MEMORANDUM

Date: September 26, 2017

To: Mark Archambault, Chair, Undergraduate Curriculum Committee

Through: Hamid K. Rassoul, Dean, College of Science

From: Richard B. Aronson, Head, Department of Biological Sciences

Subject: An Option in Fisheries and Aquaculture for Biological Sciences

The attached paperwork describes a ‘new’ option proposed for the Department of Biological Sciences. Fisheries and Aquaculture updates the curriculum and the name of the Aquaculture option (major code 7026) and will replace it. The accompanying paperwork includes the rationale for the option and changes in the course requirements, a modified flow-chart, and rubrics to assess the academic progress of our students. Also included are new course descriptions that will enable existing aquaculture courses to be replaced by courses that enhance the educational value and career-development potential of the Fisheries and Aquaculture option.

The schedule for teach-out will be as follows. The replacement option will be effective in August 2018. All incoming students who sign up for Aquaculture (7026) through July 2018 will be encouraged to switch to Fisheries and Aquaculture. Option 7026 will, therefore, be terminated at the end of the 2021–2022 academic year at the latest, but possibly earlier.

Thank you,
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.

SUBJECT B I O COURSE NO.* (eg, BIO) 4520 CREDIT HOURS 4 ACADEMIC YEAR TO BE ADDED TO THE FILE Fall 2018 (eg, 2010)

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

CLASS HOURS 90/semester LECTURE HOURS 45/semester LAB HOURS 45/semester CONTACT HOURS (CEU ONLY) N/A

DEPARTMENT BIOLOGICAL SCIENCES BIOLOGICAL SCIENCES Schedule Type Lecture / Lab (C) (e.g. Lecture, Lab or Special Topics/Project)

□ COLLEGE OF AERONAUTICS – 23 □ COLLEGE OF SCIENCE – 26
□ NATHAN M. BISK COLLEGE OF BUSINESS – 24 □ EXTENDED STUDIES/NMB COLLEGE OF BUSINESS – 90
□ COLLEGE OF ENGINEERING – 1 □ SCHOOL OF COMPUTING – 29
□ COLLEGE OF PSYCHOLOGY AND LIBERAL ARTS – 25 □ SCHOOL OF HUMAN-CENTERED DESIGN, INNOVATION & ART – 28

COMPUTER TITLE Invertebrate Aquaculture 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

CATALOG TITLE: Invertebrate Aquaculture

CATALOG DESCRIPTION OF COURSE Restricted to 350 characters, including spaces

Covers a diverse array of invertebrate species and their culture in laboratory or field settings. Includes the aquaculture technology and techniques for animals such as corals, mollusks and crustaceans cultured for human consumption, ornamental display or restoration of wild populations.

This description has been approved by the catalog office. Date

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

RESTRICTIONS □ Prerequisite BIO 2801 □ Corequisite Course Number □ and □ or □ A, B, C, D, F
□ Prerequisite Course Number □ Corequisite Course Number □ and □ or □ A, B, C, D, F, CEU/Audit
□ Prerequisite Course Number □ Corequisite Course Number □ and □ or □ CEU
□ Prerequisite Course Number □ Corequisite Course Number □ and □ or □ S, U
□ Prerequisite Course Number □ Corequisite Course Number □ and □ or □ P, F
□ Prerequisite Course Number □ Corequisite Course Number □ and □ or □ Other

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.

SUBJECT Alpha Prefix (e.g., BIO) B I O COURSE NO. (eg, 1301) 3625 TERM TO INACTIVATE Fall 2018

□ 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.

Original: 9/26/17 Date: Chair, Graduate Council Date: OR

Department Head/Program Chair: 9/26/17 Date: Chair, Undergraduate Curriculum Committee Date:

Dean or Associate Dean: 10/2/17 Date:

**Chief Academic Officer Date:

CATALOG & CURRICULUM MANAGER

These changes/additions have been made for the University Catalog and entered into the BANNER term named above.

Catalog & Curriculum Manager Date:

REGISTRAR’S USE ONLY

SCARS R SCADE TF SCAIReq SCABASE ACALOG

SCARR SES CIP Code _______________ Operator Init. _______________ Date:

Florida Institute of Technology • Office of the Registrar

130 West University Boulevard, Melbourne, FL 32901-6975 • (321) 674-8114 • Fax (321) 674-7927

RGR-297-816
ADDING A NEW COURSE TO THE CURRICULUM

This course is to be added to the permanent file, "Master Course Index", in the Associate Registrar's Office. I understand it will not be made available to the student body until proper approvals have been affixed.

COURSE NUMBER: BIO-4520 CREDIT HOUR: 4 CLASS HOURS: 3 LAB HOURS: 1

CATALOG TITLE: Invertebrate Aquaculture

COMPUTER TITLE (restricted to 21 spaces including blanks): Invert Aquaculture

CATALOG DESCRIPTION OF COURSE: A study of the basic biology, ecology, life history, and culturing techniques of the major crustacean and molluscan species of commercial value. Major diseases and parasites of crustacean and molluscan aquaculture are discussed. Laboratory work includes spawning, hatchery, and rearing of selected species.

PRE-REQUISITE and/or CO-REQUISITE: BIO-3510, BIO-3620

SEMESTER TO BE ADDED TO THE FILE: Fall, 1993

APPROVALS:

[Signatures and dates]

TUITION REMISSION CREDIT: 4

Chairman, Council on Engineering Curricula Date

Dean of Assoc. Dean (Appropriate School) Date

Upon completion of above approvals submit to Dean, Graduate Studies and Research (Graduate Courses); or Chairman, Curriculum Committee (Undergraduate Courses).

