491D. Low Temperature Biotechnology
Fall, Spring. 3(3-0)
Department(s): Agricultural Engineering
P: BME 311.
Special topics in biotechnology of current interest and importance.
QP: APPROVAL QA: BME 499

BOTANY AND PLANT PATHOLOGY/NATURAL SCIENCE

105. Plant Biology
Fall, Spring. 3(3-0)
Plant structure, function, development, genetics, diversity and ecology.
QA: BOT 205

106. Plant Biology Laboratory
Fall, Spring. 1(0-3)
P: BOT 105 or concurrently.
Cell structure, anatomy, physiology, growth and development, and diseases of plants.
QA: BOT 206

The Form and Evolution of Plants
Spring. 3(3-0)
P: BOT 105 or BOT 106.
Divergent and convergent evolution throughout the plant kingdom. Basic principles underlying the structure, function, and reproduction of plants.
QP: BUS 212 ORBS 265 QA: BOT 302

218. Plants of Michigan
Fall. 3(2-3)
P: BUS 110 or BOT 105.
Plant taxa of Michigan and the Great Lakes region and the major habitats in which they occur. Principles and rationale of classification. Relationships between life histories, morphology, and environment.
QP: BOT 205 ORBS 212

301. Introductory Plant Physiology
Fall, Spring. 3(3-0)
P: CEM 141 or CEM 151; CEM 161; BOT 105 or BUS 111 or ORBS 141; General chemistry
General principles of plant physiology relating plant structure to function. Cell physiology, water relations, effects of light and temperature, respiration, photosynthesis, mineral nutrition, and hormone action.
QP: CEM 141 or CEM 151; CEM 161; BOT 206 QA: 301

335. Plants Through Time
Spring. 3(3-0)
Interdepartmental with the Department(s) of Geosciences, P: BUS 110 or BOT 105 or ORBS 201; R: Juniors and above.
Evolutionary history of plants, the development of ecosystems, and the use of plant fossils in the reconstruction of ancient environments and climate.
QP: BOT 205 ORBS 212 ORLS 210 QA: ORLS 335 ORLS 335

336. Useful Plants
Spring. 3(3-0)
P: CEM 141 or CEM 151 or CEM 152; BOT 105 or BUS 110 and BOT 111.
Ways in which plants are used for myriad purposes from food and construction materials to medicine and perfume. The potential for expanding the uses of plants through biotechnology will be explored.
QP: BOT 205 ORBS 212 QA: BOT 336

402. Biology of Fungi
Fall, Spring. 3(3-3)
P: BUS 110, BUS 111 or BOT 105 or ORLS 140 or MPH 302.
Major groups of fungi: characterization, habitat and diversity. Significance of fungi in nature and their economic importance.
QP: BOT 205 ORLS 140 ORLS 212 QA: BOT 402 ORLS 320

405. Introductory Plant Pathology
Fall, Spring. 3(3-0)
P: BUS 110, BUS 111 or BOT 105 or ORLS 140; R: Not open to students with credit in BOT 407.
Important plant diseases and their organisms that cause them. Principles of disease management including application of chemicals, plant breeding, biological control, and genetic engineering.
QP: BOT 306 ORLS 212 ORLS 140 QA: 405

406. Medical Mycology
Spring. 3(2-3)
Interdepartmental with the Department(s) of Medical Technology, Microbiology and Public Health.
P: BOT 301 and BOT 312 OR ORLS 320 or BOT 406.
Characteristics and laboratory identification of fungal diseases in humans and other animals. Emphasizing laboratory techniques and morphological characteristics of the causative fungi.
QP: BOT 302 ORLS 330 QA: BOT 406

407. Diseases and Insects of Forest and Shade Trees
Spring. 3(3-0)
Interdepartmental with the Department(s) of Botany, Entomology, and Plant Pathology.
P: BUS 212 OR ORLS 212 ORLS 210.
Diseases, insects, and environmental problems which affect trees, parks, shrubs, and nurseries, and methods of control.
QP: BOT 301 ORLS 212 ORLS 300 ORLS 300 QA: ORLS 407 ENT 337

414. Plant Physiology: Growth, Development and the Environment
Spring. 3(3-0)
P: CEM 251; BOT 105 or BUS 110, BUS 111 or ORLS 210.
General principles underlying metabolic processes of plants. Photosynthesis, translocation and water relations, nitrogen metabolism, cell wall biosynthesis, and structures associated with these processes.
QP: BOT 205 ORLS 210 ORLS 210 AND ORLS 211 QA: ORLS 414

