Insider’s Guide to Energy Business and Finance (EBF) at Penn State University, AY 2016-17

For students in the General Option with a Program Year of 2015 or Later

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This version of the EBF Insider’s Guide is for students in the General Option with a program year of 2015 or later. If you are in the Energy Land Management Option or have a program year prior to 2015, a different set of requirements applies to you. Please refer to the appropriate course requirements at www.eme.psu.edu/ebf.
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1 About EBF and the Insider’s Guide

The Energy Business and Finance degree program, offered through the John and Willie Leone Family Department of Energy and Mineral Engineering at Penn State, is a unique degree program designed to train students for careers in energy or related industries. The General Option provides students with broad training in business and economics as relevant to energy production, consumption and delivery. Students are expected to supplement this training with an approved minor, concurrent major, or term abroad experience, depending on their personal and career interests.

The General Option is designed for breadth of training. Students interested in a highly focused energy-related degree program should consider the Energy Land Management Option rather than the General Option. More information on the Energy Land Management Option is available at http://www.eme.psu.edu/ebf/landmanagement-option.

While the EBF General Option covers many of the essentials that students will find in conventional economics or business programs, our requirements are much more difficult than either. In particular, the EBF program expects a level of comfort with mathematical, statistical and quantitative thinking that is higher than expectations in economics or business.

The EBF Insider’s Guide is designed to provide students in the General Option of the Energy Business and Finance program at Penn State with detailed information on program requirements, courses available to students in the major, and pathways to graduation. It expands upon information available through two online resources:

- The EBF General Option program description available through the University Bulletin (http://bulletins.psu.edu/undergrad/programs/baccalaureate/E/EBF, also known as the ‘Blue Book’);

The EBF major has a number of aspects that some students find complicated. The Insider’s Guide is designed to provide a clear explanation of program requirements and the courses that make up the EBF major. To minimize pain and confusion, all EBF General Option students are urged to read this document carefully and to take two additional steps.
1.1 Get to Know Your Advisor!
We encourage students to know their advisors. Meeting with your advisor regularly can save you lots of trouble. If you do not know who your assigned advisor is, check in your LionPATH Student Center or email Alisha Simon at anw114@psu.edu. If there is a question your advisor cannot answer, please contact the program chair, Dr. Blumsack. But do not contact the program chair first with an issue your advisor can handle. You will simply be directed to talk to your advisor.

Ms. Simon is the dedicated academic advisor for the EME Department and is available to answer questions. Please see http://www.eme.psu.edu/academics/undergraduate/advising for information about which advising topics to discuss with your faculty advisor or Ms. Simon.

1.2 Schedule Classes Early!
Demand for almost every EBF course exceeds capacity. It is therefore imperative that students schedule courses as early as possible. If you don’t know when your scheduling date is, you can find out in your LionPATH Student Center.

We suggest scheduling courses literally as soon as you can – at 12:01 am on the earliest day that you are allowed to schedule. There is very little that the faculty or advisors can do to help you if you delay scheduling, even by one day!

2 What is New in the EBF General Option?

2.1 Prerequisites for EBF Courses
Starting with the fall 2016 term, we have changed some prerequisites for 400-level EBF courses, as follows:

- EBF 401 requires EBF 200, EBF 301, EME 460 and 3 credits of statistics.
- EBF 473 requires EBF 200, EBF 301, MATH 140 and 141 and 3 credits of statistics.
- EBF 483 requires EBF 200, EBF 301, MATH 140 and 3 credits of statistics.
- EBF 484 requires EBF 200, EBF 301, MATH 140 and 3 credits of statistics.

Students will need to plan very carefully to get EBF 200, EBF 301 and statistics completed as early in their careers as possible. Note also that EBF 473 now requires MATH 141 (not just MATH 140)!

2.2 Changes in EBF Course Offerings
Students should note the following changes in EBF courses being offered during the 2016/17 academic year.
• EBF 401 will not be offered in spring 2017.
• EBF 472 will be offered only in spring 2017 and will not be offered fall 2016.
• Dr. Kleit is offering a new course in fall 2016, EBF 497, which deals with energy land contracting issues. While most relevant to students in the Land Management Option, students in the General Option may take this course in place of EBF 304 (note that EBF 304 used to be called EBF 304W).
• If all goes well, we plan to start offering EBF 483 (electricity markets) online over the summer, starting in summer 2017.

2.3 Three-Attempt Course Policy

A recent change in Penn State policy is that students may not attempt a Penn State class more than three times, regardless of the campus at which the course is taken (University Park, Commonwealth Campuses or World Campus). An “attempt” is defined as receiving a grade or late dropping the course. Courses taken in a semester when a student withdraws from the University or Penn State equivalent courses taken at other universities are not counted as “attempts.”

Students should be aware that this policy is retroactive, meaning that if you attempted a course three times before the policy went into place, you may not sign up for that course again! If you are in a situation where you have attempted a required class (such as MATH 141) three times without passing, then you basically have a few options:

• You may petition to take the class a fourth time. The process of petitioning starts with a visit to the EME or EMS advisors (Alisha Simon or the Ryan Family Student Center). Do not see your faculty advisor to ask about petitions for exceptions to the Three-Attempt policy. Students must meet certain criteria to have a petition approved; it is not automatic.
• You may take an equivalent class at another university and have the credits transfer to Penn State.
• You may look for alternative majors besides EBF.