Approved (Graduate Courses Only):

[Signatures and dates]

Distribution:

Original - Registrar
Copy - Departmental Files
Proposed Course: BIO 4520
Invertebrate Aquaculture

Instructor: Dr. J. Shenker
Email: shenker@fit.edu
Office: Harris Building Room 112
Phone: 674-8145
Teaching Assistant: TBA
Office Hours: TBA

Rationale: Aquaculture is rapidly expanding throughout the world, and has recently exceeded commercial fisheries in terms of annual levels of productivity of food resources. It is a significant component of population and habitat restoration programs, and also is a mainstay of the ornamental aquarium industry. This course combines two previous 3 credit courses (BIO 3625 Molluscan Aquaculture and BIO 4625 Crustacean Aquaculture) with a higher-intensity 4 credit course. The laboratory for the earlier courses essentially set up cultures of different species, and monitored growth and development over the semester. This course will include overlapping culture systems for mollusks and crustaceans, and include aquaculture of corals as well. This course will provide students with the experience to develop their careers and join the large group of Florida Tech Aquaculture alumni who are highly regarded in commercial and research aquaculture programs.

Prerequisites: BIO 2801 or equivalent

Primary research literature

Class format:
Three 50 minute lectures/week + 1 laboratory session per week, with extended daily duties for monitoring and maintaining culture systems. Students will conduct individual or group aquaculture research projects. Field trips to regional aquaculture facilities will be provided outside of the regular class hours (e.g. Harbor Branch Oceanographic Institution, Ocean and Reef Aquaculture).

Lecture and Laboratory Syllabus: Laboratory and field exercises will be closely integrated with this sequence of topics.

Week 1: Introduction to Invertebrate Aquaculture. Species discussions, status and trends.

Laboratory: Aquaculture laboratory set-up

Weeks 2-6: Coral aquaculture – coral biology and culture technology and methods. Student-led Case Study Discussion (CSD).
Laboratory: Establish corals, molluscan and crustacean culture systems.

Weeks 7-10: Molluscan aquaculture – biology and culture technology and methods. CSD.
Laboratory: Maintain culture systems, work on relevant life stages of cultured organisms

Weeks 10-14: Crustacean aquaculture – biology and culture technology and methods. CSD.
Laboratory: Maintain culture systems, work on relevant life stages of cultured organisms

Week 15: Additional case studies; research project presentations
Laboratory: Clean-up

Grading: A-F letter grades, to be awarded based on the following:

Midterm Exam 25%
Final Exam 25%
Case Study Discussion 10%
Research Paper 30%
Research Paper Presentation 10%
Florida Institute of Technology

ADD A NEW COURSE TO THE CURRICULUM

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

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

SUBJECT B I O
Course No.* 4 6 2 1
(e.g., CSE) 1301
Credit Hours 4
Academic Year to be Added to the File Fall 2018
(e.g., Fall 2010)

Class Hours 90
Lecture Hours 45
Lab Hours 45
Contact Hours (CEU Only)

Department Biological Sciences
(e.g., Biological Sciences)

School of Physical Sciences

College of Biology and Liberal Arts

College of Science

College of Human-Centered Design, Innovation and Art

Computer Title Fisheries Management
Restricted to 25 characters, including spaces

Catalog Title Principles of Fisheries Management

Catalog Description of Course Restricted to 350 characters, including spaces

Incorporates the theories and methods of fisheries science, marine ecology, ecosystem management and social/economic considerations into the development of sustainable management of finfish and invertebrate fishery resources.

This description has been approved by the catalog office

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

Restrictions

Prerequisite BIO 2801
Course Number

Corequisite Course Number

A, B, C, D, F
CEU
S, U
P, F
Other

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.

Subject Alpha Prefix (e.g., CSE) B I O
Course No. (e.g., 1301) 4 6 2 0
Term to Inactivate Fall 2018

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.

Chair, Graduate Council Date

Chair, Undergraduate Curriculum Committee Date

Catalog & Curriculum Manager

These changes/additions have been made for the University Catalog and entered into the BANNER term named above.

Catalog & Curriculum Manager Date

Registrar's Use Only

SCACRSE SCADETL SCAPREQ SCARASE ACASLOG

SCARRS CIP Code Operator Init. Date

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RGR-338-417
Proposed Course: BIO 4ZZZ  
Principles of Fisheries Management

Instructor: Dr. J. Shenker  
Office: Harris Building Room 112
Email: shenker@fit.edu  
Phone: 674-8145  
Teaching Assistant: TBA

Rationale:
Fisheries management is an interdisciplinary field of study that incorporates the theories and methods of fisheries science, marine ecology, ecosystem management, and social/economic considerations onto the development of sustainable management of finfish and invertebrate fishery resources. Local and worldwide fishery resources are under tremendous stress, and the need for fishery scientists and managers is increasing. State and Federal fisheries agencies are among the most important employers of Florida Tech graduates in aquaculture, marine biology and oceanography. This course is intended to provide students with a foundation of the principles of Fisheries Management, the collection and analysis of data that provide the biological basis for management strategies, and a survey of strategies designed to restore or stabilize fisheries and habitats. The course will help students fulfill the requirements of the Associate Fisheries Professional certification from the American Fisheries Society, and will provide them with experience that will assist in the development of their careers.

Prerequisites:
BIO 2801 or equivalent

Structure, Identification and Natural History.  
Primary research literature

Class format:
Three 50 minute lectures/week + 1 field/laboratory session per week (extended hours for nighttime or weekend field excursions will occur several times each semester). Students will conduct individual or group fisheries research projects.

Lecture and Laboratory Syllabus: Laboratory and field exercises will be closely integrated with this sequence of topics.

Laboratories: IACUC Training; Field sampling exercises in Indian River Lagoon and St. Johns River, establish research animals in Aquaculture Lab.

