Undergraduate Curriculum Committee:

The documents and forms for proposed curriculum changes in the Meteorology program, which has recently moved from the COE to the COS, are included herein. The changes involve the Environmental Science (ENS) QEP course sequence which currently consists of 7 ENS credits beginning the junior spring semester (1 credit, ENS 3911), followed by summer Field Projects, FP (6 credits, ENS 4911 – 1 credit, ENS 4912 – 2 credits, ENS 4913 – 3 credits).

1. We propose to remove the 7 credit FP QEP and replace it with a new 4-credit course "Computational Data Analysis in Meteorology and Geosciences (MET 3xxx). The course will include a 1-credit lab section. The course will be offered during the junior spring semester per the attached program plan (flow chart).

The proposed course, designed specifically for QEP purposes, is developed around (individual and group) supervised projects that will provide students with the opportunity to 1) develop and improve their programming skills, 2) hone their analytic and critical thinking, 3) learn to apply visualization tools to large meteorological data streams, and 4) conduct meteorological research (see attached syllabus).

2. In order to maintain the credit hours at 17 during the junior spring semester, we also propose the removal of the "Technical Elective". This will reduce the total number of curriculum hours for Meteorology majors from 133 to 127 – a number that is closer to that of our in-state rivals (Miami, FSU) who require between 120-130 total credit hours.

The current SACs BS evaluation, for the meteorology program, depends, primarily, on FP-based outcomes. We have begun the process (with APAC assistance) of developing a completely new assessment that will fully incorporate the proposed QEP course. Because the class will be taught for the first time during spring 2018, we would prefer to delay the changes until the summer at which point we can use the experience, feedback (course evaluations), etc. to help with the process.

Sincerely

[Signature]

Dr. Steven M. Lazarus
Program Chair, Meteorology
Physics and Space Sciences

---

1 The proposed mid-year program changes have been pre-approved by Dr. Baloga (see accompanying material).
Florida Institute of Technology

ADDING A NEW COURSE TO THE CURRICULUM

This is a request for reactivation of a course in the system. [ ] Yes  [ ] No

New courses are available beginning with the fall term in which they appear in the University Catalog.

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>M E T</th>
<th>COURSE NO.*</th>
<th>CREDIT HOURS</th>
<th>ACADEMIC YEAR TO BE ADDED TO THE FILE</th>
<th>CONTACT HOURS (CEU ONLY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e.g., CSE)</td>
<td>(e.g., 1301)</td>
<td></td>
<td>4</td>
<td>Spring 2018</td>
<td></td>
</tr>
</tbody>
</table>

*Justify level if 1000-level and no co- or prerequisites.

<table>
<thead>
<tr>
<th>CLASS HOURS</th>
<th>80/semester</th>
<th>LECTURE HOURS</th>
<th>45/semester</th>
<th>LAB HOURS</th>
<th>15/semester</th>
<th>SCHEDULE TYPE</th>
<th>Lecture/Lab (C)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>DEPARTMENT</th>
<th>Physics and Space Sciences</th>
<th>(e.g., Biological Sciences)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>COMPUTER TITLE</th>
<th>Data Analytics in Meteorology</th>
</tr>
</thead>
</table>

Restricted to 25 characters, including spaces

This course will be entered into the system as: [ ] Bi-Level [ ] Cross-Listed [ ] Dual-Numbered [ ] Full-Load [ ] None of these/Standard Listing [ ]

<table>
<thead>
<tr>
<th>CATALOG TITLE</th>
<th>Data Analysis in Meteorology and Geosciences</th>
</tr>
</thead>
</table>

Covers different types of multidimensional large datasets (i.e., big data) from a variety of sources used to describe physical and dynamical processes of the weather and climate system. Emphasizes understanding and interpreting the data through basic programming, plotting and analysis. Lab requires use of various data and formats. (Q)

This description has been approved by the catalog office [ ]

Catalog & Curriculum Manager [ ]

Date [ ]

In addition, please attach a course syllabus and/or more detailed description.

RESTRICTIONS

<table>
<thead>
<tr>
<th>[ ] Prerequisite</th>
<th>CSE 1100</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Co-requisite</td>
<td>Course Number</td>
</tr>
<tr>
<td>and</td>
<td>[ ] or</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[ ] Prerequisite</th>
<th>CSE 1502</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Co-requisite</td>
<td>Course Number</td>
</tr>
<tr>
<td>and</td>
<td>[ ] or</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[ ] Prerequisite</th>
<th>CSE 1503</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Co-requisite</td>
<td>Course Number</td>
</tr>
<tr>
<td>and</td>
<td>[ ] or</td>
</tr>
</tbody>
</table>

ADDITIONAL RESTRICTION [ ] and [ ] or

(e.g., Major, Class Level, Department Head Approval)

If this course replaces a course currently offered in BANNER, please indicate old course information and the date/term the course may be removed from the system.