3 Requirements for the EBF General Option

This section details the requirements for the EBF General Option. It largely repeats material available from the University Bulletin, but with some additional information.

3.1 Entry to the Major

Students must complete all of the following requirements to enter the EBF General Option:
• Completion of at least 29.1 credits of coursework;
• Cumulative GPA of 2.0 or higher;
• Completion of ECON 102 and MATH 140, with a grade of C or higher in each.

3.2 Overview of EBF General Option Requirements
The EBF General Option requirements consist of a set of coursework and supplementary training aimed at complementing the major coursework.

3.2.1 Coursework Requirements
We divide coursework for the EBF General Option into core EBF courses, required supporting courses, and electives.

Core EBF Courses: EBF 200, EBF 301, EBF 304, EBF 401, EME 460, EBF 483 or 484, and EBF 473. These courses provide the business and economics foundation for careers in the energy industries. A grade of C or higher is required for all core EBF courses with the exception of EBF 473.

Required Supporting Courses:

Mathematics: MATH 140 and 141. A grade of C or higher is required for each of MATH 140 and 141. The EBF program takes this requirement very seriously. We will not accept MATH 110/111 in place of MATH 140/141. Even if you have taken higher-level math, you still need to pass MATH 140/141 with a grade of C or higher in each.

Statistics: STAT 301, 401 or EBF 472. A grade of C or higher is required.


Economics: ECON 102, ECON 104, ECON 302. A grade of C or higher is required for ECON 102 and ECON 302.

Business: ACCTG 211, B LAW 243 (or B A 241 and B A 242), IB 303, R M 302. A grade of C or higher is required for R M 302.

English: ENGL 15 or ENGL 30, ENGL 202C or ENGL 202D.

Electives
• 6-7 credits of introductory electives (200-level or lower) from an approved list.
• 3 credits of advanced electives (400-level) from an approved list.

The approved electives lists can be found in the PSU Bulletin: http://bulletins.psu.edu/undergrad/programs/baccalaureate/E/EBF.
Some course substitutions are possible, and the EBF program will accept a wider range of electives than what is on the approved list. Common substitutions are discussed in Section 3.4 of this document. Electives that the EBF program will accept are found in Section 5, which also provides detailed course descriptions.

3.2.2 Supplementary Training and Experience
In addition to the coursework requirements, all EBF General Option students are required to attain one of the following:

- A concurrent major in any subject;
- A 15-credit term abroad program approved by the program chair for EBF;
- A minor in Asian Studies combined with an approved summer term abroad experience.

Students wishing to fill this requirement using a minor should be aware of two things.

1. **It is the student’s responsibility, not the responsibility of the EME Department or advisors, to ensure that minor requirements have been met prior to graduation.** Before students are certified for graduation, the EBF program chair and EME staff will check degree audits to ensure that minors have been completed. The department will not certify students to graduate if minor requirements have not been completed.

2. **Any student wanting to take a minor not on the approved list should consult with the EBF program chair well in advance of starting to take coursework in the minor. It is the program chair’s responsibility, not the responsibility of individual faculty or academic advisors, to approve minors that are not already on the approved list.** The program chair will not approve minors just because all of the requirements for the minor have been fulfilled! In particular, **students should be aware that a minor in Economics or Business Administration cannot be used to fill this EBF requirement.**

Students considering using a term abroad experience to fill this requirement should look at the EBF Study Abroad Guide (posted on the EBF web site) and will need to consult with their faculty advisor or the EBF program chair to discuss the appropriateness of programs and coursework. Students taking term abroad programs to meet the EBF General Option requirement are expected to take at least 12 credits of coursework relevant to the EBF program (i.e., that would fill the EBF
core or elective requirements, as opposed to general education requirements). Courses taken during the term abroad experience can cover specific program requirements. For example, a student who takes the equivalent of Intermediate Microeconomics (ECON 302) during a term abroad program would not be required to take ECON 302 at Penn State. Please speak with your faculty advisor concerning the use of term-abroad courses to cover specific EBF program requirements.

Students wishing to take an Asian Studies minor in conjunction with the summer term abroad experience are strongly encouraged to apply to the Dalian University of Technology summer program in China. For more information see [http://www.eme.psu.edu/ebf/dalian](http://www.eme.psu.edu/ebf/dalian) or contact Prof. Andrew Kleit (coordinator for the Dalian program).

### 3.3 An Important Note on Math Requirements

The EBF General Option requires completion of both MATH 140 and MATH 141, with a grade of C or higher in each.

The EBF program takes the math requirement very seriously. Our experience has been that a student’s grade in calculus is one of the best predictors of success in the EBF major. We urge students to fulfill the mathematics requirement as early in their careers as possible. **The mathematics requirements for the major will not be waived!** This means that students in the EBF General Option need to take MATH 140 and 141 (or a direct equivalent from another institution) and to earn a grade of C or higher in both courses. In particular, the program will no longer accept MATH 110 in place of MATH 140 for entrance to major under any circumstances.

