restrictions: Level ___ Class ___ Program/Major ___ Student attribute ___

Catalog Course Description:

In this combination lab lecture course, students explore the latest applications of digital 3D scanning and direct digital manufacturing. Through this course, students are introduced to current developments and the critical challenges of digital 3D technologies. Emphasis is placed on practical experience in utilizing departmental equipment to produce digital 3D files and output them to appropriate direct digital manufacturing equipment. Students will apply knowledge of 3D scanners for reverse engineering and direct digital manufacturing purposes.

Specific Variable Topics Course Description (if applicable, umbrella course description included above

Required Reading and Other Materials will be equivalent to:

Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student should be able to:
1. Analyze the strengths and weaknesses of different 3D manufacturing techniques
2. Evaluate and select appropriate 3D manufacturing technologies for specific applications.
3. Demonstrate proficiency in the use of product scanning technologies
4. Develop clean digital 3D files of product designs
5. Create the design of an object suitable for additive manufacturing processes.
6. Effectively output digital files to 3D manufacturing equipment

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision):

I. Introduction to 3D Scanning Technologies
   A. Contact
   B. Non-contact active
      1. Time-of-flight
      2. Triangulation
      3. Conoscopic holography
      4. Hand-held laser scanners
      5. Structured light
      6. Modulated light
      7. Computer Tomography (CT), Microtomography, and Magnetic Resonance Imaging (MRI)
   C. Non-contact passive
   D. User assisted (image-based modeling)
II. Introduction to Direct Digital Manufacturing Technologies
   A. Stereolithography (SLA)
   B. Selective Laser Sintering (SLS)
   C. Fused Deposition Modeling (FDM)
   D. “3DP” and printed liquid binders
   E. Printed polymers
   F. Computer Numerical Control (CNC) machining
III. Modeling Techniques for 3D Output
IV. Design for Direct Digital Manufacturing
   A. Design for manufacturing and assembly
   B. Design tools
   C. Production planning and control
V. Post-processing of Direct Digital Manufactured Components
   A. Surface texture improvement
   B. Property enhancements
   C. Cost estimation
   D. Applications

Evaluation of Student Performance:
1. Quizzes
2. Exams
3. Project deliverables
This is to confirm that the undersigned have met, discussed, and agreed that the following course be crosslisted as follows:

### Original/Standing Course:

<table>
<thead>
<tr>
<th>Prefix</th>
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<th>Course Title</th>
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<tbody>
<tr>
<td>MET</td>
<td>3260</td>
<td>Direct Digital Manufacturing</td>
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</table>

**PRIMARY COURSE OWNER (Dept.):** MET

### Course to be crosslisted with (one or more courses):

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Beginning Fall 2015 (semester and year).

### Approvals:

- **Department Chair OR Institute Director:**
  - Date: 8/31/14

- **Department Chair OR Program Director:**
  - Date: 9/29/14

- **Dean OR Associate Dean:**
  - Date: 12/18/14

Please forward the completed form to the Office of Academic and Student Affairs for processing (SSB 330, Box 48). It will remain in force until rescinded by one of the parties using the Crosslisting Termination Form.