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>Alpha Prefix (e.g., CSE)</th>
<th>COURSE NO. (e.g., 1301)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>TERM TO INACTIVATE</th>
</tr>
</thead>
</table>

| [ ] Yes | [ ] No | Will this course be used to measure program-level student learning outcomes? If yes, review and signature required.** |
| [ ] Yes | [ ] No | Will this course be used to satisfy the scholarly inquiry requirement? If yes, attach "Q" materials for review. |
| [ ] Yes | [ ] No | Will this course impact any existing programs? If yes, attach "Changing Graduation Requirements" form for each program impacted. |

APPROVALS: On completion of description and course number verification, affix appropriate signatures as indicated, and submit to the Office of Graduate Programs, or Undergraduate Curriculum Committee Chair for placement on agenda.

<table>
<thead>
<tr>
<th>Original</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

Department Head/Program Chair [ ]

Date [ ]

Chair, Graduate Council [ ]

Date [ ]

Chair, Undergraduate Curriculum Committee [ ]

Date [ ]

**Chair, Academic Programs Assessment Committee

REGISTRAR'S USE ONLY

<table>
<thead>
<tr>
<th>SCACRESE</th>
<th>SCADREL</th>
<th>SCAPREQ</th>
<th>SCABASE</th>
<th>ACALOG</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SCARIES</th>
<th>CIP Code</th>
<th>Operator Init.</th>
<th>Date</th>
</tr>
</thead>
</table>

Catalog & Curriculum Manager [ ]

Date [ ]

Florida Institute of Technology • Office of the Registrar

130 West University Boulevard, Melbourne, FL 32901-6973 • (321) 674-8114 • Fax (321) 674-7827

RGR-388-417
BASIC COURSE INFORMATION

DEPARTMENT: Physics and Space Sciences (PSS)  FACULTY DEVELOPER(S): Pallav Ray, Steven M. Lazarus

Course Name and Course Sequence Information

<table>
<thead>
<tr>
<th>COURSE NUMBER</th>
<th>COURSE TITLE</th>
<th>CREDITS</th>
<th>TERM(S) OFFERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>3610</td>
<td>Data Analysis in Meteorology and Geosciences</td>
<td>4</td>
<td>Spring Junior</td>
</tr>
</tbody>
</table>

Is this course part of a multi-course sequence? □ Yes  □ No

Course sequence (if applicable)

Course Used in the following degree program(s)

<table>
<thead>
<tr>
<th>DEPARTMENT</th>
<th>DEGREE PROGRAM</th>
<th>REQUIRED</th>
<th>ELECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meteorology (PSS)</td>
<td>BS</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

Proposed Course Instructor(s)

Pallav Ray

INFORMATION ABOUT STUDENTS WHO WILL TAKE COURSE

LEVEL(S) □ Senior  □ Other  □ Junior  ABILITY □ Open  □ Restricted  □ Other

Additional Information/Student Characteristics

Students in their junior spring year will take this class. Students should have taken at least one of the following classes: CSE 1502, CSE 1503, or CSE 1100.

GOALS AND OUTCOMES (additional pages may be necessary)

HOW DOES THIS COURSE ADDRESS SCHOLARLY INQUIRY OUTCOMES?

The students are expected to learn about different types of multi-dimensional large meteorological datasets (i.e., big data) and apply that knowledge to describe and better understand physical and dynamical processes of the weather and climate system. Emphasis will be placed on understanding and interpreting the data through basic programming, plotting (visualization) and analysis.

HOW DOES THIS COURSE ADDRESS THE PLAN REQUIREMENT?

Students will be required to develop a formal timeline, submit regular progress reports that identify any problems encountered as well as proposed action items that are required to resolve them.

HOW DOES THIS COURSE ADDRESS THE CONDUCT REQUIREMENT?

The course is designed to replicate the end-to-end scientific process. Students will engage and develop individual projects that include: big picture content (outline); basic research questions; a clear proposal (i.e., statement of the problem, how they plan to answer the questions, and a literature review). Data sourcing (i.e., identifying / locating relevant data sets) and the application of computational skills (coding, software tools) to the processing and analysis of the data (results, summary / conclusions).