Weeks 3-4: Fishing and research sampling gear and methodologies, remote and in situ habitat and fishery assessment techniques; Student-led Case Study Discussion (CSD)  
Laboratories: Select and initiate student research projects; additional field sampling, fish taxonomy and life stage analysis

Weeks 5-7: Fishery monitoring and assessment, data requirements, collection and analyses (CSD)  
Laboratories: Sample analysis, including otoliths, feeding habits, length-frequency cohort analysis

Weeks 8-9: Population dynamics, life cycle analysis, reproduction and recruitment, growth, mortality, population dynamics modeling (CSD)  
Laboratories: 1-2 days aboard Fisheries Research Vessel (ship-time proposal in review)

Weeks 10-11: Yield and fisheries models (CSD)  
Laboratories: Data analysis and models
Weeks 12-13: Fisheries management strategies, single or multiple stock approaches, habitat-based approaches, regulations (CSD).
   Laboratories: Continue data analysis and models
Weeks 13-15: Additional case studies; research project presentations
   Laboratories: Finalize research projects, clean-up

Grading: A-F letter grades, to be awarded based on the following:
- Midterm Exam: 25%
- Final Exam: 25%
- Case Study Discussion: 10%
- Research Paper: 30%
- Research Paper Presentation: 10%
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.

SUBJECT: Biological Sciences

COURSE NO.: BIO 4550

CREDIT HOURS: 4

ACADEMIC YEAR TO BE ADDED TO THE FILE: Fall 2018

DEPARTMENT: Biological Sciences

SCHEDULE TYPE: Lecture/Lab (C) / Field (J)

CLASS HOURS: 90

LECTURE HOURS: 45

LAB HOURS: 45

CONTACT HOURS (CEU ONLY):

COLLEGE OF AERONAUTICS - 23
NATHAN M. BISK COLLEGE OF BUSINESS - 24
COLLEGE OF ENGINEERING AND COMPUTING - 01

COMPUTER TITLE: Finfish Aquaculture

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

CATALOG TITLE: Principles and Practices in Fish Aquaculture

CATALOG DESCRIPTION OF COURSE: Restricted to 350 characters, including spaces

Addresses best practices in sustainable fish-culture systems rooted in the basic principles of reproductive biology and captive breeding, stress physiology, disease management and prevention, feeding and nutrition, and rearing and harvesting.

This description has been approved by the catalog office.

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

Restrictions □ Prerequisite □ Corequisite □ and □ or

Grades to be Issued □ A, B, C, D, F □ A, B, C, D, F, CEU/Audit □ CEU

Additional Restrictions □ and □ or

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.

Subject Alpha Prefix (e.g., CSE) COURSE NO. (e.g., 1301) Term to Inactivate

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.

Originator:

Date: 9/14/17

Richard P. Anderson

Department Head/Program Chair

Date: 9/26/17

Hamed K. Roshd

Dean or Associate Dean

Date: 10/12/17

**Chair, Academic Programs Assessment Committee

Date

Catalog & Curriculum Manager

Date

Registrar's Use Only

SCACRSE ___________ SCADETL _________ SCAPREQ ___________ SCABASE _________ ACALOG ___________

SCARRIS _________ CIP Code _________ Operator Init _______ Date

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RGR-336-417
Proposed Course: BIO 4YYY PRINCIPLES AND PRACTICES IN FINFISH AQUACULTURE
Instructor: Dr. R.G. Turingan Office: Harris Building Room 111
Email: turtingan@fit.edu Phone: 674-8037 Office Hours: TBA
Teaching Assistant: TBA

REQUIRED TEXTBOOK

NATURE OF THE COURSE: This 4-credit course provides opportunities for students to understand the theory and practice of sustainable aquaculture of fishes. It primarily addresses best practices in culture systems including captive breeding and reproductive biology, disease management and prevention, hatchery to grow-out methods and management, nutrition and feeding, harvesting and marketing. This course utilizes the ‘inquiry-based’ learning strategy, in which the students actively participate in the learning process through investigative research and cooperative learning. Students are given the opportunity to identify a variety of aquaculture problems, develop specific questions, and then design and conduct experiments to address these questions.

STRUCTURE OF THE COURSE:

I. Lectures. Three 50-minute lectures per week are devoted to discussions of fish-aquaculture concepts. Examples drawn from recently published aquaculture manuscripts are used to demonstrate the utility of a particular aquaculture technique in addressing contemporary problems in aquaculture production.

II. Laboratory. A four-hour laboratory per week gives the students more opportunity to develop an aquaculture-business plan and conduct aquaculture research. The key feature of this laboratory is the use of the FIT-Aquaculture Laboratories, coupled with several visits to nearby aquaculture facilities.

IMPORTANT POLICY STATEMENTS

ATTENDANCE IS A MUST!!! All assigned homework problems are due during laboratory hours. If you plan to be absent during a scheduled examination and class discussion of assigned homework problems, you must notify the instructor at least one week before your scheduled absence. If such advance notice is given, you will be excused from the oral discussion, but will be required to submit a written solution to the assigned exercise and to take a make-up examination. If you fail to notify the instructor of your absence, you will get a grade of zero for the missed class discussion, examination and for failure to submit written solutions to problems on time. Only serious illness will be an acceptable excuse for failing to notify the instructor of your absence during scheduled class discussions.
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<thead>
<tr>
<th>WEEK</th>
<th>TOPICS</th>
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<tbody>
<tr>
<td>1</td>
<td>Overview of Aquaculture</td>
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<td>2</td>
<td>The Business of Aquaculture</td>
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<td>3</td>
<td>Species and Site Selection</td>
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<td>4</td>
<td>Aquaculture Systems: Recirculating Systems</td>
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<td>5</td>
<td>Aquaculture Systems: Ponds and Raceways</td>
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<td>6</td>
<td>Aquaculture Systems: Cage and Net Pens</td>
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<td>7</td>
<td>Aquaculture Systems: Integrated Systems</td>
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<td>8</td>
<td>Spring Break</td>
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<td>9</td>
<td>Water Quality and Management</td>
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<td>10</td>
<td>Fish Diseases, Treatment and Management</td>
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<td>11</td>
<td>Reproductive Biology of Cultured Fishes</td>
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<td>12</td>
<td>Feeding and Nutrition</td>
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<td>13</td>
<td>Aquaculture Production: From eggs to market</td>
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<td>14</td>
<td>Aquaculture and Environmental Issues</td>
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<td>15</td>
<td>Project Presentations</td>
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<td>WEEK</td>
<td>TOPICS</td>
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<td>1</td>
<td>Set-up for Aquaculture Research</td>
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<td>Set-up for Aquaculture Research</td>
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<td>3</td>
<td>Visit to Aquaculture Facility</td>
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<td>Visit to Aquaculture Facility</td>
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<td>5</td>
<td>Visit to Aquaculture Facility</td>
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<td>6</td>
<td>How to Write an Aquaculture Business Plan</td>
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<td>7</td>
<td>Water Quality Exercise</td>
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<td>8</td>
<td>Spring Break</td>
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<td>9</td>
<td>Identification of Common Pathogens</td>
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<tr>
<td>10</td>
<td>Best Practices in Disease Prevention and Management</td>
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<td>11</td>
<td>Best Practices in Hatchery Production</td>
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<td>12</td>
<td>Best Practices in Nursery Production</td>
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<tr>
<td>13</td>
<td>Best Practices in Grow-out Production</td>
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<tr>
<td>14</td>
<td>Wrap-up Aquaculture Research and Business Plan</td>
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<tr>
<td>15</td>
<td>Clean-up</td>
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BIO 4YYY

