Internationalization

Interdisciplinarity

Innovation

Quality

2018 UNDERGRADUATE STUDENT HANDBOOK

UNIVERSITY OF MICHIGAN - SHANGHAI JIAO TONG UNIVERSITY JOINT INSTITUTE

UNIVERSITY OF MICHIGAN

JOINT INSTITUTE
交大密西根学院

Notes to Users

1. Policies in this handbook apply to all UM-SJTU Joint Institute students.
2. The newest handbook shall always prevail if there is any inconsistency across different versions, unless it has been specified in special cases.
3. The JI students must abide by the common rules and regulations of SJTU unless they are specified differently in this handbook.
4. The JI reserves the right to review and revise this handbook in the future.

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1. Introduction of UM-SJTU Joint Institute

The UM-SJTU Joint Institute (JI) is an equal-partner institution cooperatively sponsored by the University of Michigan (UM) and Shanghai Jiao Tong University (SJTU). The Chinese Government and both partner universities have made a strong commitment to develop JI as a world class research oriented high-learning institute.

As a specially designated reform zone in Shanghai Jiao Tong University, JI has been given a high degree of autonomy to model itself after the University of Michigan. Through the merging and utilization of the best practices of both universities, JI has demonstrated rapid development in its management model, organizational structure and educational system.

The unique and strategic characteristic of the JI is its global approach to structural and operational development leading to JI's long term vision of I^3Q (Internationalization, Interdisciplinarity, Innovation, and Quality). The JI is governed by the Board of Directors (co-chaired by the top leaders of both parent universities, UM President and SJTU Chair of University Console) and an Academic Program Group (a decision making body composed of faculty members from UM and SJTU). Over the past twelve years, the JI has developed an effective model for training globally astute and creative talents. In addition to its unique program curricula modeled after the UM and an all-English learning environment, the JI students are exposed to an educational approach focused on holistic and rounded development of students' abilities and character.

As of the 2018 Fall semester, JI has 32 full-time tenured or tenure-track faculty members. All come from the world leading universities. JI also has 22 full-time non-tenure-track faculty members in engineering, math and science, as well as liberal arts and business. For the 2018-2019 academic year, JI has over 1000 students from freshman to senior year on the SJTU campus, and over 200 junior and senior students embarking on dual degree studies at the UM Ann Arbor campus.

History of JI

In the year 2000 Shanghai Jiao Tong University (SJTU) and the University of Michigan (UM) signed an agreement which effectively launched a joint collaboration in teaching, research and personnel exchange in Mechanical Engineering and which aimed simultaneously to further develop the Mechanical Engineering School of Shanghai Jiao Tong University. The collaboration proved to be a great success and has been recognized as a model of Sino-American collaborative education for the following characteristics: a world-class education management model, educational programs and course systems based on the UM system, joint bilingual teaching by Chinese and foreign teachers, mutual recognition of academic credits, an innovative education system adapted to the global environment and its high caliber graduates.

From 2000 till 2005, their UM pilot class has enrolled nearly 500 students and piloted dual bachelor degree, dual master degree and continues BS/MS/PhD programs. These graduates enjoy an advantage in the job market and are welcomed by well-known multi-national companies and big enterprises because of their strong practical ability, international competitiveness and over-all high quality of academic preparation.

In June of 2005 the President of the University of Michigan, Dr. Mary Sue Coleman, visited Shanghai Jiao Tong University and signed the agreement to officially establish the University of Michigan - Shanghai Jiao Tong University Joint Institute, marking a further increase in the collaboration between the two universities. Supported by both the Central Government and the Shanghai Government, the new UM-SJTU Joint Institute was launched in April of 2006.

2. Academic Calendar for 2018-2019

Fall Term (14 weeks)

Sept. 8 Registration day for freshman students

Sept. 9 Registration day for current students

Sept. 10 Classes begin for current students

Sept. 10-11 Freshman orientation

Sept. 12 Classes begin for freshman students

Sept. 21 Last day for adding/dropping courses freely. After this day, all adding/dropping requests must be approved by course instructor and Program Advisor

Sept. 24. Mid-Autumn Festival

Oct. 1-7 National Holidays

Oct. 8 Last day for adding/dropping courses without petition to the JI Undergraduate Committee. The petition must also be supported by course instructor, Program Advisor, and other required documents. Only special cases will be approved based on discretion of the committee.

Dec. 14 Last day of the term

Winter Break

Dec. 17 - Feb. 22 (Including New Year's Day & Spring Festival)

Spring Term (10 weeks)

Feb. 24 Registration day

Feb. 25 Classes begin

Mar. 8 Last day for adding/dropping courses freely. After this day, all adding/dropping requests must be approved by course instructor and Program Advisor

Mar. 22 Last day for adding/dropping courses without petition to the JI Undergraduate Committee. The petition must also be supported by course instructor, Program Advisor, and other required documents. Only special cases will be approved based on discretion of the committee.

Apr. 5 Holiday for Tomb Sweeping

May 1 Labor Day

May 3 Last day of the term

Spring Break

May 6 – May 10

Summer Term (13 weeks)

May 13 Classes begin

May 24 Last day for adding/dropping courses freely. After this day, all adding/dropping requests must be approved by course instructor and Program Advisor

Jun. 7 Dragon Boat Festival

Jun. 10 Last day for adding/dropping courses without petition to the JI Undergraduate Committee. The petition must also be supported by course instructor, Program Advisor, and other required documents. Only special cases will be approved based on discretion of the committee.

Aug. 9 Last day of the term

3. General Information

3.1 Mission of the JI

The Joint Institute's primary mission is to establish a highly reputable institution for innovative global engineering education and research activities that will eventually extend to various other academic disciplines.

3.2 The JI Model

- The Education System

  The Joint Institute is pioneering an independent educational system within Shanghai Jiao Tong University. The University of Michigan's experience and knowledge in education will be realized and exemplified within the Joint Institute. Our objective is to be an institute with its own unique characteristics, distinguishable from Shanghai Jiao Tong University.

- The Management System

  The Joint Institute is an autonomous and unique organization. Its independent management structure, financial management, faculty engagement and evaluation system will be introduced and developed sequentially and progressively, under the guidance of both the University of Michigan and Shanghai Jiao Tong University.

- Research and Academic Focus

  Cooperation is especially emphasized in the area of collaborative research between the Joint Institute and both partner universities. While selecting the direction of research, the Joint Institute will place emphasis on shared learning based on Chinese society and economics, combining an academic and research base with mutually beneficial development.

- Education Method and Culture

  Cooperation with both universities allows the Joint Institute to create new cross-subjects with the introduction of the University of Michigan's teaching styles, dual degree programs and sequential graduate/undergraduate study programs, student exchanges and summer programs. JI provides international study and practice opportunities for students to ensure that they will be the academic elites of our future society.

3.3 Undergraduate Degree Programs

JI offers three undergraduate programs leading to Bachelor of Science in Engineering:

- Mechanical Engineering (ME)
- Electrical and Computer Engineering (ECE)
- Material Science and Engineering (MSE)

The ECE and ME programs are accredited by the Engineering Accreditation Commission (EAC) of ABET.

3.4 Graduate Degree Programs

The JI offers Master of Science (MS) and Doctor of Philosophy (PhD) degrees in areas of Mechanical Engineering, Electrical and Computer Engineering, as well as Material Science and Engineering. While the undergraduate program focuses on developing knowledge and skills through class and laboratory work, graduate education puts increased emphasis on developing students' independent research abilities. During their Master's program of studies, students must still take a substantial number of courses, whereas original research is the central focus of their doctoral program. Qualified Bachelor and Master students are encouraged to apply for admission to the graduate program.

4. Undergraduate Degree Programs

4.1 Mission

The mission of the undergraduate degree programs of the UM-SJTU Joint Institute is to prepare our graduates to begin a lifetime of technical and professional creativity and leadership in their chosen fields by:

- Providing students with a comprehensive education that includes in-depth instruction in their chosen fields of study and work.
- Emphasizing analysis and problem-solving, exposure to open-ended problems, design studies and apply critical thinking.
- Fostering teamwork, communication skills, and individual professionalism including ethics and environmental awareness.
- Providing adequate co-curricular opportunities that cultivate lifelong learning skills and get further deep research in their chosen field.
- Providing adequate flexible choice of technical and unrestricted electives by a program of related technical electives.

4.2 Academic Requirements for the First Two Years

Typically, a student will be expected to complete the following courses in the first two years at JI:

- Calculus sequence Vv116, Vv215 and Vv216 or Honors Calculus sequence Vv156, Vv255 and Vv256 or Honors Mathematics sequence Vv186, Vv285 and Vv286
- Additional math course required by the degree program
- Chemistry Vc209 or Vc210
- Chemistry Lab Vc211
- Introduction to Engineering Vg100
- Introduction to Computer and Programming Vg101
- Physics Vp140 and Vp240 or honors sequence Vp160 and Vp260
- Physics Lab Vp141 and Vp241
- English Vy100 and Vy200
- Some core courses for the degree program
- Some humanity and social science courses
- Subjects required by the Ministry of Education and the SJTU

4.3 Mechanical Engineering Program

4.3.1 Introduction to the ME Program

The Mechanical Engineering program at UM-SJTU Joint Institute is fully supported by the ME Department of the UM and the ME School of the SJTU.

This program is built on a common science and engineering core. In the first 3 semesters all students will receive strict training in math, physics, chemistry, engineering basics and computer programming. These courses have been verified by the UM College of Engineering as equivalent to corresponding UM courses.

The Mechanical Engineering program provides students with an excellent foundation in the core technical competencies of the discipline: thermal and fluid sciences, solid mechanics and materials, and dynamics and control. Built upon these strengths is a very strong focus on application of these technical abilities through our design and manufacturing sequence. In addition, an array of technical electives is offered to enable students to tailor their mechanical engineering education to best suit their career goals.

Throughout the program students work with modern laboratory equipment and computer systems and they are exposed to the most recent analytical techniques and technological developments in their field. Students have many opportunities to associate with outstanding faculty, most of whom will be actively engaged in research and/or professional consulting.

There are numerous programs offered to enrich students' education such as the Dual Degree program with UM, JI-Sequential Graduate Undergraduate Study program with UM, Enrichment & Study Abroad Programs and independent study opportunities with ME faculty. Our students are encouraged to seek an advanced degree if further specialization and a higher degree of competence in a particular area are desired.

4.3.2 Mission

The mission of ME program is to prepare the graduates for diverse careers in mechanical engineering and related engineering fields.

4.3.3 Program Educational Objectives

Within 3 to 5 years after graduation from the ME program, the graduates are expected to:

- Further their intellectual growth through graduate education or professional development.
- Apply their creativity and global perspective in their engineering or non-engineering professions.
- Assume leadership roles in a variety of contexts.

4.3.4 Student Outcomes

Graduates of the ME program should be able to demonstrate:

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3) an ability to communicate effectively with a range of audiences
4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

4.3.5 Curriculum

Candidates for the Bachelor of Science in ME must satisfactorily complete 136 credit hours required by the JI ME program, including:

- Engineering Foundation: 39 credits
- Program Subjects: 50 credits
- Academic Writing 8 credits
- Intellectual Breadth: 16 credits
- Electives:
  - Advanced Mathematics: 3 credits
  - Flexible Technical Electives: 11 credits
  - General Electives: 9 credits

Domestic Chinese students are also required to take all Chinese politics courses required by the Ministry of Education of China. International students are required to take 12 credits of Chinese language and culture courses.

Course requirements for each of the credit categories are listed below:

Engineering Foundation (39 credits)

- Calculus II - Vv116 or Honors Calculus II - Vv156 or Honors Mathematics II - Vv186
- Calculus III - Vv215 or Honors Calculus III - Vv255 or Honors Mathematics III - Vv285

- Calculus IV - Vv216 or Honors Calculus IV - Vv256 or Honors Mathematics IV - Vv286
- Linear Algebra - Vv214 or Vv417
- Chemistry Vc209 or Vc210
- Chemistry Lab - Vc211
- Physics I & II - Vp140 & Vp240 or Honors Physics I & II – Vp160 & Vp260
- Physics Lab I & II - Vp141 & Vp241
- Introduction to Engineering - Vg100
- Introduction to Computer and Programming - Vg101

Program Subjects (50 credits)

- Introduction to Circuits - Ve215
- Engineering Practice Training – Vm020
- Introduction to Solid Mechanics -Vm211
- Thermodynamics - Vm235
- Introduction to Dynamics and Vibrations - Vm240
- Design and Manufacturing I - Vm250
- Fluid Mechanics I – Vm320
- Heat Transfer – Vm335
- Design and Manufacturing II – Vm350
- Modeling, Analysis and Control of Dynamic Systems – Vm360
- Mechanical Behavior of Materials – Vm382
- Laboratory I – Vm395
- Design and Manufacturing III or Global MDP – Vm450 or Vg450
- Laboratory II – Vm495

Academic Writing (8 credits)

- Academic Writing I – Vy100
- Academic Writing II – Vy200

Intellectual Breadth (16 credits)

This category requires:

- 2 credits of Professional Ethics – Vg496, and
- 14 credits of courses in humanities, social sciences, professional development, and natural sciences.
- At least 3 credits in humanities and at least 3 credits in social sciences must be completed.

The 14 credits may include courses with code Vr, Vx, Vw, Vf, and Vb. Vz courses are acceptable only for international students. Vy courses are acceptable except Vy100 and Vy200. UM courses that can be used to satisfy the CoE Intellectual Breadth requirements are acceptable. SJTU courses taught in English are acceptable with approval of the JI Undergraduate Committee.

Humanities category includes, but not limited to, Philosophy, English Language and Literature, Asian Languages and Culture, American Culture, Comparative Literature, Film Studies, etc.

Social Sciences category includes, but not limited to, International and Comparative Studies, Political Science, Asian Studies, Economics, Environmental Studies, History, etc.

Professional Development category includes, but not limited to, Engineering Ethics, Business Studies, Entrepreneurship Studies, etc.

Natural Sciences includes Biology, Chemistry, Physics, Astronomy, and Earth Sciences.

A complete list of courses is maintained at the JI Undergraduate Education Office.

Advanced Mathematics (3 credits):

The advanced mathematics requirement can be fulfilled by taking Ve401, Vv454, Vv471, Vv556, Vv557, Vv570, or other courses approved by the ME Program Advisor. Any qualified credits in excess of 3 may be applied to the Flexible Technical Elective (non-ME) or General Elective categories.

Flexible Technical Electives (11 credits):

It is the intent of the flexible technical elective requirement that students take a number of core technical electives to develop a deeper technical knowledge in specific areas of mechanical engineering.

The flexible technical electives credits are broken down into two categories:

- Two courses (totaling at least 6 credit hours) on 300-level or higher in mechanical engineering. One of the two courses must be 400-level or higher.
- Any 300-level or higher courses in ME or in other engineering, biology, chemistry, mathematics, and physics fields, excluding Ve300 and Ve496.

Up to 3 credits of courses taken from other engineering or science departments of SJTU may be counted in this category but must be 300-level or higher. These courses must be approved by the ME Program Advisor. The JI Undergraduate Education Office keeps a list of pre-approved courses.

Any credits in excess of 11 may be applied to the General Elective category.

For students in the UM-JI Dual-Degree program, the Flexible Technical Elective requirement can be satisfied by taking any 300-level or higher courses in ME or in other engineering, biology, chemistry, mathematics, and physics fields, excluding Ve300 and Ve496.

The technical elective courses are categorized into three disciplinary areas including Design, Manufacturing, and Systems; Solid Mechanics; and Thermal Fluids. The courses JI offers in each area are listed as follows. The Undergraduate Education Office maintains a complete list of the courses.

Discipline Areas	Required Courses	Elective Options
Design, Manufacturing, and Systems	Vm240 – Intro to Dynamics and Vibrations Vm250 – Design & Manufacturing I Vm350 – Design & Manufacturing II Vm360 – Modeling, Analysis and Control of Dynamic Systems Vm450 – Design & Manufacturing III	Vm440 – Intermediate Dynamics and Vibrations Vm461 – Automatic Control Vm467 – Introduction to Robotics Vm481 – Manufacturing Processes Vm482 – Machining Processes Vm513 – Continuum Mechanics Vm552 – Mechatronic Systems Design Vm564 – Linear Systems Vm583 – Manufacturing Processes and Systems
Solid Mechanics	Vm211 – Intro to Solid Mechanics Vm382 – Mechanical Behavior of Materials	Vm305 – Introduction to finite elements in mechanical engineering Vm311 – Strength of Materials Vm412 – Advanced Strength of Materials Vm418 – Mechanics of Composite and Microstructured Media Vm511 – Foundations of Solid Mechanics
Thermal and Fluids	Vm235 – Thermodynamics I Vm320 – Fluid Mechanics Vm335 – Heat Transfer	Vm421 – Thermal-Fluids Systems Design Vm432 – Combustion Vm433 – Advanced Energy Solutions Vm458 – Automotive Engineering Vm523 – Computational Fluid Dynamics

General Electives (9 credits):

General electives are intended to allow students to explore any dimension of intellectual endeavor that they elect, in both technical (including engineering) and non-technical fields. This requirement can be met by any course subject to the following restrictions:

- A maximum of 4 credit hours of research work (including PRP, IAP, and independent study) can be counted towards graduation.

Students should select their general elective classes either to explore an area of cultural interest or to explore an area of professional interest such as:

- Management, business, or finance classes in preparation for working in industry.
- Classes to prepare for further study outside engineering such as medicine, dentistry, law or education.
- Additional language, literature or culture classes to prepare for a career in the global economy.
- Additional Mechanical Engineering classes to go into more depth than the limited program of technical electives allows.
- Engineering classes in other departments in preparation for graduate school outside Mechanical Engineering.

4.3.6 Sample Schedule for ME program

The following Sample Schedule is an example that explains how a student may satisfy the course requirements in each category in four years.

Course Title & Course Code			Credit	Terms									
				1	Sp	2	3	Sp	4	5	6	7	8
Engineering Foundation			**39**	**12**	**1**	**13**	**9**	**0**	**4**	**0**	**0**	**0**	**0**
Calculus I-Vv115[1]				4*									
Calc. II-Vv116[2]	Hnr. Calc. II-Vv156	Hnr. Math II-Vv186	16	4	4*								
Calc. III-Vv215	Hnr. Calc. II-Vv255	Hnr. Math III-Vv285				4							
Calc. IV-Vv216	Hnr. Calc. II-Vv256	Hnr. Math IV-Vv286					4						
Linear Algebra - Vv214 / Vv417									4	4*			
Introduction to Engineering - Vg100			4	4		4*							
Introduction to Computer and Programming - Vg101			4	4*		4							
Chemistry - Vc210			5	4									
Chemistry Lab - Vc211					1								
Physics I - Vp140	Honors Physics I - Vp160		10			4							
Physics II -Vp240	Honors Physics II - Vp260						4						
Physics Lab I - Vp141						1							
Physics Lab II -Vp241							1						
Academic Writing			**8**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Academic Writing I-Vy100			4	4									
Academic Writing II-Vy200			4		4								
Intellectual Breadth			**16**	**0**	**0**	**4**	**0**	**0**	**0**	**3**	**0**	**5**	**4**
Humanities, Social Sc., Prof. Development, Natural Sci.			14			4				3		3	4
Professional Ethics - Vg496			2								2*	2	
Program Subject			**50**	**0**	**0**	**0**	**8**	**0**	**8**	**15**	**15**	**4**	**0**
Engineering Practice Training - Vm020			1				1	1*					
Introduction to Circuits - Ve215			4							4			
Introduction to Solid Mechanics - Vm211			4				4						
Thermodynamics - Vm235			3				3		3*				
Introduction to Dynamics and Vibrations - Vm240			4					4*	4				
Design and Manufacturing I - Vm250			4					4*	4				
Fluid Mechanics I - Vm320			3						3*	3			
Heat Transfer - Vm335			3								3		
Design and Manufacturing II - Vm350			4								4		
Modeling, Analysis and Control of Dynamic Systems - Vm360			4								4		
Mechanical Behavior of Materials - Vm382			4					4*		4			
Laboratory I - Vm395			4							4	4*		
Laboratory II - Vm495			4								4	4*	
Design and Manufacturing III - Vm450			4									4	4*
Electives			**23**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**7**	**12**
Advanced Mathematics			3						3				
Flexible Technical Electives			11									7	4
General Electives			9						1				8
Subjects Required by MOE and SJTU[3]													
Chinese politics courses				✓	✓		✓	✓					
Physical Education				✓	✓		✓	✓					
Total Credits:			***136***	***16***	***5***	***17***	***17***	***0***	***16***	***18***	***15***	***16***	***16***

1. Vv115 is only required for students who do NOT have sufficient preparation in mathematics, counted as General Elective
2. Vv116 is only offered in spring semester
3. These courses are not required for the international students

* Alternative semester in which a course is offered

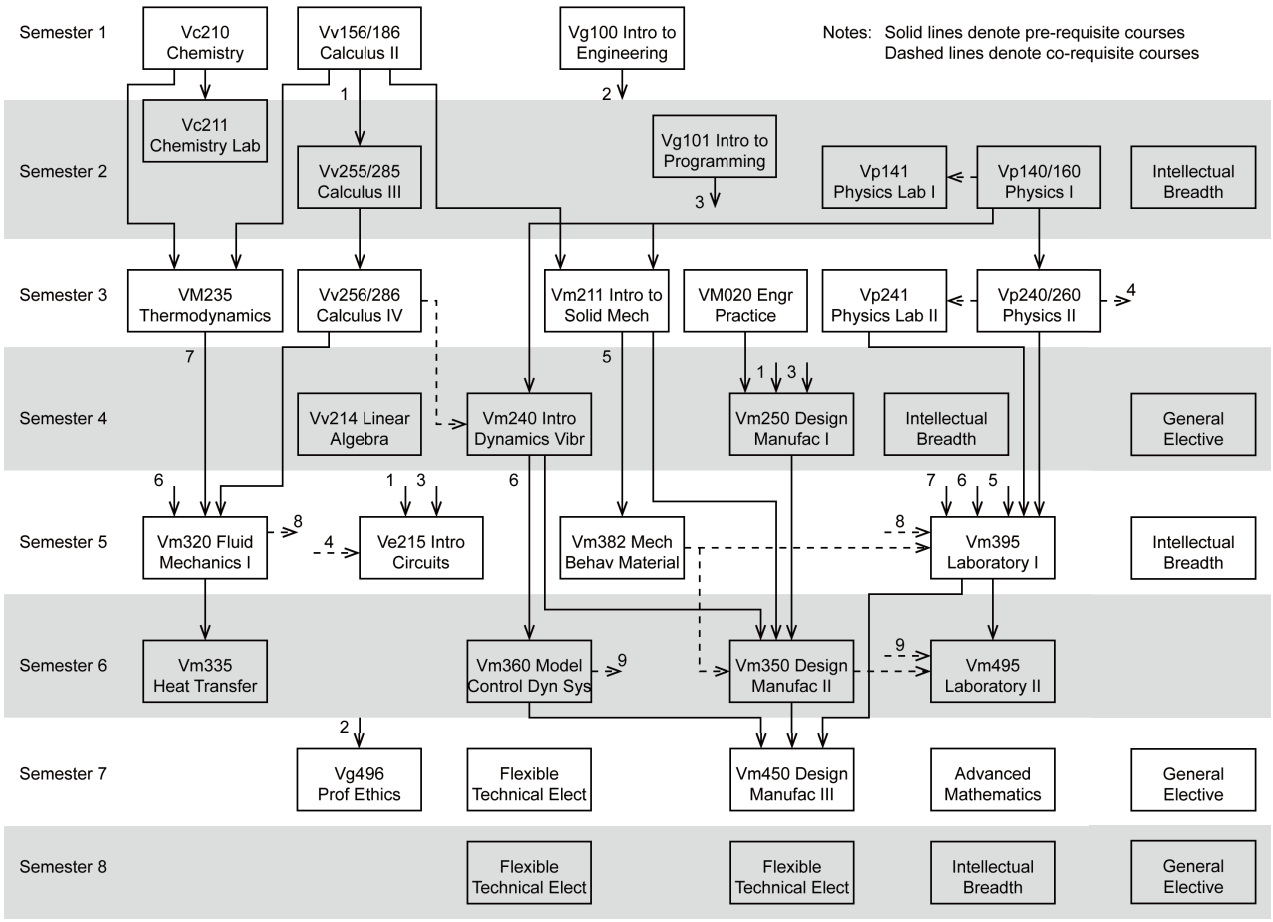
Alternatively, the following Sample Schedule is an example that explains how a student may satisfy the course requirements in each category in five years.

