

CURRICULUM SHEETS FOR
BIOMEDICAL, CHEMICAL AND ENVIRONMENTAL ENGINEERING
MS-BS AND GRADUATE PREPARATION (GPST) S-STEM TRACKS

BIOMEDICAL ENGINEERING (BME)
S-STEM BS+MS and GSPT Changes Indicated

Fall 2014 CHEM 1040 Gen Chemistry I 4 CHEM 1040L Gen Chem Lab I 1 ENED 1020 Engrg Foundations 2 ENED 1090 Engineering Models I 2 ENGL 1001 English Composition 3 MATH 1061 Calculus I 4 Total SH 16	Spring 2015 CHEM 1041 Gen Chemistry II 4 CHEM 1041L Gen Chem Lab II 1 ENED 1030 Statics & BSOM 3 ENED 1091 Engineering Models II 2 MATH 1062 Calculus II 4 PD 1011 COOP for CEAS 1 Total SH 15	Summer 2015 <p style="text-align: center;">OFF</p>
Fall 2015 BoK 3 BIOL 1081 Biology 1 3 BIOL 1081L Biology I Lab 1 BME 2000C BME in the Clinic 3 ENVE 2093C Engr Apps of Diff Eqns 2 MATH 2074 Dynamical Systems 3 COOP 2011 Practice Evaluation Total SH 15	Spring 2016 <p style="text-align: center;">Cooperative Education Work Semester</p>	Summer 2016 BOK 3 BME 2010 Research Methods 3 TECH ELEC 3 BME 3071C Basic Electric Circuits 4 ENVE 4051 Stats & Reliability 3 COOP 2012 Practice Evaluation Total SH 16
Fall 2016 <p style="text-align: center;">Cooperative Education Work Semester</p>	Spring 2017 BOK 3 BME Focus Elective 3 TECH ELEC 3 BME 3020C Sensing & Measure. 4 ENGL 2089 Intermediate Comp. 3 COOP 3011 Practice Evaluation ENFD 3020 Undergrad Res I 2 Total SH 18	Summer 2017 <p style="text-align: center;">Cooperative Education Work Semester</p>
Fall 2017 BOK 3 BME Focus Elective 3 TECH ELEC 3 BME 4020C Control & Lab. 4 PD 4001 Prof. Development 1 COOP 4011 Practice Evaluation ENFD 4020 Undergrad Res II 1 Total SH 15	Spring 2018 <p style="text-align: center;">Cooperative Education Work Semester</p>	Summer 2018 ENFD 5030 Prep Grad Research 1-12 <p style="text-align: center;">OR</p> ENFD 5020 Undergrad Res III 1-12 Other Coursework 0-11 Total SH 12
Fall 2018 SELE ELEC 3 SELE ELEC 3 BME ELEC 4 BME 5001 BME Sr. Capstone 6 COOP 4012 Practice Evaluation Total SH 16	Spring 2019 SELE ELEC 3 TECH-PROF ELEC 3 BME 5001 BME Sr. Capstone 6 Total SH 12	

BOK = Breadth of Knowledge -- General Education Requirements

UC's College of Engineering and Applied Science BOK requirements are as follows:

Take one course from any two of the following

- FA Fine Arts
- HP Historical Perspectives
- HU Humanities
- SS Social Sciences

AND Take one course from each of the following

- DC Diversity and Culture
- SE Social and Ethical Issues

CHEMICAL ENGINEERING (CHE)
Section 1: S-STEM BS+MS and GSPT Changes Indicated

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Fall 2017 Cooperative Education Work Semester	Spring 2018 TECH ELEC 3 CHE 4075 Undergrad Res II 1 CHE 4001 UG Seminar 4 CHE 4061 Separation Processes 3 CHE 4062 Chem React Engn 3 CHE 4071 Proc Dynam/Control 3 PD 4001 Prof. Development 1 COOP 4011 Practice Evaluation Total SH 14	Summer 2018 ENFD 5030 Prep Grad Research 1-12 OR ENFD 5020 Undergrad Res III 1-12 Other Coursework 0-11 Total SH 12
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ENVIRONMENTAL ENGINEERING (ENVE)
S-STEM BS+MS and GSPT Changes Indicated