Students who were accepted into the program in prior years with MATH 110 in place of MATH 140 should be aware that the math department may become more stringent about prerequisites, meaning that MATH 140 will need to be taken prior to MATH 141. The EBF program cannot waive this prerequisite since that is controlled by the math department. Students who were granted entrance to the EBF major with MATH 110 and are granted admission to MATH 141 by the math department may petition to have MATH 140 waived under the following circumstances:

1. A grade of C or higher is earned in MATH 141.
2. A grade of B or higher is earned in MATH 110 (This means that a grade of B- is not sufficient).
3. Achieved a score of 76% or higher on the ALEKS exam.

### 3.4 Common Course Substitutions

Many EBF students fill some of their program requirements with courses taken at other institutions, or in some cases with other Penn State courses besides those listed in the curriculum. There is a three-step process for approving course substitutions:
1. Have the substitution approved in writing by your faculty advisor or the program chair.
2. Once the substitute course appears on your degree audit, fill out a petition form (available in 110 Hosler or in the Ryan Family Student Center) and bring it to your advisor to sign.
3. Place the completed petition form with supporting documentation (written approvals for the substitution and transcripts from other institutions where appropriate) in Dr. Blumsack’s mailbox in 110 Hosler.

If you take a course at another university that Penn State recognizes as equivalent to one of its own courses (you can find out whether this is the case through LionPATH), then you don’t need to go through the course substitution approval process but you do need to make sure that the transcript is sent to the Penn State Admissions Office.

Here are some of the more common course substitutions used by EBF students:

- Either EBF 483 or EBF 484 may count to meet core EBF requirements. If a student takes (and passes) both, one may be used to fill the advanced elective requirement. **Students are encouraged to take both EBF 483 and 484 but are not required to.**

- Virtually any introductory accounting course from a community college or other university may be used to meet the ACCTG 211 requirement. Many introductory accounting courses at other universities are 3-credit courses, whereas ACCTG 211 is a 4-credit course. We will waive the extra credit of the ACCTG 211 requirement for students taking introductory accounting at other universities, though students will still need to meet the requirement of 120 credits for graduation.

- B A 241 and B A 242 may be taken in place of B LAW 243 or B A 243.

- Students may meet the mathematics requirements using calculus courses taken at community colleges or other universities. You will need to be sure that the substitute course is a close match for MATH 140 or 141. In particular, substitute courses should demonstrate the use of trigonometric derivatives (which are used in MATH 140 and 141 but not in MATH 110). **Students should be aware that the program chair will be very stringent in enforcing this requirement.**

  - We do not require that a substitute calculus course taken at another university be a 4-credit course. 3-credit calculus courses are acceptable, as long as they are taught at the right level and cover very similar material.

- Students may meet the statistics requirement using a course taken at a community college or another university. EBF requires a calculus-based statistics course, and this requirement extends to any substitute statistics course. **The program chair will not approve any substitute statistics course that does not have calculus as a pre-requisite.**
• Equivalent courses for ECON 102, ECON 104 and ECON 302 can be found at many other universities.
• Students may elect to take a computer science course from another university or one at Penn State other than those listed in the degree requirements. EBF requires a course in a programming language (e.g., C++, Python, Matlab). Courses in word processing or spreadsheet management (e.g., Excel) or courses in web design (HTML), for example, do not meet this requirement.
• FIN 301 or FIN 305 can be used in place of EBF 401. The Smeal College places some controls on these courses during the academic year but sections are available over the summer, at some branch campuses or through the World Campus. Corporate finance courses from other universities may be acceptable substitutes for EBF 401 but must cover very similar material and have a statistics prerequisite. **Students should be aware that BA 301 is not an acceptable substitute for EBF 401.**

### 3.5 Credit for Summer Internships

Some students wish to get credit for summer internships. Advanced students in the general option (rising juniors or higher) can meet their 3-credit advanced elective requirement using a qualified internship. Students wishing to take this option must meet the following requirements:

1. Entrance to the major prior to the start of the internship;
2. Completion of at least four semesters of university coursework prior to the start of the internship;
3. Completion of EBF 200 and EBF 301, with grades of C or higher in each.

There is a four-step process for getting internship credit:

1. An internship that clearly builds upon and complements the EBF curriculum (just working for an energy company is not sufficient – qualifying internships will utilize industry or analytic skills developed through coursework or will build upon a student's analytic tools in a meaningful way);
2. You must get permission of your faculty advisor by June 1 of the relevant year (much earlier if possible, since many faculty travel a lot over the summer);
3. You need to sign up for a section of ENNEC 496 in the fall term (your advisor can help with this);
4. You need to write a 20-page paper describing your internship, to be evaluated by your advisor.

### 3.6 Summer Coursework

A number of EBF General Option requirements can be met by taking summer courses, either at University Park, online or through other institutions. Some EBF
core courses, such as EBF 200 and EBF 301, can be taken over the summer through World Campus. More information on summertime course availability is available at http://www.eme.psu.edu/sites/default/files/ebf-summertime.pdf. The guide to summertime courses for EBF students is updated in January or February of each year.