Course Title & Course Code			Credit	Terms										
				1	Sp	2	3	Sp	4	5	6	7	8	9	10
Engineering Foundation			**39**	**8**	**5**	**13**	**9**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**
Calculus I-Vv115[1]				4*											
Calc. II-Vv116[2]	Hnr. Calc. II-Vv156	Hnr. Math II-Vv186	16		4										
Calc. III-Vv215	Hnr. Calc. II-Vv255	Hnr. Math III-Vv285				4									
Calc. IV-Vv216	Hnr. Calc. II-Vv256	Hnr. Math IV-Vv286					4								
Linear Algebra - Vv214 / Vv417											4	4*			
Introduction to Engineering - Vg100			4	4											
Introduction to Computer and Programming - Vg101			4			4									
Chemistry - Vc210			5	4											
Chemistry Lab - Vc211					1										
Physics I - Vp140	Honors Physics I - Vp160		10			4									
Physics II - Vp240	Honors Physics II - Vp260						4								
Physics Lab I - Vp141						1									
Physics Lab II -Vp241							1								
Academic Writing			**8**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Academic Writing I-Vy100			4	4											
Academic Writing II-Vy200			4		4										
Intellectual Breadth			**16**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**0**	**4**	**2**	**4**
Humanities, Social Sc., Prof. Development, Natural Sci.			14							3	3		4		4
Professional Ethics - Vg496			2											2	
Program Subject			**50**	**0**	**0**	**0**	**5**	**0**	**11**	**7**	**7**	**8**	**8**	**4**	**0**
Engineering Practice Training - Vm020			1				1	1*							
Introduction to Circuits - Ve215			4									4			
Introduction to Solid Mechanics - Vm211			4				4								
Thermodynamics - Vm235			3						3						
Introduction to Dynamics and Vibrations - Vm240			4						4						
Design and Manufacturing I - Vm250			4						4						
Fluid Mechanics I - Vm320			3							3					
Heat Transfer - Vm335			3								3				
Design and Manufacturing II - Vm350			4								4				
Modeling, Analysis and Control of Dynamic Systems - Vm360			4										4		
Mechanical Behavior of Materials - Vm382			4							4					
Laboratory I - Vm395			4									4			
Design and Manufacturing III - Vm450			4											4	
Laboratory II - Vm495			4										4		
Electives			**23**	**4**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**4**	**0**	**5**	**7**
Advanced Mathematics			3											3	
Flexible Technical Electives			11									4			7
General Electives			9	4						3				2	
Subjects Required by MOE and SJTU[3]															
Chinese politics courses				✓	✓		✓	✓							
Physical Education				✓	✓		✓	✓							
Total Credits:			***136***	***16***	***9***	***13***	***14***	***0***	***11***	***13***	***14***	***12***	***12***	***11***	***11***

1. Vv115 is only required for students who do NOT have sufficient preparation in mathematics, counted as General Elective
2. Vv116 is only offered in spring semester
3. These courses are not required for the international students

* Alternative semester in which a course is offered

Following is a flow chart for the ME curriculum, in which solid lines denote prerequisite courses, while dashed lines denote co-requisites.



4.4 Electrical and Computer Engineering (ECE) Program

4.4.1 Introduction to the ECE Program

The rapidly converging world needs more professionals with profound knowledge of electrical engineering, computer engineering, and computer science. The Electrical and Computer Engineering program at UM-SJTU Joint Institute is an interdisciplinary program. It places emphasis on both hardware and software technology, and the students' capability to creatively use the knowledge learned in the class to solve real world problems.

This program is built on a common science and engineering core. In the first 2 semesters, all students will receive rigorous instruction in math, physics, chemistry, engineering basics and computer programming. These courses have been verified by the UM College of Engineering as equivalent to corresponding UM courses. After the second semester, students choose to enter the ECE program. The ECE program at JI covers all the core requirements of both EE and CE programs at UM (including all the program subjects, technical cores and upper level technical electives).

The ECE program provides students with a fundamental background in the basic theoretical concepts and technological principles of modern electrical and computer engineering. A flexible curriculum allows students to emphasize a wide variety of subject areas within the field including: analog and digital circuits, communication systems, control systems, integrated circuit (microprocessor) design, micro electromechanical devices, signal processing, computer architecture, computer network, and embedded systems. A degree in electrical and computer engineering can lead to a wide range of work opportunities. Automotive applications include engine control processors and sensors to trigger airbags or activate antilock brake systems. Electrical and computer engineers work in the wireless communications field, including mobile phone systems and global positioning systems. They also work in remote sensing to infer characteristics of a region of the earth from the air or from space. They design, manufacture, test and market the microprocessor, analog and RF integrated circuits from which computers, digital

movie and still cameras, the internet, communication systems and many other modern conveniences are made. Electrical and computer engineers develop signal processing algorithms and hardware for multimedia devices and develop control algorithms and electronics for mechanical systems such as automobiles, planes and spacecraft. They embed microprocessors in everything from entertainment gadgets to industrial plants.

Throughout the program students work with modern laboratory equipment and computer systems and are exposed to the most recent analytical techniques and technological developments in their field. Students have many opportunities to associate with outstanding faculty, most of whom are actively engaged in research and/or professional consulting. Such interaction serves to acquaint students with the opportunities and rewards available to practicing electrical or computer engineers and scientists. Our students are encouraged to seek an advanced degree if further specialization and a higher degree of competence in a particular area are desired.

4.4.2 Mission

The ECE program is designed to provide each student with a solid foundation in the scientific, engineering, and societal aspects of engineering that prepares the student for a career that can advance the creation and application of electrical and computing technologies for the benefit of society.

4.4.3 Program Educational Objectives

Within 3 to 5 years after graduation from the ECE program, the graduates are expected to:

- Further their intellectual growth through graduate education or professional development.
- Apply their creativity and global perspective in their engineering or non-engineering professions.
- Assume leadership roles in a variety of contexts.

4.4.4 Student Outcomes

Graduates from the ECE program should be able to demonstrate:

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3) an ability to communicate effectively with a range of audiences
4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

4.4.5 Curriculum

Candidates for the Bachelor of Science in ECE must satisfactorily complete 136 credit hours required by the JI ECE program, including:

- Engineering Foundation: 39 credits
- Program Subjects: 43 credits
- Academic Writing 8 credits
- Intellectual Breadth: 16 credits
- Electives:
  - Core Electives: 4 credits
  - Upper Level Technical Electives: 7 credits
  - Flexible Technical Electives: 12 credits

- General Electives: 7 credits

Domestic Chinese students are also required to take all Chinese politics courses required by the Ministry of Education of China. International students are required to take 12 credits of Chinese language and culture courses.

Course requirements for each of the credit categories are listed below:

Engineering Foundation (39 credits)

- Calculus II - Vv116 or Honors Calculus II - Vv156 or Honors Mathematics II - Vv186
- Calculus III - Vv215 or Honors Calculus III - Vv255 or Honors Mathematics III - Vv285
- Calculus IV - Vv216 or Honors Calculus IV - Vv256 or Honors Mathematics IV - Vv286
- Discrete Mathematics - Ve203
- Chemistry - Vc209 or Vc210
- Chemistry Lab - Vc211
- Physics I & II - Vp140 & Vp240 or Honors Physics I & II - Vp160 & Vp260
- Physics Lab I & II - Vp141 & Vp241
- Introduction to Engineering - Vg100
- Introduction to Computer and Programming - Vg101

Program Subject (43 credits)

- Introduction to Circuits - Ve215
- Introduction to Signals and Systems - Ve216
- Programming &Introductory Data Structures -Ve280
- Electromagnetics I - Ve230
- Introduction to Logic Design -Ve270
- Electronic Circuits - Ve311
- Introduction to Semiconductor Devices -Ve320
- Introduction to Computer Organization -Ve370
- Probabilistic Methods in Engineering -Ve401
- Technical Communication -Ve300
- Advanced Technical Communication - Ve496
- Capstone Design or Global MDP - Ve450 or Vg450
  Major Design Experience (MDE) – Ve411, Ve413, or Ve438

Note: Ve300 can be taken independently of any ECE course, but it is a prerequisite for Ve496. Ve496 must be taken prior to or concurrently with Ve450, Vg450, or an MDE course.

Academic Writing (8 credits)

- Academic Writing I – Vy100
- Academic Writing II – Vy200

Intellectual Breadth (16 credits)

This category requires:

- 2 credits of Vg496 Professional Ethics, and
- 14 credits of courses in humanities, social sciences, professional development, and natural sciences.
- At least 3 credits in humanities and at least 3 credits in social sciences must be completed.

The 14 credits may include courses with code Vr, Vx, Vw, Vf, and Vb. Vz courses are acceptable only for international students. Vy courses are acceptable except Vy100 and Vy200. UM courses that can be used to satisfy the CoE Intellectual Breadth requirements are acceptable. SJTU courses taught in English are acceptable with approval of the JI Undergraduate Committee.

Humanities category includes, but not limited to, Philosophy, English Language and Literature, Asian Languages and Culture, American Culture, Comparative Literature, Film Studies, etc.

Social Sciences category includes, but not limited to, International and Comparative Studies, Political Science, Asian Studies, Economics, Environmental Studies, History, etc.

Professional Development category includes, but not limited to, Engineering Ethics, Business Studies, Entrepreneurship Studies, etc.

Natural Sciences category includes Biology, Chemistry, Physics, Astronomy, and Earth Sciences.

A complete list of courses is maintained at the JI Undergraduate Education Office.

Core Electives (4 credits):

A minimum of 4 credits from one of the following categories:

- Circuits and Devices: Ve312
- Computer Science and Engineering: Ve281, Ve373
- Electromagnetics, Optics, and Photonics: Ve330, Ve334
- Communications, Signal Processing, and Control: Ve451, Ve455, Ve460

Additional courses may be acceptable but must be approved by the JI Undergraduate Committee.

The JI undergraduate education office keeps a current list of courses counted towards this category.

Any qualified credits in excess of 4 may flow into Upper Level Technical Elective, Flexible Technical Elective, or General Elective categories.

Students in the UM-JI Dual-Degree program may satisfy this requirement by taking a course in the Flexible Technical Elective category.

Upper Level ECE Technical Electives (7 credits):

The upper level technical elective courses give students options to either explore further in the area same as the core elective or discover interests in other ECE disciplines. This category of requirement may be satisfied by taking:

- Approved ECE courses at the 300-level or higher, excluding Ve300, Ve496, and Ve490
- At least one course must be at 400-level or higher

The JI undergraduate education office keeps a current list of courses counted towards this category.

Additional courses may be acceptable but must be approved by the ECE Program Advisor. Any qualified credits in excess of 7 may flow into Flexible Technical Elective or General Elective categories.

Flexible Technical Electives (12 credits):

The flexible technical elective requirement may be fulfilled by taking 300-level or higher courses in ECE or in other engineering, biology, chemistry, mathematics, and physics fields.

Up to 6 credits of courses taken from other engineering or science departments of SJTU may be counted in this category but must be 300-level or higher. These courses must be approved by the ECE Program Advisor. The JI Undergraduate Education Office keeps a list of pre-approved courses.

Any credits in excess of 12 may be applied to the General Elective category

The technical courses in the ECE curriculum are categorized into four disciplinary areas including Circuits and Devices; Electromagnetics, Optics, and Photonics; Communications, Signal Processing, and Control; and Computer Science and Engineering. The courses JI offers in each area are listed as follows. The Undergraduate Education Office maintains a complete list of the courses.

Discipline Areas	Required Courses	Elective Options
Circuits and Devices	VE215 Intro to Circuits VE311 Electronic Circuits VE320 Intro to Semicon. Devices	VE312 Digital IC Design VE413 Monolithic Amplifier Circuits VE420 Underlying Smart Devices VE427 VLSI Design
Electromagnetics, Optics, and Photonics	VE215 Intro to Circuits VE230 Electromagnetics I VE320 Intro to Semicon. Devices	VE330 Electromagnetic II VE334 Principles of Optics VE434 Principles of Photonics VE438 Adv. Lasers and Optics Lab
Communications, Signal Processing, and Control	VE215 Intro to Circuits VE216 Signals and Systems VE401 Probabilistic Methods in Engr.	VE353 Intro to Comm. Systems VE451 Digital Signal Processing VE455 Digital Comm. Sig. and Sys. VE460 Contr. Sys. Analysis and Dsn. VE489 Computer Networks VE501 Probability and Random Processes
Computer Science and Engineering	VE270 Intro to Logic Design VE280 Progra. And Data Structures VE370 Intro to Comp. Organization	VE281 Data Structure and Algorithms VE373 Microprocessor Based Sys. Dsn VE475 Intro to Cryptography VE477 Intro to Algorithms VE482 Intro to Operating Sys. VE487 Interactive Computer Graphics VE489 Computer Networks

General Electives (7 credits):

General electives are intended to allow students to explore any dimension of intellectual endeavor that they elect, in both technical (including engineering) and non-technical fields. This requirement can be met by any course subject to the following restrictions:

- A maximum of 4 credit hours of research work (including PRP, IAP, and independent study) can be counted towards graduation.

Students are encouraged to select their general elective classes either to explore an area of cultural interest or to explore an area of professional interest such as:

- Management, business, or finance classes in preparation for working in industry.
- Classes to prepare for further study outside engineering such as medicine, dentistry, law or education.
- Additional language, literature or culture classes to prepare for a career in the global economy.
- Additional Electrical and Computer Engineering classes to go into more depth than the limited program of technical electives allows.
- Engineering classes in other departments in preparation for graduate school outside Electrical and Computer Engineering.

4.4.6 Sample Schedule for ECE Program

The following Sample Schedule is an example that explains how a student may satisfy the course requirements in each category in four years.

Course Title & Course Code			Credit	Terms									
				1	Sp	2	3	Sp	4	5	6	7	8
Engineering Foundation			**39**	**12**	**1**	**13**	**13**	**0**	**0**	**0**	**0**	**0**	**0**
Calculus I-Vv115[1]			16	4*									
Calc. II-Vv116[2]	Hnr. Calc. II-Vv156	Hnr. Math II-Vv186		4	4*								
Calc. III-Vv215	Hnr. Calc. II-Vv255	Hnr. Math III-Vv285				4							
Calc. IV-Vv216	Hnr. Calc. II-Vv256	Hnr. Math IV-Vv286					4						
Discrete Mathematics - Ve203							4		4*				
Introduction to Engineering - Vg100			4	4*		4							
Introduction to Computer and Programming - Vg101			4	4		4*							
Chemistry - Vc210			5	4									
Chemistry Lab - Vc211					1								
Physics I - Vp140	Honors Physics I - Vp160		10			4							
Physics II -Vp240	Honors Physics II - Vp260						4						
Physics Lab I - Vp141						1							
Physics Lab II -Vp241							1						
Academic Writing			**8**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Academic Writing I-Vy100			4	4									
Academic Writing II-Vy200			4		4								
Intellectual Breadth			**16**	**0**	**0**	**4**	**0**	**0**	**0**	**4**	**0**	**6**	**2**
Humanities, Social Sc., Prof. Development, Natural Sc.			14			4				4		4	2
Professional Ethics - Vg496			2								2*	2	
Program Subject			**43**	**0**	**0**	**0**	**4**	**0**	**17**	**4**	**12**	**6**	**0**
Introduction to Circuits - Ve215			4				4						
Introduction to Signals and Systems - Ve216			4					4*	4				
Programming & Introductory Data Structures - Ve280			4						4				
Probabilistic Methods in Eng. - Ve401			4					4*			4		
Electromagnetics I - Ve230			4						4				
Introduction to Logic Design - Ve270			4				4*		4				
Electronic Circuits - Ve311			4								4		
Introduction to Semiconductor Devices - Ve320			4								4		
Introduction to Computer Organization - Ve370			4							4			
Technical Communication - Ve300			1				1*	1*	1				
Capstone Design - Ve450/Major Design Experience (MDE)			4									4	4*
Advanced Technical Communication - Ve496			2									2	2*
Electives			**30**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**4**	**4**	**14**
Core Electives			4							4			
Upper Level Technical Electives			7								4		3
Flexible Technical Elective			12									4	8
General Elective			7							4			3
Subjects Required by MOE and SJTU[3]													
Chinese politics courses				✓	✓		✓	✓					
Physical Education				✓	✓		✓	✓					
Total Credits:			***136***	***16***	***5***	***17***	***17***	***0***	***17***	***16***	***16***	***16***	***16***

1. Vv115 is only required for students who do NOT have sufficient preparation in mathematics, counted as General Elective
2. Vv116 is only offered in spring semester
3. These courses are not required for the international students

* Alternative semester in which a course is offered

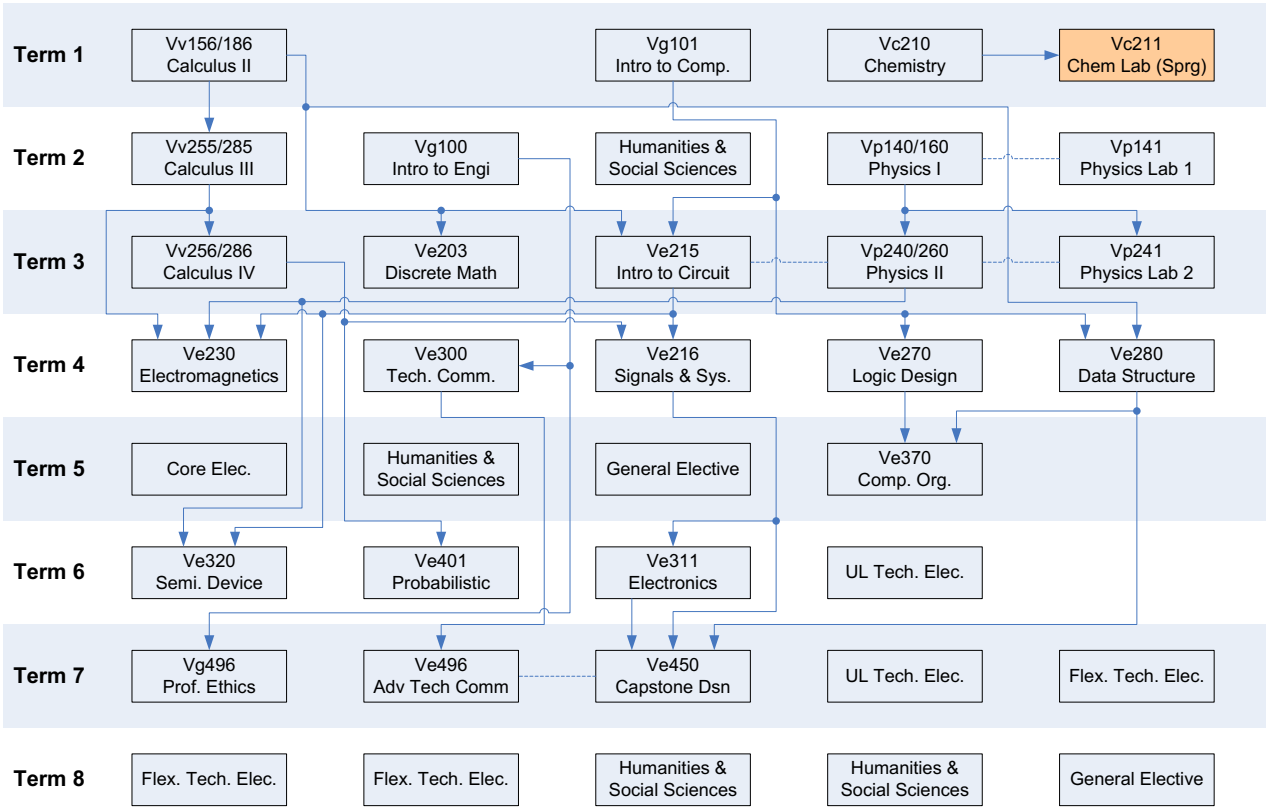
Alternatively, the following Sample Schedule is an example that explains how a student may satisfy the course requirements in each category in five years.