GRADING SYSTEM

The final grade in BIO 4620 will be based on the student's performance in both lecture (400 Points) and laboratory (400 Points) components of the course.

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<thead>
<tr>
<th>LECTURE GRADED REQUIREMENTS:</th>
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<tr>
<td>Exam 1 (100 pts)</td>
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<tr>
<td>Exam 2 (100 pts)</td>
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<tr>
<td>Final Exam (100 pts)</td>
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<td>Quizzes and class participation (100 pts)</td>
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<thead>
<tr>
<th>LABORATORY GRADED REQUIREMENTS:</th>
<th>DUE DATE</th>
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</thead>
<tbody>
<tr>
<td>Lab Reports (100 pts)</td>
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<tr>
<td>Aquaculture Research (200 pts)</td>
<td>TBA</td>
</tr>
<tr>
<td>Aquaculture Business Plan (100 pts)</td>
<td>TBA</td>
</tr>
</tbody>
</table>
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ADDING A NEW MAJOR OR MINOR TO THE CURRICULUM

Please provide the following information when requesting a new major or minor (program or option) to be added to the curriculum. Only new majors, minors and options are assigned a new code and print on the diploma. The code will be assigned by the Office of the Registrar and information emailed to all appropriate personnel.

COLLEGE: College of Science
DELIVERY MODE(S): Classroom (classroom, online)

DEPARTMENT: Biological Sciences
CAMPUS/SITE(S): Melbourne

PROGRAM TO BE ADDED: □ Major □ Minor □ Option for (existing degree program)

NOTE: Only Majors, Minors and Options receive new codes and print on the diploma; use Option for new program name to appear with existing degree name.

☐ Associate of Arts (A.A.)
☐ Associate of Science (A.S.)
☐ Bachelor of Arts (B.A.)
☐ Bachelor of Science (B.S.)
☐ Master of Arts (M.A.)
☐ Master of Business Administration (M.B.A.)
☐ Master of Education (M.Ed.)
☐ Master of Public Administration (M.P.A.)
☐ Master of Science (M.S.)
☐ Master of Science in Aviation (M.S.A.)
☐ Master of Arts in Teaching (M.A.T.)
☐ Educational Specialist (Ed.S.)
☐ Doctor of Business Administration (DBA)
☐ Doctor of Philosophy (Ph.D.)
☐ Doctor of Psychology (Psy.D.)
☐ Graduate Certificate

OTHER ADDITION TO THE CURRICULUM NOTE: Only Majors, Minors and Options receive new codes and print on the diploma; use the Adding a New Concentration or Specialization form if the new program represents less than a full degree curriculum.

PROGRAM TITLE: Restricted to 10 characters, including spaces
Fisheries and Aquaculture

ACADEMIC YEAR TO BE INITIATED: FALL 2017
ADVISOR FOR NEW PROGRAM: Shenker & Turingan

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

ROUTING APPROVALS: 1) Department head/program chair and college dean approve and sign form. 2) The chief academic officer reviews and approves business plan of the program in terms of financial viability and impact on the university mission and signs form. 3) Graduate Council or Undergraduate Curriculum Committee approves academics and signs form. 4) The chief academic officer signs and signs form, and forwards to the Catalog & Curriculum Manager.

1) Richard B. Aronson 
Date: 3/15/17

2) Monica d'Alboga 
Date: 3/17/17

3) Chair, Graduate Council 
Date

4) Chair, Undergraduate Curriculum Committee 
Date

Chief Academic Officer 
Date

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REF. 112716
Department of Biological Sciences  
Fisheries and Aquaculture (major code 70XX)  
Programmatic Modifications and Change-of-Name  
To Update Aquaculture Option (major code 7026)

I. Introduction
The Department of Biological Sciences proposes a ‘new’ option, Fisheries and Aquaculture (major code 70XX), to update the content and name of the existing option in Aquaculture (major code 7026). The proposed changes will increase the breadth of the existing option, incorporating modern research techniques and resource management strategies, ensuring that students are well prepared to enter graduate programs and careers in fisheries and aquaculture in commercial, governmental and non-governmental organizations. The proposed changes to the option will qualify graduating students for an Associate Fisheries Professional certification from the American Fisheries Society upon receipt of their B.S. These changes modify the existing aquaculture option but do not reflect a substantial change from the original focus of the program.

II. Programmatic Modifications
Several of the courses required in the existing Aquaculture program will be modified or replaced to provide an updated and comprehensive view of the discipline. These changes reflect requirements for the Associate Fisheries Professional certification and advances in aquaculture, and they reflect changes in the expertise of faculty within the department. The changes are outlined on the accompanying flow charts.