415. Plant Physiology: Growth, Development and the Environment
Spring. 3(3-0)
P: CEM 251; BOT 105 or BUS 110, BUS 111 or ORLS 210.
Principles of plant growth and development with emphasis on environmental and hormonal factors that control progression of the plant through its life cycle. Tissue culture and genetic engineering in plants.
QP: CEM 241 ORLS 205 ORLS 210 AND ORLS 211 QA: ORLS 415

416. Experiments in Plant Physiology and Molecular Biology
Fall. 2(2-5)
P: BOT 414 OR ORLS 415.
Experiments illustrating principles of plant physiology and molecular biology. Advanced techniques such as agrobacterial mediated gene transfer, DNA cloning, enzyme linked immunosassays (ELISA), protein and DNA electrophoresis.
QP: BOT 414 ORLS 415 QA: ORLS 416

418. Plant Systematics
Spring, Summer. 3(2-3)
P: BOT 105 or BUS 110, BUS 111 or ORLS 210.
Classification and evolution of higher plants, with emphasis on identification, characterization of plant families, and systematic theory and practice.
QP: BOT 205 ORLS 140 ORLS 212 QA: ORLS 418

423. Aquatic Plant Biology
Fall, Summer of even-numbered years. 3(2-4)
P: BUS 110, BUS 111 or BOT 105, BOT 106.
Identification, ecology and community relations of algae and aquatic vascular plants common to the Great Lakes area. Algae and Aquatic Plants as indicators of environmental change.
QP: BOT 206 ORLS 210 ORLS 210 AND ORLS 140 QA: 423 ORLS 447

431. Plant Structure and Function
Fall of odd-numbered years. 3(2-4)
P: BUS 110, BUS 111 or BOT 105, BOT 106 or ORLS 212 ORLS 210.
Plant anatomy from a structure and function perspective. The physiological, developmental, and ecological significance of cell types, tissue types, and meristems of vegetative and reproductive plant parts.
QP: BUS 210, BUS 211 ORLS 212 ORLS 210 AND ORLS 242 QA: ORLS 441

441. Directed Studies
Fall, Spring, Summer. 1 to 4 credits.
R: Approval of department.
Directed study of published literature in an area of botany and plant pathology.
QA: ORLS 401

449. Honors Directed Studies
Fall, Spring, Summer. 1 to 4 credits.
May reenroll for a maximum of 6 credits.
R: Approval of department.
Directed study of published literature in an area of botany and plant pathology.
QA: ORLS 401

449. Undergraduate Research
Fall, Spring, Summer. 1 to 4 credits.
May reenroll for a maximum of 12 credits.
R: Approval of department.
Laboratory and/or field research in an area of botany and plant pathology.

499. Senior Seminar
Spring. 2(2-0)
May reenroll for a maximum of 4 credits.
P: 3 credits of BOT 449.
A capstone experience that focuses on current developments and issues in plant biology. Scientific writing and oral presentation.
QA: 499

500. Seminar in Plant Biology
Fall, Spring. (1-0)
May reenroll for a maximum of 4 credits.
R: Open only to graduate students.
Current research and approaches in plant biology.

501. Seminar in Plant Pathology
Fall. (1-0)
May reenroll for a maximum of 4 credits.
R: Open only to graduate students.
Current research and approaches in plant pathology.
QA: BOT 449

Courses with an asterisk (*) have not been approved by the University Committee on Curriculum.
Course Descriptions

BOTANY AND PLANT PATHOLOGY/NATURAL SCIENCE

803*. Selected Topics (MTT)  
Fall, Spring. 1 to 4 credits. May reenroll for a maximum of 12 credits.

Topics in specific areas of botany and plant pathology  
QA: BOT 890 BOT 891

803A*. Selected Topics - Anatomy and Morphology  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Recent developments in anatomy and morphology  
QA: BOT 891

803B*. Selected Topics - Taxonomy and Systematics  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Recent developments in taxonomy and systematics  
QA: BOT 891

803C*. Selected Topics - Ecology  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Recent developments in ecology  
QA: BOT 891

803D*. Selected Topics - Physiology and Biochemistry  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Recent developments in physiology and biochemistry  
QA: BOT 891

803E*. Selected Topics - Genetics and Molecular Biology  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Recent developments in genetics and molecular biology  
QA: BOT 891

803F*. Selected Topics - Plant Pathology  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Recent developments in plant pathology  
QA: BOT 891

804*. Special Problems (MTT)  
Fall, Spring. Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits.