Course Title & Course Code			Credit	Terms										
				1	Sp	2	3	Sp	4	5	6	7	8	9	10
Engineering Foundation			**39**	**8**	**5**	**13**	**9**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
Calculus I-Vv115[1]			16	4*											
Calc. II-Vv116[2]	Hnr. Calc. II-Vv156	Hnr. Math II-Vv186			4										
Calc. III-Vv215	Hnr. Calc. II-Vv255	Hnr. Math III-Vv285				4									
Calc. IV-Vv216	Hnr. Calc. II-Vv256	Hnr. Math IV-Vv286					4								
Discrete Mathematics - Ve203										4					
Introduction to Engineering - Vg100			4	4											
Introduction to Computer and Programming - Vg101			4			4									
Chemistry - Vc210			5	4											
Chemistry Lab - Vc211					1										
Physics I -	Honors Physics I - Vp160		10			4									
Physics II -	Honors Physics II - Vp260						4								
Physics Lab I - Vp141						1									
Physics Lab II -Vp241							1								
Academic Writing			**8**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Academic Writing I-Vy100			4	4											
Academic Writing II-Vy200			4		4										
Intellectual Breadth			**16**	**0**	**0**	**0**	**0**	**0**	**4**	**4**	**0**	**0**	**3**	**2**	**3**
Humanities, Social Sc., Prof. Development, Natural Sc.			14						4	4			3		3
Professional Ethics - Vg496			2											2	
Program Subject			**43**	**0**	**0**	**0**	**4**	**0**	**9**	**0**	**12**	**4**	**8**	**6**	**0**
Introduction to Circuits - Ve215			4				4								
Introduction to Signals and Systems - Ve216			4						4						
Programming & Introductory Data Structures - Ve280			4						4						
Probabilistic Methods in Eng. - Ve401			4										4		
Electromagnetics I - Ve230			4								4				
Introduction to Logic Design - Ve270			4								4				
Electronic Circuits - Ve311			4								4				
Introduction to Semiconductor Devices - Ve320			4										4		
Introduction to Computer Organization - Ve370			4									4			
Technical Communication - Ve300			1						1						
Capstone Design - Ve450/Major Design Experience (MDE)			4											4	4*
Advanced Technical Communication - Ve496			2											2	2*
Electives			**30**	**4**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**8**	**3**	**3**	**8**
Core Electives			4							4					
Upper Level Technical Electives			7									4		3	
Flexible Technical Elective			12									4			8
General Elective			7	4									3		
Subjects Required by MOE and SJTU[3]															
Chinese politics courses				✓	✓		✓	✓							
Physical Education				✓	✓		✓	✓							
Total Credits:			***136***	***16***	***9***	***13***	***13***	***0***	***13***	***12***	***12***	***12***	***14***	***11***	***11***

1. Vv115 is only required for students who do NOT have sufficient preparation in mathematics, counted as General Elective
2. Vv116 is only offered in spring semester
3. These courses are not required for the international students

* Alternative semester in which a course is offered

Following is a flow chart for the ECE curriculum, in which solid lines denote prerequisite courses, while dashed lines denote co-requisites.



4.5 Material Science and Engineering (MSE) Program

4.5.1 Introduction to the MSE Program

Material Science and Engineering (MSE) is widely recognized as one of the key disciplines for the 21st century. In China, the government has designated new materials as one of the priority areas for rapid development with strong government support. It is expected that the demand for MSE engineers that has the professional knowledge, international outlook, and leadership and communication skills will show a significant growth in the coming years. As the third engineering program of the JI, the MSE program emphasizes on the education of well-rounded MSE engineers. The main purpose of establishing an MSE program at JI is to internationalize the materials science and engineering discipline at SJTU, strengthen SJTU's MSE program in the areas of functional and non-metallic materials, and promote education and research collaborations between UM and SJTU in the area of material science and engineering.

The MSE program is designed to prepare students for the careers of the 21st century, whether they continue in engineering or pursue other paths after graduation. The goal of the program is to train students with an understanding of the fundamental knowledge in the MSE discipline; an ability to recognize and define a problem, and strong quantitative and qualitative problem solving skills; a mindset and skills that support lift-long learning; a deep understanding of professional ethics, social responsibilities, and multi-cultural working environment; and skills in team effort, interpersonal and professional communication, time and risk management, as well as critical thinking.

Curriculum of the MSE program closely follows the curriculum of MSE program at UM. It is built on a common science and engineering core. In the first 2 semesters, all students will receive rigorous instruction in math, physics, chemistry, engineering basics and computer programming. These courses have been verified by the UM College of Engineering as equivalent to corresponding UM courses. After the second semester, students choose to enter the MSE program. The program provides students with an excellent foundation in the core technical competencies

of the discipline. In addition, an array of technical electives is offered to enable students to tailor their education to best suit their career goals.

4.5.2 Mission

The MSE program is designed to prepare graduates for diverse careers in material science and engineering, as well as various other engineering fields.

4.5.3 Program Educational Objectives

Within 3 to 5 years after graduation from the MSE program, the graduates are expected to:

- Further their intellectual growth through graduate education or professional development.
- Apply their creativity and global perspective in their engineering or non-engineering professions.
- Assume leadership roles in a variety of contexts.

4.5.4 Student Outcomes

Graduates from the MSE program should be able to demonstrate:

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3) an ability to communicate effectively with a range of audiences
4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

4.5.5 Curriculum

Candidates for the Bachelor of Science in MSE must satisfactorily complete 136 credit hours required by the JI MSE program, including:

- Engineering Foundation: 39 credits
- Program Subjects: 40 credits
- Academic Writing 8 credits
- Intellectual Breadth: 16 credits
- Electives:
  - Advanced Mathematics: 3 credits
  - MSE Electives: 9 credits
  - Flexible Technical Electives: 12 credits
  - General Electives: 9 credits

Domestic Chinese students are also required to take all Chinese politics courses required by the Ministry of Education of China. International students are required to take 12 credits of Chinese language and culture courses.

Course requirements for each of the credit categories are listed below:

Engineering Foundation (39 credits)

- Calculus II - Vv116 or Honors Calculus II - Vv156 or Honors Mathematics II - Vv186
- Calculus III - Vv215 or Honors Calculus III - Vv255 or Honors Mathematics III - Vv285

- Calculus IV - Vv216 or Honors Calculus IV - Vv256 or Honors Mathematics IV - Vv286
- Linear Algebra – Vv214 / Vv417
- Chemistry - Vc209 or Vc210
- Chemistry Lab - Vc211
- Physics I & II - Vp140 & Vp240 or Honors Physics I & II - Vp160 & Vp260
- Physics Lab I & II - Vp141 & Vp241
- Introduction to Engineering - Vg100
- Introduction to Computer and Programming - Vg101

Program Subject (40 credits)

- Introduction to Solid Mechanics - Vm211
- Principles of Engineering Materials - Vk250
- Physics of Materials - Vk242
- Thermodynamics of Materials - Vk330
- Kinetics and Transitions in Material Engineering - Vk335
- Principles of Engineering Materials II - Vk350
- Mechanical Behavior of Materials - Vm382
- Materials Lab I - Vk360
- Materials Lab II - Vk365
- Materials and Engineering Design - Vk480
- Materials Processing Design - Vk489

Academic Writing (8 credits)

- Academic Writing I – Vy100
- Academic Writing II – Vy200

Intellectual Breadth (16 credits)

This category requires:

- 2 credits of Vg496 Professional Ethics, and
- 14 credits of courses in humanities, social sciences, professional development, and natural sciences.
- At least 3 credits in humanities and at least 3 credits in social sciences must be completed.

The 14 credits may include courses with code Vr, Vx, Vw, Vf, and Vb. Vz courses are acceptable only for international students. Vy courses are acceptable except Vy100 and Vy200. UM courses that can be used to satisfy the CoE Intellectual Breadth requirements are acceptable. SJTU courses taught in English are acceptable with approval of the JI Undergraduate Committee.

Humanities category includes, but not limited to, Philosophy, English Language and Literature, Asian Languages and Culture, American Culture, Comparative Literature, Film Studies, etc.

Social Sciences category includes, but not limited to, International and Comparative Studies, Political Science, Asian Studies, Economics, Environmental Studies, History, etc.

Professional Development category includes, but not limited to, Engineering Ethics, Business Studies, Entrepreneurship Studies, etc.

Natural Sciences category includes Biology, Chemistry, Physics, Astronomy, and Earth Sciences.

A complete list of courses is maintained at the JI Undergraduate Education Office.

Advanced Mathematics (3 credits):

The advanced mathematics requirement can be fulfilled by taking Ve401, Vv454, Vv471, Vv556, Vv557, Vv570, or other courses approved by the MSE Program Advisor. Any qualified credits in excess of 3 may be applied to the Flexible Technical Elective or General Elective categories.

MSE Electives (9 credits):

This category can be fulfilled by taking 9 credits from a list of upper level technical courses in MSE and related areas, such as Vm434 and Vm508. The list of courses is maintained by the JI Undergraduate Education Office.

Any credits in excess of 9 may be applied to the Flexible Technical Elective category.

Flexible Technical Electives (12 credits):

The flexible technical elective requirement may be fulfilled by taking courses in MSE or in other engineering, biology, chemistry, mathematics, and physics fields.

Any credits in excess of 12 may be applied to the General Elective category

General Electives (9 credits):

General electives are intended to allow students to explore any dimension of intellectual endeavor that they elect, in both technical (including engineering) and non-technical fields. This requirement can be met by any course subject to the following restrictions:

- A maximum of 4 credit hours of research work (including PRP, IAP, and independent study) can be counted towards graduation.

Students are encouraged to select their general elective classes either to explore an area of cultural interest or to explore an area of professional interest such as:

- Management, business, or finance classes in preparation for working in industry.
- Classes to prepare for further study outside engineering such as medicine, dentistry, law or education.
- Additional language, literature or culture classes to prepare for a career in the global economy.
- Additional Electrical and Computer Engineering classes to go into more depth than the limited program of technical electives allows.
- Engineering classes in other departments in preparation for graduate school outside Electrical and Computer Engineering.

4.5.6 Sample Schedule for MSE Program

The following Sample Schedule is an example that explains how a student may satisfy the course requirements in each category in four years.

Course Title & Course Code			Credit	Terms									
				1	Sp	2	3	Sp	4	5	6	7	8
Engineering Foundation			**39**	**12**	**1**	**13**	**9**	**0**	**4**	**0**	**0**	**0**	**0**
Calculus I-Vv115[1]				4*									
Calc. II-Vv116[2]	Hnr. Calc. II-Vv156	Hnr. Math II-Vv186	16	4	4*								
Calc. III-Vv215	Hnr. Calc. II-Vv255	Hnr. Math III-Vv285				4							
Calc. IV-Vv216	Hnr. Calc. II-Vv256	Hnr. Math IV-Vv286					4						
Linear Algebra - Vv214 / Vv417									4	4*			
Introduction to Engineering - Vg100			4	4		4*							
Introduction to Computer and Programming - Vg101			4	4*		4							
Chemistry - Vc210			5	4									
Chemistry Lab - Vc211					1								
Physics I - Vp140	Honors Physics I - Vp160		10			4							
Physics II -Vp240	Honors Physics II - Vp260						4						
Physics Lab I - Vp141						1							
Physics Lab II -Vp241							1						
Academic Writing			**8**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Academic Writing I-Vy100			4	4									
Academic Writing II-Vy200			4		4								
Intellectual Breadth			**16**	**0**	**0**	**4**	**0**	**0**	**3**	**0**	**5**	**0**	**4**
Humanities, Social Sc., Prof. Development, Natural Sci.			14			4			3		3		4
Professional Ethics - Vg496			2								2	2*	
Program Subject			**40**	**0**	**0**	**0**	**4**	**0**	**8**	**11**	**7**	**7**	**3**
Introduction to Solid Mechanics - Vm211			4				4						
Principles of Engineering Materials - Vk250			4						4				
Physics of Materials - Vk242			4						4				
Thermodynamics of Materials - Vk330			4							4			
Kinetics and Transitions in Matl Engi., Vk335			4								4		
Principles of Engineering Materials II - Vk350			4							4			
Mechanical Behavior of Materials - Vm382			4									4	
Materials Lab I - Vk360			3							3			
Materials Lab II - Vk365			3								3		
Materials and Engineering Design - Vk480			3										3
Materials Processing Design - Vk489			3									3	
Electives			**33**	**0**	**0**	**0**	**3**	**0**	**3**	**6**	**3**	**9**	**9**
Advanced Mathematics			3									3	
MSE Electives			9									3	6
Flexible Technical Electives			12						3	3	3	3	
General Electives			9				3			3			3
Subjects Required by MOE and SJTU[3]													
Chinese politics courses				✓	✓		✓	✓					
Physical Education				✓	✓		✓	✓					
Total Credits:			***136***	***16***	***5***	***17***	***16***	***0***	***18***	***17***	***15***	***16***	***16***

1. Vv115 is only required for students who do NOT have sufficient preparation in mathematics, counted as General Elective
2. Vv116 is only offered in spring semester
3. These courses are not required for the international students

* Alternative semester in which a course is offered

4.6 Student Research Opportunities

The Undergraduate Research Courses (VE/VM490) provide undergraduate students opportunities to work with individual faculty members on their research projects. The courses allow students to engage in scientific research early during their undergraduate study, and to get prepared for their future academic career in selected engineering fields. All undergraduate research courses are 3 credits counted towards graduation as Flexible Technical Elective or General Elective. A student may take up to three VE/M490 courses towards graduation, up to 6 credits can be counted in Flexible Technical Elective category. The courses are graded as A to F and counted in GPA calculation. A student may not earn credits for both VE/VM490 and other undergraduate research effort (such as PRP and IPP) with the same research work. A faculty member can offer on more than one section of the course in a semester, and each section is capped by 2 students. Students must be junior standing or up. Registration in the undergraduate research courses must be approved by the supervising faculty member. The supervising faculty member and the students must schedule at least one meeting per week. Students must complete a final research report and additional requirements per supervising faculty member's decision. Student performance will be graded by the supervising faculty member based on the satisfaction of above requirements.

The Participation Research Program (PRP) was created by SJTU. It enables students to work one-on-one or as part of a small group of students with faculty members conducting research. Students will choose research projects by looking through a catalog of faculty research projects and will then interview for the positions with the faculty researcher. Students spend on an average nine to ten hours per week working on their research projects. Students participating in the program are also required to attend a biweekly research peer group meeting, meet monthly with a peer advisor, read research-related articles and verify and improve their findings by implementation of algorithms proposed in those articles. All first- and second-year Engineering students are eligible to apply for PRP. Selection is done on a rolling basis and determined by a student's level of interest in research, academic background, area of research interest and availability of positions. For more information, visit the SJTU Academic Affairs Division website.

4.7 Minor in Entrepreneurship

JI offers a minor in Entrepreneurship to encourage students to learn practical skills that may help translate innovate ideas into real impact. A minimum of 15 credits of courses are required for the minor, including:

- Core (required) courses (5 credits)
  - VX420 Entrepreneurship Basics (3 credits)
  - VX402 Managing a Business (2 credits)
- At least 6 credits of Practicum from the following:
  - VM/VE/VG450 Capstone Design Projects (4 credits)
  - VX423 Intrapreneurship (3 credits)
  - VE449 Mobile Applications for Entrepreneurs (3 credits)
- At least 3 credits of Elective courses selected from the following list
  - VX203 Leadership and Management (3 credits)
  - VX251 Branding and Brand Management (2 credits)
  - VX351 Advanced Branding and Brand Management (2 credits)
  - VX422 E-Business Management (3 credits)
  - VX440 Introduction to Social Entrepreneurship (3 credits)
  - VR208 Business and Natural Environment (3 credits)

  More course may be added to this list with prior approval

Eligibility:

- Sophomore standing and above
- Having declared a major
- In good academic standing

If planned well in advance of the senior year, the program should not add to the credits required for a bachelor's degree at JI. A student should receive a grade of C or better for all the courses required for the minor. The Minor in Entrepreneurship should be declared before graduation. Transfer credits are acceptable for the Elective courses.

No credits may be used to satisfy the requirements of more than one minor. No credits may be double counted for a minor and an undergraduate research certificate.

4.8 Minor in Computer Science

JI offers a minor in Computer Science to broaden students' horizon in a different discipline and make the students more marketable to employers. A minimum of 15 credits of courses are required for this minor, including:

- Prerequisites
  - VV116/156/186 Calculus II (or equivalent)
  - VG101 Intro to Computer and Programming
- Core (required) courses (12 credits)
  - VE203 Discrete Math (4 credits)
  - VE280 Programming and Introductory Data Structure (4 credits)
  - VE281 Data Structures and Algorithms (4 credits)
- At least 3 credits of Elective courses from the following list
  - VE445 Introduction to Machine Learning (4 credits)
  - VE475 Introduction to Cryptography (4 credits)
  - VE477 Introduction to Algorithms (4 credits)
  - VE482 Introduction to Operating Systems (4 credits)
  - VE483 Compiler Construction (4 credits)
  - VE484 Data Mining (4 credits)
  - VE485 Web Systems (4 credits)
  - VE487 Interactive Computer Graphics (4 credits)
  - VE492 Introduction to Artificial Intelligence VE493

  More courses may be added to this list with prior approval, such as AI and machine learning

Eligibility:

- JI students majoring in ME or MSE (JI students in ECE may NOT declare a Computer Science minor)
- Sophomore standing and above
- Having declared a major
- In good academic standing

If planned well in advance of the senior year, the program should not add to the credits required for a bachelor's degree at JI. A student should receive a grade of C or better for all the courses required for the minor. The Minor in Computer Science should be declared before graduation. Transfer credits are acceptable for the Elective courses. No credits may be used to satisfy the requirements of more than one minor. No credits may be double counted for a minor and an undergraduate research certificate.

4.9 Minor in Data Science

JI offers a minor in Data Science to provide students with a basic understanding in those aspects of computer science, statistics, and mathematics that are relevant for analyzing and manipulating large complex datasets. A minimum of 15 credits of courses are required for this minor, including:

- Core (required) courses (8 credits)
  - Ve401 Probabilistic Method in Engineering (4 credits)
  - Vv414 Bayesian Data Analysis (4 credits)
- Elective Courses: at least two out of the following courses:
  - Ve406 Applied Regression Analysis using R (4 credits)
  - Ve445 Introduction to Machine Learning (4 credits)
  - Ve484 Data Mining (4 credits)
  - Ve492 Artificial Intelligence (4 credits)
  - Ve501 Random Processes (4 credits particularly for undergraduate students)
  - Ve572 Methods and Tools for Big Data (3 credits)
  - Vv409 Models and Methods for Financial Data (3 credits)

More courses may be added to this list with prior approval.

Eligibility:

- Sophomore standing and above
- Having declared a major
- In good academic standing

If planned well in advance of the senior year, the program should not add to the credits required for a bachelor's degree at JI. A student should receive a grade of C or better for all the courses required for the minor. The Minor in Data Science should be declared before graduation. Transfer credits are acceptable for the Elective courses. No credits may be used to satisfy the requirements of more than one minor. No credits may be double counted for a minor and an undergraduate research certificate.

4.10 Dual BS Degree Program with UM

This program is designed to allow a student entering the JI undergraduate program to earn a Bachelor of Science (BS) degree from the UM and a second BS degree from the SJTU in two different academic areas. It will offer JI students a high-quality international educational experience and an ability to engage in international engineering efforts in cooperation between China and the United States.

To enter the dual degree program, students must first apply and be admitted to the JI, and then apply and be admitted as a transfer student to the UM. After finishing their study at the UM, students must return to the JI to finish their graduation thesis and other necessary graduation requirements of the SJTU.

Students are subject to all the academic regulations and eligibility requirements of the school that they are attending at any time (the JI during their first two years, the UM during the completion of their UM degree, and the JI during the completion of their JI degree). To obtain both Bachelor's degrees, a student must complete the requirements of each of the degree programs. For the second degree, a student must complete at least a minimum of 14 credit hours in pertinent technical subjects in addition to the credits required by the first degree. JI Undergraduate Education Office maintains a complete list of courses that may be used to satisfy this 14-credit requirement.

After completing each university's requirements, students will receive a BS Degree from the UM, the Graduation Diploma from the Ministry of Education of China, a BS Degree Ordinance from the SJTU, and a JI Study Certificate jointly granted by Shanghai Jiao Tong University and University of Michigan.

4.10.1 Application and Admissions

In the first semester of their sophomore year, interested JI students may apply for admissions to this program. The application and admission process is the same as a regular transfer student application for the UM.

A. Admissions Guidelines and Eligibility Requirements

Standard UM eligibility requirements apply at all times. These can be found at:
http://www.engin.umich.edu/college/admissions/

There is no distinction between students from the JI and other institutions for transfer eligibility at the UM.

B. Required Documents for UM Transfer Application

All documents provided should be in English with the official seal. Translated copies must be authenticated with an official seal.

- Completed University of Michigan College of Engineering International Transfer Application (online)
- Official transcripts from all universities that have been attended
- Course descriptions and syllabi from all classes taken at any universities outside of the US if transfer credit is requested
- Proof of English proficiency
- High School/secondary school transcript/certificate or copy of diploma
- AP, IB, or A-Level exam scores, if any were taken
- Financial resource statement

- Proof of funding (official bank statement) for one full year of study (two full semester terms).
- Copy of the ID page of passport

C. UM Departmental Specific Requirements

For current departmental specific requirements, refer to:
http://www.engin.umich.edu/college/admissions/undergrad/transfer/requirements.

D. English Language Proficiency

Proficiency in English must be demonstrated by test results of the Michigan English Language Assessment Battery (MELAB), or the Test of English as a Foreign Language (TOEFL), or the International English Language Testing System (IELTS). For detailed English language proficiency requirement information, refer to: http://www.engin.umich.edu/college/admissions/international/requirements/english-proficiency.

Information about the TOEFL test dates and fees can be found at http://www.toefl.org. Information about IELTS may be found at http://www.ielts.org. Information about the MELAB can be found at http://www.cambridgemichigan.org/melab. Arrangements for administration of the MELAB can be made by coordination through the JI International Programs Office (IPO). Note that MELAB results may not be an acceptable assessment for some other universities.