The required biology and sustainability courses specific to this major will be:
BIO 1500 Introduction Aquaculture, 1 credit-hour  
ISC 1500 Introduction to Sustainability, 3 credit-hours  
BIO 4411 Conservation Genetics, 4 credit-hours  
BIO 4520 Invertebrate Aquaculture, 4 credit-hours  
BIO 4YYY Principles and Practices in Finfish Aquaculture, 4 credit-hours  
BIO 4ZZZ Fisheries Management, 4 credit-hours

Changes to the existing Aquaculture option are as follows:

1) Add ISC 1500 Introduction to Sustainability (3 cr), to replace BIO 4010 Biochemistry (4 cr) in Junior year,
2) Add BIO 4411 Conservation Genetics (4 cr), to replace OCN 3201/3211 (4 cr) in Junior year.
3) Add BIO 4520 Invertebrate Aquaculture (4 cr), to replace BIO 3625 Molluscan Aquaculture (3 cr) and BIO 4625 Crustacean Aquaculture (3 cr) in Junior year. BIO 4520 was taught in previous years, and will be reactivated. BIO 3625 and 4625 will be deactivated.
4) Split the current BIO 4620 Finfish Aquaculture and Fisheries Management (4 cr) into two courses: BIO 4YYY Principles and Practices in Finfish Aquaculture (4 cr) and BIO 4ZZZ Fisheries Management (4 cr, to include both finfish and invertebrate fisheries), in fall and spring of Senior year. BIO 4620 will be deactivated.
5) Replace BIO 4530 Biology of Fishes (4 cr) with BIO 4550 Comparative Vertebrate Anatomy (4 cr), in fall of Senior Year. BIO 4530 Biology of Fishes will be deactivated.
6) Remove one Liberal Arts Elective, reducing total credits required from 129 to 127.
These changes ensure that the university core and computer literacy (BIO 2801) requirements will be met. In the current Aquaculture option, approved Q-courses include BIO 4410 Community Ecology, BIO 4720 Marine Ecology and BIO 4991/2/3 Undergraduate Research. For the proposed Fisheries and Aquaculture program, BIO 4YYY Fish Aquaculture will be designated as the Q-course. This senior-level, fall semester course includes student research projects that will be presented at the Florida Tech Engineering and Science Student Design Showcase the following spring. We are presently working with Dr. Marcinkowski to complete the Q-course designation paperwork.

There will be no hidden prerequisites. The total credits required will be 127 credit hours.

Because we are not requesting new faculty or resources, a formal business plan is not required (per email from Dr. M. Baloga, Senior VP for Academics and Provost, 16 August, 2017)

III. Name of the Program
The name of the program will be Fisheries and Aquaculture (major code 70XX). The new name will have broader appeal and should improve student recruitment, a conclusion based on:

- Our discussions with current FIT students and visiting high school/transfer students
- Participation of our undergraduates as research volunteers and their enrollment in formal Undergraduate Research (BIO 4991/4992/4993)
- Tracking the careers of our graduates (20 of our alumni attended and presented papers at the annual meeting of the American Fisheries Society, held in Tampa in August 2017).
- Availability of research funding, graduate programs, and career opportunities.

The curriculum of the Fisheries and Aquaculture option will provide our students with a stronger background and more diverse preparation, making them highly competitive for immediate employment or entry into graduate studies. The benefit of earning an Associate Fisheries Professional certification from the American Fisheries Society upon completion of the B.S. underscores the job-ready approach to the revised program.

IV. Teach-Out of 7026
All freshman and sophomore students in Aquaculture (7026) will be encouraged to switch to the replacement option of Fisheries and Aquaculture (70XX). Juniors and seniors will enroll in the new courses, which will be substituted into the requirements for the existing program. Although no serious disruptions in course offerings are expected, Undergraduate Research in the appropriate topic(s) will be provided as independent study to students to help them complete their degrees in a timely fashion.

V. Assessment
Revised rubrics for assessment are provided below. We thank Dr. Marcinkowski for his assistance in developing these rubrics.
Assessment Rubric for Fisheries and Aquaculture Option
Revised from Aquaculture Option

Outcomes/Objectives

Outcome 1: Understand Principles of Biology (DSK)
Students will explain fundamental principles of biology that all biology undergraduates should grasp, regardless of their specific area of study within biology

Measure 1: Answer embedded questions in BIO 2110
- Description: Students will answer embedded questions in exams of General Genetics (BIO 2110) that address principles of inheritance, a topic that all biology students should understand.
- Target 1 = 75% of students will attain an 80% or better on embedded questions in exams of General Genetics (BIO 2110)

Measure 2: Answer embedded questions in BIO 3410
- Description: Students will answer embedded questions in exams of General Ecology (BIO 3410) that address principles of natural selection, a topic that all organismal biologists should understand.
- Target 1 = 75% of students will attain an 80% or better on embedded questions in exams of General Ecology (BIO 3410)

Outcome 2: Demonstrate Data Analysis Skills (CT, DSK)
Students will demonstrate ability to analyze types of data that are utilized in Fisheries and Aquaculture research.

Measure 3: Answer examination questions in Biometry (BIO 2801)
- Description: Students will answer examination questions in Biometry (BIO 2801) that address fundamental statistical techniques and principles that all fisheries and aquaculture students should understand, such as descriptive statistics, parametric and nonparametric statistical tests.
- Target 2 = 75% of students will attain an 80% or better on embedded questions in exams of Biometry (BIO 2801)

Measure 4: Demonstrate data analysis skills in Fisheries Management (BIO 4ZZZZ)
- Description: Students will answer embedded questions in exams of Fisheries Management (BIO 4ZZZZ) that demonstrate the ability to analyze and interpret data to assess critical components of fisheries biology and management, such as von Bertalanffy growth equations, cohort growth and survival calculations, and effectiveness of fishery management strategies. Examples of embedded questions for this course are provided in the next section of this document.
• Target 2 = 75% of students will attain an 80% or better on embedded questions in Fisheries Management (BIO 4ZZZ).