Topics may be selected from any area of botany and plant pathology.  
QA: BOT 890 BOT 891

804A*. Special Problems in Taxonomy and Systematics  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Individual, faculty-directed study in taxonomy  
QA: BOT 801

804B*. Special Problems in Anatomy & Morphology  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Individual, faculty-directed study in anatomy & morphology  
QA: BOT 801

804C*. Special Problems in Plant Pathology  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Individual, faculty-directed study in plant pathology  
QA: BOT 801

804D*. Special Problems in Physiology & Biochemistry  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Individual, faculty-directed study in physiology & biochemistry  
QA: BOT 801

804E*. Special Problems in Genetics & Molecular Biology  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Individual, faculty-directed study in genetics & molecular biology  
QA: BOT 801

804F*. Special Problems in Mycology  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Individual, faculty-directed study in mycology  
QA: BOT 801

804G*. Special Problems in Ecology  
1 to 4 credits. May reenroll for a maximum of 12 credits.

Individual, faculty-directed study in ecology  
QA: BOT 801

810*. Current Concepts in Plant Pathology  
Spring. 3(3-0) P: BOT 405 or BOT 414 or BOT 415. Recent findings in mycology, plant virology, bacteriology, nematology, disease physiology and epidemiology. QP: BOT 405; OR QP: BOT 414; OR QP: BOT 415.

Recent developments in plant pathology  
QA: BOT 890

812*. Epidemiology of Plant Diseases  
Spring of even-numbered years. 3(3-0) P: BOT 810. Populations of plant pathogens within populations of plant hosts as affected by the environment and human involvement. QP: BOT 405 QA: BOT 812

823*. Flowering Plant Diversity  
P: BOT 418. Evolutionary diversity of flowering plants. Family characteristics, patterns of distribution, systems of classification, evolutionary trends, economic importance. QP: BOT 318 QA: BOT 823 BOT 824

824*. Principles and Methods of Plant Systematics  
Spring of even-numbered years. 3(3-0) P: BOT 823. Classification methods, quantification of evolutionary relationships, plant, phyletic, morphologic, and cladistic approaches. QP: BOT 823 BOT 824

826*. Tropical Biology: An Ecological Approach  
Spring, Summer. 8(4-8) Interdepartmental with the Department(s) of Zoology. P: Approval of department. Graduate students only. Principles of tropical ecology at the population, community and ecosystem levels. Given at various sites in Costa Rica by the Organization for Tropical Studies. QP: BOT 826 ZOL 826

827*. Tropical Managed Ecosystems  
Spring, Summer. 8(4-8) Interdepartmental with the Department(s) of Zoology. R: Open only to graduate students. The scientific and social dimensions of sustainable development in the tropics. Given at various sites in Costa Rica by the Organization for Tropical Studies.

830*. Paleobotany  
Fall of even-numbered years. 3(2-3) Interdepartmental with the Department(s) of Geological Sciences. R: Open only to graduate students. An interdisciplinary study of fossil plants: preservation, occurrence, geological relations, taphonomy, whole plant reconstruction, evolutionary history, and paleobotany. QA: BOT 830; GLG 830

840*. Ecology and Evolution in Terrestrial Systems  
Summer of even-numbered years. 3(3-0) P: STT 422. Field experimental and quantitative approaches to ecological and evolutionary mechanisms. QP: STT 422 QA: BOT 839

844*. Organelle Genetics  
Spring of even-numbered years. 3(3-0) Interdepartmental with the Department(s) of Zoology. P: BOT 302 or BOT 417; ZOL 341 Organization, structure, function, heredity, molecular biology and manipulation of chloroplasts and mitochondria. Biological interaction between nucleus and organelles. QP: BOT 856 ZOL 441 QA: BOT 844

847*. Advanced Mycology  
Spring of even-numbered years. 3(2-6) P: BOT 341. Classification, morphology and relationships of fungi; physiology, genetics, and molecular biology of fungi; identification techniques within selected orders. QP: BOT 359 QA: BOT 847 BOT 848