E. Pre-Screening by Joint Institute

Once students have communicated their interest in applying for UM transfer admission, the JI will pre-screen applicants using the following guidelines:

1) GPA requirements, course pre-requisites, engineering core and departmental specific requirements.
2) English proficiency.
3) Special attributes:
   - Sports
   - Student Activities
   - Communication skills
   - Leadership
4) Financial capacity. The cost of attendance for a given UM school year can be found at http://ro.umich.edu/tuition-residency/tuition-fees. Most transfer students are admitted with junior level (upper division) standing and tuition and fees are assessed accordingly. Financial resources to cover educational cost of attendance will include tuition and fees, room and board, books and supplies, as well as personal and miscellaneous. Certificates of eligibility for visas cannot be issued until proof of the financial ability has been assessed. Note that the UM requires that students/families or sponsors are able to finance 12 months of living cost. Pre-screening by JI will require that the following official documents be submitted as proof of the financial ability.

Acceptable types of financial documents	Unacceptable types of financial documents
Savings Account Bank Statement– statement must have the exact amount on account in savings account.	Investments
Checking Account Bank Statement– statement must have the exact amount on account in checking account	Tax Returns
Mature Bonds– has to be maturing on a date prior to arrival in the US.	Financial Affidavits of support (These do not substitute for FRS or Guaranteed Backing forms.)
Annual salary statement of sponsor	Sponsor insurance
	Stock, bonds, equity, or security statements.

F. Application Timeline

In order to expedite the decision and notification of JI students, application deadlines and notification timelines have been agreed upon by the UM Office of Undergraduate Admissions (OUA) in cooperation with the JI International Programs Office (dates are approximate and will change slightly each year):

- **December 10th**: Students must submit all required supportive paper documents to the Joint Institute by this date.
- **End of December**: Deadline for submission of online application.

- **Early March**: Notification of admissions decisions from UM
- **April 1**: Deadline for notification of intention to enroll

All official documents should be sent to the IPO for final verification and delivery to UM OUA. UM will waive transfer application fees for JI students. The application fee waiver (AFW) code will be provided to the JI representative for distribution to the pre-screened students that will be applying.

JI students will be flagged in the University's admissions system so that they can be easily tracked and identified for reporting and system actions to expedite their admissions. JI students will be issued a student identification number after the submission of their application which will allow them to track the progress and status of their application throughout the review process.

G. Admissions Decision

Applications will be reviewed by the OUA according to the guidelines stated above. Admitted JI students will receive an offer of admission via email. The message will direct students to an online confirmation of enrollment form. Students who wish to accept their admissions offer must complete a confirmation of enrollment form no later than April 1.

H. Visa Application

Once the decision to enroll has been officially confirmed, SEVIS form process will begin. Upon completion of the process, the official forms for all JI students will be delivered to the JI IPO so they can be securely distributed to the students. After receiving proper documents, they must complete the visa application process at the U.S. Embassy or Consulate in China. It is recommended that this process be conducted as early as possible. A useful website that provides guidance for the visa application process is: https://www.internationalcenter.umich.edu/students.

I. Orientation

The UM offers special orientation programs that help international transfer students adjust to the American culture and the UM study, connect with advisors, register for courses, and maintain visa compliance. To ensure a smooth transition to the UM, JI transfer students will be required to attend the following programs:

- UM-wide Transfer Orientation (organized by Office of New Student Programs)
- UM College of Engineering Transfer Orientation (organized by Office of Recruitment and Admissions)
- International Student/SEVIS Check-In (organized by International Center)

Note that orientation programs require students to arrive on the UM-Ann Arbor campus 7-10 days prior to the start of classes.

J. Scholarships for Incoming JI Transfer Students

Scholarships for transfer students may be awarded from gift funds designated for that purpose. The scholarships may be awarded by the JI, SJTU or the UM in accordance with the stipulations of the donor.

K. Transfer Credit

OUA will evaluate coursework completed at the JI for credit transfer to UM. Approved JI courses will appear as transfer courses on the UM transcript. Grades will not be transferred, only credit hours.

4.10.2 Requirements of UM-JI Dual BS Degree Program

To obtain both degrees, the following requirements must be met:

- Students are subject to all the academic regulations and eligibility requirements of the school that they are attending at any time (the JI during their first two years, the UM during the completion of their UM degree, and the JI during the completion of their JI degree).
- After they finish their study at UM, students will return to the JI for the last summer semester to finish their graduation thesis and other necessary graduation requirements of the SJTU.
- Although double counting a course for both degrees is allowed, JI does not accept credit transfer of courses graded as Pass/Fail.
- A minimum of 14 additional credits of technical subjects pertaining to the second degree program must be obtained beyond the credit requirements of the first degree. These additional credits may include core program

subjects, technical electives, capstone design courses, and other relevant courses in the second degree program. A complete list of acceptable courses is maintained at the JI Undergraduate Education Office.

4.11 Global Degree Pathway (GDP) Program

In the spirit of innovation, JI will continue to lead on the next generation of global degree combinations based on the JI's place as a hub for international education, recognized by students, employers, and graduate schools as the new standard of excellence in academic preparation and international experience. The GDP program offers a pathway that allows students to seek Bachelor's degree at the JI followed by a Master's degree from a global partner institution generally with some modest double counting of credit in accordance with the academic policies of the governing schools and colleges and with a specialized and early admission process. This will greatly expand the number of disciplines the JI students may pursue after.

Students may apply in their junior or senior years depending on the different GDP program application timelines. A typical GDP program is a 5-year program. Students participating in the GDP programs may be offered a provisional admission to a Master's program in as early as their junior year. Some GDP programs will allow students to study graduate-level courses in a global partner university in the senior year for one to two semesters. After graduating from the JI, the students will return to the global partner university and continue their Master's study.

GDP Program allows JI students to seek further development in and beyond engineering, with a more direct, simple and accelerated way. JI currently offers GDP programs in engineering, business, statistics, information, environment, and other disciplines with our partner universities.

Programs and detailed information are available at the International Programs Office.

4.12 Joint Undergraduate Master Program (JUMP)

Qualified JI undergraduate students may be admitted to the Joint Undergraduate Master Program (JUMP) in the first semester of the senior year. This program is developed to promote greater enrollment of qualified JI students in the JI Master's program by double counting credits for both bachelorette and master's degrees. This program also provides JI students opportunities to spend more time on research rather than course work during their graduate study.

To be eligible for the SGUS program, a student must satisfy the following minimum requirements:

- Has enrolled in an undergraduate degree program at JI;
- Has NOT enrolled in a dual-degree program;

The application process includes three steps:

1) In the second semester of the junior year, a student fills a JUMP Application Form to apply for the program. The student should also outline a preliminary study plan for the rest of the undergraduate study, including the courses used for double counting.
2) The student who applies for the JUMP program should participate in the same graduate student admission processes and meet the same requirements as the other applicants for the JI graduate program.
3) Admission result will be announced before the first semester of the senior year. Admitted students are encouraged to meet with the graduate advisors (if decided) to update the study plan including the proposed double counting courses.

Double counting and transfer credits:

- Double counting can only be on the 400-level or above courses in the Technical Elective and Advanced Math categories; required courses cannot be double counted;
- JUMP students may double count a maximum of 6 credits of their undergraduate work towards their Master's degree, including graduate courses;
- JUMP students may also request to transfer any number of graduate level credits that are not used for any portion of the undergraduate degree towards the Master's degree, in addition to the 6 double counting credits;

- All double counting and transfer courses must have grades of "B" or above, but not for GPA calculation of the graduate study.
- No transferred credit may be more than seven years old at the time of a student's graduation from JI.
- In some circumstances a student may need to take a graduate course at another institution (outside of SJTU) while enrolled in JI. The transfer of such credit back to JI must be approved by the graduate office and by the Associate Dean for Graduate Education prior to the student enrolling at the other institution.

4.13 Transfer Students

JI can admit transfer international students satisfying the following basic requirements:

- Students applying to transfer must be in good standing, both academically and socially, at the institution(s) attended.
- The JI will consider the quality of an applicant's attending institution(s) as well as the transferable college credits.
- TOEFL or IELTS test scores are required of all speakers with English as a second language.
- Final official high school/secondary school record, including 9th-12th grades and graduation date, may be needed. The more credits a student is able to transfer, the less the student's high school work will be used in the evaluation.
- Official transcripts from all post-secondary institutions. Successful candidates usually will present a cumulative GPA of B (3.0 on a 4.0 scale) or better.
- Students wishing to transfer should complete a series of prerequisite courses. All courses should be taken for a letter grade and not pass/fail. A letter grade of a "C" or better is required for the prerequisite courses including:
    - College level Calculus I, II, III
    - Calculus-based Physics I with lab
    - General college Chemistry with lab
    - Computer programming, C/C++ preferred
    - English composition

The admission decision is made by the JI International Admissions Committee.

5. Academic Rules

5.1 General Standards of Conduct for Engineering Students

(Adopted from the University of Michigan College of Engineering)

In establishing a standard of student conduct, the UM-SJTU Joint Institute is committed to the basic principles of entrusting each student with a high degree of freedom to govern his or her life and conduct while enrolled at the University. The Joint Institute encourages its students to protect and use this freedom with wisdom and good judgment, and to accept and discharge the responsibility inherent to such freedom.

Students are expected to respect the rights and property of others and to comply with university regulations and public laws.

The Joint Institute welcomes the participation of students in decision making relevant to their affairs and provides channels of communication. To benefit from such activity, each student should recognize his or her responsibility to fellow students and to the faculty and staff, and should discharge all duties with the standards that make such student-college relationships effective and valuable.

The Joint Institute reserves the right to discipline, exclude from participation in relevant activities, or dismiss any student whose conduct or performance is considered a violation of standards. Such a decision will be made only after review by the appropriate student and faculty committees. During this review, the student will have full opportunity to present his or her position. A student also has the right of appeal to the Academic Program Group of the Institute.

The Honor Code of the Joint Institute bears witness to the deep trust that characterizes the student-faculty relationships in one of the most important aspects of student conduct.

5.2 Student Rights and Responsibilities

The UM-SJTU Joint Institute is dedicated to supporting and maintaining a scholarly community. As its central purpose, this community promotes intellectual inquiry through vigorous discourse. Values which undergird this purpose include civility, dignity, diversity, education, equality, freedom, honesty, and safety. When students choose to accept admission to the SJTU, they must accept the rights and responsibilities of membership in the University's academic and social community.

5.2.1 Student Rights

The rights students have include:

1) Participate in community service and part-time jobs
2) Organize student societies upon approval, and join student organizations and extracurricular activities
3) Hold activities involving academic endeavors, scientific and technological innovations, arts, entertainments and sports
4) Appeal to the university or the educational administration institution regarding any disciplinary decisions
5) Lodge a complaint against the university, faculty or staff if you believe your legal rights have been infringed.
6) Other rights protected by the laws and regulations of China.

5.2.2 Student Responsibilities

Along with rights come certain responsibilities that include:

1) Comply with the Constitution, laws and regulations of China
2) Comply with the administration rules of the university and the Joint Institute
3) Pay the tuition and fees according to the tuition policies.
4) Fulfill the obligations and requirements of any study loans or financial aids received
5) Seek to obtain legal approval if students intend to have a mass gathering, parade or protest. The university has the right to prevent or stop activities that are not approved.
6) Use the internet appropriately according to regulations of the University and China. Browsing illegal websites or spreading harmful information is forbidden.

5.2.3 Sanctions

Students who violate the laws, ordinances or regulations will receive sanctions. Disciplinary decisions will be made according to the nature and severity of the behavior. For details, please refer to "*SJTU Rules for Disciplinary Actions*" specified in the SJTU Student Handbook. For more information about appeal and hearing procedures, please refer to "*SJTU Rules for Student Appeal System*" in SJTU Student Handbook. Students may also be subject to procedures and sanctions under the JI's Honor Code, in addition to the requirements of SJTU.

5.3 Registration

Freshman students should ensure that they are registered on time with the letter of admission and the relative documents required by the university. If a student is not able to be registered at the expected date, the student should write a letter of application with the necessary documents of proof to the university. The extension should be no more than two weeks. Students who do not apply for extension or do not get registered within the permitted extension period will be deemed as a waiver of admission, unless there is justifiable reason like unexpected natural disasters.

Students are expected to register at the beginning of each term, according to the SJTU regulations. For every academic year, new student registration occurs one day before the first classes commence. Students must pay the full annual tuition fees at the SJTU Financial Department on the registration day, before getting registered. Students with financial difficulties may seek a document allowing permission for delay in payment from the SJTU Student Division, to allow them to register. Students who have paid tuition should go through the designated registration procedures at the SJTU Registration and Students Affairs Center of the Academic Affairs Division. Those who are unable to be registered on time should apply for extension with the approval of the JI Undergraduate Education Office. Those who do not get registered within two weeks after the registration day will be regarded as dropping out, and the paid tuition and fees are not refundable.

5.4 Tuition Policies

- The total JI annual tuition is calculated based on degree requirements consisting of 128 JI credits. The annual tuition covers Fall and Summer semesters only. There will be no tuition refund or discount of this total for graduation in less than four academic years of registration in Fall and Summer semesters.
- JI tuition is charged on an annual basis. For students participating the Dual Bachelor's Degree program or the Global Degree Pathway program, tuition is charged for any semester in which the student takes classes at SJTU.
- In Fall and Summer semesters, any enrolled SJTU student registering for classes pays ½ of the JI annual tuition. This is independent of the number of credits taken. In these semesters students can take up to 18 credits. These credits can consist of a mixture of JI and SJTU classes. There is no reduction in tuition if all credits taken in a particular semester are only non-JI courses offered by SJTU.
- Spring semester tuition is not included in the annual JI tuition and must be paid separately. Prior to each Spring semester, the JI Undergraduate Education Office publishes a list of courses which are subject to tuition. Spring semester tuition is always charged on a 'per credit' basis for these courses taken by a student.

5.5 Transfer, Suspension, and Resumption

5.5.1 Transfer to Other Schools or Universities

Students who want to transfer to other schools of SJTU or to other universities should follow the rules and procedures specified in the SJTU Student Handbook.

5.5.2 Suspension and Resumption of Studies

Students applying for suspension and resumption of their study at JI, should follow the rules and procedures specified in the SJTU Student Handbook. The paid tuition and dorm fee for the year of suspension will be returned to the student according to the policy below:

- If a student suspends their study in the first 1/2 of a semester, 1/2 of the tuition for that semester will be refunded.

- If a student suspends their study after the first 1/2 of a semester, no tuition for that semester will be refunded.
- If a student suspends their study prior to the start of a semester, all tuition for that semester will be refunded.
- A fee of 2% of the full semester tuition will be charged for handling the refund in all cases. The 2% fee will be deducted directly from the refund.
- Dormitory fees are refunded according to regulations made by the SJTU Dormitory Administration Department.

These rules apply to students suspending or terminating their study at the JI. They do not apply for situations of early graduation. No portion of annual tuition is refunded for early graduation.

5.6 General Course Policies

5.6.1 Course Selection

In each semester, JI students are encouraged to meet with an academic advisor or a program advisor to select appropriate classes and complete the course registration process. Pre-requisites and co-requisites will be enforced. Requests for overriding the pre-requisite and/or co-requisite requirements in principle wi unless there are special reasons. Courses can be selected online or by completion of the necessary paper forms at appropriate JI office.

Normally, with the advices of appropriate academic advisors, students log onto the JI Course Election System to select the courses they wish to enroll for and arrange their own class schedules according to their chosen major, academic capability, hobbies, etc.

5.6.2 Credit Hour and Work Load

A credit hour (semester hour) generally requires fifteen 45 minutes of lectures per semester. Preparation, review and homework for each credit hour normally require two to three hours of self-study per week. Generally, one period of laboratory work (2.5 hours) is considered to be equal to one lecture hour. The number of credit hours a student is able to carry in any one term depends upon a number of factors including study capabilities, health condition and the amount of time devoted to extracurricular activities.

- Twelve credit-hours are considered a minimum academic load for a normal student in a regular term. JI undergraduates must carry a minimum of 12 credit hours to be considered full-time students except the graduating semester.
- Full-time students can take up to 18 credits per semester. These include credits from both JI and SJTU courses.
- Students are required to obtain approval from the JI Undergraduate Committee for taking less than 12 credits or more than 18 credits (overload) of courses per semester.
- Requests for overload/underload should be submitted to the JI Undergraduate Education Office by the end of Friday of the first teaching week in every semester. The overload/underload requests are reviewed on a case-by-case basis and are approved only under special circumstances of academic need. Final decisions will be announced to the applicants within the second teaching week of the same semester.
- It is the student's responsibility to obtain proper approvals for an overload/underload. Consequences without approval include: 1) Forced withdrawal from the courses, and 2) Invalidation of the credits such that the grades are not recorded and the credits are not counted towards the degree requirements.

5.6.3 Adding/Dropping Courses

Once particular courses are selected, students should attend classes according to the class schedule. Any changes to the course selection without appropriate approval may not be permitted. If students make such changes without approval, the grade received for the involved courses may be nullified.

During the first two weeks of classes, students may modify their course selection by dropping or adding courses using the online course registration system of the JI. An exception is for Ve/Vm/Vg450 where different course policy may apply.

In the 3rd and the 4th week, students can add or drop a course by submitting an Add/Drop form signed by the requester, instructor, and Program Advisor (in this order) to the JI Academic Office.

From the 5th week to the end of a semester, students must petition to the Undergraduate Committee by submitting the Add/Drop form signed by the petitioner, instructor, and Program Advisor (in this order), as well as any supporting documents required by the Undergraduate Committee. Only special cases will be approved based on discretion of the committee.

This policy applies to all JI undergraduate students in all JI semesters for any courses of any length.

5.6.4 Attendance and Absences

- Students should attend the classroom instruction, experiments and other teaching contents of each course. An advance request for leave of absence is required if the student cannot attend the class due to illness or other reasons. Absence without approval will be regarded as skipping classes.
- The instructor for each class establishes his/her own policies on how to handle absences and how such absences affect assignments, exams, and grades. Instructors are not required to give make-up assignments or exams. Students should consult all of their instructors as soon as possible about possible absence from class. Instructors are free to request documentation proving the necessity of an absence.
- A note that a student visited a medical facility is not sufficient excuse for missing an assignment or an exam. The note must specifically indicate that the student was incapable of completing an assignment or taking the exam due to medical problems and that this condition was sudden enough that it was impractical to contact the instructor in advance. Instructors choose how to handle cases of medical emergency.
- A written request for leave of absence is required. Absence for illness should be supported by a hospital/doctor's certificate. Absence for three days and less should be approved by the class advisor, student counselor and the instructor. Absence for three days to two weeks should be verified and approved by the Manager for JI Undergraduate Education Office. Students must provide formal documentation of the reasons for the absence to the JI Undergraduate Education Office. Absence for two weeks to one month should be approved by the JI Associate Dean for Undergraduate Education. Absence for longer than one month should be submitted to SJTU Academic Affairs Division with the advice of the JI Associate Dean for Undergraduate Education. Relevant proof materials for all types of absence will be recorded at the JI Undergraduate Education Office. Copies will be passed to the instructors for further reference.
- A student who has been absent from studies for more than one week because of illness or other emergency should consult the program advisors to determine the advisability of reducing elections.

5.6.5 Retaking Courses

For program required courses: If students did not complete a course with a passing grade, they must make it up in the following semesters.

For elective courses: If students did not complete a course with a passing grade, they may choose to make it up or instead take another qualified course with a program advisor's approval to satisfy the credit requirement.

Students are not allowed to retake a course with satisfactory grade, where "satisfactory grade" means the earned grade allows the course credits to be used to satisfy the JI graduation requirements, with the following exceptions:

- Retaking will be allowed for these courses: Vc210, Vc211, Vg100, Vg101, Vp140/160, Vp240/260, Vp141/241, Vv156/186, Vv255/285, Vv256/286, Vm211, Vm235, Vm240, Vm250, Ve203, Ve215, Ve216, Ve230, Ve270, and Ve280.
- Retaking of above listed courses is allowed only when the final letter grade for the course is C- or below.

This new policy does not change the passing (satisfactory) grade which is D or above. Therefore, retaking is not mandatory when a student receives a C- or D for the above listed courses. The policy applies to all JI undergraduate students effective from Fall 2013.

When students retake a course, all grades will be shown on their transcripts, but only the last grade will be counted in GPA calculation and to satisfy the graduation requirements.

If retaking a course is necessary, students are advised to retake the course as early as they can to avoid possible time conflict in class schedules.

5.6.6 Makeup Homework and Exams

In general, instructors are not obligated to give makeup assignments and exams to any students that missed an assignment or exam for personal reasons. Instructors may choose to specify alternative arrangements.

Advance permission may be given by the course instructor to students with a medical emergency or other special reasons for missing a particular assignment or exam, if it is not the final exam.

Students may be allowed by an instructor to make up missed final exams only with permission of the JI Associate Dean for Undergraduate Education. The instructor will decide the form of the make-up arrangement. So a student must communicate closely with their instructors if missing the final exam is foreseeable.

5.6.7 Grades and Grade Points

A. Academic Records

The official student transcript is the cumulative record of courses taken and grades earned while enrolled at the SJTU. All courses students have taken at the SJTU will be recorded in their academic record; but only those listed in the study plan or pre-approved by the JI Program Advisors will count towards the required graduation credits of the JI. All courses students have taken at the SJTU will be used for JI GPA calculations for specific JI requirements like academic standing, declaring major, enroll for graduation thesis, receiving JI awards, etc.

If a course has to be repeated, all grades will be shown on the transcript, but only the last grade will be counted in GPA calculation and to satisfy the graduation requirements.

B. Grade Grievance Procedure

If students have questions about their grade after the exams (excluding the finals), they could check it with the instructor during his/her office hours in the first week after scores are released. In order to do this, special requests should be sent to the JI Undergraduate Education Office. The instructor or a TA should be present while the student looks over his/her original test paper and answer sheet. Score corrections may be made by the instructor only. All corrections should be made in red-ink pen, with the instructor's signature and date beside it. An e-copy of the correction must be sent to the JI Undergraduate Education Office to be kept on file.