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CHEM 1040 Gen Chemistry I 4 CHEM 1040L Gen Chem Lab I 1 ENED 1020 Engrg Foundations 2 ENED 1090 Engineering Models I 2 ENGL 1001 English Composition 3 MATH 1061 Calculus I 4 Total SH 16	CHEM 1041 Gen Chemistry II 4 CHEM 1041L Gen Chem Lab II 1 ENED 1030 Statics & BSOM 3 ENED 1091 Engineering Models II 2 MATH 1062 Calculus II 4 PD 1011 COOP for CEAS 1 Total SH 15	OFF
Fall 2015 CHE 4075 Research Methods 3 BIOL 1081 Biology 1 3 BIOL 1081L Biology I Lab 1 CHE 2064 Matl & Energy Bal 4 ENFD 2000C Grd Challen in Engrn 2 ENVE 2093C Engr Apps of Diff Eqns 2 MATH 2074 Dynamical Systems 3 COOP 2011 Practice Evaluation Total SH 18	Spring 2016 Cooperative Education Work Semester	Summer 2016 CHEM 2040 Organic Chem I 4 CHEM 2040L Organic Chem Lab I 1 CHE 3022 Transport I 4 ENGL 4092 Technical Writing 3 ENVE 4010 Water & Waste 3 ENVE 4010L Envir & Radiolog 2 ENVE 4051 Stats & Reliability 3 COOP 2012 Practice Eval # Total SH 16
Fall 2016 Cooperative Education Work Semester	Spring 2017 CHEM 2040 Organic Chem I 4 CHEM 2040L Organic Chem Lab I 1 CHE 4075 Undergrad Res I 2 CVE 3002C Soil Mech & Lab 4 CHE 3022 Transport I 4 ENVE 3040 C&E System Anal 3 ENVE 4011 Air Pollution Cont 3 COOP 3011 Practice Eval # Total SH 17	Summer 2017 Cooperative Education Work Semester
Fall 2017 CHE 4071 Proc Dynam & Cntl 3 ECON 1001 Economics (BOK) 3 ENVE 4093 Hydraulic Systems 3 ENVE 4093L Flu Mech & Hyd Sy 2 GEOG 6071C Geog Informa Syst 3 PD 4001 Prof. Development 1 CHE 4075 Undergrad Res II 1 COOP 4011 Practice Eval # Total SH 16	Spring 2018 Cooperative Education Work Semester	Summer 2018 ENFD 5030 Prep Grad Research 1-12 OR ENFD 5020 Undergrad Res III 1-12 Other Coursework 0-11 Total SH 12
Fall 2018 BOK 3 BOK 3 ENVE 5001 Capstone Design I 2 ENVE 5003 Capstone Seminar 1 ENVE 6014 Sol & Haz Waste 3 GEOG 6009 Environ Geochem 3 COOP 4012 Practice Eval # Total SH 15	Spring 2019 BoK 3 ENVE ELEC 3 ENVE ELEC 3 ENVE 5002 Capstone Design II 2 ENVE 5004 Capstone Seminar 1 ENVE 6058C Environ Instrumentn 3 Total SH 15	

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 Curriculum changes from ENVE faculty

COURSE REQUIREMENTS FOR BS-MBA WITH CERTIFICATE IN
ENTREPRENEURSHIP TRACK
AND
PROFESSIONAL PREPARATION TRACK WITH BS + MINOR IN
ENTREPRENEURSHIP

Course Requirements for Graduate Certificate in Entrepreneurship

[12 semester hours to be earned by MBA-ACCEND students in the S-STEM scholarship program]

MGMT 7035 Management of Innovation
ENTR 7005 New Venture Creation (Syllabus included in Supplemental Material)
ENTR 7089 Capstone in Entrepreneurship (Syllabus included in Supplemental Material)
One ENTR Elective; possibilities include, but are not limited to
 MGMT 7012 Leadership and Organizations
 ENTR 7025 Global Entrepreneurship
 ENTR 7035 Management of Closely Held/Family Business
 MKTG 7021 Design Thinking for Business

Courses Requirements for Minor in Entrepreneurship

[18 semester hours to be earned by S-STEM students in the Professional Preparation track]

Prerequisites for Minor:

ECON 1001 Intro to Microeconomics
FIN 3080 Business Finance

Classes for Minor:

FIN 4008 New Venture Finance
ENTR 5070 New Venture Creation (Syllabus parallels syllabus for ENTR 7005)
ENTR 5089 Capstone in Entrepreneurship (Syllabus parallels syllabus for ENTR 7089)
One ENTR Elective; possibilities include, but are not limited to:
 BLAW 4035 Legal Aspects of Entrepreneurship
 ENTR 4001 Intro to Innovation
 ENTR 4010 Management of Closely Held and Family Business
 ENTR 5001 Corporate Entrepreneurship