HOW DOES THIS COURSE ADDRESS THE REPORT REQUIREMENT?

Course outcomes are designed, in part, to promote professional development and include the following 1) a scientific (conference style) poster per American Meteorological Society (AMS) standards and specs, 2) oral presentation (also conference style), and 3) student peer-review (poster and presentations). The posters will be presented at the FIT Engineering Showcase (or at the AMS student conference).

See assessment descriptions on reverse – Additional documentation may be needed.
STUDENT LEARNING OUTCOMES INSTRUCTIONS

PLAN
In completing a QEP experience within their field of study, students will be able to 1) prepare a well-written plan for the experience including how to achieve objectives, and a timetable and description of required resources [synthesis/evaluation]; 2) regularly document progress on the experience and communicate that progress to others; and 3) when appropriate, adjust the plan to overcome barriers and/or capitalize on opportunities that arise [synthesis/evaluation].

CONDUCT
In completing a QEP experience within their field of study, students will be able to 1) delimit and describe the objectives to be accomplished [analysis/synthesis]; 2) conduct a search for published work on theory, research and practices related to the objectives when appropriate [analysis/synthesis]; and 3) collect and analyze pertinent information and data called for in the plan [application/analysis].

REPORT
In completing a QEP experience within their field of study, students will be able to 1) present the results of the experience in one or more documents that include correctly designed and executed graphics and as an oral presentation that includes effectively designed and executed graphics; 2) communicate all elements of the experience using standard English conventions (including effective sentence and paragraph structure, appropriate voice and verb tense, and suitable word choice) and a report formatted and styled in a way appropriate to the academic/professional field (including text citations and bibliographic references to document others' intellectual contributions); and 3) handle all aspects of the experience with a professional demeanor (including responsibly interacting with team members, meeting deadlines, and preparing and presenting project materials in their final form).

[Signatures and dates]
Computational Data Analysis in Meteorology and Geosciences

**Course Objectives:** Gain a thorough understanding of different types of multi-dimensional large datasets (i.e., big data) from a variety of sources that are used to describe physical and dynamical processes of the weather and climate system. Emphasis will be placed on understanding and interpreting the data through basic programming, plotting and analysis. Topics include, but are not limited to, global surface and top of the atmosphere energy balance, simple one-dimensional ocean/atmosphere models, hydrological cycle and atmospheric/ocean general circulation. Students will hone their computational and critical thinking skills in preparation for data intensive careers. Student collaboration on projects is encouraged.

**Grading:** A (80-100%), B (70-80%), C (60-70%), D (50-60%), F (<50%). Grading is based on equal weighting of Homework (50%) and Class Project (50%).

**Books:** No formal textbook is required for this class. Materials for reading will be supplied in the class. Two references that might help


Pre-requisites: CSE 1502, CSE 1503 or CSE 1100 or instructor’s approval

**FIT Updated Title IX Statement**

**Topics Covered: (Topics in parentheses will be part of the lab)**

1. Introduction (1 week)
   Data sources (e.g., *in situ*, Reanalysis, Satellite and Model)
   Data types (e.g., Ascii, Binary, GRIB, HDF, NetCDF)
   Software packages (e.g., GrADS and its installation, NCL, Python)

2. Zero-dimensional datasets (2 weeks)
   - Point observation over land (e.g., surface observations) and ocean (e.g., moored buoy)
   - 0\textsuperscript{th} order mixed layer model

3. One-dimensional datasets (2 weeks)
   - Vertical structure at a point (e.g., sounding)

4. Two-dimensional datasets (2 weeks)
   - Structure at a particular level (e.g., global surface temperature)

---

\(^1\)QEP
- Zonal-mean structure (i.e., in YZ plane) of the atmosphere (e.g., Hadley Cell) and ocean (e.g., meridional profiles of temperature and salinity)
- Vertically integrated parameters (i.e., in XY plan) over the globe (e.g., precipitable water, meridional heat transport)

5. Three-dimensional datasets (2 weeks)
- Global or regional datasets that vary in three dimensions, X (longitude), Y (latitude) and Z (height).

6. Complex datasets including model and reanalysis (4 weeks)
- Multi-dimensional variables (i.e., time and space)
- Variables with varying dimensions in the same data file (e.g., reanalysis, model)
- Components of a numerical model and the basis for weather and climate prediction
- Model evaluation and verification
The addition or removal of any graduation requirement in a major or minor requires that this form, accompanied by supporting documentation, be completed and approved as indicated below. Incomplete or incorrect forms will not be processed.