If there is justification to question the accuracy of an assigned grade, the student should first pursue the matter with the instructor. The responsibility for the assignment of grades is primarily that of the instructor and should be settled between the student and instructor whenever possible. Further pursuit of a grade grievance should be addressed with the Associate Dean for Undergraduate Education.

C. Grade Point Averages (GPA)

Both term GPA and the cumulative GPA are computed for each student at the end of each term and become part of the academic records. The grades are valued per hour of credits as follows:

Letter Grades	Grade Points
A+	4.0
A	4.0
A-	3.7
B+	3.3
B	3.0
B-	2.7
C+	2.3
C	2.0
C-	1.7
D	1.0
P（Pass）	N/A
F（Failure）	0
U（Uncompleted）	0
N（Null，absent）	0

These items do not affect GPAs:

- Pass/Fail
  - P (passed): receives class credits, no grade points
  - F (failed): receives no class credits, no grade points
- "U" and "N" as informal scores are used to represent the score status in the score sheet. When the score is obtained, "U" or "N" should be replaced by the final score.

The calculation of GPA is shown as follows:

$$\text{GPA} = \frac{\sum(\text{course credit} \times \text{grade points for that course})}{\sum \text{course credit}}$$

D. Grade Point Deficit (GPD)

Both term GPA and cumulative GPA should be equal to or above 2.0. If either part is less than 2.0, it is called Grade Point Deficit (GPD). The calculation of GPD is shown as follows:

$$\text{GPD} = (\Sigma\text{course credit}) \times 2.0 - \Sigma(\text{course credit} \times \text{course grade points})$$

5.6.8 Scholastic Standing

The scholastic standing of JI undergraduate students are classified as good standing, probation, dismissal warning, drop-out recommendation, and dismissal. Students with unsatisfactory scholastic performance will receive academic warnings and are mandated to select courses under direction of the program advisor. The scholastic standing will be determined as follows:

A. Good Standing

When a student maintains a 2.0 GPA or better for both the term and the cumulative average, the student is considered in good scholastic standing. The student may take courses normally.

B. Probation

When a student has a GPD between 0 and 10 for either the term or cumulative GPA, the student is placed on probation. The notation "Probation" will be entered on the unofficial transcript.

A student on probation may continue the enrollment, but is required to meet with the program advisor for course selection in the following year. Failure to do so may prevent the student from enrolling in or attending future terms. Probation constitutes a serious warning that there is a need for the student to improve academic performance or further enrollment may be suspended.

The number of credits a student on probation is allowed to take in a semester is limited to 16 or by the program advisor's discretion.

C. Dismissal Warning

A student will receive a Dismissal Warning if he/she: a) is on Probation for three consecutive times, or b) has a GPD of 10 or more for either the term or the cumulative average. A student with Dismissal Warning will not be allowed to enroll for classes.

The student must submit a petition in writing to the Associate Dean for Undergraduate Education requesting reinstatement. The petition must document the reasons for the unsatisfactory performance, and provide sufficient and convincing evidence that another opportunity is deserved. If health condition has been a factor, students must include supporting information, including a doctor's note with signatures and dates. Documents supporting other contributing factors must also be included.

Students who are not reinstated will be placed on suspension, and the enrollment status is removed.

If reinstated, the number of credits a student on dismissal warning is allowed to take in a semester is limited to 12 or by the program advisor's discretion.

D. Drop-Out Recommendation

Students who get two or more consecutive Dismissal Warnings and fail to meet the agreed conditions of reinstatement will be advised to leave the institute voluntarily. A student with a Drop-Out Recommendation will not be allowed to enroll for classes.

When a student receives a drop-out recommendation, a formal notification will also be sent to his/her parents. To reinstate registration status, the student must submit a petition in writing with his/her parents' acknowledgement to the Associate Dean for Undergraduate Education. The petition must document the reasons for the unsatisfactory performance and provide sufficient and convincing evidence that another opportunity is deserved. If health condition has been a factor, students must include supporting information, including a doctor's note with signatures and dates. Documents supporting other contributing factors must also be included.

Students who are not reinstated will be placed on suspension, and the enrollment status is removed.

If reinstated, the number of credits a student on Drop-Out Recommendation is allowed to take in a semester is limited to 12 or by the program advisor's discretion.

E. Dismissal

Permanent dismissal will be enforced if a student:

- Has received two Drop-out Recommendations and has not been able to improve their academic performance significantly. The student will be dismissed from the JI permanently. A formal report will be submitted to the SJTU Academic Affairs Division for further processing.
- Has not resumed registration within the required time at the end of the suspension period or have failed the reinstatement;
- is unable to study at school because of illness or accidental disability confirmed by the designated hospital;
- is absent for more than two weeks without appropriate approval while the school is still in session;
- Does not register within the required time and without any justifiable reasons;
- Has applied for dropping out by a student himself/herself.

5.7 Major Declaration

A JI student needs to declare an engineering major at the end of their freshman summer term. To be qualified for declaring a major, students must have completed the first year level of Math, Chemistry, Physics, Introduction to Engineering, and Introduction to Computer & Programming with satisfactory grades.

Students who have met the basic requirements are eligible to apply to either of the two programs. Final decisions will be made based on the student's preference, score ranking, overall performance as well as the capacity limits of each program. No decision will be made until the student has completed at least one full term at the JI. Due to resource constraints, the JI may limit the number of students accepted into each program.

Students who have not met the basic requirements should make a study plan under the direction of a program advisor, and choose a major after completion of the requirements for that major.

5.8 Degree Requirements

5.8.1 Requirements for Bachelor's Degree from SJTU

To obtain a Bachelor's degree from the SJTU, students must meet the following requirements:

- A student must complete 136 credits required by the JI programs. A student may receive credit toward a degree in one or more of the following ways:
  - By passing a course with a satisfactory grade (D or better) for courses specified in the curriculum of a degree program.
  - By transferring equivalent credits from other schools of SJTU, the UM, or other institutions recognized by the JI. Transfer credits must be evaluated by relevant JI faculty and approved by the Undergraduate Committee. JI does not accept transfer credits for courses graded as Pass or Fail.

- A student must also complete all additional courses required by the Ministry of Education (MoE) of China as well as by the SJTU.
- A student must accumulate a final GPA of 2.0 or more for all credits taken while enrolled in SJTU.
- A student must file a formal application for graduation.

5.8.2 Time Requirement

The longest study period for undergraduate students is 6 years starting from the first day of registration as a student of the SJTU.

5.9 Diploma and Certificate

5.9.1 Graduation Diploma and Certificates

After successfully completing all the requirements for their undergraduate study at the JI, students will receive the Graduation Diploma from the Ministry of Education of China, a BS Degree Ordinance from SJTU, and a JI Study Certificate jointly granted by Shanghai Jiao Tong University and University of Michigan (UM).

Students participating the dual degree program, upon completion of each university's degree requirements, will receive a BS Degree from the UM, the Graduation Diploma from the Ministry of Education of China, a BS Degree Ordinance from SJTU, and a JI Study Certificate jointly granted by Shanghai Jiao Tong University and University of Michigan.

Students who fulfill the requirements of a secondary Bachelor degree of SJTU will be awarded a second degree.

Students who satisfy all graduation requirements in advance can apply for early graduation. After the JI and the SJTU Academic Division approve the application, it will be sent to the Ministry of Education for final approval.

5.9.2 Certificate of Completion and Non-completion

Students applying for Certificate of Completion and Non-completion should follow the rules and procedures specified in the SJTU Student Handbook.

6. JI Honor Code

(*Adopted from the University of Michigan College of Engineering Honor Code*)

6.1 Preamble

The Honor Code outlines certain standards of ethical conduct for persons associated with the University of Michigan – Shanghai Jiao Tong University Joint Institute (UM-SJTU JI). The policies of the Honor Code apply to all graduate and undergraduate students of JI or taking courses at JI, faculty members, staff members, and administrators.

The Honor Code is based on the following tenets:

- Engineers must possess personal integrity as students and as professionals. They must honorably ensure safety, health, fairness, and the proper use of available resources in their undertakings.
- Members of JI are honorable and trustworthy persons.
- The students, faculty members, and staff members of JI trust each other to uphold the principles of the Honor Code. They are jointly responsible for precautions against violations of its policies.
- It is dishonorable for students to receive credit for work that is not the result of their own efforts.

6.2 Application of the Honor Code

The Honor Code is intended to support and enforce course policies at JI. Course instructors have significant latitude to prepare policies for their courses. This can lead to variations between policies of different courses. It is the instructor's responsibility to craft the course policies in accordance with the doctrine of the Honor Code.

Students are responsible for understanding the Honor Code and its implementation. JI identifies and pursues violations more vigorously than most SJTU schools. In particular, any copying of other students' work in homework assignments, reports, and course projects not specifically permitted by the instructor as well as any plagiarism of other sources in written work are considered violations of the Honor Code.

As the specific policies of different instructors can vary significantly, it is the instructors' responsibility to specify their policies in writing at the beginning of each term. Students are responsible for understanding these policies and should consult the instructor if any ambiguities remain. The Honor Code supports the individual course policy, whatever it may be.

If a student feels that an instructor is not implementing all aspects of the Honor Code, the student should contact the instructor or a member of the Honor Council for discussion and to consider further steps, if necessary.

Students of JI enrolled in courses offered by other colleges must abide by the policies of the school or college in which the course is offered. Any suspected policy violations will be referred to the appropriate authorities of the school in question.

JI and the University of Michigan (UM) may share records on Honor Code violations. An Honor Code violation by JI students at UM may be considered an Honor Code violation at JI. JI students are obligated to inform JI if they are found by UM's Faculty Committee on Discipline to have violated UM's Honor Code while at UM. JI may share records of Honor Code violations of dual-degree students with UM.

Students who are not members of JI and who take a course offered by JI or make use of JI facilities are bound by the policies of the Honor Code. Any suspected policy violations will be referred to the Honor Council and Faculty Committee on Discipline. The appropriate authorities of the student's school or college will be notified.

6.3 Examinations, Quizzes, and In-Class Assignments

The statements that follow apply to quizzes or in-class assignments as well as examinations.

Students must follow instructions to sit at the designated seats for in-class exams. There should be at least one empty seat between students. This helps ensure comfort during the examination and reduces the temptation to cheat. The Honor Code applies even if the seating arrangement does not permit an empty seat between all students.

Students are required to bring their student ID card and have it available for the purpose of verification. Students are not allowed to take items not directly related to the exam to the classroom. In particular, computers, music and video players, cell phones, and other electronic devices are prohibited unless clearly specified otherwise. The instructor will inform the class prior to the examination if aids such as calculators, notes, or textbooks are permitted.

During the examination, students are allowed to leave the room briefly with permission. No communication regarding the examination is allowed inside or outside the room. All questions about the examination should be directed to the instructor.

After each examination, students must sign their name to the Honor Pledge on their test paper. The Honor Pledge reads as follows:

"I have neither given nor received unauthorized aid on this examination, nor have I concealed any violations of the Honor Code by myself or others."

Instructors are not required to grade exam papers in which the signed Honor Pledge does not appear. The Honor Code remains enforced whether or not the student signs the Pledge.

6.4 Coursework and Attribution of Sources

The principles of the Honor Code apply to out-of-class coursework, such as homework, programming assignments, laboratory reports, essays, class projects, take-home examinations and other activities as designated by the course instructor.

Student collaboration on coursework may be allowed by the instructor. However, students should assume that coursework is to be done independently unless otherwise informed. If collaboration is allowed, the instructor is to make clear what forms of collaboration are permissible. The instructor may also require students to sign the Honor Pledge (see 6.3) on the coursework.

It is a violation of the Honor Code for students to submit, as their own, work that is not the result of their own labor and thoughts. This applies, in particular, to ideas, expressions or work obtained from other students as well as from books, the internet, and other sources. The failure to properly credit ideas, expressions or work from others is considered plagiarism.

Plagiarism is taken extremely seriously at JI. A student is required to follow the rules of citation and attribution as set down by the instructor. The following list includes some specific examples of plagiarism:

- Use of any passage of three words or longer from another source without proper attribution. Use of any phrase of three words or more must be enclosed in quotation marks ("example, example, example").
- Use of material from an uncredited source, making very minor changes (like word order or verb tense) to avoid the three-word rule.
- Inclusion of facts, data, ideas or theories originally thought of by someone else, without giving that person (organization, etc.) credit.
- Paraphrasing of ideas or theories without crediting the original thinker.

There are many different style guidelines for the correct formatting of attributions (e.g., APA style, MLA style etc.). When determining whether a violation of the Honor Code has occurred, the particular method of citation is generally not relevant unless the instructor has specified otherwise. However, students must always make clear which words or ideas are being used, and identify their sources with sufficient precision to allow readers to locate the original material or original text.

Use of machines translation software (such as Google Translate) is generally not permitted. It may only be used rarely, with explicit, previous authorization from an instructor.

While plagiarism is generally a violation of the Honor Code, it is recognized that the procedures of proper attribution are initially unknown to students. If a student is found to have committed plagiarism in an assignment or other course work whose specific goal is to teach students about proper procedures of summation, citation and attribution, then the instructor or the Honor Council may decide that no violation of the Honor Code has occurred.

6.5 Collaborative Group Work

Assignments involving collaboration within a group (e.g., lab reports, project reports, collaborative course work) require that all members of the group whose name appears on the assignment are jointly and fully responsible for the entirety of the submitted work. If any section of the submission is found to violate the Honor Code, all group members whose name appears on the submission are equally and jointly liable for the violation. An exception is possible, at the instructor's discretion, if part of the work is clearly delineated as originating only from specific group members.

6.6 University Documents

Official academic forms and records, including electronic records, are the property of JI and/or SJTU. Tampering with, altering, improperly accessing, disrupting availability of, or misusing these documents or electronic resources is a violation of the Honor Code, as is submitting falsified or altered documents.

6.7 Computer Accounts and Software

Students may not attempt to access or tamper with the class account or records of another student unless permission has been given by the class instructor and the student to whom the account is assigned. Students may not inappropriately alter, attempt to gain access to, or disrupt availability of any academic records, course materials, and institutional computing tools without proper approval.

Computers made available for students' use are the property of JI. All software made available for students' use is the property of JI or is used under license. Any unauthorized attempt to copy or improperly distribute software or to tamper with computers or software is a violation of the law and of the Honor Code.

6.8 Non-Academic Violations

The Honor Code applies to behavior outside of academic matters. For example, the following actions would be reviewed under Honor Code processes: theft, damaging of property, causing physical harm to others, deliberate disruption of computing resources. This is not a complete list but rather gives examples of possible violations. Under exceptional circumstances, such matters may be investigated directly by the Faculty Committee on Discipline rather than first passing through the Honor Council.

6.9 Honor Council

The Honor Council is composed of students of JI. The primary purpose of the Honor Council is to investigate suspected violations of the Honor Code.

Members of the Honor Council may visit classes to answer questions about the Honor Code and acquaint students with its ideals. Openings may occur on the Honor Council as members graduate and leave the institute. At such times, the Honor Council follows its established procedures to select new members. The Honor Council can be contacted at jihonor@sjtu.edu.cn .

The Honor Council investigates each suspected violation of the Honor Code and determines whether or not a violation has occurred. Its determination together with a recommendation for sanctions is then passed to the Faculty Committee on Discipline.

If a student or faculty member disagrees with the Honor Council's determination, he or she may ask the Faculty Committee on Discipline for a review of the decision.

6.10 Faculty Committee on Discipline

The Faculty Committee on Discipline (FCD) consists of faculty members of JI. The main purpose of the FCD is to impose sanctions on students that have been found to have violated JI's Honor Code by the Honor Council. It will take the Honor Council's recommendations into account when determining the sanctions.

The FCD may return a case to the Honor Council for review if it feels that certain aspects have not been sufficiently considered. However, the FCD will not usually investigate purported violations of the Honor Code itself.

The decisions of the FCD are ordinarily final. They may, however, be appealed to the Dean's Cabinet of JI as outlined in §12 below. Such appeals should be addressed directly to the Dean's Office.

6.11 Reporting Honor Code Violations

The Honor Code works to the benefit of students, instructors, and staff members of JI. It is based on the mutual trust that all those bound by it will uphold its principles and enforce its policies.

This makes it the duty and responsibility of students and instructors to report promptly any suspected violations of the Honor Code. It is considered a violation of the Honor Code to not report a suspected violation of the Honor Code.

Students should inform the instructor in a timely manner when a violation of the Honor Code is observed. To ensure uniformity and fairness, the instructor is required to take the appropriate actions in accordance with the Honor Code if the instructor feels there is just cause to do so.

The proceedings of the Honor Council are confidential. Therefore, the students and faculty involved are obligated to refrain from discussing the case with persons not directly involved in the case. Disclosure of confidential information is a violation of the Honor Code.

The UM-SJTU Joint Institute maintains records of all Honor Code convictions. However, all Honor Council and Faculty Committee on Discipline records are confidential and kept separately from the student's regular file. Honor Code violation records may be shared with UM as appropriate for students with affiliations to both JI and UM.

6.12 Investigation of Honor Code Violations

When a student is suspected of an Honor Code violation it is his/her right and responsibility to cooperate with the Honor Council investigation, provide evidence and defend himself/herself in the hearing.

The accused student has the right to attend every hearing on his case and has a right to see all the relevant evidence.

The Honor Council will make a determination of whether a violation of the Honor Code has occurred and may make a recommendation regarding suitable sanctions. The Honor Council will notify the student, the course instructor (if applicable) and the FCD of its decision within three days of the hearing.

The student and the instructor both have the right to appeal the Honor Council's decision to the FCD within two weeks of the Honor Council's decision. The FCD may also decide to review the case itself. The FCD may void the Honor Council's decision and remand the case back to the Honor Council for further review. The final decision of whether or not a violation occurred is made by the Honor Council.

The FCD will review the determination made by the Honor Council. If the Honor Council finds that a violation of the Honor Code has occurred, the FCD will consider the Honor Council's recommendation for sanctions, but it is not bound by that recommendation. The FCD will render a final and binding decision on the sanctions to be imposed on the accused student.

The student and the instructor both have the right to appeal any decision by the FCD to the Dean's Cabinet of JI within two weeks of the FCD's decision. Such an appeal may be based only on the following grounds:

Proper procedures were not followed;

Sanctions are not consistent with past practice;

There is new evidence not reasonably available at the time of the decision of the FCD.

The Dean's Cabinet shall not review findings of fact made by the FCD.

The Dean's Cabinet has sole discretion to determine if sufficient grounds exist for consideration of an appeal.

If the request for appeal has merit, the Dean's Cabinet shall review the appeal as soon as practical after it has been filed and will give the student, along with the Chair of the FCD, an opportunity to address the Cabinet in person.

Following the review, the Dean's Cabinet may sustain or reverse the finding of an honor code violation. If the finding of academic dishonesty stands, the Cabinet may sustain, modify, or increase the sanction imposed.

6.13 Sanctions

Typical sanctions for a first violation include a grade reduction on the work in question and a reduction in letter grade for the course.

Second violations of the Honor Code are especially major. For a second violation, students will normally receive a grade reduction for the work in question, a reduction in letter grade for the course, and an increase in the number of academic credits required for graduation.

In addition to the above, JI may recommend to SJTU that the student receive one of the following administrative entries in his personal file: Jinggao (warning), Yanzhong Jinggao (serious warning), Ji Guo (recorded demerit), Liu Xiao Chakan (probation), or expulsion according to the rules in the SJTU Handbook. These or other sanctions appropriate to the violation are determined by the FCD based on the severity and circumstances of the violation.

For non-academic violations, any of the above sanctions may be imposed by the FCD according to the nature of the violation.

If a student violates the Honor Code after already having received either Ji Guo or Liu Xiao Chakan, they will be expelled from JI. JI will recommend to SJTU that the student be expelled from the university.

For a first or later violation of the Honor Code, SJTU may follow their specified policies on student conduct in addition to JI process outlined in this document. SJTU's processes may lead to additional sanctions beyond those administered by JI, including expulsion from SJTU (see the SJTU Student Handbook for details).

7. International Programs

7.1 SJTU and JI International Exchange Programs

The exchange programs provide opportunities for the JI students to gain the international experience in universities outside the mainland China for a short term (typically one semester). JI has developed tuition-waiver based international exchange programs with close to 90 foreign institutions including all campuses of the University of California (Berkeley, UCLA, etc.), University of Maryland, Royal Institute of Technology Sweden, Technical University of Munich, etc. More information can be found at the JI International Programs Office.

Students can also participate in exchange programs between SJTU and universities in foreign countries, Hong Kong, Macao, and Taiwan. For more details, please refer to "*SJTU Rules for Transfer Undergraduates*" in the SJTU Student Handbook.

7.2 Enrichment Study Abroad Program

During the winter break, JI offers students a variety of study abroad opportunities in foreign countries including Germany, Spain, France, Australia, US, etc. The study abroad programs are offered for the JI students to have opportunities to study in a foreign country while experiencing different cultures. The enrichment study abroad programs are typically 3-5 weeks. More study abroad programs are being developed every year. A complete list of programs is available at the International Programs Office.

7.3 Summer and Fall Program

During the regular JI Summer and Fall semesters, international students from the UM and other foreign partner universities are invited to Shanghai to take academic courses at JI together with the JI students. These programs offer the international students an opportunity to immerse themselves in Chinese language and culture, while gaining credits towards their engineering degrees in their home institutions. Built into the program schedule is various cultural excursions in and around Shanghai. This program is also a good opportunity for the JI students to interact with students coming from all over the world.

8. Financial Aid and Student Awards

8.1 Government Loan for Undergraduate Students

(For Chinese nationals only)

Chinese students may apply for the Chinese government loan program. For detailed requirements and application procedures, please refer to "*Guidelines for the Implementation of Chinese Government Student Loan at SJTU*" in SJTU Student Handbook.

8.2 Employment Opportunity for Undergraduate Students

(For Chinese nationals only)

SJTU encourages and supports students to participate in healthy and beneficial work-study activities during their after-school hours and holidays. A work-study program is thereby offered for all full-time students at SJTU which is in the charge of Office of Work-Study Program. For more details, please refer to "*SJTU Regulations for Work-Study Program*" in SJTU Student Handbook.