3.7 Honors Coursework
We strongly encourage students with GPAs greater than 3.7 and at least an A- in EBF 200 who have not yet entered their junior year to apply to the Schreyer Honors College. More information on the “sophomore gateway” is available from the Honors College at https://www.shc.psu.edu/admissions/apply/gateway.cfm. Students wishing to write an EBF honors thesis are expected to take additional coursework in statistics beyond what is required for the EBF General Option – specifically, either ECON 490/306 or STAT 462. The EBF program will allow this additional statistics work to count as the 3 required advanced elective credits. If you wish to apply to the Honors College at the end of your freshman year, please contact Dr. Blumsack about getting into EBF 200 if you have not yet scheduled it.

For students with strong quantitative and analytical skills, the Honors College provides an excellent pathway to get involved in EBF faculty research. If you have any interest in research-based graduate study someday (see Section 3), getting research experience as an undergraduate is extremely beneficial. Many EBF honors theses wind up getting published!

4 Considering Graduate School?
The EBF General Option positions students very well for graduate study in a number of areas, including economics, finance, law and public policy. A number of our alumni have gone on to graduate study, either directly from Penn State or after a stint in the workplace.

Students with an interest in graduate study should consider taking additional coursework that complements the EBF General Option and will strengthen their applications. How best to do this depends on the type of graduate study – professional degrees (e.g. a law degree or MBA) or research-based graduate study (e.g. the M.S. or Ph.D.). Students with an interest in graduate study are encouraged to discuss the type of program of interest with faculty advisors or with Dr. Blumsack.

Students interested in M.S. or Ph.D. programs in economics, finance or in some cases public policy should plan to take as much mathematics and statistics as possible. Minoring in math, physics or statistics (or double-majoring) is very strongly encouraged as preparation before pursuing admission to an M.S. or Ph.D. program in one of these fields. Students interested in most areas of professional graduate study are advised to take coursework that develops written communication skills (such as
history). An exception might be quantitative MBA programs, where mathematical skills are more highly valued.

4.1 The IUG Program in Energy and Mineral Engineering
The EME Department has now adopted an IUG program which allows successful students to graduate in five years with both the B.S. in EBF and the M.S. in Energy and Mineral Engineering (Energy Management and Policy Option). EBF General Option students who wish to be considered for this program need to have a GPA of 3.5 or better and should be pursuing a minor in a relevant engineering field (math does not count). Students interested in the IUG option should discuss this interest with an advisor as soon as possible.

5 Detailed Course Descriptions
This section contains detailed descriptions of courses that can be used to meet EBF requirements (Sections 4.1 through 4.3), as well as a list of minors that will satisfy General Option requirements (Section 4.4). Course descriptions are largely from the University Bulletin, with some commentary. Students should be aware that in some cases the prerequisites are strictly enforced and in some cases not. Prerequisite checking across the University will become more stringent in the near future, so it is always best to check with the instructor or department offering the course if you have questions about prerequisites!

5.1 EBF General Option Core and Required Courses

**ECON 102** (GS) **INTRODUCTORY MICROECONOMIC ANALYSIS AND POLICY** (3)
Methods of economic analysis and their use; price determination; theory of the firm; distribution. *A grade of C or better is required.*

Students should take this as early as possible (it is required for entrance into the major). It is offered in the summer at most PSU campuses, and equivalents are offered in the summer at most universities.

**ECON 302** (GS) **INTERMEDIATE MICROECONOMIC ANALYSIS** (3) Allocation of resources and distribution of income within various market structures, with emphasis on analytical tools. Prerequisite: ECON 102. *A grade of C or better is required.*

This should be taken immediately after students take ECON 102, or during sophomore year as stated on the Recommended Academic Plan. It can be taken in the summer at several campuses, and equivalents can be taken at many universities.
EBF 200 (GS) INTRODUCTION TO ENERGY AND EARTH SCIENCES ECONOMICS (3) Resource use decisions and their effect on local, national, and global development. A grade of C or better is required. Prerequisite: ECON 102

This is the introductory course to the major. ECON 102 is a prerequisite, along with MATH 022 (or a more advanced math course). It is offered both fall and spring semesters, in person and on the web. It is offered online in the summer, and some other Penn State campuses are beginning to offer it periodically.

EBF 301 GLOBAL FINANCE FOR THE EARTH, ENERGY, AND MATERIALS INDUSTRIES (3) The aim of this course is to introduce fundamental concepts of financial management and illustrate their global applications. A grade of C or better is required. Prerequisite: ECON 102

EBF 301 focuses on commodity markets. Students should take this course early in their EBF career, but not before taking ECON 102. It is offered in the fall and spring semesters, and over the summer. This course is offered only on-line.

EBF 304 GLOBAL MANAGEMENT FOR THE EARTH, ENERGY, AND MATERIALS INDUSTRIES (3) This class is designed to introduce students to modern management and organization strategies for resource businesses. Prerequisite: EBF 200. A grade of C or better is required. Prerequisite: EBF 200

We offer this class, which focuses on risk analysis and making decisions in the face of uncertainty, during both semesters. Since EBF 304 is the writing-intensive course for the EBF program, seats are limited and the course can be hard to get in to. Students taking a concurrent major can have the class with the writing attribute required for their other major count in place of EBF 304.

