601. Osteopathic Manipulative Medicine Clerkship
Fall, Spring, Summer. 1 to 20 credits. A student may earn a maximum of 30 credits in all enrollments for this course.
R: Open only to professional students in the College of Osteopathic Medicine upon completion of Units I and II.
Advanced training in the diagnosis of musculoskeletal dysfunction and application of osteopathic manipulative techniques.
QA: BIM 601

820. Directed Studies
Fall, Spring, Summer. 1 to 30 credits. A student may earn a maximum of 30 credits in all enrollments for this course.
Individual or group work on special problems related primarily to the biomechanics of the musculoskeletal system.
QA: BIM 820

800. Special Topics
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 3 credits in all enrollments for this course.
Directed study in topics of biomechanics.
QA: BIM 800

Tissue Biomechanics
Fall, 3(2-2)
Integrate concepts of tissue mechanics and microstructure, develop experimental methodology to study connective tissue mechanics using engineering principles.
QA: BIM 812

Biomechanical Analysis
Fall, 2(2-0)
Methods for analysis of biokinematic and biokinetic data.
QA: BIM 811

Experimental and Analytical Biomechanics
Spring, 3(2-2)
P: BIM 811.
Experimental and analytical methods to measure and interpret biomechanics of musculoskeletal system.
QA: BIM 805 QA: BIM 811, BIM 873

Kinanthropometry and Biomechanics
Spring, 3(2-2)
P: BIM 811.
Size, position, and mobility of the human body as a mechanical biological system. Detailed study of body joints and kinematic models.
QA: BIM 805 QA: BIM 810, BIM 872

Theory of Connective Tissue Mechanisms
Spring of odd-numbered years, 2(2-0)
P: BIM 870.
Mechanical properties, chemical content, and anatomical structure in connective tissues.
QA: BIM 812 QA: BIM 812

Theory of Neuromuscular Mechanics
Fall of even-numbered years, 2(2-0)
Neurological control of joint mechanics.
QA: BIM 810, BIM 895

Theory of Joint Mechanics
Spring, 2(2-0)
P: BIM 811.
Motion and force transmission, and their relationship to anatomical structure and tissue function in joints.
QA: BIM 810 QA: BIM 819, BIM 895

Occupational Biomechanics
Fall, 3(3-0)
Applications of biomechanics in ergonomics with emphasis on the whole body.
QA: BIM 810 QA: BIM 810

Clinical Biomechanics
Spring of even-numbered years, 3(3-0)
Application of biomechanics to medicine.

Independent Study
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 22 credits in all enrollments for this course.
R: Open only to graduate professional students in the College of Osteopathic Medicine upon completion of Units I and II.
Advanced training in the diagnosis of musculoskeletal dysfunction and application of osteopathic manipulative techniques.
QA: BIM 820

Experimental Research Methods
Fall, Spring, Summer. 1 to 25 credits. A student may earn a maximum of 25 credits in all enrollments for this course.
R: Open to Biomechanics graduate students.
Methods of experimental research in biomechanics.
QA: BIM 871, BIM 872, BIM 873

Master's Thesis Research
Fall, Spring, Summer. 1 to 25 credits. A student may earn a maximum of 25 credits in all enrollments for this course.
QA: BIM 889

Botany and Plant Pathology—Descriptions of Courses

BOTANY AND PLANT PATHOLOGY

BOTANICAL BOTANY

Department of Botany and Plant Pathology
College of Natural Science

195. Plant Biology
Fall, Spring, 3(3-0)
Plant structure, function, development, genetics, diversity and ecology.
QA: BOT 206

196. Plant Biology Laboratory
Fall, Spring, 1(0-3)
P: BOT 105 or concurrent. Cell structure and function, physiology, growth and development, and diversity of plants.
QA: BOT 206

202. The Form and Evolution of Plants
Spring, 3(3-0)
P: BS 110 or BOT 105. Divergent and convergent evolution throughout the plant kingdom. Basic principles underlying the structure, function, and reproduction of plants.
QA: BS 212, BOT 205 QA: BOT 302

213. Plants of Michigan
Fall, 3(3-2)
QA: BOT 205, BS 212

310. Introductory Plant Physiology
Fall, Spring, 3(3-0)
Interdepartmental with Geological Sciences.
P: CE 141 or CE 151, CE 161; BOT 105 or BS 111 or LBS 145. 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.
QA: CE 141, CE 161, CE 161, BOT 205, BS 216, LBS 141 QA: BME 301