8.3 SJTU Financial Aid for Undergraduate Students

In order to help students with family financial difficulties successfully complete their education in SJTU, the university provides financial aid assistance for them in an open, fair, and just way. SJTU also provides Outstanding-Student Scholarship for all SJTU students. About 30% of the students can get this scholarship every year. For detailed requirements and application procedures, please refer to "*SJTU Regulations for Financial Aid*" in SJTU Student Handbook.

8.4 SJTU Awards for Undergraduate Students

Every year, SJTU offers a limited number of awards to students based on their outstanding academic performance and leadership which are respectively called "Three Good Student" and "Excellent Student Leader". For detailed requirements and application procedures, please refer to "*SJTU Regulations for Three Good Student and Excellent Student Leader Awards*" in SJTU Student Handbook.

8.5 JI Awards for Undergraduate Students

Students need to have at least 12 credits for each semester upon which their performance is being evaluated for any awards.

8.5.1 The Dean's List

Students who completed a minimum of 12 credit hours with grades and earned a 3.5 GPA term average or better, attain the distinction of the Dean's List for that term.

8.5.2 Distinguished Academic Achievement Award

This award is presented to the students whose academic performance is on the top 2% of the comparing group. It is awarded annually from the Dean's office.

8.5.3 Distinguished Leadership Award

The Distinguished Leadership Award is presented to those students who have demonstrated outstanding leadership through their contributions to the institute, university and/or the community. It is awarded annually to the students in the JI. Candidates are nominated by classes, student organizations, and special programs; self-recommendation is acceptable too.

8.5.4 Outstanding Student Organization

The Outstanding Student Organization Award recognizes organizations that consistently provide leadership and service by making meaningful contributions to students, the university and the surrounding communities.

Candidates are nominated by classes, student organizations, and special programs; self-recommendation is acceptable too

8.5.5 Program of the Year

The Program of the Year Award recognizes programs in student organizations which make meaningful contributions to students, the university and the community. Candidates are nominated by classes, student organizations, and special programs; self-recommendation is acceptable too.

8.5.6 Civil Engagement/Community Service

This award is conferred on those who are actively involved in addressing serious social issues through community service and social action. The goal is to heighten campus awareness of social issues, increase student involvement in the community, address community problems and raise social consciousness. Students should apply for that individually, and it can also be nominated by classes, student organizations, and special programs.

9. College Life

9.1 Student Organizations

The Joint Institute Student Union (JISU) is the leading student organization which organizes, assists, and supervises other student organizations and activities.

The purpose of this organization shall be to act as the duly constituted student government of UM-SJTU Joint Institute of Shanghai Jiao Tong University; to help coordinate the activities of organizations and groups within the Joint Institute; to gather and formulate student opinion on policies of the Joint Institute affecting the student body; to provide a liaison between the student body and the administration; to undertake service projects for the general good of the Joint Institute and Shanghai Jiao Tong University; and to stimulate interest in the student activities of Joint Institute.

For more information, please refer to the JI website: http://umji.sjtu.edu.cn/current-students/student-affairs/student-organizations/.

9.2 Student Services

9.2.1 Student ID and Campus Card

A unique student ID will be assigned to every UM-SJTU JI student once he/she is admitted. It is the official form of identification required for all students, and should be in the individual students' possession at all times.

The campus card is used as a form of identification as well as an electronic purchase card in all the campuses of SJTU. Students can use their campus cards to get registered, go to libraries to read and borrow books, receive treatment in the campus hospital, and pay for what they have consumed on campus including dining, purchase, bath, and bus fees to and from campuses. Regarding how to use the campus card, please read "*Instructions of Using Campus Card*" below:

Instructions of Using Campus Card

Applying for the card: The Campus Card Operation Center is responsible for the issue of campus card. There are two offices respectively located in Room 225 of the Old Administration Building in Minhang Campus and the 4th floor of Hao Ran Tower in Xuhui Campus. Newly-enrolled students must bring a form of identification (including PRC citizen ID card, passport, Military ID card, Pass of Hong Kong and Macao, Taiwan ID card, etc.) and enrollment document when applying for the campus card.

Recharging and checking balances: The campus card cannot be overdrawn. Students can recharge their campus cards, using cash at the designated card recharge sites located in or around the various campus canteens, or using Alipay. Freshmen students who have a deposit account with Bank of China can arrange to have their campus card account connected with their BoC account. This needs to be done before the issue of the campus card. Students whose bank accounts and campus accounts are connected can recharge their campus cards through self-service by bank money transfer or at the recharge machines on campus. Card users can check the account balance by calling 34202020, logging on to http://ecard.sjtu.edu.cn/homeLogin.action or at the recharge and Proof of Sales (POS) machines on campus.

Making purchases: When purchases are made in campus shops, the seller inputs the cost amount into the POS machine. The card user then places his card on the electronic reader of the POS machine to validate the purchase and have the cost deducted electronically from the campus card. The payment is successful when the card balance is displayed on the POS machine screen.

Reporting loss of the card: Loss of the campus card can be reported by calling 34202020, logging on http://ecard.sjtu.edu.cn/homeLogin.action, or the money transfer machine. Students would need to remember the card ID and password.

Reactivating the card: If the user finds the card after reporting its loss, and has not yet applied for a new replacement card, he/she can get the card reactivated at the Campus Card Operation Center. If the user has applied for a new card, the old card will not be reactivated.

Replacing the card: When the campus card is damaged or lost, the user should apply for a new replacement card at the Campus Card Operation Center by bringing along an official form of ID. It costs 20RMB for the replacement of a card. The money that was in credit on the old card can be transferred to the new card.

Cancelling the card: The user should cancel the campus card upon graduation. He/she can go through the required procedure and get the money in the card returned at any recharge sites, by showing a proof of the graduation/school-leaving document.

NOTE：

The campus card cannot be assigned to others. When you pick up a lost card, you should hand it in to the Campus Card Operation Center or find ways to return it to the user. The university has the right to discipline those persons who use others' cards and cause economic loss to others.

There's an electronic chip in every campus card, so users should avoid oil and heat or bending or puncturing the card. Malicious damage to the card or using counterfeit cards is strictly forbidden. Violations of these card regulations will be reported to the related legal institution.

For more information, please refer to http://ecard.sjtu.edu.cn/homeLogin.action.

9.2.2 Accommodation on campus

SJTU provides standard accommodation for every enrolled student. If a student wants to change or discharge from his/her dormitory, or to live outside of the campus, special permission needs to be granted. As the student dormitory is a public place for students' study, living, and rest, every student living on campus is responsible for its civilized and harmonious environment. For more details about accommodation and its management, please refer to "*SJTU Regulations for Student Dormitory Management (Minhang Campus)*" in the SJTU Student Handbook.

9.2.3 JI Accommodation

A. General Issues

Student dormitories of UM-SJTU Joint Institute (JI) adopt the JI management model and introduce the "extracurricular classroom" for the holistic education of students. JI students will participate in the dormitory management and culture development according to the details below. This regulation applies to all JI students (international students included).

B. Management Model and Organization

- The JI dormitory management system shall apply to every aspect of on-campus living to facilitate the overall education of students.
- A Residential Advisor will live in the same dormitory buildings with students to expand the traditional work of student counselors to other aspects of student life.

To enhance awareness& understanding of the JI Honor Code, there shall be branches of the JI Honor Code Council, with each dormitory building as one unit and students as the main body.

C. Regulations on Dormitory Check-in and Changes

- Students enrolled for degree programs according to the national recruitment policy and regulations can live in dorms during the time-limited study period. Students who cannot graduate within the expected study period and who get approval of extension of study period can apply to the SJTU Dormitory Management Department for extended dormitory accommodation.
- JI has two kinds of dorm management structures: while most students could enjoy the maximum flexibility of their own working schedule and living habits in a so called self-management structure, some of the students might prefer a common & regular living schedule in a more controlled structure called group-management. By default, every student will be assigned into a self-managed dorm unless they make an explicit request on their dorm inquiry forms. Students could apply to move to other dorm with a different management structure and the application should be submitted to the student affairs office before the end of each summer semester. Physical move will be implemented only after the application has been granted.
- For each dormitory building, one or two assistant positions will be open for students to apply. The term of service is one year. Individual application should be submitted before the end of each summer semester.

- The study room on each floor serves as an important place for students to study, communicate and develop JI culture. Everyone has the responsibility to observe relative regulations and protect public facilities.
- According to students' preferences, the ground floor of each dormitory building may adopt the same work-and-rest schedule. In principle, students living in such dorms are voluntary. The application time is before the end of each annual summer semester.
- Students with GPA ranking in the last 10% among the grade or having received academic warning in the last academic year will be encouraged to move into a group-management dorm. A petition letter should be submitted to the student affairs office if they do not want to move. During the period of one semester of observation, if they still performed badly in study due to poor self-management, advisors will require the student to move into a group-management dorm after communication with his/her parents.
- Each dormitory building can hold various themed activities based on its individual dormitory characteristics.

9.2.4 Medical Care and Physical Examination

For Chinese students: SJTU provides medical care service for students. Please refer to "*SJTU Rules for Medical Care Service*" in SJTU Student Handbook. The rules are not applied to students from Shanghai University of Traditional Chinese Medicine, entrusted students from other universities and foreign students.

***For international students*:** As part of the admissions process, all international students should take health checks at the hospital designated by the SJTU International Education Office according to the requirement of the visa. International students will be informed of these details on the day of registration.

9.2.5 Medical Insurance

For Chinese students: Under the principle of voluntary insurance purchase, SJTU encourages all students to participate in insurance for university students. For more details, please refer to "*Insurance Policy for SJTU Students*" in SJTU Student Handbook.

For international students: Please refer to the following web site at http://isc.sjtu.edu.cn/EN/content.aspx?info_lb=172&flag=3.

All international students studying at SJTU are required to buy insurance. When registering for each academic term, students should present valid insurance documents, otherwise they must buy the insurance suggested by the university.

Further detailed policies and regulations are supplied in the insurance contract.

Appendix A. Course Description

(*Not all the courses listed in this appendix are offered on a regular basis*)

A.1 Mathematics, Science, and General Engineering Course Descriptions

Vv115 - Calculus I (4 credits)

Credits: Counted as General Elective credits

Prerequisites: 3-4 years high school math including trigonometry

Back ground and Goals: The sequence Vv115-116-215-216 is the standard complete introduction to the concepts and methods of calculus. It is taken by the majority of students intending to concentrate in mathematics, science, or engineering as well as students heading for many other fields. The emphasis is on concepts and solving problems rather than theory and proof.

Content: The course presents the concepts of calculus from four points of view: geometric (graphs), numeric (tables), symbolic (formulas), and verbal descriptions. Students will develop their reading, writing, and questioning skills, as well as their ability to work cooperatively. Topics include functions and graphs, derivatives and their applications to real-life problems in various fields, and an introduction to integration. The classroom atmosphere is interactive and cooperative. Both individual and team homework is assigned.

Vv116 - Calculus II (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vv156 or Vv186

Prerequisites: Vv115

Back ground and Goals: The sequence Vv115-116-215-216 is the standard complete introduction to the concepts and methods of calculus. It is taken by the majority of students intending to concentrate in mathematics, science, or engineering as well as students heading for many other fields. The emphasis is on concepts and solving problems rather than theory and proof.

Content: The course presents the concepts of calculus from four points of view: geometric (graphs), numeric (tables), symbolic (formulas), and verbal descriptions. Students will develop their reading, writing and questioning skills, as well as their ability to work cooperatively. Topics include techniques of integration, applications of integration, Taylor series, an introduction to differential equations, and infinite series. The classroom atmosphere is interactive and cooperative. Both individual and team homework is assigned.

Vv215 - Calculus III (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vv255 or Vv285

Prerequisites: Vv116

Back ground and Goals: The sequence Vv115-116-215-216 is the standard complete introduction to the concepts and methods of calculus. It is taken by the majority of students intending to concentrate in mathematics, science, or engineering as well as students heading for many other fields. The emphasis is on concepts and solving problems rather than theory and proof.

Content: Topics include vector algebra and vector functions; analytic geometry of planes, surfaces, and solids; functions of several variables and partial differentiation; line, surface, and volume integrals and applications; vector fields and integration; Green's Theorem, Stokes' Theorem, and Gauss' Theorem.

Vv216 - Calculus IV (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vv256 or Vv286

Prerequisites: Vv215

Back ground and Goals: The sequence Vv115-116-215-216 is the standard complete introduction to the concepts and methods of calculus. It is taken by the majority of students intending to concentrate in mathematics, science, or engineering as well as students heading for many other fields. The emphasis is on concepts and solving problems rather than theory and proof.

Content: Vv216 is a basic course on differential equations, intended for engineers and other scientists who need to apply the techniques in their work. Topics covered include some material on complex numbers and matrix algebra, first and second order linear and non-linear systems with applications, introductory numerical methods, and elementary Laplace transform techniques.

Vv156 - Honors Calculus II (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vv186

Prerequisites: having passed math placement test

Back ground and Goals: The sequence Honors Calculus Vv156-255-256 is an introduction to basic calculus. It differs from the Honors Mathematics sequence in that new concepts are often introduced and extended from concrete examples, remaining closely aligned to applications. Most theorems are stated rigorously and motivated from examples, but complicated proofs and abstract generalizations are often omitted. The emphasis is on applying mathematical results to concrete problems. The present course covers the calculus of functions of a single real variable.

Content: Review of trigonometry, complex numbers and functions; sequences and convergence; functions and continuity; the derivative and applications; the Riemann integral; applications of integration; series and power series; curves (as time permits)

Alternatives: Vv186 (Honors Mathematics II) is a more theoretical course, which covers much of the same material.

Vv255 - Honors Calculus III (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vv285

Prerequisites: Vv156, Vv186 or permission of instructor

Background and Goals: The sequence Honors Calculus Vv156-255-256 is an introduction to basic calculus. It differs from the Honors Mathematics sequence in that new concepts are often introduced and extended from concrete examples, remaining closely aligned to applications. Most theorems are stated rigorously and motivated from examples, but complicated proofs and abstract generalizations are often omitted. The emphasis is on applying mathematical results to concrete problems. The present course includes an overview of linear algebra followed by the calculus of functions in multidimensional euclidean space.

Content: Linear systems of equations and the Gauss-Jordan algorithm; finite-dimensional vector spaces (with an emphasis on euclidean space), linear independence and bases; scalar products and Gram-Schmidt orthonormalization; linear maps and matrices; determinants; analytic geometry of lines and planes; parametric representation of curves and surfaces; partial derivatives and applications; line, surface and volume integrals; vector fields the classical theorems of vector analysis in three dimensions (Green, Gauss and Stokes) and applications.

Alternatives: Vv285 (Honors Mathematics III) is a more theoretical course, which covers much of the same material.

Vv256 - Honors Calculus IV (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vv286

*Prerequisites***:** Vv255, Vv285 or permission of instructors

*Background and Goals***:** The sequence Honors Calculus Vv156-255-256 is an introduction to basic calculus. It differs from the Honors Mathematics sequence in that new concepts are often introduced and extended from concrete examples, remaining closely aligned to applications. Most theorems are stated rigorously and motivated from examples, but complicated proofs and abstract generalizations are often omitted. The emphasis is on applying mathematical results to concrete problems. The present course focuses on ordinary differential equations and their applications.

*Content***:** Ordinary differential equations (ODEs) of first order; Systems of first-order equations; eigenvalue problems; diagonalization and the Jordan normal form; application to linear systems of first-order equations and linear second-order equations; nonlinear systems of ODE and stability analysis; elements of complex analysis and residue theory; the Laplace transform and its applications to ODEs; power series solutions of ODEs by the Frobenius method; Bessel's and Legendre's differential equations; introduction to the classical partial differential equations of physics and some basic solutions by separation of variables.

*Alternatives***:** Vv286 (Honors Mathematics IV) is a more theoretical course, which covers much of the same material.

Vv186 - Honors Mathematics II (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vv156

Prerequisites: having passed math placement test

Background and Goals: The sequence Honors Mathematics Vv186-285-286 is an introduction to calculus at the honors level. It differs from the Honors Calculus sequence in that new concepts are often introduced in an abstract context, so that they can be applied in more general settings later. Most theorems are proven and new ideas are shown to evolve from previously established theory. Initially, there are fewer applications, as the emphasis is on first establishing a solid mathematical background before proceeding to the analysis of complex models. The present course covers the calculus of functions of a single real variable.

Content: Elements of logic; set theory; properties of real and complex numbers; sequences, convergence, completeness of metric spaces; functions, convergence and continuity; the derivative and applications; normed vector spaces; series and power series; transcendental functions; the regulated and Riemann integrals and applications; the Lebesgue integral (as time permits).

Alternatives: Vv156 (Honors Calculus II) is an applications-oriented course, which covers much of the same material.

Vv285 - Honors Mathematics III (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vv255

Prerequisites: Vv186 or permission of instructor

Background and Goals: The sequence Honors Mathematics Vv186-285-286 is an introduction to calculus at the honors level. It differs from the Honors Calculus sequence in that new concepts are often introduced in an abstract context, so that they can be applied in more general settings later. Most theorems are proven and new ideas are shown to evolve from previously established theory. Initially, there are fewer applications, as the emphasis is on first establishing a solid mathematical background before proceeding to the analysis of complex models. The present course includes an overview of linear algebra followed by the calculus of functions in multidimensional euclidean space.

Content: Linear systems of equations and the Gauss-Jordan algorithm; finite-dimensional vector spaces, linear independence and bases; scalar products and Gram-Schmidt orthonormalization; linear maps and matrices; determinants; topology of normed spaces; the derivative and applications; curves, potentials and vector fields; higher derivatives and applications; the Riemann integral in n-dimensional space; integration on curves and surfaces; the classical theorems of vector analysis in three dimensions (Green, Gauss and Stokes); the inverse and implicit function theorems (as time permits).

Alternatives: Vv255 (Honors Calculus III) is an applications-oriented course, which covers much of the same material.

Vv286 - Honors Mathematics IV (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vv256

Prerequisites: Vv285 or permission of instructor

Background and Goals: The sequence Honors Mathematics Vv186-285-286 is an introduction to calculus at the honors level. It differs from the Honors Calculus sequence in that new concepts are often introduced in an abstract context, so that they can be applied in more general settings later. Most theorems are proven and new ideas are shown to evolve from previously established theory. Initially, there are fewer applications, as the emphasis is on first establishing a solid mathematical background before proceeding to the analysis of complex models.The present course focuses on ordinary differential equations and their applications.

Content: Ordinary differential equations (ODEs) of first order; Systems of first-order equations; the existence and uniqueness theorem of Picard-Lindeloef; eigenvalue problems, diagonalization and the spectral theorem; Jordan normal form; application to linear systems of first-order equations; linear second-order equations; elements of complex analysis and residue theory; the Laplace transform and its inverse with applications to ODEs; power series solutions of ODEs by the Frobenius method; Bessel's and Legendre's differential equations; the Weierstrass approximation theorem and generalized Fourier series; introduction to the classical partial differential equations of physics and some basic solutions by separation of variables.

Alternatives: Vv256 (Honors Calculus IV) is an applications-oriented course, which covers much of the same material.

Vv214 - Linear Algebra (4 credits)

*Credit*s: 4 Credits. No credit granted to those who have completed or are enrolled in Vv417.

Prerequisites: none

Background and Goals: An introduction to matrices and linear algebra. This course covers the basics needed to understand a wide variety of applications that use the ideas of linear algebra, from linear programming to mathematical economics. The emphasis is on concepts and problem solving.

Content: An introduction to the main concepts of linear algebra: matrix operations, echelon form, solution of systems of linear equations, Euclidean vector spaces, linear combinations, independence and spans of sets of vectors in Euclidean space, eigenvectors and eigenvalues, similarity theory. There are applications to discrete Markov processes, linear programming, and solutions of linear differential equations with constant coefficients.

Alternatives: Vv417

Vv417 - Linear Algebra (4 credits)

*Credit*s: 4 Credits. No credit granted to those who have completed or are enrolled in Vv214.

Prerequisites: Vv216/256/286

Background and Goals: This course is an introduction to the properties of and operations on matrices with a wide variety of applications.

Content: Many problems in science, and engineering, and statistics are best formulated in terms of matrices. This course is a discussion of linear algebra, with emphasis on the properties of and operations on matrices. Diversity rather than depth of applications is stressed.

Alternatives: Vv214

Vv454 - Boundary Value Problems for Partial Differential Equations (4 credits)

*Prerequisites***:** Vv255 and Vv256; or Vv285 and Vv286; or permission of instructor

*Background and Goals***:** The course is intended as an introduction to the classical theory of first- and second-order quasilinear partial differential equations (PDEs) and boundary value problems. The main focus lies on gaining familiarity with a range of solution methods. Rigorous proofs play only a subordinate role. A strong emphasis is placed on applications from fluid dynamics, electrodynamics, the theory of heat transfer, the analysis of vibrations and other fields of engineering.

*Content***:** Conservation laws and the derivation of PDEs from physical models; quasilinear first-order PDEs and the method of characteristics; Burgers's equation and weak solutions; shock waves; the eikonal equation and other nonlinear first-order PDEs; classification of quasilinear second-order PDEs and their transformation into normal form; boundary value problems of various kinds; the wave equation on an infinite string and d'Alembert's method; the heat equation in a finite bar and its solution through separation of variables; Fourier-Euler series and their convergence; spaces of weighted square-integrable functions and the problem of best approximation; Sturm-Liouville boundary value problems; separation of variables for nonhomogeneous one-dimensional evolution equations; problems on infinite and semi-infinite bars and the Fourier transform; dispersive solutions; analysis of the telegraph equation; separation of variables in higher dimensions; Bessel functions and Legendre polynomials; multipole expansions in electromagnetics; the Poisson equation and properties of harmonic functions.

*Alternatives***:** None.

Vv471 - Introduction to Numerical Methods (4 credits)

*Prerequisites***:** Vg101; and Vv256 or Vv286

*Background and Goals***:** This is a survey of the basic numerical methods which are used to solve scientific problems. The emphasis is evenly divided between the analysis of the methods and their practical applications. Some convergence theorems and error bounds are proved. The course also provides an introduction to MATLAB, an interactive program for numerical linear algebra, as well as practice in computer programming. One goal of the course is to show how calculus and linear algebra are used in numerical analysis.