**Additional Coursework Required (Besides BS) for MBA with Graduate Certificate
Entrepreneurship¹**

Course Name	Number	Hrs.
<i>Foundations</i>		
Fdns in Management	MGMT 7000	2
Fdns in Marketing	MKTG 7000	1
Fdns in Acct	ACCT 7000	2
Fdns in Finance	FIN 7000	1
Fdns in Economics**	ECON 7000	2
Total Foundations		8
<i>Core</i>		
Leadership & Orgs	MGMT 7014	2
Decision Modeling	BANA 7012	2
Managerial Economics	ECON 7020	2
Info & Tech Mgmt	IS 7011	2
Mgmt of Operations	OM 7011	2
Marketing for Managers	MKTG 7011	2
Financial Management	FIN 7014	3
Acct for Mgr Decisions	ACCT 7012	3
Strategic Management	MGMT 7012	2
Corp Legal & Social	BA 7010	2
Global	ENTR 7025 (3 hr course, w/1 hr carryover to elective)	2
Capstone***	Various	2
Total Core		26
<i>Grad. Cert. ENTR</i>		
Entrep. New Venture Creation	ENTR 7005	3
Strategy Implementation	ENTR 7089	3
Management of Innovation	MGMT 7035	3
Elective	Various	3
Total Electives		12
TOTAL SEMESTER HRS		46

¹ There is not one curriculum sheets for the BS-MBA Program which applies for all students in BME, CHE and ENVE. Each student varies with regard to AP credit, undergraduate business courses, and other aspects that put them ahead in the program. Students are informed they have to complete all the requirements of the undergraduate BS program and for the MBA the curriculum requirements given below. Additionally, the courses that count for the Graduate Certificate in Entrepreneurship are indicated. The students need to work with the undergraduate Degree Academic Advisor and the S-STEM Mentor on what courses are appropriate given any advanced standing they have on undergraduate coursework. The student also needs to work with the MBA Degree Advisor on what

course to take for the MBA and Graduate Certificate in Entrepreneurship requirements (the MBA curriculum is much less constrained than engineering curriculum). A dedicated team of undergraduate Degree Academic Advisors in CEAS, who advise all dual degree BS-Master's program (also called ACCEND) students, are very familiar with the advising and know how to guide students.

Students with a business minor will be waived from the foundations courses, but will need 36 total hours to graduate (to be completed through additional elective hours).

ACCEND students are permitted to take only 50% of the MBA classes online.

All Foundations classes are offered each term in an online format.

All core classes are offered each term in an online format.

All core classes are offered term, but in differing formats: evening, online, or daytime.

Foundations classes should be taken before the core class in that discipline; core should be taken before electives in that discipline.

* Students who have not taken an engineering stats and/or CVE 3003 will be required to take BANA 7011, Data Analysis Foundations course

** Students who have taken an Engineering Econ class can waive this course.

***Capstones should be taken towards the end of the program as it is a culminating project. Students should consult with their program advisors as several courses, e.g., ENTR 7005, ENTR 7025, and ENTR 7089 can serve as both requirements and/or electives for the Graduate Certificate in Entrepreneurship as well as meet the MBA capstone paper requirements.

Updated 2/25/15

Courses Requirements for BS with Minor in Entrepreneurship

Non-Lindner College students interested in the Minor in Entrepreneurship must meet the following requirements to apply:

- Have 30 earned semester credit hours
- Have at least a 3.0 University GPA and be enrolled in a four-year degree granting program
- Complete at least 50 percent of all minor coursework in the Lindner College of Business.
- Earn a 2.0 in minor courses to be certified with the minor.

How to Apply:

File an online **Business Minor Application** form. Students will be notified by email of their acceptance into the program and the process for registration in the required Lindner classes.

Foundational Courses:

- BBA and BSIM (Bachelor of Science in Industrial Management) students will fulfill the foundational courses through the completion of their primary degrees.
- ECON-1001 Introduction to Microeconomics 3 semester hours
- FIN-3080C Business Finance 3 semester hours
- or
- ENTP-3071 Business Startup Experience 3 semester hours

Required Minor Courses:

Lindner students may not double count these courses between majors and minors.

Course Number	Course Titles	12 Credit Hours
FIN 4008	New Venture Finance ^{***}	3
ENTR 5070	Entrepreneurship: New Venture Creation	3
ENTR 5098	Capstone in Entrepreneurship	3
Choose from one of the following: ACCT 6076; BLAW 4035; ENTR 4001; ENTR 4010; ENTR 4060; ENTR 5001; ENTR 5093; ENTR 5099; MKTG 4029	Entrepreneurship Elective	3

^{***} May have a new course number and area designation in ENTR b

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**APPENDIX IC: SYLLABUS FOR 20 BME 2010 RESEARCH METHODS IN
BIOMEDICAL ENGINEERING (SUMMER SEMESTER 2014)**

Course Description: Required for all Biomedical Engineering students

Catalog Description: This course will help students to develop methods and skills necessary to create, develop and execute a successful research project. The material covers an introduction in the scientific methods with in depth discussion of case studies from several topics of biomedical engineering.