Outcome 3: Give Effective Oral Presentation (COM; DSK)

Students will give an effective oral presentation about an aspect of biology based on scientific literature or laboratory research

**Measure 5: Oral presentation in Science and Technical Communication (COM 2223) - Literature**

- Description: Students will give an oral presentation in Science and Technical Communication (COM 2223) on a fisheries or environmental issue that includes a review of background literature and a discussion of the current issue. Presentations will be evaluated using a rubric established by the Communications Program.
- Target 3 = 75% of students will attain an 80% or better on the species evaluation section of their oral presentation for Science and Technical Communication (COM 2223).

**Measure 6: Oral presentation in senior course Principles and Practices in Fish Aquaculture (BIO 4YYY)**

- Description: Students will give an oral presentation in the senior-level Principles and Practices in Fish Aquaculture course (BIO 4YYY) that will include a discussion of the students’ own thoughts or findings in relation to the development and implementation of fish aquaculture program for a species. Presentations will be evaluated using a rubric: species selection rationale (10% of the project grade); market or restoration goals of aquaculture (10%); discussion of biological characteristics of cultured species and technologies (50%), positive and negative environmental impacts of culture program (20%); development of future aquaculture efforts (10%). Assessment methods for each component will be derived from the QEP Reference Form for Course Instructors: Problem-Solving/Critical Thinking Skills (Marckinkowski, pers. comm.).
- Target 3 = 75% of students will attain an 80% or better on the oral presentation on a fish aquaculture program for the course Fish Aquaculture (BIO 4YYY).

Outcome 4: Compose Effective Written Presentation (COM; DSK, CT)

Students will compose an effective research paper based on an aspect of biology based on laboratory or field research.

**Measure 7: Laboratory Report - Discussion**

- Description: Students will write a laboratory report for General Genetics (BIO2110) that will include a discussion of their laboratory findings. Reports will be evaluated using a rubric established by the professor of the course.
• Target 4 = 75% of students will attain an 80% or better on the laboratory report for General Genetics (BIO2110).

Measure 8: Research paper – Discussion
• Description: Students will write a research paper in the capstone course in Fisheries and Aquaculture (Fisheries Management BIO 4ZZZ) that will include a discussion of their research findings. Papers will be evaluated using a rubric: Rationale (10% of project grade); review of relevant literature (20%), summary of research findings (30%), evaluation and comparison of research findings within the context of the relevant literature (40%). Assessment methods for each component will be derived from the QEP Reference Form for Course Instructors: Problem-Solving/Critical Thinking Skills (Marckinkowski, pers. comm.).
• Target 4 = 75% of students will attain an 80% or better on the discussion section of their research paper for Fisheries Management (BIO 4ZZZ).

Outcome 5: Demonstrate Problem Solving Skills (CT). Students will demonstrate an ability to solve problems in biology.

Measure 9: Embedded problem solving questions in General Genetics (BIO 2110)
• Description: Students will answer embedded problem solving questions in exams of General Genetics (BIO 2110).
• Target 5 = 75% of students will attain an 80% or better on embedded problem solving questions in exams of General Genetics (BIO 2110).

Measure 10: Embedded problem solving questions in senior-level Principles and Practices in Fish Aquaculture (BIO 4YYY) course. Description: Students will answer embedded problem solving questions in the Principles and Practices in Fish Aquaculture Course (BIO 4YYY). Examples of embedded questions are provided in the next section of this document.
• Target 5 = 75% of students will attain an 80% or better on embedded problem solving questions in exams of Fish Aquaculture (BIO 4YYY).

Outcome 6: Ability to Integrate Biological Principles in Problem Solving (DSK)
Students will demonstrate the ability to effectively integrate biological principles into solving research related problems

Measure 11: Research paper in senior course Principles and Practices in Fish Aquaculture (BIO 4YYY) - Project development
• Description: Students will develop a research project and write a paper based on their findings in the senior-level course Principles and Practices in Fish Aquaculture BIO 4YYY. Papers will be evaluated using a rubric: Objectives and hypotheses (20% of project grade); review of relevant research literature (20%); presentation of research
methods and experimental design (40%); statistical analyses (20%). Assessment methods for each component will be derived from the QEP Reference Form for Course Instructors: Problem-Solving/Critical Thinking Skills (Marckinkowski, pers. comm.). Posters derived from the research projects will be presented at the Florida Tech Engineering and Science Student Design Showcase in the following spring semester.

- Target 6 = 75% of students will attain an 80% or better on the project development sections of their research paper for Fisheries Management (BIO 4ZZZ).

**Measure 12: Research paper in capstone course Fisheries Management (BIO 4ZZZ) - Results**

- Description: Students will write a paper based on their research project in the capstone course in Fisheries and Aquaculture (Fisheries Management (BIO 4ZZZ)). Results within the paper will be evaluated using a rubric: concise and accurate verbal description of the results (40% of project grade); figures and graphic presentation of results (30%); statistical analysis of results (30%). Assessment methods for each component will be derived from the QEP Reference Form for Course Instructors: Problem-Solving/Critical Thinking Skills (Marckinkowski, pers. comm.).

- Target 6 = 75% of students will attain an 80% or better on the Results section of their research paper for Fisheries Management (BIO 4ZZZ).
Examples of Embedded Examination Questions

Outcome 2: Demonstrate Data Analysis Skills (CT, DSK)
Students will demonstrate ability to analyze types of data that are utilized in Fisheries and Aquaculture research.

Measure 4: Demonstrate data analysis skills in Fisheries Management (BIO 4ZZZ)
Students will answer embedded questions in exams of Fisheries Management (BIO 4ZZZ) that demonstrate the ability to analyze and interpret data to assess critical components of fisheries biology and management, such as von Bertalanffy growth equations, cohort growth and survival measurements, and effectiveness of fishery management strategies.