EBF 401 STRATEGIC CORPORATE FINANCE FOR THE EARTH, ENERGY, AND MATERIALS INDUSTRIES (3) Financial decisions corporations in the earth science area make and the tools and analyses used to make these decisions. A grade of C or better is required. Prerequisites: EBF 200, EBF 301, EME 460, 3 credits of statistics and junior or senior standing

This course is offered only in the fall during the 2016/17 academic year. Students may take EBF 301 concurrently with EBF 401 during fall 2016, but in the future all prerequisites for this course will be strictly enforced. The program will accept FIN 301 or 305 as a substitute, but EBF students may not be able to schedule these courses during the regular academic year due to controls. It may be possible to find a corporate finance course at another university, but the material will need to closely match what is taught in EBF 401, and statistics must be a prerequisite.

EBF 473 RISK MANAGEMENT IN ENERGY INDUSTRIES (3) Analysis of strategies for mitigating business risk from market, atmospheric, geophysical uncertainties
including the use of energy/mineral commodity futures/options, weather derivatives, and insurance. **Prerequisites: EBF 200, EBF 301, MATH 140, MATH 141, 3 credits of statistics**

Many statistics classes (STAT 200/301/401 or EBF 472) could serve as the statistics prerequisite. Note that MATH 141 is now required for EBF 473!

This is the most challenging course in the major and is one of the most relevant to employment opportunities. Less than fully motivated students taking this course senior year should beware – you can fail this class, if you work at it!

Alternatives for this class are difficult to find. It may be helpful to take EBF 401 previously or concurrently.

**EBF 483 Introduction to Electricity Markets** (3) This course will introduce students to the structure of regulated and deregulated electricity markets; emerging environmental regulations shaping the electricity industry; and the potential impacts of the "smart grid" on electricity generation, transmission and utilization. **Prerequisites: EBF 200, EBF 301, MATH 140, 3 credits of statistics**

Students are required to take either EBF 483 or EBF 484. If you take both, one of the classes can count for the 400-level elective course. EBF 483 is offered only in the spring term. EBF 483 provides excellent preparation for a career in the electric power sector.

**EBF 484 ENERGY ECONOMICS** (3) Economics of energy demand, production, storage, and pricing; advanced energy policy issues including regulation, climate change, new energy technology. Prerequisite: ECON 102 or EBF 200, 3 credits of calculus. *A grade of C or better is required. Prerequisites: EBF 200, EBF 301, MATH 140, 3 credits of statistics*

EBF 484 focuses on the economics of the oil and natural gas industries. Students are required to take either EBF 483 or EBF 484. If you take both, one of the classes can count for the 400-level elective course.

**ENGL 202C (GWS) Effective Writing: Technical Writing** (3) Writing for students in scientific and technical disciplines. (A student may take only one course for credit from ENGL 202A, 202B, 202C, and 202D.) Prerequisite: ENGL 015 or ENGL 030; fourth-semester standing

Or

**ENGL 202D (GWS) Effective Writing: Business Writing** (3) Writing reports and other common forms of business communication. (A student may take only one course for credit from ENGL 202A, 202B, 202C, and 202D.) Prerequisite: ENGL 015 or ENGL 030; fourth-semester standing
IB 303 (IL) INTERNATIONAL BUSINESS OPERATIONS (3) A survey of the major aspects of international business environment and operations with an emphasis on the cultural dimension. Prerequisite: fifth-semester standing

This class does not appear to be taught at other PSU campuses but may be offered during the summer at University Park.

RM 302 RISK AND INSURANCE (3) Introduction to the principles and methods of handling business and personal risks; emphasis on insurance techniques. Prerequisite: fourth-semester standing. *A grade of C or better is required.*

EBF students should plan to take this class in the fall, when there are many more seats offered than during the spring.

EMSC 100 (GWS) Earth and Mineral Sciences First-Year Seminar (3) Writing, speaking, and critical thinking skills applied to topics of general interest in Environmental and Materials Science. This is only for first year students in the EMS College.

Or

CAS 100 (GWS) Effective Speech (3) Introduction to speech communication: formal speaking, group discussion, analysis and evaluation of messages.

If you entered the EMS College as a freshman, you should have taken EMSC 100. If you entered EMS after your freshman year, you need to take CAS 100 and a freshman seminar. You probably already took the freshman seminar from another college. If you are a transfer student, you do not have to take the freshman seminar, and you will need CAS 100 in place of EMSC 100.

ACCTG 211 FINANCIAL AND MANAGERIAL ACCOUNTING FOR DECISION MAKING (4) Introduction to the role of accounting numbers in the process of managing a business and in investor decision making.

This is the standard accounting course, taught at almost every university in the country. Most UP sections are now offered as hybrid resident-online courses. Unfortunately, the Smeal College has made it difficult for EBF students to take this course in the fall term, so it is usually taken in the spring semester by EBF students. In the summer, you may wish to take it online through the World Campus.

Substitutes for this class can be taken at almost all universities. If you take an accounting course at another university that is only worth 3 credits, Penn State will not recognize it as "ACCTG 211", but merely "Accounting." The EBF program will recognize 3-credit accounting courses as satisfying our accounting requirement as
long as the material is similar to ACCTG 211. (But students should be aware that Smeal will not accept 3-credit accounting courses as equivalent to ACCTG 211, which means that if you want to take finance courses then you need to take Penn State’s version of ACCTG 211.) Courses in personal finance are not considered an appropriate substitute for ACCTG 211.