**COLLEGE:** College of Science

**DEPARTMENT:** PSS

**DEGREE LEVEL:** BS

**PROGRAM TITLE:** Meteorology

**TO BE INITIATED WITH CATALOG YEAR:** 20 18 / 20 19

**CHANGE REQUESTED FOR:** □ major program □ minor program

**Major/Minor Code:** 7 2 2 4

Program changes are effective beginning with the fall term in which they appear in the University Catalog.

□ Yes □ No Will this change impact the program’s assessment process? If yes, attach a description of how the assessment will be impacted and the new process.

**DESCRIPTION OF REQUESTED CHANGES:** Attach a more detailed description and any supporting documentation.

We propose to:

1. Remove the Environmental Science (ENS) 7 credit QEP Field Projects (FP) course sequence that includes:
   - ENS 3911 1 credit (Junior Spring)
   - ENS 4911 1 credit, ENS 4912 2 credits, ENS 4913 3 credits (Junior Summer)

2. Replace the summer FP QEP with a new 4-credit course (3 credit lecture/1 credit lab) "Computational Data Analysis in Meteorology and Geosciences (MET 3610). The course will be offered during the junior Spring semester.

3. Maintain the credit hours at 17 during the junior spring semester. This will be accomplished by removing the "Technical Elective" scheduled that semester. These changes will reduce the total number of credit hours for Meteorology majors from 133 to 127.

* Dr. Baloga’s approval of the mid-year (Spring 2018) curriculum change is attached (email correspondence).
* Our current SACs BS evaluation depends on FP-related outcomes. See cover letter for details.
* See attached flow charts for curriculum impact (current/proposed).
* See attached syllabus for course outline, content and objectives.
* The required QEP summary form is also included per items 1) and 2 above.

**Approvals: On completion of appropriate department approvals, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee, for approval below and forward to the Catalog & Curriculum Manager.**

<table>
<thead>
<tr>
<th>Original</th>
<th>11-1-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department Head / Major Program Chair</td>
<td>1/2/17</td>
</tr>
<tr>
<td>Chair, Graduate Council</td>
<td>Date</td>
</tr>
</tbody>
</table>

| Department Head / Minor Program Chair | 11/2/17 |
| Chair, Undergraduate Curriculum Committee | Date |

**DEAN OR ASSOCIATE DEAN**

<table>
<thead>
<tr>
<th>CAPP / Degree Evaluation</th>
<th>Academic Year</th>
<th>□ Yes □ No</th>
<th>Update completed</th>
<th>Date</th>
<th>Initials</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Catalog Management System</th>
<th>Academic Year</th>
<th>□ Yes □ No</th>
<th>Update completed</th>
<th>Date</th>
<th>Initials</th>
</tr>
</thead>
</table>

---

**Florida Institute of Technology • Office of the Registrar**

150 West University Boulevard, Melbourne, FL 32901-6975 • (321) 674-8114 • Fax (321) 674-7827

RGR-21-15
Meteorology Undergraduate Curriculum Change Summary

- New Course
- Removed Courses

CURRENT JUNIOR

Spring (17 credit hours)

- ENS 3105 Atmospheric Pollution Lab 1
- ENS 3911 Environmental Field Projects Proposal 1
- MET 3402 Synoptic Meteorology 2 3
- SPS 4030 Physics of the Atmosphere 3
- Humanities Core Course Credit Hours: 3
- Restricted Elective (ENS, COM, MET, MTH, OCN) Credit Hours: 3
- Technical Elective Credit Hours: 3

Summer (6 credit hours)

- ENS 4911 Environmental Field Projects 1
- ENS 4912 Environmental Field Projects 2
- ENS 4913 Environmental Field Projects 3 (Q)

TOTAL CREDIT HOURS FOR GRADUATION: 133

PROPOSED JUNIOR:

Spring (17 credit hours)

- DATA ANALYSIS IN MET
  - MET 3XXX Data Anal in Meteorology (Q) 4
- ENS 3105 Atmospheric Pollution Lab 1
- MET 3402 Synoptic Meteorology 2 3
- SPS 4030 Physics of the Atmosphere 3
- Humanities Core Course Credit Hours: 3
- Restricted Elective (ENS, COM, MET, MTH, OCN) Credit Hours: 3

Summer (0 credit hours)

No classes

TOTAL CREDIT HOURS FOR GRADUATION: 127