Prerequisites: Differential Equations; Introductory computer programming. BIOL1081L & CHEM1041L
Or 15BIOL101 & 15BIOL111 & 15CHEM101 & 15CHEM111

Required Texts:

- 1) A Beginner's Guide to Scientific Method, 4th Edition by Stephen S Carey, Wadsworth Cengage Learning, c2012
- 2) Introduction to Biomedical Engineering [electronic resource] / [edited by] John Enderle, Joseph D. Bronzino, Academic Press, c2012
- 3) Matlab

Optional Reading:

- 1) The art of scientific investigation, William IB Beveridge, Blackburn Press, 2004
- 2) Biomedical engineering [electronic resource] : bridging medicine and technology / W. Mark Saltzman, Cambridge University Press, 2009
- 3) The biomedical engineering handbook [electronic resource] / edited by Joseph D. Bronzino, CRC/Taylor & Francis, 2006

Instructor:

Dr. Vasile Nistor
858 ERC
556-2521

nistorve@ucmail.uc.edu

Office Hours: 2:00-2:45pm MW, or by appointment

Learning Objectives: Upon completion of this course, students will be able to:

1. Communicate legal and ethical issues in biomedical research.
2. Overview the stages of a research project from proposal through to publication, and processes used to evaluate the research.
3. Demonstrate written and oral scientific communication skills.
4. Perform appropriate statistical analyses on biomedical data.
5. Give an account of evidence-based medicine and clinical audit.

Class Schedule: Class meets MWF at 1:00 – 2:00, RECCENTR 3230

Attendance Policy: Attendance is not required but strongly recommended.

Grading Policy:

- Weekly Quiz: 25%
- Midterm Exam #1 25%
- Midterm Exam #2 25%
- Final Exam 25%

Missed Exam Policy: Students will not be allowed to make up a missed exam unless he/she has provided an excusable absence prior to the exam date.

Schedule of Lectures and Reading Materials

Date	Topic	Examinations
May 12	Class organization	
	The Scientific Method	
	Science & Observation	
	Explanation & Experimentation	Q1
	Establishing causal links	
	Fallacies in Science	
May 28	Midterm Exam #1	MT1
	Moral and Ethical issues	Q2-Q5
	Anatomy and Physiology	
	Biomechanics	
	Biomaterials	
	Tissue Engineering	
	Compartmental modeling	
July 2	Midterm Exam #2	MT2
	Biochemical reactions and enzyme kinetics	Q6-Q7
	Bioinstrumentation and Sensors	
	Bioelectric phenomena and signal processing	
	Biomedical mass transport	
	Radiation and Medical Imaging	
July 30	Final Exam	Final

APPENDIX ID: COURSE REQUIREMENTS FOR BS-MBA WITH CERTIFICATE IN
ENTREPRENEURSHIP TRACK
AND
PROFESSIONAL PREPARATION TRACK WITH BS + MINOR IN
ENTREPRENEURSHIP

Course Requirements for Graduate Certificate in Entrepreneurship

[12 semester hours to be earned by MBA-ACCEND students in the S-STEM scholarship program]

MGMT 7035 Management of Innovation
ENTR 7005 New Venture Creation (Syllabus included in Supplemental Material)
ENTR 7089 Capstone in Entrepreneurship (Syllabus included in Supplemental Material)
One ENTR Elective; possibilities include, but are not limited to
 MGMT 7012 Leadership and Organizations
 ENTR 7025 Global Entrepreneurship
 ENTR 7035 Management of Closely Held/Family Business
 MKTG 7021 Design Thinking for Business

Courses Requirements for Minor in Entrepreneurship

[18 semester hours to be earned by S-STEM students in the Professional Preparation track]

Prerequisites for Minor:

ECON 1001 Intro to Microeconomics
FIN 3080 Business Finance

Classes for Minor:

FIN 4008 New Venture Finance
ENTR 5070 New Venture Creation (Syllabus parallels syllabus for ENTR 7005)
ENTR 5089 Capstone in Entrepreneurship (Syllabus parallels syllabus for ENTR 7089)
One ENTR Elective; possibilities include, but are not limited to:
 BLAW 4035 Legal Aspects of Entrepreneurship
 ENTR 4001 Intro to Innovation
 ENTR 4010 Management of Closely Held and Family Business
 ENTR 5001 Corporate Entrepreneurship