**CMPSC 101** (GQ) **INTRODUCTION TO ALGORITHMIC PROCESSES** (3) Properties of algorithms, languages, and notations for describing algorithms, applications of a procedure-oriented language to problem solving. A student may receive credit for only one of the following courses: CMPSC 101, 200, 201, 202, 121. Prerequisite: 2 entrance units in mathematics.

Or

**CMPSC 121** (GQ) **Introduction to Programming Techniques** (3) Design and implementation of algorithms. Structured programming. Problem solving techniques. Introduction to a high-level language, including arrays, procedures, and recursion. Prerequisite: MATH 110 or MATH 140

Or

**CMPSC 200** (GQ) **PROGRAMMING FOR ENGINEERS WITH MATLAB** (3) Development and implementation of algorithms in a MATLAB environment, with emphasis on numerical methods for engineering problems. Students can receive credit for only one of the following: CMPSC 101, 200, 201, 202, 121. Prerequisite: MATH 140 Concurrent: MATH 141

Or

**CMPSC 201** (GQ) **PROGRAMMING FOR ENGINEERS WITH C++** (3) Development and implementation of algorithms in a procedure-oriented language, with emphasis on numerical methods for engineering problems. Students can receive credit for only one of the following: CMPSC 101, 200, 201, 202, 121. Prerequisite: MATH 140 Concurrent: MATH 141

Or

**CMPSC 202** (GQ) **Programming for Engineers with FORTRAN** (3) Development and implementation of algorithms in a procedure-oriented language, with emphasis on numerical methods for engineering problems. A student may receive credit for only one of the following courses: CMPSC 101, 102, 200, 201, or 202. Prerequisite: MATH 140 Concurrent: MATH 141

The idea here is that we want you to take a programming class. Lots of alternatives are available at other universities.
**MATH 140 (GQ)  CALCULUS WITH ANALYTIC GEOMETRY I** (4) Functions, limits; analytic geometry; derivatives, differentials, applications; integrals, applications. Students may only take one course for credit from MATH 110, 140, 140A, 140B, and 140H. **Prerequisite:** MATH 022, MATH 026; or MATH 040 or MATH 041 or satisfactory performance on the mathematics proficiency examination. *A grade of C or better is required.*

These classes, or their equivalents, are offered in a large number of places and times. We emphasize again that students need to earn a C or higher in this course and in MATH 141. Frankly, if you got a D in calculus, you are probably in the wrong major.

Many students take pre-calculus courses in the math department (i.e., MATH 26, MATH 40, etc.) These classes do not count toward your 120 credits required for University graduation if you are in a major that requires calculus (such as EBF). No exemptions are allowed.

**MATH 141 (GQ)  Calculus with Analytic Geometry II** (4) Derivatives, integrals, applications; sequences and series; analytic geometry; polar coordinates. Students may take only one course for credit from MATH 141, 141B, and 141H. *A grade of C or better is required.*

**Prerequisite:** MATH 140, MATH 140A, MATH 140B or MATH 140H

**B LAW 243  LEGAL ENVIRONMENT OF BUSINESS** (3) Social control through law: courts, basic policies underlying individual and contractual rights in everyday society. May not be used to satisfy Smeal College baccalaureate degree requirements.

Or

**E R M 411  LEGAL ASPECTS OF RESOURCE MANAGEMENT** (3) Legal systems and lawmaking processes; property rights in land, water, and wildlife resources; jurisdictional problems in planning resource use. **Prerequisite:** E R M 151

B LAW 243 is offered in the summer at various PSU campuses. There may be alternatives available in the summer at other universities. ERM 411 is offered fall term. You can take E R M 411 in place of B LAW 243 or as a 400-level elective, but not both. You can also take B A 241 and B A 242 (together 4 credits) for this requirement, though you have to be in DUS or the Smeal College to do so. These classes are described below.

Or
**B A 241 Legal Environment of Business** (2) Examines the legal system's role and impact regarding business transactions, liability issues, and ownership of intellectual property. Students earning credit for B A 241 may not earn credit toward Smeal College baccalaureate degree for B LAW 243 and/or B A 243.

And (if you take this route)

**B A 242 Social and Ethical Environment of Business** (2) Explores the social and ethical environment of business and ethical decision making in a business context.

**ECON 104 (GS) INTRODUCTORY MACROECONOMIC ANALYSIS AND POLICY** (3) National income measurement; aggregate economic models; money and income; policy problems.

ECON 104 not a prerequisite to anything in the EBF curriculum, and so there is no need to take it at a particular time. ECON 104 is offered in the summer at most PSU campuses, and equivalents are offered in the summer at most universities.