Examples of embedded questions:

1) Consider multi-year hypothetical summer time survey data for populations of sea trout in the Indian River Lagoon. Diagram length-frequency histograms for 4 consecutive years of the survey that demonstrates the presence of at least 5 cohorts of trout. Something unusual happens in Year 2: a recruitment failure. Using these histograms, show how you would calculate age-specific growth rates and mortality rates for each age group? How does the recruitment failure affect overall population size and stability?

2) You're examining the effectiveness of a Marine Protected Area in maintaining the population of a valuable grouper species. Design a survey to determine whether the MPA is indeed working as planned. Discuss the methods of data collection you would use, including sampling techniques and sampling design. What is the statistical framework for your sampling design, and how would you analyze the data?

3) Diagram von Bertalanffy growth curves for an unfished population of snappers where \( L_e \) is about 200 mm higher for females than for males, and age at first reproduction is 6 years for females and 5 years for males. How would the \( v_B \) curves change after 10 years of intense fishing? What are the implications of those changes on the reproductive output and stability of the population?

Outcome 5: Demonstrate Problem Solving Skills (CT, DSK)
Students will demonstrate an ability to solve problems in biology.

Measure 10: Embedded problem solving questions in the senior-level Principles and Practices in Fish Aquaculture Course (BIO 4YYY). Students will answer embedded problem solving questions in Principles and Practices in Fish Aquaculture (BIO 4YYY) that demonstrate their knowledge of biological and technological components of aquaculture, including manipulation of reproductive biology of fishes, development of culture methods for different life stages of fishes, and environmental impacts of aquaculture operations.
Examples of embedded questions:

1) You intend to culture ornamental clownfish (Pomacentridae: Amphiprionae). Define appropriate conditions to maintain broodstock and get them to produce larvae. You have to select among a variety of possible food types that you can provide to the fry during the first few weeks of their life. Choose two possible types of food, and explain your choice. How can you increase the nutritional value of the foods? How can you evaluate the success of these nutritional supplements?

2) Manipulation of the hormonal controls of reproduction is an important part of many aquaculture operations. Diagram/describe the hormonal cascade that controls reproduction. As you try to get a new aquaculture species to spawn in captivity, females don’t begin the vitellogenic stage of ovarian development. How could you manipulate the hormonal cascade to get the females to undergo complete oocyte development and ovulation?

3) When building a new aquaculture facility, you have the option to use water from wells or from surface water supplies. Provide 2 positive and negative factors of each type of water supply. Which would you choose, and why? How could you overcome the negative factors inherent in your selection of a water supply?
Degree: Biological Sciences/Aquaculture Option

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Total Credits Required: 129

†Free Elective for exempted transfer students

Restricted electives must contain 1 Q course

Remarks/Extra Courses:

Signatures:

Student: ___________________________
Advisor: ___________________________
Department Head: _______________________

TC, transfer credit
INSTRUCTIONS AND GUIDELINES FOR COMPLETING FLOWCHART FOR BIOLOGICAL SCIENCES/AQUACULTURE OPTION (7026)

Complete all parts in ink except for advisor's temporary notes in pencil, erased before submission.

Use the flowchart for the year that represents the student's academic peer group based on majority of curriculum (mainly biology and chemistry courses) satisfied upon entry to FIT.

Enter full name and full student number.

The only entries under "GRADE" column are earned grades: A–F; TC (official transfer credit); AP (official advanced placement); EE (FIT equivalency exam). If student re-took course, entry might appear as "F/C".

The only entries under "SUBSTITUTION" are alphanumeric FIT course numbers either from transfer credit evaluation or for courses taken at FIT; no substitutions allowed for named required courses (except as noted below under "TRANSFER STUDENTS").

TRANSFER STUDENTS: students formerly matriculated at other colleges and universities (not high-school students with college credit) exempt from FYE-1000; enter "EX", indicating exemption, under "SUBSTITUTION" column and enter a 1-credit-hour free elective; entry might appear as "EX/FREE": BIO-4991 (1 of 3 cr); if awarded AA degree (NOT AS degree) on transfer evaluation sheet, HU electives may substitute for HUM-2051 and HUM-2052 if no transfer credit for them; entry might appear as "AA EX/HU": LNG-1301; only use of SCI transfer credits is for free elective; all actions require submission of a substitution form.

FREE ELEC: any course taken at FIT or by transfer credit at 1000-level or above.

HUM CORE: HUM-2052, 2142, 2212, 2213, 2331, 2332, or 3333.

HUM ELEC: any FIT course (taken at FIT or by transfer credit) with "HU" at end of course description in FIT catalog; also, MSC-4002; or any transfer course designated "HUM XXXX Humanities Elective" (or similar) on Registrar's transfer credit evaluation sheet.

LIB ARTS ELEC: any course covered here under "HUM ELEC" and "SOC SCI ELEC"; all non-required courses with prefixes COM, HUM, LNG, MUS, PSY; BUS-1801, BUS-2601, BUS-3404, BUS-3501, BUS-3801, BUS-4503, BUS-4520; EDS-1005, EDS-1502, EDS-1503, EDS-2502, EDS-2503, EDS-3131, EDS-4081; up to 6 credits of MSC-XXXX.

REST ELEC: approved subjects: BIO, CHM, ENS, ISC-4000, ISC-5016, OCN; PSY-4521; courses designated as non-majors not allowed; 1000-level courses not allowed except the few allowable 1-credit courses, usable only twice as restricted electives unless taken as the laboratory component with its lecture component: BIO-1200, BIO-2332 (if MTH-2332 not used), BIO-4990, CHM-1091, CHM-4901, COM-2012, ENS-3105, ENS-4901, ENS-4911, OCN-3111, OCN-3211, OCN-3311, OCN-3411, OCN-3433, OCN-4901, OCN-4911. At least one course must be a Q course: BIO-3210, BIO-4120, BIO-4130, BIO-4720, BIO-4991, BIO-4992, BIO-4993.