**Additional Coursework Required (Besides BS) for MBA with Graduate Certificate
Entrepreneurship¹**

Course Name	Number	Hrs.
<i>Foundations</i>		
Fdns in Management	MGMT 7000	2
Fdns in Marketing	MKTG 7000	1
Fdns in Acct	ACCT 7000	2
Fdns in Finance	FIN 7000	1
Fdns in Economics**	ECON 7000	2
Total Foundations		8
<i>Core</i>		
Leadership & Orgs	MGMT 7014	2
Decision Modeling	BANA 7012	2
Managerial Economics	ECON 7020	2
Info & Tech Mgmt	IS 7011	2
Mgmt of Operations	OM 7011	2
Marketing for Managers	MKTG 7011	2
Financial Management	FIN 7014	3
Acct for Mgr Decisions	ACCT 7012	3
Strategic Management	MGMT 7012	2
Corp Legal & Social	BA 7010	2
Global	ENTR 7025 (3 hr course, w/1 hr carryover to elective)	2
Capstone***	Various	2
Total Core		26
<i>Grad. Cert. ENTR</i>		
Entrep. New Venture Creation	ENTR 7005	3
Strategy Implementation	ENTR 7089	3
Management of Innovation	MGMT 7035	3
Elective	Various	3
Total Electives		12
TOTAL SEMESTER HRS		46

¹ There is not one curriculum sheets for the BS-MBA Program which applies for all students in BME, CHE and ENVE. Each student varies with regard to AP credit, undergraduate business courses, and other aspects that put them ahead in the program. Students are informed they have to complete all the requirements of the undergraduate BS program and for the MBA the curriculum requirements given below. Additionally, the courses that count for the Graduate Certificate in Entrepreneurship are indicated. The students need to work with the undergraduate Degree Academic Advisor and the S-STEM Mentor on what courses are appropriate given any advanced standing they have on undergraduate coursework. The student also needs to work with the MBA Degree Advisor on what

course to take for the MBA and Graduate Certificate in Entrepreneurship requirements (the MBA curriculum is much less constrained than engineering curriculum). A dedicated team of undergraduate Degree Academic Advisors in CEAS, who advise all dual degree BS-Master's program (also called ACCEND) students, are very familiar with the advising and know how to guide students.

Students with a business minor will be waived from the foundations courses, but will need 36 total hours to graduate (to be completed through additional elective hours).

ACCEND students are permitted to take only 50% of the MBA classes online.

All Foundations classes are offered each term in an online format.

All core classes are offered each term in an online format.

All core classes are offered term, but in differing formats: evening, online, or daytime.

Foundations classes should be taken before the core class in that discipline; core should be taken before electives in that discipline.

* Students who have not taken an engineering stats and/or CVE 3003 will be required to take BANA 7011, Data Analysis Foundations course

** Students who have taken and Engineering Econ class can waive this course.

***Capstones should be taken towards the end of the program as it is a culminating project. Students should consult with their program advisors as several courses, e.g., ENTR 7005, ENTR 7025, and ENTR 7089 can serve as both requirements and/or electives for the Graduate Certificate in Entrepreneurship as well as meet the MBA capstone paper requirements.

Updated 2/25/15

Courses Requirements for BS with Minor in Entrepreneurship

Non-Lindner College students interested in the Minor in Entrepreneurship must meet the following requirements to apply:

- Have 30 earned semester credit hours
- Have at least a 3.0 University GPA and be enrolled in a four-year degree granting program
- Complete at least 50 percent of all minor coursework in the Lindner College of Business.
- Earn a 2.0 in minor courses to be certified with the minor.

How to Apply:

File an online **Business Minor Application** form. Students will be notified by email of their acceptance into the program and the process for registration in the required Lindner classes.

Foundational Courses:

- BBA and BSIM (Bachelor of Science in Industrial Management) students will fulfill the foundational courses through the completion of their primary degrees.
- ECON-1001 Introduction to Microeconomics 3 semester hours
- FIN-3080C Business Finance 3 semester hours
- or
- ENTP-3071 Business Startup Experience 3 semester hours

Required Minor Courses:

Lindner students may not double count these courses between majors and minors.

Course Number	Course Titles	12 Credit Hours
FIN 4008	New Venture Finance ^{***}	3
ENTR 5070	Entrepreneurship: New Venture Creation	3
ENTR 5098	Capstone in Entrepreneurship	3
Choose from one of the following: ACCT 6076; BLAW 4035; ENTR 4001; ENTR 4010; ENTR 4060; ENTR 5001; ENTR 5093; ENTR 5099; MKTG 4029	Entrepreneurship Elective	3

^{***} May have a new course number and area designation in ENTR b