**EBF 472 QUANTITATIVE ANALYSIS IN EARTH SCIENCES** (3) Quantitative analysis of decision making in atmospheric/geophysical sciences: exploratory data analysis, quantification of uncertainty, parametric/non-parametric testing, forecasting, time series analysis. Prerequisite: MATH 110 or MATH 140

Or

**STAT 301 (GQ) STATISTICAL ANALYSIS I** (3) Probability concepts; nature of statistical methods; elementary distribution and sampling theory; fundamental ideas relative to estimation and testing hypotheses. Prerequisite: 3 credits of calculus

Or

**STAT 401 EXPERIMENTAL METHODS** (3) Random variables; probability density functions; estimation; statistical tests, t-tests; correlation; simple linear regression; one-way analysis of variance; randomized blocks. Prerequisite: MATH 111 or MATH 141

*A grade of C or better is required for any statistics class used to fill this requirement.* Some students come into the EBF program already having taken STAT 200; they still have to take one of the above classes. The statistics department generally offers more STAT 401 than STAT 301 sections and sometimes offers STAT 401 over the
summer. EBF 472 (which we encourage students to take), will be taught only in the spring term during Academic Year 2016/17.

Options at other universities are limited because we require a higher level of statistics than other programs. The EBF program requires a statistics class with a calculus prerequisite.

Some students may have AP Statistics credit from high school, but that is not an acceptable substitute for the EBF statistics requirement.

EME 460 ENGINEERING EVALUATION OF OIL AND GAS PROPERTIES (3)
Application of present worth and rate-of-return analysis; reserve calculations; decline curve analysis; uncertainty and risk analysis to engineering project design and evaluation.

This class is offered in both the fall and the spring terms. It is often (but not always) offered on-line over the summer. IE 302 is a potential substitute for this class, but talk to the instructor first. IE 302 has a MATH 141 prerequisite, and the IE department often has enrollment controls on their courses.
5.2 Introductory Electives
There are a large number of potential classes here, not all of which are listed on the degree audit or in the University Bulletin. Basically, the program will accept any GN class offered by the College of Earth and Mineral Sciences. Below is a discussion of a few classes that we particularly encourage students to take.

**EGEE 101 (GN) (MATSE)** ENERGY AND THE ENVIRONMENT (3) Energy utilization and technological development, energy resources, conversion and consequences on the local and global environment, and future energy alternatives.

This is an excellent introduction to energy engineering issues and is taught by popular instructors. It is also offered online.

**EGEE 102 (GN) ENERGY CONSERVATION FOR ENVIRONMENTAL PROTECTION** (3) Exposure to energy efficiency in day-to-day life to save money and energy, and thereby protect the environment.

This is an excellent introduction to energy conservation issues and is again taught by popular instructors and offered online.

**EGEE 120 (GS;US;IL)** OIL: INTERNATIONAL EVOLUTION (3) Survey of the commercial development of the world petroleum industry from various international, historical, business, and cultural perspectives.

This course investigates historical issues relevant to the major and is therefore a good choice for GS, US, and IL requirements (but note that it does not satisfy GN requirements). It is only offered online.

**METEO 4 (GN) Weather and Risk** (3) Non-technical introduction to the science and historical development of meteorology, and the role of weather forecasting as a tool for risk management by individuals, businesses, and societies.

This is a very nice non-technical elective that discusses many risk management issues.

5.3 Advanced Electives
There are a number of choices here, and not all will be discussed. If students desire to concentrate in areas relevant to the major with courses not listed here, they should contact Dr. Blumsack.

5.3.1 Advanced Electives from the Energy Land Management Option
The recently-opened Energy Land Management Option within the EBF program offers some specialized courses focused on contractual and land-use issues related to energy development. EBF General Option students are welcome to take these
courses if space is available, which can count toward the 3-credit advanced elective requirement.

**E B F 402 Energy Law and Contracts** (3) An examination of the law that applies to acquiring the property rights for exploration and drilling of energy sources. Effective: Spring 2014
Prerequisite: **B LAW 243**

**E B F 410 Petroleum and Natural Gas Operations** (3) The course is designed to instruct energy land management option students of the EBF major in the drilling of petroleum and natural gas wells and the challenges in that process. Effective: Summer 2015
Prerequisite: **PHYS 211** or **PHYS 250, GEOSC 001**

**E B F 411 Petroleum and Natural Gas Geology for Land Professionals** (3) This course provides energy land students with a knowledge base, as well as a set of notes and references, that they can draw on during a career in the petroleum industry. Effective: Summer 2015
Prerequisite: **GEOSC 001**

### 5.3.2 Advanced Electives from Other Programs

Prerequisite: **ECON 302, SCM 200** or **STAT 200**

**ECON 444 Economics of the Corporation** (3) Coordination and incentive issues within a corporation. Topics include employment contracts, performance incentives and pricing of financial assets. Effective: Summer 1997
Prerequisite: **ECON 302**

**EME 432 (GEOG 432) Energy Policy** (3) Analysis, formulation, implementation, and impacts of energy-related policies, regulations, and initiatives. Prerequisite: **E B F 200, EGEE 120, PL SC 490**

This course is offered online periodically (check the Penn State scheduling web site or contact the Dutton e-Education Institute). The prerequisites have not been strictly enforced in the past.
**FIN 406 Security Analysis and Portfolio Management** (3) Advanced valuation theory; fundamentals of security analysis; portfolio construction and management. Prerequisite: B A 301 or FIN 301

This class has historically only been available to EBF students during the summer.