849*. Evolutionary Biology  
Spring of odd-numbered years. 3(3-0) Interdepartmental with the Department(s) of Zoology. P: ZOL 341; STT 422 or concurrently. Major monographs, theoretical and empirical questions in evolutionary biology. Readings and lectures are synthesized in student discussions. QP: ZOL 441 STT 423

855*. Plant Molecular Biology  
Spring of odd-numbered years. 3(3-0) Interdepartmental with the Department(s) of Biochemistry, Plant Physiology, and Plant Pathology. P: ZOL 341 Advances in genetics and molecular biology of higher plants. QP: ZOL 441 QA: BOT 856; BCH 856; GEN 856

863*. Environmental Plant Physiology  
Spring of odd-numbered years. 3(3-0) Interdepartmental with the Department(s) of Horticulture, Plant Physiology and Plant Pathology. P: BOT 301 OR QP: BOT 410 or BOT 415 The interaction of the plant and its environment, photosynthesis, thermophysics, and water relations. QP: BOT 301 OR QP: BOT 410 OR QP: BOT 414 QA: BOT 863

865*. Plant Growth and Development  
Fall. 3(3-0) P: BOT 415. Physiology and biochemistry of growth and development as regulated by internal and external factors. Biosynthesis and action of plant hormones. Environmental factors: light and temperature. QP: BOT 415 QA: BOT 865

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Courses are subject to revision and final approval.

BOTANY AND PLANT PATHOLOGY/NATURAL SCIENCE

889. Plant Virology  Fall and even numbered years. 4(2-4)  P: BCH 465, BOT 810. R: Open only to graduate students.  
Biological and molecular aspects of viruses causing plant diseases.  
QF: BOT 406 BCH 453  QA: BOT 880

891. Molecular and Biochemical Plant Pathology  Spring of odd-numbered years. 3(2-3)  P: BCH 462, BOT 414 or BOT 415; BOT 810; ZOL 341. R: Open only to graduate students.  
Biochemical and molecular bases of host-pathogen interactions. Methods of pathogenicity and the nature of disease resistance.  
QF: BCH 453 ZOL 441 BOT 415 ZOBOT 406  QA: BOT 881

894. Prokaryotic Diseases of Plants  Fall of odd numbered years. 4(2-4)  P: BOT 810.  
Description of prokaryotic genera associated with plant disease identification, physiology, and genetics. Laboratory techniques.  
QF: BOT 405  QA: BOT 884

895. Plant Diseases in the Field  Summer. 2(1-3)  P: BOT 810. R: Open only to graduate students.  
Diagnosis of plant diseases and disorders in a field setting. Field trips and independent study are required.  
QF: BOT 405  QA: BOT 885

899. Master's Thesis Research  Fall, Spring, Summer. 1 to 12 credits.  
May reenroll for a maximum of 24 credits.  
R: Open only to graduate students.  
Research in anatomy, histology, cell biology, ecology, genetics, molecular biology, morphology, mycology, paleobotany, pathology, physiology, and systematicatics.  
QF: BOT 405  QA: BOT 899

900. Doctoral Dissertation Research  Fall, Spring, Summer. 1 to 24 credits.  
May reenroll for a maximum of 39 credits.  
R: Open only to doctoral students.  
Research in anatomy, histology, cell biology, ecology, genetics, molecular biology, morphology, mycology, paleobotany, pathology, physiology, and systematicatics.  
QF: BOT 405  QA: BOT 900

BUILDING CONSTRUCTION MANAGEMENT  BCM

125. Residential Construction  Materials, Methods and Drafting  Fall, Spring, Summer. 5(4-4)  R: Open only to Building Construction Management students. Not open to students with credit in HED 150.  
Materials, methods, codes, and drafting in residential construction.  
QF: BCM 214 BVM 215 BCM 415

227. Commercial Building Construction  Methods  Fall, Spring. 3(3-0)  P: BCM 126. R: Open only to Building Construction Management students.  
Methods, codes, and plans for constructing commercial buildings. Construction system details include: site preparation, foundations, floors, framing systems, and roof systems.  
QF: BCM 215 BCM 214  QA: BCM 217

230. Utilities  Fall, Spring. 3(0-0)  P: BCM 126. R: Not open to freshmen.  
Open only to Building Construction Management students.  
QF: BCM 215 BCM 217  QA: BCM 412