Q-COURSE: At least one restricted elective, technical elective, or free elective must be a course designated "Q" in the university catalog.

SOC SCI ELEC: any FIT course (taken at FIT or by transfer credit) with "SS" at end of course description in FIT catalog; also, MSC-4002; or any transfer course designated "S S XXXX Social Science Elective" (or similar) on Registrar's transfer credit evaluation sheet.

TECH ELEC: approved subjects: AHF, AVS, BCM, BIO, BME, CHE, CHM, CIS, CON, CSE, CVE, ECE, ENS, ISC, MAE, MET, MTH, OCE, OCN, ORP, PHY, SPC, SPS, SWE, SYS; PSY-3423, PSY-4521; courses designated as non-majors (e.g., BIO-3010) not allowed; approved levels include 3000 and 4000 as well as graduate courses; levels 1000 and 2000 allowed except: AVS-1101, AVS-1102, AVS-1202, BIO-1162, BIO-1XXX transfer credit, BIO-2332 if MTH-2332 used for graduation credit, CHM-1100, CSE-1101, CSE-2234, CSE-2400 (or any other statistics course), MTH-1000, MTH-1603, MTH-1701, MTH-1702, MTH-1801, MTH-2332 if BIO-2332 used for graduation credit, MTH-2401.

Be certain to submit substitution forms immediately for elective courses, any substitutions, and special situations.
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†Free Elective for exempted transfer students
TC, transfer credit

Restricted electives must contain 1 Q course

TOTAL CREDITS REQUIRED: 127
INSTRUCTIONS AND GUIDELINES FOR COMPLETING FLOWCHART FOR BIOLOGICAL SCIENCES/AQUACULTURE OPTION (7026)

Complete all parts in ink except for advisor's temporary notes in pencil, erased before submission.

Use the flowchart for the year that represents the student's academic peer group based on majority of curriculum (mainly biology and chemistry courses) satisfied upon entry to FIT.

Enter full name and full student number.

The only entries under "GRADE" column are earned grades: A-F; TC (official transfer credit); AP (official advanced placement); EE (FIT equivalency exam). If student re-took course, entry might appear as "F/C".

The only entries under "SUBSTITUTION" are alphanumeric FIT course numbers either from transfer credit evaluation or for courses taken at FIT; no substitutions allowed for named required courses (except as noted below under "TRANSFER STUDENTS").

TRANSFER STUDENTS: students formerly matriculated at other colleges and universities (not high-school students with college credit) exempt from FYE-1000; enter "EX", indicating exemption, under "SUBSTITUTION" column and enter a 1-credit-hour free elective; entry might appear as "EX/FREE: BIO-4991 (1 of 3 cr)"); if awarded AA degree (NOT AS degree) on transfer evaluation sheet, HU electives may substitute for HUM-2051 and HUM-2052 if no transfer credit for them; entry might appear as "AA EX/HU: LNG-1301"; only use of SCI transfer credits is for free elective; all actions require submission of a substitution form.

FREE ELEC: any course taken at FIT or by transfer credit at 1000-level or above.

HUM CORE: HUM-2052, 2142, 2212, 2213, 2331, 2332, or 3333.

HUM ELEC: any FIT course (taken at FIT or by transfer credit) with "HU" at end of course description in FIT catalog; also, MSC-4002; or any transfer course designated "HUM XXXX Humanities Elective" (or similar) on Registrar's transfer credit evaluation sheet.

LIB ARTS ELEC: any course covered here under "HUM ELEC" and "SOC SCI ELEC"; all non-required courses with prefixes COM, HUM, LNG, MUS, PSY; BUS-1801, BUS-2601, BUS-3404, BUS-3501, BUS-3801, BUS-4503, BUS-4520; EDS-1005, EDS-1502, EDS-1503, EDS-2502, EDS-2503, EDS-3131, EDS-4081; up to 6 credits of MSC-XXXX.

REST ELEC: approved subjects: BIO, CHM, ENS, ISC-4000, ISC-5016, OCN; PSY-4521; courses designated as non-majors not allowed; 1000-level courses not allowed except the few allowable 1-credit courses, usable only twice as restricted electives unless taken as the laboratory component with its lecture component: BIO-1200, BIO-2332 (if MTH-2332 not used), BIO-4990, CHM-1091, CHM-4901, COM-2012, ENS-3105, ENS-4901, ENS-4911, OCN-3111, OCN-3211, OCN-3411, OCN-3433, OCN-4901, OCN-4911. At least one course must be a Q course: BIO-3210, BIO-4120, BIO-4130, BIO-4720, BIO-4991, BIO-4992, BIO-4993.

Q-COURSE: At least one restricted elective, technical elective, or free elective must be a course designated "Q" in the university catalog.

SOC SCI ELEC: any FIT course (taken at FIT or by transfer credit) with "SS" at end of course description in FIT catalog; also, MSC-4002; or any transfer course designated "S S XXX Social Science Elective" (or similar) on Registrar's transfer credit evaluation sheet.

TECH ELEC: approved subjects: AHF, AVS, BCM, BIO, BME, CHE, CHM, CIS, CON, CSE, CVE, ECE, ENS, ISC, MAE, MET, MTH, OCE, OCN, ORP, PHY, SPC, SPS, SWE, SYS; PSY-3423, PSY-4521; courses designated as non-majors (e.g., BIO-3010) not allowed; approved levels include 3000 and 4000 as well as graduate courses; levels 1000 and 2000 allowed except: AVS-1101, AVS-1102, AVS-1202, BIO-1162, BIO-1XXX transfer credit, BIO-2332 if MTH-2332 used for graduation credit, CHM-1100, CSE-1101, CSE-2234, CSE-2400 (or any other statistics course), MTH-1000, MTH-1603, MTH-1701, MTH-1702, MTH-1801, MTH-2332 if BIO-2332 used for graduation credit, MTH-2401.

Be certain to submit substitution forms immediately for elective courses, any substitutions, and special situations.