### 1. Effective Semester: Fall 2016

### 2. College: Science & Engineering

### 3. Department/School/Program: Ingram School of Engineering

### 4. Prefix/Subject Number

<table>
<thead>
<tr>
<th>Prefix/Subject</th>
<th>Number</th>
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<tbody>
<tr>
<td>EE</td>
<td>5398C</td>
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</table>

### 5. Course Title:

<table>
<thead>
<tr>
<th>Proposed Long</th>
<th>Multimedia Signal Processing</th>
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<tbody>
<tr>
<td>Abbreviated (18 characters only including spaces)</td>
<td>MULTIMEDIA SIGPRC</td>
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### 6. Course Description (complete sentences in 50 words or less):

This course covers theory and applications of digital signal processing to multimedia signals, including speech, audio, image, and video. Key concepts and algorithms are discussed first, followed by a review of relevant industry standards. Hardware architectures and real-time implementation concepts appropriate for multimedia signals are also included.

### 7. Prerequisites (Including Minimum Grade Required):

EE 3370 and either EE 4377 or EE 4323; or Instructor’s approval

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

None

### 9. Restrictions: 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>
</tr>
</thead>
<tbody>
<tr>
<td>1-Lecture</td>
<td>X</td>
<td>3</td>
<td>3</td>
<td>Yes</td>
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<td>2-Lab</td>
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<td>3-Practicum/Internship/Student Teaching</td>
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<td>No</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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<tr>
<td>8-Thesis</td>
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<tr>
<td>9-Dissertation</td>
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<tr>
<td>0-Individualized</td>
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<tr>
<td>C-Clinical</td>
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</table>

Writing Intensive? | Topics Course?
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Yes | Yes
No | No

Valid Grade Mode (choose only one)
(See PPS 4.07 for definitions.)
- Standard Letter
- Credit/ No Credit
- Leveling/Assistantships/ESL
- Developmental

Course Equivalency(s)
(Prefix and Number)
None

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.

This course prepares students in multimedia signal processing, an area that is key to continuing technological advancements in consumer and industry applications. It provides necessary background in constituent multimedia technologies including speech, audio, image, and video, thereby offering students an opportunity to select one of these areas for their Master's thesis or project.
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.

- Introduce students to theory and applications of digital signal processing to multimedia technologies.
- Provide technical background in each of the multimedia technologies, including speech, audio, image, and video.
- Provide an overview of industry standards in speech, audio, image, and video coding.
- Provide necessary background for students enabling them to select a thesis or project in one of the media technologies.
- Enable students to understand real-time hardware development using architectures including FPGA and DSP for multimedia systems.

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.

- Lecture: Two sessions of 80 minutes each weekly
- Lab practices will be performed during lecture class hours. Lab practices will include the use of computer software and hardware tools including Matlab and Xilinx FPGA, general purpose programming languages including C and C++, and HDL languages including Verilog.
- Homework, quizzes, tests, class project, and final exam.

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).

Assessment will be performed by the course instructor. The course grade will depend upon performance in tests and quizzes (60%), homework and lab practices (15%), and class project (25%). The final letter grade will be determined by the student's raw score as well as by the performance of the class (class average and standard deviation) as a whole. Additionally, attendance policies may have an impact on the letter grade.
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: Review of Digital Signal Processing and MATLAB basics</th>
<th>Week 9: Image processing basics</th>
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<tbody>
<tr>
<td>Week 2: Hardware architectures and real-time implementation basics</td>
<td>Week 10: Video processing basics</td>
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<tr>
<td>Week 3: Speech processing basics including models of speech production and speech analysis methods</td>
<td>Week 11: Industry standards in image and video coding</td>
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<td>Week 4: Speech coding algorithms and speech quality evaluation</td>
<td>Week 12: FPGA, DSP, and other tools for multimedia</td>
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<td>Week 5: Industry standards in speech coding</td>
<td>Week 13: Multimedia hardware implementation and code development</td>
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<td>Week 6: Speech and speaker recognition</td>
<td>Week 14: Real-time implementation</td>
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<tr>
<td>Week 7: Audio signal processing basics and psychoacoustic models for audio coding</td>
<td>Week 15: Course review and class project presentations</td>
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<tr>
<td>Week 8: Audio coding algorithms and industry standards</td>
<td>Week 16 (Finals Week): Final</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.).

- Instructor-provided handouts for some topics.
- References to research papers and relevant journals.
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:

Department Chair/Program Director/School Director

Chair of College Curriculum Committee

Dean of College

Dean of The Graduate College (if applicable)

Chair of University Curriculum Committee (if applicable)