250. Construction Mechanics and Equipment Management  Fall. 3(2-3)  R: Open only to Building Construction Management and Agricultural Technology and Systems Management students.  
Principles, applications, techniques, tools, materials and resources in building construction mechanics and light commercial equipment management.  
QF: BCM 201 BCM 327

255. Current Issues in the Building and Housing Industries  Fall. 3(3-0)  
Impact of government policies and regulations on the building and housing industries. Land use, construction technology, energy, Economic demographics, and lifestyle choices.  
QF: BCM 200

311. Quantitative Methods in Agriculture and Urban Planning  Fall, Spring. 3(3-0)  
P: MTH 116 or MTH 120; CPS 100 or CPS 153. R: Not open to freshmen and sophomores.  
Technology management methods including linear programming, scheduling, decision theory, queueing and simulation. Applications in building construction management, agriculture and associated industries.  
QF: MTH 108 MTH 111 CPS 110 CPS 100  QA: ATN 311

329. Structural Design  Fall, Spring. 4(3-0)  P: BCM 227; PHY 231 or PHY 231B. R: Open only to Building Construction Management majors.  
Mechanics, material strengths and section properties developed and applied to structural design using wood, steel, reinforced concrete, beams, columns, footings, and foundation walls.  
QF: BCM 215 PHY 237  QA: BCM 312 BCM 313

334. Construction Estimation  Fall, Spring. 4(3-0)  P: BCM 230, BCM 322. R: Open only to Building Construction Management majors.  
QF: BCM 217 BCM 412  QA: BCM 416

335. Construction and Real Estate  Fall, Spring. 4(4-0)  P: ECS 201 or ECS 202; MTH 115 or MTH 120. R: Not open to freshmen and sophomores.  
Open only to Building Construction Management majors.  
Financial methods and instruments utilized in construction, financing, development, and purchase of real estate. Terms, contracts, valuation, brokerage, taxation, risk, and interest rate analysis.  
QF: MTH 109 OR MTH 110 OR MTH 111  QA: ATN 417 FI 392  QA: BCM 347

340. Residential Design Evaluation  Fall. 3(3-0)  P: BCM 126 or HED 168. R: Not open to freshmen and sophomores.  Open only to Building Construction Management and Human Environment and Design majors.  
Qualitative methods for evaluating residential building designs. Design input is incorporated on building occupancy: children, families, singles, handicapped, elderly.  
QF: BCM 215

349. Construction Renovation  Spring. 3(3-0)  P: BCM 227. R: Open only to Building Construction Management and Human Environment and Design majors.  
QF: BCM 217  QA: BCM 239 BCM 339

351. Concepts of Fire Safe Construction  Fall. 3(3-0)  P: BCM 126. R: Open only to Building Construction Management and Agricultural Technology and Systems Management students.  
Safety and fire integrity of structures: principles, terminology, and techniques of construction affecting life, applicable codes, materials and assemblies. Suppression and detection systems.  
QF: BCM 215 OB BCM 317 OR BCM 412  QA: BCM 216 BCM 490

422. Construction Contracts  Spring. 3(3-0)  P: BCM 227, BCM 311, BCM 324 R: Seniors and above, BCM, CE  
QF: ATM 311 BCM 217 BCM 416

423. Construction Project Management  Fall, Spring. 3(3-0)  P: BCM 227, BCM 311, BCM 324 R: Open only to seniors and graduate students in Building Construction Management and Civil Engineering.  
Construction management principles and practices. Site and project management.  
QF: BCM 416 ATM 311  QA: BCM 420

452. Commercial Utility Systems  Spring. 3(3-0)  P: BCM 311, BCM 324. R: Open only to Building Construction Management, Civil Engineering, and Human Environment and Design majors.  
Primary electrical, heating, ventilating, air conditioning, plumbing, elevator, and fire detection and suppression systems for commercial buildings.  
QF: BCM 412

490. Independent Study  Fall, Spring, Summer. 1 to 4 credits.  
May reenroll for a maximum of 8 credits.  
R: Open only to Building Construction Management majors. Approval of department; application required.  
Special problems in acquisition and development of residential land, design, construction technology, building materials, finance, marketing, construction management, or land use codes and regulations.  
QF: BCM 418

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