335. Plants Through Time
Spring of even-numbered years, 3(3-0)
Interdepartmental with Geological Sciences.
P: BS 110 or BOT 105 or GLG 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.
QA: BOT 205, BS 212, LBS 140 QA: GUG 325

336. Useful Plants
Spring, 3(3-0)
P: CE 141 or CE 143 or CE 152; BOT 105 or BS 110, BS 111 or LBS 144, LBS 145. Ways in which plants are used for myriad purposes from food and construction materials to medicines and perfumes. The potential for expanding the uses of plants through biotechnology will be explored.
QA: BOT 205, BS 212 QA: BOT 306

402. Biology of Fungi
Fall, 3(3-2)
P: BS 110, BS 111 or BOT 105 or LBS 140 or MPH 302. Major groups of fungi: characteristics, habitats and diversity. Significance of fungi in nature and their economic importance.
QA: BOT 205, LBS 140, BS 212 QA: BOT 402, BOT 306

405. Introductory Plant Pathology
Spring, 3(3-0)
P: BS 110, BS 111 or BOT 105 or LBS 140. R: Not open to students with credit in BOT 407. Important plant diseases and the organisms that cause them. Principles of disease management including application of chemicals, plant breeding, biological control, and genetic engineering.
QA: BOT 302, BS 212, LBS 140 QA: BOT 405
Building Construction Management—Descriptions of Courses

826. **Tropical Biology: An Ecological Approach**
   Spring, Summer. 6 credits. Interdepartmental with Zoology.
   R: Approval of department; application required.
   Principles of tropical ecology. Given at various sites in Costa Rica by the organization for Tropical Studies.
   QP: BOT 826

827. **Tropical Managed Ecosystems**
   Spring, Summer. 8(4-8)
   R: Approval of department; application required.
   The scientific and social dimensions of sustainable development in 10 ecosystems. Given at various sites in Costa Rica by the organization for Tropical Studies.
   QP: BOT 827

830. **Paleobotany**
   Fall of even numbered years. 3(2-3) Interdepartmental with Geological Sciences.
   R: Open only to graduate students. Approval of department.
   Survey of fossil plant preservation, occurrence, geological relationships, taphonomy, whole plant reconstruction, evolutionary history, and paleoecology.
   QP: BOT 830, GLG 850

842. **Application of Ecological Principles**
   Spring. 2 credits. Given only at W.K. Kellogg Biological Station.
   A student may earn a maximum of 8 credits in all enrollments for this course. Interdepartmental with Zoology.
   R: Approval of department.
   Workshops and discussions with experts from industry, regulatory agencies, conservation groups, and academia on application of basic ecology and evolutionary biology to real-world problems.
   QP: BOT 842

844. **Organelle Genetics**
   Spring of even numbered years. 3(3-0)
   Interdepartmental with Zoology.
   P: BCH 811 or BOT 855, ZOL 341.
   Organization, structure, function, heredity, molecular biology and manipulation of chloroplasts and mito- chondria. Biological interaction between nucleus and organelles.
   QP: BOT 844, ZOL 441 QA: BOT 844

847. **Advanced Mycology**
   Spring of even numbered years. 5(2-8)
   P: BOT 402
   Classification, morphology and relationships of fungi; physiology, genetics, and molecular biology of fungi; identification techniques within selected orders.
   QP: BOT 320 QA: BOT 847, BOT 848

849. **Evolutionary Biology**
   Spring, 3(3-0) Interdepartmental with Zoology.
   P: ZOL 341, STT 422 or concurrently, C; STT 422
   Major concepts and empirical questions in evolutionary biology. Readings and lectures are synthesized in student discussions and on paper.
   QP: ZOL 441, STT 425

856. **Plant Molecular Biology**
   Spring, 3(3) Interdepartmental with Biochemistry.
   P: ZOL 341.
   Recent advances in genetics and molecular biology of higher plants.
   QP: ZOL 441 QA: BOT 856

860. **Ecology and Evolution in Terrestrial Systems**
   Summer. 4 credits. Given only at W.K. Kellogg Biological Station. Interdepartmental with Zoology, and Crop and Soil Science.
   P: STT 422.
   Field experimental and quantitative approaches to ecological and evolutionary mechanisms.
   QP: STT 423 QA: BOT 856

865. **Environmental Plant Physiology**
   Spring of even numbered years. 3(3-0)
   Interdepartmental with Horticulture.
   P: BOT 301 or BOT 414 or BOT 415.
   Interaction of plant and environment, Photosynthesis, thermophysiology, and plant-water relations.
   QP: BOT 301, BOT 413, BOT 414, BOT 415 QA: BOT 865