*Content***:** Topics may include computer arithmetic, Newton's method for non-linear equations, polynomial interpolation, numerical integration, systems of linear equations, initial value problems for ordinary differential equations, quadrature, partial pivoting, spline approximations, partial differential equations, Monte Carlo methods, 2-point boundary value problems, Dirichlet problem for the Laplace equation.

Alternatives: Vv371 (Numerical Methods) is a less sophisticated version. Only one class (Vv371 or Vv471) can be taken for credit.

Ve203. Discrete Mathematics (4 credits)

Prerequisite: Vv156 or Vv186.

Content: Introduction to the mathematical foundations of computer science. Topics covered include: propositional and predicate logic, set theory, function and relations, growth of functions and asymptotic notation, introduction to algorithms, elementary combinatorics and graph theory, and discrete probability theory.

Vc210 (Vc209) - Chemistry (4 credits)

Prerequisites: 3 years high school math, high school chemistry

Background and Goals: This General Chemistry course is intended to satisfy the one-term chemistry requirement for students interested in science, or as a natural science elective for non-science concentrators. This course may also be used as the first term in a four or more term chemistry sequence for science concentrators and pre-professional students.

Content: Vc210 provides an introduction to the major concepts of chemistry, including the microscopic picture of atomic and molecular structure, periodic trends in the chemical reactivity, the energetics of chemical reactions, and the nature of chemical equilibria. Students will be introduced to the fundamental principles of modern chemistry, the descriptive chemistry of the elements, and to the underlying theories that account for observed macroscopic behavior. In Chem. 210, students will learn to think critically, examine experimental data, and form generalizations about data as chemists do.

Vc230 - Honors Chemistry (4 credits) (Has not been offered in the past 2 years)

Prerequisites: 3 years high school math, strong background in high school chemistry

Background and Goals: This is a more advanced course than Vc210. It is a honors chemistry for better prepared students. This course excludes the option to take Vc210 for credits.

Content: In Vc230, students will be introduced to the physical principles underlying some of the major topics of inorganic and analytical chemistry. These include the gaseous, liquid, and solid states of matter; phase transitions and solutions; electrochemistry and the principles of oxidation-reduction reactions; chemical kinetics and the study of chemical orbitals and chemical bonding; transition metal chemistry and coordination complexes. These topics will be treated from the viewpoint of the experimental scientist, with an emphasis on the application of physical chemical principles to chemical behavior in a broad spectrum of settings.

Vc211 - Chemistry Laboratory (1 credit)

Prerequisites: Vc210

Background and Goals: The focus of this guided inquiry laboratory is to foster critical thinking that allows students to design, perform, and interpret experiments. In addition, the student acquires technical skills that are required for further advancement in experimental sciences. Although an ability to collect and analyze data in a quantitative manner is developed, the emphasis of the course is to provide a qualitative understanding of the basic concepts of chemistry. This is accomplished by demonstrating that chemical principles are derived from experimental data. The goal is to provide students both with a more accurate picture of the scientific process and also with skills that are relevant to solving real life problems.

Content: The course is organized into three sections. Pre-laboratory reading and questions are completed prior to each multi-period project laboratory. A one-hour lecture provides support for the topics and problems that will be investigated in the laboratory. The second component is performance in the laboratory where team data are shared, analyzed, and evaluated. The third begins in the first hour following completion of each multi-period project lab where groups communicate their findings during a student-led discussion.

Vp140 - Physics I (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vp160

Prerequisites: Calculus I or equivalent training from high school

Co-requisites: Vp141

Content: This is the first of a two-term sequence in general physics for scientists and engineers. Covers topics from classical mechanics, including vectors, motion in one dimension, circular motion, projectile motion, relative velocity and acceleration, Newton's laws, particle dynamics, work and energy, linear momentum, torque, angular momentum of a particle, simple harmonic motion, gravitation, planetary motion, pressure and density of fluids, and Archimedes principle.

Vp141 - Physics Laboratory I (1 credit)

Co-requisites: Vp140 or Vp160

Content: Introduction to Excel; Probability and Statistics for Beginners; Uniform Velocity and Uniform Acceleration; Non-Uniform Acceleration; Impact, Momentum and Energy; Rotational Motion; The Gyroscope; Bernoulli's Equation and Hydrodynamics; Simple Harmonic Motion

Vp240 - Physics II (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vp260

Prerequisites: Vp140 or Vp160

Co-requisites: Vp241

Content: Electricity and magnetism: charge, Coulomb's law, electric fields, Gauss' law, electric potential, capacitors and dielectrics, current and resistance, EMF and circuits, magnetic fields, Biot-Savart law, Amperes law, Faraday's Law of Induction, and simple AC circuits.

Vp241 - Physics Laboratory II (1 credit)

Prerequisites: Vp140 or Vp160

Co-requisites: Vp240 or Vp260

Content: Electrostatics; Electric Fields; Capacitance; DC Circuits; Magnetic Fields and Forces I; Magnetic Fields and Forces II; *e/m* of the Electron; Faraday's Law; AC Generators; AC Transformers; AC Circuits

Vp160 - Honors Physics I (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vp140.

Prerequisites: Calculus I or equivalent training from high school

Co-requisites: Vp141

Content: A rigorous introduction to particle mechanics and the motion of extended objects. Particular topics include vectors, one and two dimensional motion, conservation laws, linear and rotational dynamics, gravitation, fluid mechanics and thermodynamics.

Vp260 - Honors Physics II (4 credits)

Credits: No credits are counted towards graduation for those who have completed Vp240

Prerequisites: Vp160

Co-requisites: Vp241

Content: A rigorous introduction to the theory of electromagnetic phenomena. Topics include electric and magnetic fields and potentials, DC and AC circuits, inductance and Maxwell's equations.

Vp390 - Modern Physics (3 credits)

Prerequisites: Vv256/286 and Vp240/260

Content: Modern Physics is a course in relativistic classical mechanics and elementary non-relativistic quantum mechanics. The formalism of quantum mechanics is introduced in the wave function approach and illustrated by discussing standard quantum mechanical problems. The concepts are further illustrated by applying the formalism to describe properties of molecules, solids, and nuclear matter.

Vg100 - Introduction to Engineering (4 credits)

Introduces students to the professional technical and communication skills required of engineers and provides them with an overview of engineering at the beginning of their program. An important component of the course is the real-world engineering projects.

Vg101 - Introduction to Computers and Programming (4 credits)

This course is to introduce students in Engineering to basic algorithmic method and specific languages including MATLAB and C/C++. Algorithms are an organized means to construct the solution of a problem, structured as a well-defined set of steps that can be carried out by a mechanism such as a computer. MATLAB is widely used to solve engineering problems and for quick prototyping of solutions. And C and C++ are within the most popular programming languages in current information industry. Vg101 focuses on the development of algorithms to solve problems of relevance in engineering practice and on the implementation of these algorithms using MATLAB and C/C++.

A.2 ECE Course Descriptions

Ve215. Introduction to Circuits (4 credits)

Prerequisite: Vv156 or Vv186, Vg101, accompanied or preceded by Vp240 (or Vp260)

Introduction to electronic circuits. Basic Concepts of voltage and current; Kirchhoff's voltage and current laws; Ohm's law; voltage and current sources; Thevenin and Norton equivalent circuits; DC and low frequency active circuits using operational amplifiers, diodes, and transistors; small signal analysis; energy and power. Time- and frequency-domain analysis of RLC circuits. Basic passive and active electronic filters. Laboratory experience with electrical signals and circuits.

Ve216. Introduction to Signals and Systems (4 credits)

Prerequisite: Ve215 and preceded or accompanied by Vv256 or Vv286

Theory and practice of signals and systems engineering in continuous and discrete time. Continuous-time linear time-invariant systems, impulse response, convolution. Fourier series, Fourier transforms, spectrum, frequency response and filtering. Sampling leading to basic digital signal processing using the discrete-time Fourier and the discrete Fourier transform. Laplace transforms, transfer functions, poles and zeros, stability. Applications of Laplace transform theory to RLC circuit analysis. Introduction to communications, control, and signal processing. Weekly recitations and hardware/Matlab software laboratories.

Ve230. Electromagnetics I (4 credits)

Prerequisite: Vv255 or Vv285, Vp240 (or Vp260), Ve215

Vector calculus. Electrostatics. Magnetostatics. Time-varying fields: Faraday's Law and displacement current. Maxwell's equations in differential form. Traveling waves and phasors. Uniform plane waves. Reflection and transmission at normal incidence. Transmission lines. Laboratory segment may include experiments with transmission lines, the use of computer-simulation exercises, and classroom demonstrations.

Ve270. Introduction to Logic Design (4 credits)

Prerequisite: Vg101 or equivalent.

Binary and non-binary systems, Boolean algebra, digital design techniques, logic gates, logic minimization, standard combinational circuits, sequential circuits, flip-flops, synthesis of synchronous sequential circuits, PLAs, ROMs, RAMs, arithmetic circuits, computer-aided design. Laboratory includes design and CAD experiments.

Ve280. Programming and Introductory Data Structures (4 credits)

Prerequisite: Vv156 or Vv186, and Vg101 or equivalent

Techniques and algorithm development and effective programming, top-down analysis, structured programming, testing, and program correctness. Program language syntax and static and runtime semantics. Scope, procedure instantiation, recursion, abstract data types, and parameter passing methods. Structured data types, pointers, linked data structures, stacks, queues, arrays, records, and trees.

Ve281. Data Structures and Algorithms (4 credits)

Prerequisite: Ve203 and Ve280.

Introduction to algorithm analysis and O-notation; Fundamental data structures including lists, stacks, queues, priority queues, hash tables, binary trees, search trees, balanced trees and graphs; searching and sorting algorithms; recursive algorithms; basic graph algorithms; introduction to greedy algorithms and divide and conquer strategy. Several programming assignments.

Ve300. Technical Communication (1 credit)

Prerequisite: Vg 100.

Professional communication to the general public, managers, and other professionals about electrical and computer engineering ideas as presented in written reports and oral presentations. Functional, physical and visual/diagrammatic description; job letters and resumes.

Ve311. Electronic Circuits (4 credits)

Prerequisite:Ve216.

Circuit models for bipolar junction and field-effect transistors; nonlinear elements; small-signal and piecewise analysis of nonlinear circuits; analysis and design of basic single-stage transistor amplifiers: gain, biasing, and frequency response; digital logic circuits; memory circuits (RAM, ROM). Design projects. Lecture and laboratory.

Ve312. Digital Integrated Circuits (4 credits)

Prerequisite: Ve216.

Design and analysis of static CMOS inverters and complex combinational logic gates. Dynamic logic families, pass-transistor logic, ratioed logic families. Sequential elements (latches, flip-flops). Bipolar-based logic; ECL, BiCMOS. Memories; SRAM, DRAM, EEPROM, PLA. I/O circuits and interconnect effects. Design project(s). Lecture, recitation and software labs.

Ve320. Introduction to Semiconductor Devices (4 credits)

Prerequisite: Ve215, Vp240 (or Vp260).

Introduction to semiconductors in terms of atomic bonding and electron energy bands. Equilibrium statistics of electrons and holes. Carrier dynamics; continuity, drift, and diffusion currents; generation and recombination processes, including important optical processes. Introduction to: PN junctions, metal-semiconductor junctions, light detectors and emitters; bipolar junction transistors, junction and MOSFETs.

Ve330. Electromagnetic II(4 credits) (Has not been offered in the past 2 years)

Prerequisite:Ve230.

Time-varying electromagnetic fields and Maxwell's equations. Plane-wave propagation, reflection, and transmission. Geometric optics. Radiation and antennas. System applications of electromagnetic waves. Laboratory segment consists of experiments involving microwave and optical measurements and the design of practical systems.

Ve334. Principles of Optics (4 credits)

Prerequisite:Vp240 or Vp260.

Basic principles of optics: light sources and propagation of light; geometrical optics, lenses and imaging; ray tracing and lens aberrations; interference of light waves, coherent and incoherent light beams; Fresnel and Fraunhofer diffraction. Overview of modern optics with laboratory demonstrations.

Ve370. Introduction to Computer Organization (4 credits)

Prerequisite: Ve270 and Ve280

This course is designed to cover basic concepts of computer organization and hardware. Instructions executed by a processor and how to use these instructions in simple assembly-language programs. Stored-program concept. Datapath and control for multiple implementations of a processor. Performance evaluation, pipelining, caches, virtual memory, input/output.

Ve373. Design of Microprocessor Based Systems (4 credits)

Prerequisite: Ve270 and Ve370 or instructor's permission.

This course is designed to cover different aspects of microprocessor-based system, and consists of both lecture and laboratory sessions. Topics include microprocessor memory map, software development, simulation, debugging and testing; hardware and software interfacing; principles of interrupts; peripheral configuration and control for Timers, UART, ADC, PWM, I2C, and other external devices. Experiments with specially designed

laboratory facilities will help students to develop skills for embedded software development using assembly and C programming languages.

Ve401. Probabilistic Methods in Engineering (4 credits)

Prerequisite: *Vv186/285/286 or Vv156/255/256*.

Combinatorics and counting, basic concepts in probability, discrete and continuous probability distributions, joint distributions, descriptive statistics, estimation, hypothesis testing, non-parametric methods, analysis of categorical data, simple and multiple regression analysis, model selection, introduction to analysis of variance and experimental design.

Ve406. Applied Regression Analysis using R (4 credits)

Prerequisite: Ve401

This course provides an introduction to the process and procedures of statistical modelling. We will explore real data sets, examine various models for the data, assess the validity of their assumptions, and determine which conclusions we can make, if any. In this course you will learn how to program in R and how to use R for effective data analysis.

Ve411. Microwave Circuits I (4 credits) (Has not been offered in the past 2 years)

Prerequisite: Ve311 or Ve330

Transmission-line theory, microstrip and coplanar lines, S-parameters, signal-flow graphs, matching networks, directional couplers, low-pass and band-pass filters, diode detectors. Design, fabrication and measurements (1-10GHz) of microwave-integrated circuits using CAD tools and network analyzers.

Ve413. Monolithic Amplifier Circuits (4 credits)

Prerequisite: Ve311 and Ve320 or graduate standing.

Analysis and design of BJT and MOS multi-transistor amplifiers. Feedback theory and application to feedback amplifiers. Stability considerations, pole-zero cancellation, root locus techniques in feedback amplifiers. Detailed analysis and design of BJT and MOS integrated operational amplifiers. Lectures and laboratory.

Ve415. Introduction to MEMS (3 credits)

Prerequisite: Vv216/256/286 and Vp240

Micro-electro-mechanical systems (MEMS), devices, and technologies. Micro-machining and microfabrication techniques, including planar thin-film processing, silicon etching, wafer bonding, photolithography, deposition, and etching. Transduction mechanisms and modeling in different energy domains. Analysis of micromachined capacitive, piezoresistive, and thermal sensors/actuators and applications.

Ve420. Physical Principles Underlying Smart Devices (4 credits)

Prerequisite: Ve320 or graduate standing.

This course provides a general introduction to the underlying physics behind solid state devices. General topics include: Introduction to Quantum Mechanics; Low dimensional conductors; Electronic band structure; Ballistic transport; Carrier generation-recombination; Minority carrier diffusion and drifting process; Light absorption and emission; Magnetic effects; Low dimensional optoelectronic devices and CMOS transistors. In addition to studying these topics, students are expected to have a reasonably good understanding of today's advanced research topics in the related fields by reading research articles in top journals.

Ve427. VLSI Design I (4 credits) (Has not been offered in the past 2 years)

Prerequisite: Ve270, Ve312, and Ve320.

Design techniques for rapid implementations of very large-scale integrated (VLSI) circuits, MOS technology and logic. Structured design. Design rules, layout procedures. Design aids: layout, design rule checking, logic, and circuit simulation. Timing. Testability. Architectures for VLSI. Projects to develop and lay out circuits.

Ve434. Principles of Photonics (4 credits)

Prerequisite: VE230 or Ve334 or graduate standing

Introduction to the fundamental concepts in lightwave propagation, confinement and resonance, and semiconductor optoelectronic devices. Selected topics on applications and frontier research will be discussed, e.g.

imaging, photonic integrated circuits, fiber-optic communication, display, solar cells and LEDs, and nanophotonics. One lab session on fiber-optic sensors.

Ve438. Advanced Lasers and Optics Laboratory (4 credits)

Prerequisite: Vp240

Construction and design of optics, lasers; nonlinear optics; fiber optics; detectors; optical communication; display; spectroscopy. Project requires the design and set-up of a practical optical system.

Ve449. Mobile Applications for Entrepreneurs (3 credits)

Prerequisite: Ve281 and Ve370

Mobile apps provide one of the most prolific and popular ways to implement entrepreneurship ideas in the service industry today. This course focusses on the holistic approach to entrepreneurial service development using apps on Android, iOS, VR, AR, car, drone, IoT, etc. The course will discuss best practices in the software engineering of mobile applications and best practices of software entrepreneurs in the design, production and marketing of mobile apps. Students will engage in the hands-on practice of entrepreneurship by actually inventing, building and marketing their own mobile apps. The course does not teach students how to program a mobile device, students are expected to learn that on their own.

Ve450. Capstone Design (4 credits)

Prerequisite: Ve216, Ve280, Ve311, and senior standing or instructor's permission

This is the Capstone Design course for ECE major. The educational goal of this course is to give each student a deep understanding of how to approach open ended challenges by process, and to learn how to innovate andapply the seemingly fragmented engineering knowledge acquired at JI to the design and manufacturing of real mechanical, mechatronic or electrical/computer systems.

Ve451. Digital Signal Processing and Analysis (4 credits)

Prerequisite: Ve216

Introduction to digital signal processing of continuous and discrete signals. The family of Fourier Transforms including the Discrete Fourier Transform (DFT). Development of the Fast Fourier Transform (FFT). Signal sampling and reconstruction. Design and analysis of digital filters. Correlation and spectral estimation.

***Ve452. Digital Signal Processing Design Laboratory (4 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: Ve280 and Ve216

Architectures of single-chip DSP processors. Laboratory exercises using two state-of-the-art fixed-point processors; A/D and D/A conversion, digital wave-form generators, and real-time FIR and IIR filters. Central to this course is a team project in real-time DSP design (including software and hardware).

Ve455. Digital Communication Signals and Systems (4 credits)

Prerequisite: Ve216 and Ve401

Digital transmission techniques in data communications, with application to computer and space communications; design and detection of digital signals for low error rate; forward and feedback transmission techniques; matched filters; modems, block and convolutional coding; Viterbi decoding.

Ve458. Biomedical Instrumentation and Design (4 credits)

Prerequisite: Ve215

Students design and construct functioning biomedical instruments. Hardware includes instrumentation amplifiers and active filters constructed using operational amplifiers. Signal acquisition, processing analysis and display are performed. Project modules include measurement or respiratory volume and flow rates, biopotentials (electrocardiogram), and optical analysis of arterial blood oxygen saturation (pulse-oximetry).

Ve460. Control Systems Analysis and Design (3 credits)

Prerequisite: Ve216

Basic techniques for analysis and design of controllers applicable in any industry (e.g. automotive, aerospace, computer, communication, chemical, bioengineering, power, etc.) are discussed. Both time- and frequency-domain methods are covered. Root locus, Nyquist and Bode plot-based techniques are outlined. Computer-based experiment and discussion sessions are included in the course.

***Ve461. Embedded Control Systems (4 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: Ve216 or Ve373 or Graduate Standing.

Basic interdisciplinary concepts needed to implement a microprocessor based control system. Sensors and actuators. Quadrature decoding. Pulse width modulation. DC motors. Force feedback algorithms for human computer interaction. Real time operating systems. Networking. Use of MATLAB to model hybrid dynamical systems. Autocode generation for rapid prototyping. Lecture and laboratory.

***Ve470. Computer Architecture (4 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: Ve270 and Ve370, or Graduate Standing.

Basic concepts of computer architecture and organization. Computer evolution. Design methodology. Performance evaluation. Elementary queuing models. CPU architecture. Introduction sets. ALU design. Hardware and micro-programmed control. Nanoprogramming. Memory hierarchies. Virtual memory. Cache design. Input-output architectures. Interrupts and DMA. I/O processors. Parallel processing. Pipelined processors. Multiprocessors.

Ve475. Introduction to Cryptography (4 credits)

Prerequisite: Ve203 and Ve280

Covers fundamental concepts, algorithms, and protocols in cryptography. Topics: ancient ciphers, Shannon theory, symmetric encryption, public key encryption, hash functions, digital signatures, key distribution. Highlights AES, RSA, discrete log, elliptic curves. Emphasizes rigorous mathematical study in terms of algorithmic complexity. Includes necessary background from algorithms, probability, number theory and algebra.

Ve477. Introduction to Algorithms (4 credits)

Prerequisite: Ve281 or graduate standing

Fundamental techniques for designing efficient algorithms and basic mathematical methods for analyzing their performance. Paradigms for algorithm design: divide-and-conquer, greedy methods, graph search techniques, dynamic programming. Design of efficient data structures and analysis of the running time and space requirements of algorithms in the worst and average cases.

***Ve478. Logic Circuit Synthesis and Optimization (4 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: (Ve203, Ve270 and Senior Standing) or Graduate Standing.

Advanced design of logic circuits. Technology constraints. Theoretical foundations. Computer-aided design algorithms. Two-level and multilevel optimization of combinational circuits. Optimization of finite-state machines. High-level synthesis techniques: modeling, scheduling, and binding. Verification and testing.

Ve482. Introduction to Operating Systems (4 credits)

Prerequisite: Ve281 andVe370 or Graduate Standing

Operating system design and implementation: multi-tasking; concurrency and synchronization; inter-process communication; deadlock; scheduling; resource allocation; memory and storage management; input-output; file systems; protection and security. Students write several substantial programs dealing with concurrency and synchronization in a multi-task environment, with file systems, and with memory management.

***Ve483. Compiler Construction (4 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: Ve281 or Graduate Standing.

Introduction to compiling techniques including parsing algorithms, semantic processing and optimization. Students implement a compiler for a substantial programming language using a compiler generating system.