**FIN 408 Financial Markets and Institutions** (3) Functional analysis of major credit institutions; sources and uses of funds; impact of government regulation. Prerequisite: B A 301 or FIN 301

This class has historically only been available to EBF students during the summer.

**GEOSC 450 RISK ANALYSIS IN THE EARTH SCIENCES** (3) An introduction to concepts and methods of quantitative risk analysis with focus on water, climate, and energy related risks.

Prerequisite: MATH 140 or MATH 110, introductory earth science or geoscience class, introductory statistics class (e.g. STAT 200 or STAT 301 or EBF 472)

Make sure you have the prerequisites. There will be a lot of math in this class.

**GEOSC 454 GEOLOGY OF OIL AND GAS** (3) Properties, origin, migration, and occurrence of oil and gas. This course has one or more required field trips for which a fee is charged to the student. Prerequisite: GEOSC 001

This is a challenging yet highly relevant class. Speak to the instructor before you sign up for it, particularly if you have struggled with other Geosciences courses.

**METEO 473 APPLICATION OF COMPUTERS TO METEOROLOGY** (3) Application of statistical and numerical methods to practical problems in meteorology. Prerequisite: CMPSC 101, CMPSC 201, or CMPSC 202

This is a challenging class. If you are not also a meteorology major or minor, speak with the instructor before signing up to ensure that the class will be appropriate for you.

**GEOG 430 HUMAN USE OF ENVIRONMENT** (3) The human use of resources and ecosystems and social causes and consequences of environmental degradation in different parts of the world; development of environmental policy and management strategies. Prerequisite: GEOG 030

**GEOG 424** (US;IL) **GEOGRAPHY OF THE GLOBAL ECONOMY** (3) Focus on industrial location theory, factors in industrial location, studies of selected industries and problems of industrial development. Prerequisite: ECON 102, ECON 104, GEOG 126.
In the past, students have needed only 2 of the 3 listed prerequisites.

**GEOG 431 GEOPHYSICS OF WATER RESOURCES (3)** Perspectives on water as a resource and hazard for human society; water resource issues in environmental and regional planning. Prerequisite: 6 credits in geography or natural sciences.

**GEOG 444 AFRICAN RESOURCES AND DEVELOPMENT (3)** Ecological and cultural factors in the geography of Africa; natural resources and development. Prerequisite: GEOG 010, GEOG 020, GEOG 030, or GEOG 124

**CED 404 (AG EC) METHODS IN NATURAL RESOURCE AND ENVIRONMENTAL ECONOMICS (3)** Students will learn empirical research methodology in the areas of environmental and natural resource economics. Prerequisite: AG EC 201 or ECON 302, ECON 428

**CED 409 LAND USE PLANNING AND PROCEDURE (3)** General land use planning laws and procedures.

Prerequisite: 6 credits of B LAW, CED, ECON, E R M, E RRE, PL SC, R EST, SOC, or S T S (any combination)

**CED 429 (AG EC) NATURAL RESOURCE ECONOMICS (3)** Optimal management of resources; roles of markets and other institutions; resources and economic development; public policy. Prerequisite: ECON 302

**CED 431W (AG EC) ECONOMIC ANALYSIS OF ENVIRONMENTAL AND RESOURCE POLICIES (3)** Economic analysis of environmental and natural resource policies, benefit-cost analysis, non-market valuation techniques; resource damage assessment. Prerequisite: ECON 302

**CED 450 (IL) INTERNATIONAL DEVELOPMENT, RENEWABLE RESOURCES, AND THE ENVIRONMENT (3)** Theories of agricultural and economic development, with particular attention to interactions between development, renewable resources, and the environment.

Prerequisite: 6 credits in agricultural economics or economics

**FOR 440 Forest Economics and Finance (3)** The application of economic theory to forest resources systems, with emphasis on production and investment analyses. Prerequisite: ECON 102 or ECON 104

**PL SC 490 POLICY MAKING AND EVALUATION (3)** Advanced analysis of public policy, emphasizing policy evaluation and the factors that determine policy success and failure. Prerequisite: PL SC 001 or PL SC 002
5.4 Approved Minors for the EBF General Option

This section provides a list of approved minors. The list is also available at the EBF General Option Recommended Academic Plan, https://rap.psu.edu/recommended-academic-plan-bs-energy-business-and-finance-general-option-ebf-gen-minor-university.

Approved minors are chosen to complement the EBF program and include technical engineering or earth science minors, as well as foreign language minors. Students wishing to use a minor not on the approved list to satisfy the EBF requirement will need to speak with the program officer, preferably before taking lots of courses for the minor.

The following minors are examples of those approved to satisfy the requirements of the EBF General Option. In general, the program chair will approve any minor offered by the Earth and Mineral Sciences College, any hard science or engineering minor (such as biology, physics, environmental engineering), or a foreign language minor.

- Arabic
- Chinese
- Civic and Community Engagement
- Earth Systems
- Energy Engineering
- Entrepreneurship and Innovation
- Environmental Resource Management
- Environmental Systems Engineering
- Geographic Information Science
- Geosciences
- Mathematics
- Meteorology
- Mining Engineering
- Petroleum and Natural Gas Engineering
- Russian
- Spanish
- Statistics
- Sustainability Leadership
- Watersheds and Water Resources