***Ve484. Data Mining (4 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: Background on a programming language

Data mining, graph data, kernel methods, dimensionality reduction, sequence mining, clustering, representative-based clustering, hierarchical clustering, density-based clustering, spectral clustering, classification, decision trees, linear discriminant analysis, support vector machines, principal component analysis, singular value decomposition, search engines, recommender systems, high-dimensional data, large-scale data.

***Ve487. Interactive Computer Graphics (4 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: Ve281 or graduate standing.

Computer graphics hardware, line drawing, rasterization, anti-aliasing, graphical user interface (GUI), affine geometry, projective geometry, geometric transformation, polygons, curves, splines, solid models, lighting and shading, image rendering, ray tracing, radiosity, hidden surface removal, texture mapping, animation, virtual reality, and scientific visualization.

Ve488. Data Mining and Machine Learning (4 credits)

Prerequisite: Vv214/Vv286 and Ve401

The course covers data mining and machine learning algorithms for analyzing modern datasets. The emphasis will be on statistical (eg. model bias, overfitting, and interpreting results) and computational issues (eg. computational complexity, efficient implementations) that arise in contemporary applications.

Ve489. Computer Networks (4 credits)

Prerequisite: Ve482 or Graduate Standing or instructor's permission.

This course covers basic system architecture, protocol stack, and algorithms and protocols of computer communication networks. Students will get the basic knowledge of computer network architectures, services, applications, and protocol models; study protocols in different layers including physical, data link, network, and transport layers; understand transmission media, switching, multiple access arbitration, network routing, congestion control, flow control. multicast, and security; and learn the detailed Internet architecture.

Ve490. Undergraduate Research (3 credits)

Prerequisite: junior standing and up

The Undergraduate Research Courses provide undergraduate students opportunities to work with individual faculty members on their research projects. The course allows students to engage in scientific research early during their undergraduate study, and to get prepared for their future academic career in selected engineering fields.

Ve492. Introduction to Artificial Intelligence (4 credits)

Prerequisite: Ve281

Introduction to the core concepts of AI, organized around building computational agents. Emphasizes the application of AI techniques. Topics include search, logic, knowledge representation, reasoning, planning, decision making under uncertainty, and machine learning.

Ve496. Advanced Technical Communication (2 credits)

Prerequisite: Ve300, must be taken prior to or concurrently with a Major Design Experience (MDE) course or the Capstone Design course (Ve450).

Engineers must be able to express their ideas clearly. Building communication skills, both written and verbal, is as important for an engineer's career success as is building a base of technical knowledge. Therefore, the course will cover the conventions of several types of documents engineers will have to produce during their working life. Students will then apply their knowledge by writing some of these documents. As verbal communication and presentation skills are essential for engineers as well, students will read about how to craft a successful scientific presentation, and apply this knowledge by making a presentation with partners during the second half of the semester.

Vg496. Professional Ethics (2 credits)

Prerequisite: Vg100 and Junior or Senior standing

Introduction to the nature of professional responsibilities and engineering ethics. Students become acquainted with the basic ethical demands made by their future profession. They learn how to critically examine their role in society and how to independently make decisions on an ethical basis. They improve their ability to work in teams and to make presentations to fellow professionals and to the public. Specific topics include engineering codes of ethics, safety, possibilities of dissent, and cross-cultural issues.

Ve498. Special Topics (1-4 credits) (Has not been offered in the past 2 years)

Prerequisite: Permission of instructor.

Topics of current interest selected by the faculty. Lecture, seminar or laboratory.

A.3 ME Course Descriptions

Ve215. Introduction to Circuits (4 credits)

Prerequisite: Vv156 or Vv186, Vg101, accompanied or preceded by Vp240 (or Vp260)

Introduction to electronic circuits. Basic Concepts of voltage and current; Kirchhoff's voltage and current laws; Ohm's law; voltage and current sources; Thevenin and Norton equivalent circuits; DC and low frequency active circuits using operational amplifiers, diodes, and transistors; small signal analysis; energy and power. Time- and frequency-domain analysis of RLC circuits. Basic passive and active electronic filters. Laboratory experience with electrical signals and circuits.

Vm020 (Vm010). Machineshop Training

Prerequisite: none

This is an introductory course on the practice of manufacturing processes. In this course, students will gain hands-on skills in operating basic machine tools and equipment, as well as background knowledge on related manufacturing technologies; and familiarity with the complete process of product design, analysis, and fabrication.

Vm211. Introduction to Solid Mechanics (4 credits)

Prerequisite: Vp140 or Vp160, Vv156 or Vv186

Statics: Moment and force resultants, equilibrium. Mechanics of deformable bodies: stress/strain, classification of material behavior, generalized Hooke's law. Engineering applications: axial loads, torsion of circular rods and tubes bending and shear stresses in beams, deflection of beams, combined stresses, stress and strain transformation. Four lecture classes per week.

Vm235. Thermodynamics I (3 credits)

Prerequisite: Vc210, and Vv156 or Vv186.

Introduction to engineering thermodynamics. First law, second law system and control volume analyses; properties and behavior of pure substances; application to thermodynamic systems operating in a steady state and transient processes. Heat transfer mechanisms. Typical power producing cycles and refrigerators. Ideal gas mixtures and moist air applications.

Vm240. Introduction to Dynamics and Vibrations (4 credits)

Prerequisite: Vp140 or Vp160, preceded or accompanied by Vv256 or Vv286.

Vector description of force, position, velocity and acceleration in fixed and moving reference frames. Kinetics of particles, of assemblies of particles and of rigid bodies. Energy and momentum concepts. Euler's equations. Moment of inertia properties. The simple oscillator and its applications.

Vm250. Design and Manufacturing I (4 credits)

Prerequisite: Vv156 or Vv186, Vg101, and Vm020 or Vm010

Basics of mechanical design: visual thinking, engineering drawing, and machine anatomy. Basics of manufacturing: processes, materials, and thermo-fluid aspects. Use of computers in various phases of design and manufacturing. Exposure to CAD systems and basic machine shop techniques. Design/manufacturing project. Three hours of lecture and two hours laboratory.

Vk250. Principles of Engineering Materials (4 credits)

Prerequisite: Vc210.

Introductory course to engineering materials. Properties (mechanical, thermal and electrical) of metals, polymers, ceramics and electronic materials. Correlation of these properties with: (1) their internal structures (atomic, molecular, crystalline, micro- and macro-); (2) service conditions (mechanical, thermal, chemical, electrical, magnetic, and radiation); and (3) processing.

Vm305. Introduction to Finite Elements in Mechanical Engineering (3 credits)

Prerequisites: Vm211

Introduction to theory and practice of the finite element method. One-dimensional, two-dimensional, and three dimensional elements are studied, including structural elements. Primary fields of applications are strength of

materials (deformation and stress analysis) and dynamics and vibrations. Extensive use of commercial finite element software packages, through computer labs and graded assignments.

Vm311. Strength of Materials (3 credits)

Prerequisites: Vm211and Vv256 or Vv286

Energy methods; buckling of columns, including approximate methods; bending of beams of asymmetrical cross-section; shear center and torsion of thin-walled sections; membrane stresses in axisymmetric shells; elastic-plastic bending and torsion; axisymmetric bending of circular plates.

Vm320.Fluid Mechanics I (3 credits)

Prerequisite: Vm235, Vm240, and Vv256 or Vv286

Fluid statics; conservation of mass, momentum and energy in fixed and moving control volumes; steady and unsteady Bernoulli's equation; differential analysis of fluid flow; dimensional analysis and similitude; laminar and turbulent flow; boundry layers; lift and drag; introduction to commercial CFD packages; applications to mechanical, biological, environmental, and micro-fluidic systems.

Vm335. Heat Transfer (3 credits)

Prerequisite: Vm320.

Heat transfer by conduction, convection, radiation; heat storage, energy conservation; steady-state/transient conduction heat transfer; thermal circuit modeling; multidimensional conduction; surface radiation properties, enclosure radiation exchange; surface convection/fluid streams over objects, nondimensional numbers, laminar, turbulent, thermobuoyant flow, boiling and condensation; heat exchangers; design of thermal systems, solvers for problem-solving/design.

Vm350. Design and Manufacturing II (4 credits)

Prerequisite: Vm211, Vm240, Vm250, preceded or accompanied by Vm382.

Principles of machine and mechatronic design and manufacturing. Analysis, synthesis and selection of mechanisms, machine components, mechatronic components, and associate manufacturing processes. Semester-long, model-based design/build/test project in a team setting.

Vm360. Modeling, Analysis and Control of Dynamic Systems (4 credits)

Prerequisite: Vm240.

Unified approach to abstracting real mechanical, fluid, and electrical systems into proper models in graphical and state equation form to meet engineering design and control system objectives. Introduction to system analysis (eigen values, time and frequency response) and linear feedback control. Synthesis and analysis by analytical and computer methods.

Vm382. Mechanical Behavior of Materials (4 credits)

Prerequisite: Vm211

Material microstructures, dislocations and defects; processing and mechanical properties of metals, polymers, and composites; heat treatment of metals; elastic, plastic, and viscoelastic behavior of materials, strain hardening; fracture, fracture mechanics, fatigue and multiaxis loading; creep and stress relaxation; materials-related design issues, materials selection, corrosion and environmental degradation of materials.

Vm384. Engineering Project Management (3 credits)

Prerequisite: Senior Standing

Introduction to TQM approaches to managing engineering projects from inception stages to production, including setting objectives and goals, feasibility, part-process and plant design, optimization of design and operation using Taguchi method, allocating the use of resources, planning and scheduling using CPM & PERT tools for managing activities and resources with minimum delays, contract and licensing procedures. Algorithm method strategy will be introduced to solve and optimize multi-design variables. Considerations to other important factors limiting the design such as laws and regulations, licensing, safety, hazardous waste, OSHA/EPA/DEQ, community rights-to-know laws, pollution and environmental protection, and intellectual rights protection. Maturity management

models. Consideration of economic feasibility analysis based on all aspects of engineering project from design to plant erection and production.

Vm395. Laboratory I (4 credits)

Prerequisite: Vp240 or Vp260, Vp241, Vm211, Vm235, and Vm240; preceded or accompanied by Vm320 and Vm382.

Lectures and experiments designed to introduce the student to the basics of experimentation, instrumentation, data collection and analysis, error analysis, and reporting. Topics may include fluid mechanics, thermodynamics, mechanics, materials, and dynamical systems. Emphasis is placed on report writing and team-building skills.

Vm412. Advanced Strength of Materials (3 credits)

Prerequisite: Vm311

Review of energy methods, Betti's reciprocal theorem; elastic, thermoelastic and elastoplastic analysis of axisymmetric thick cylinders and rotating discs; bending of rectangular and circular plates, including asymmetric problems; beams on elastic foundations; axisymmetric bending of cylindrical shells; torsion of prismatic bars.

***Vm418. Mechanics of Composite Materials (3 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: Vm382

An introduction to the mechanics of composite solids with an emphasis on the derivation of macroscopic constitutive laws based on the microstructure. Homogenization theory for periodic media. Effective stiffness properties of composites. Classical laminated plate theory. Failure theories and experimental results for laminates.

Vm421. Thermal-Fluids Systems Design (3 credits)

Prerequisite: Vm235, Vm320, Vm335

The course is intended to develop the concepts and methodology of system design and optimization applied to fluid, thermal and energy systems. Topics include: a) simulation of systems in which the system components are known and the system operational parameters (such as flow, temperature, pressure etc.) are to be determined and b) design of systems involving the selection of right type, size and combinations of equipment to optimize different aspects of system performance. Thermal fluid systems such as heat exchangers, power plants, turbo machinery and HVAC components will be covered.

Vm432. Combustion (3 credits)

Prerequisite: Vm235 and Vm320

Introduction to combustion processes; combustion thermodynamics, reaction kinetics and combustion transport. Chain reactions, ignition, quenching, and flammability limits, detonations, deflagrations, and flame stability. Introduction to turbulent premixed combustion. Applications in IC engines, furnaces, gas turbines, and rocket engines.

Vm433. Advanced Energy Solutions (3 credits)

Prerequisite: Vm235

Introduction to the challenges of power generation for a global society using the thermodynamics to understand basic principles and technology limitations. Covers current and future demands for energy; methods of power generation including fossil fuel, solar, wind and nuclear; associated detrimental by-products; and advanced strategies to improve power densities, efficiencies and emissions.

Vm434. Materials for Energy Conversion (3 credits)

Prerequisite: Senior standing

The course provides an overview about materials used in advanced renewable energy conversion and storage systems and devices, including solar cells, thermoelectrics, batteries, fuel cells, photoelectrochemical cells and hydrogen storage. It begins with an introduction to energy conversion and storage issues. The operating principles of energy conversion and storage devices are discussed next. The remainder of the course focuses on the material structure, physics and chemistry, material design and the processing approaches to enhance the performance for the energy conversion and storage devices.

***Vm440. Intermediate Dynamics and Vibration (4 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: Vm240

Newton/Euler and Lagrangian formulations for three-dimensional motion of particles and rigid bodies. Linear free and forced responses of single and multiple degree of freedom systems, gyroscopic systems, and simple continuous systems. Applications to engineering systems involving vibration isolation, rotating imbalance and vibration absorption.

Vm450. Design and Manufacturing III (4 credits)

Prerequisite: Vm350, Vm360 and Vm395. May not be taken concurrently with Vm495 or instructor's permission.

The educational goal of VM450 is to give each student a deep understanding of how to approach open ended challenges by process, and to learn how to innovate and apply the seemingly fragmented engineering knowledge acquired at JI to the design and manufacturing of real mechanical, mechatronic or electrical/computer systems.

***Vm452. Design for Manufacturability (3 credits)* (*Has not been offered in the past 2 years*)**

Prerequisite: Vm350

Conceptual design. Design for economical production, Taguchi methods, design for assembly; case studies. Product design using advanced polymeric materials and composites; part consolidation, snap-fit assemblies; novel applications. Design projects.

Vm458. Automotive Engineering (3 credits)

Prerequisite: Vm350

Introduction to the practice of engineering in the automotive field; systems approach to automotive design; vehicle system, powertrain, driveline, chassis, braking, cooling system, as well as automotive component function, operating, and design principles, and current trends; analytical approach to the engineering problem and performance analysis related to automobile engines which affect engine power, efficiency, emissions, design and operating characteristics.

Vm461. Automatic Control (3 credits)

Prerequisite: Vm360

Feedback control design and analysis for linear dynamic systems with emphasis on mechanical engineering applications such as autonomous vehicles, drones, motors, nano/micro-mechanical systems; transient and frequency response; root locus, Nyquist and Bode plot; stability; system performance; control modes; state space; digital control; computer methods for simulation of control systems.

Vm466. Statistical Quality Control (3 credits)

Prerequisite: Ve401

This course will teach students about key methods and applications related to the use of statistical data-driven methods for modeling, analysis and optimization of processes. Applications examples include manufacturing, oil/gas extraction, measurement systems analysis, statistical polling, etc. First part of the course will focus on understanding and use of key tools for data-driven process modeling and monitoring using various statistical process control charts. The focus will then move to regression analysis and Design-of-Experiments (DOE) theory to understand how data can be strategically generated through experiments in a way that enables one to learn the most about the underlying processes. Finally, methods for DOE based optimization will be taught to teach the students how optimization/design of real-life engineering systems and processes can be conducted efficiently.

Vm467. Introduction to Robotics (3 credits)

Prerequisite: Vm240 or Ve216

This course provides a comprehensive introduction to robotic systems. General topics include: homogeneous representation of rigid body motion, forward and inverse kinematics, equations of motion, Lagrange's equations with constraints, position and trajectory tracking control, force control, cameras and stereo vision, image processing and filtering, edge detection, feature extraction and detectors, Kalman filter and localization, Markov localization, extended Kalman filter SLAM, SLAM with a single camera, motion planning algorithms using graph search and potential field, and obstacle avoidance methods

Vm481. Manufacturing Processes (3 credits)

Prerequisite: Vm382

Manufacturing processes deal with production methods for converting primary materials into product. Introduction to processing methods with quantitative analysis as applied to fabrication of engineering materials focus on five major categories of forming and shaping processes: solidification, particulate, deformation, material removal and joining. Shaping processes for plastics, polymer matrix composites and rubber technology. Processing of ceramics and cermets for tooling and shaping. Theory and practice of metal machining, operations, machine tools and cutting tool technology. Influence of processes on the final mechanical properties of the product. Reconfigurable manufacturing. Reconfigurable manufacturing system (RMS) for rapid process design change in hardware and software to quickly adjust its production. Case studies with design, some cost analysis and limits.

Vm482. Machining Processes (3 credits) (Has not been offered in the past 2 years)

Prerequisite: Vm382

Introduction to machining operations. Cutting tools and tool wear mechanisms. Cutting forces and mechanics of machining. Machining process simulation. Surface generation. Temperatures of the tool and workpiece. Machining dynamics. Non-traditional machining. Two hours of lecture and one laboratory session.

Vm490. Undergraduate Research (3 credits)

Prerequisite: junior standing and up

The Undergraduate Research Courses provide undergraduate students opportunities to work with individual faculty members on their research projects. The course allows students to engage in scientific research early during their undergraduate study, and to get prepared for their future academic career in selected engineering fields.

Vm495. Laboratory II (4 credits)

Prerequisite: Vm395, preceded or accompanied by Vm350 and Vm360. May not be taken concurrently with Vm450 or instructor's permission.

Design, construction, and operation of extended experimental projects related to mechanical systems. Weekly lectures in theoretical and applied experimental methods, and technical communication. Project topics may include controls, heat transfer, fluid mechanics, thermodynamics, mechanics, materials, and dynamical systems. Emphasis on research report writing, oral presentations, team-building skills, and the design of experiments.

Vg496. Professional Ethics (2 credits)

Prerequisite: Vg100 and Junior or Senior standing

Introduction to the nature of professional responsibilities and engineering ethics. Students become acquainted with the basic ethical demands made by their future profession. They learn how to critically examine their role in society and how to independently make decisions on an ethical basis. They improve their ability to work in teams and to make presentations to fellow professionals and to the public. Specific topics include engineering codes of ethics, safety, possibilities of dissent, and cross-cultural issues.

A.4 MSE Course Descriptions

Vm211. Introduction to Solid Mechanics (4 credits)

Prerequisite: Vp140 or Vp160, Vv156 or Vv186

Statics: Moment and force resultants, equilibrium. Mechanics of deformable bodies: stress/strain, classification of material behavior, generalized Hooke's law. Engineering applications: axial loads, torsion of circular rods and tubes bending and shear stresses in beams, deflection of beams, combined stresses, stress and strain transformation. Four lecture classes per week.

Vk242. Physics of Materials (4 credits)

Prerequisite: Vp240 and preceded or accompanied by Vv216/256/286

Basic principles and applications of solid state physics. Mathematical and physical description of classical and quantum mechanics, crystallography and diffraction. Applications to solid, including brand structure, bonding and physical properties.

Vk250. Principles of Engineering Materials (4 credits)

Prerequisite: Vp140 or Vp160, Vv156 or Vv186

Statics: Moment and force resultants, equilibrium. Mechanics of deformable bodies: stress/strain, classification of material behavior, generalized Hooke's law. Engineering applications: axial loads, torsion of circular rods and tubes bending and shear stresses in beams, deflection of beams, combined stresses, stress and strain transformation. Four lecture classes per week.

Vk330. Thermodynamics of Materials (4 credits)

Prerequisite: Vc209/210, Vp140, Vv215/255/285, and Vk250

The laws of thermodynamics and their consequences. Applications to solid and liquid materials. Mass and energy balances. Gas reactions. Phase diagrams. Ellingham, Pourbaix and stability diagrams. Defects in solids. Interfaces. Statistical thermodynamics.

Vk335. Kinetics and Transitions in Material Engineering (4 credits)

Prerequisite: Vv216/256/286, Vk250, and Vk330

Application of basic principles of molecular transport and mass, energy and momentum balance to the solution of heat, diffusion and fluid flow problems relevant to materials processing. Introduction to radiative heat transfer. Empirical approaches to and dimensional analysis of complex transport problems including convection, turbulence and non-Newtonian flow.

Vk350. Principles of Engineering Materials II (4 credits)

Prerequisite: Vk250

Basic principles of Materials Science & Engineering; including bonding, structure and microstructure and how they are influenced by thermodynamics and kinetics.

Vm382. Mechanical Behavior of Materials (4 credits)

Prerequisite: Vm211

Material microstructures, dislocations and defects; processing and mechanical properties of metals, polymers, and composites; heat treatment of metals; elastic, plastic, and viscoelastic behavior of materials, strain hardening; fracture, fracture mechanics, fatigue and multiaxis loading; creep and stress relaxation; materials-related design issues, materials selection, corrosion and environmental degradation of materials.

Vk360. Materials Lab I (3 credits)

Prerequisite: accompanied or preceded by Vk350

Laboratory experiences based on principles emphasized in Fundamentals of Materials Science including processing, properties, and structure with a focus on micro structural analysis and structure-property relationships. Continued as Vk365.

Vk365. Materials Lab II (3 credits)

Prerequisite: Vk360

Laboratory experiences based on principles emphasized in Physics of Materials and Fundamentals of Materials. Processing, properties and microstructure with a focus on electronic and magnetic phenomena.

Vm434. Materials for Energy Conversion (3 credits)

Prerequisite: Senior standing

The course provides an overview about materials used in advanced renewable energy conversion and storage systems and devices, including solar cells, thermoelectrics, batteries, fuel cells, photoelectrochemical cells and hydrogen storage. It begins with an introduction to energy conversion and storage issues. The operating principles of energy conversion and storage devices are discussed next. The remainder of the course focuses on the material structure, physics and chemistry, material design and the processing approaches to enhance the performance for the energy conversion and storage devices.

Vk480. Materials and Engineering Design (3 credits)

Prerequisite: Senior standing

Design concepts. Engineering economics. Various design criteria, processes and process control. Materials substitution. Competitive design. Case histories. Professional and ethical considerations. Written and oral presentations of solutions to design problems.

Vk489. Materials Processing Design (3 credits)

Prerequisite: Vk330 and Vk335

The design of production and refining systems for engineering materials. Design of problems for the extraction and refining of metals, production and processing of ceramics, polymeric materials and electronic materials. Written and oral presentation of solutions to processing design problems.

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