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. Biosyntheses and action of plant hormones. Environmental factors: light and temperature.
   QP: BOT 415 QA: BOT 865

880. **Plant Virology**
   Fall of odd-numbered years. 4(2-4)
   P: BCH 462, BOT 410.
   Virology of plant diseases and disorders in a field setting. Field trips and independent study are required.
   QP: BOT 405, R: BOT 880

881. **Molecular and Biochemical Plant Pathology**
   Spring of odd-numbered years. 3(2-0)
   P: BCH 462, ZOL 341, BOT 410, BOT 414 or BOT 415.
   Biochemical and molecular bases of host-plant interactions. Mechanisms of pathogenicity and the nature of disease resistance.
   QP: BOT 450, ZOL 441, BOT 415, R: BOT 881

884. **Prokaryotic Diseases of Plants**
   Fall of even-numbered years. 4(2-4)
   P: BOT 810.
   Description of prokaryotic genera associated with plant diseases. Identification, physiology, and genetics.
   Laboratory techniques.
   QP: BOT 405 QA: BOT 884

885. **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.
   QP: BOT 405 QA: BOT 885

899. **Masters Thesis Research**
   Fall, Spring, Summer. 1 to 12 credits.
   A student may earn a maximum of 24 credits in all enrollments for this course.
   R: Open only to graduate students.
   Research in anatomy, physiology, cell biology, ecology, genetics, molecular biology, morphology, myology, paleobotany, pathology, physiology, and systematics.
   QP: BOT 899

999. **Doctoral Dissertation Research**
   Fall, Spring, Summer. 1 to 12 credits.
   A student may earn a maximum of 99 credits in all enrollments for this course.
   R: Open only to doctoral students.
   Research in anatomy, physiology, cell biology, ecology, genetics, molecular biology, morphology, myology, paleobotany, pathology, physiology and systematics.
   QP: BOT 999

**BUILDING CONSTRUCTION MANAGEMENT**

**BCM Department of Agricultural Engineering**
College of Agriculture and Natural Resources
College of Engineering

126. **Residential Construction Materials, Methods and Drafting**
   Fall, Spring, Summer. 8(0-4)
   R: Open only to Building Construction Management majors.
   This course is offered in the fall at each housing segment.
   Materials, methods, codes and drafting in residential construction.
   QP: BCM 214, BCM 215, BCM 415

127. **Commercial Building Construction Methods**
   Fall, Spring. 3(3-0)
   P: BCM 206, R: Open only to Building Construction Management majors.
   Methods, codes, and plans for constructing commercial buildings. Construction system details: site preparation, foundations, floors, framing systems, and roof systems.
   QP: BCM 215, BCM 214 QA: BCM 217

200. **Utilities**
   Fall, Winter. 3(0-0)
   QP: BCM 207, R: Not open to freshmen.
   Open only to Building Construction Management students.
   Teaching and planning electrical and utility systems for residential and light commercial construction utilizing applicable codes.
   QP: BCM 215, BCM 217 QA: BCM 212

250. **Construction Mechanics and Equipment Management**
   Fall, Spring, Summer. 3(2-3)
   R: Open only to Building Construction Management or Agricultural Technology and Systems Management majors.
   Principles, applications, techniques, tools, materials and resources in building construction equipment and light construction equipment management.
   QP: BCM 201, BCM 207

252. **Current Issues in the Building and Housing Industries**
   Fall. 3(3-0)
   Impacts of government policies and regulations on the building and housing industry, including materials, construction technology, energy, Economics, demographics, and lifestyle changes.
   QP: BCM 209

311. **Quantitative Methods in Technology Management**
   Fall, Spring. 3(3-0)
   P: MTH 116 or MTH 120; CPS 100 or CPS 150 or CPS 191.
   R: Not open to freshmen or sophomores.
   Technology management methods including linear programming, scheduling, decision theory, queuing and simulation. Applications in building construction management, agriculture and associated industries.
   QP: MTH 108, MTH 111, CPS 115, CPS 100 QA: ATM 311

322. **Structural Design**
   Fall, Spring. 4(5-0)
   P: BCM 220, PHY 251 or PHY 251B. R: Open only to Construction Management or Agricultural Technology and Systems Management majors.
   Mechanics, material strengths and section properties analyzed and applied to structural design using wood, steel and concrete. Beams, columns, foundations, and foundation walls.
   QP: BCM 215, PHY 275 QA: BCM 312, BCM 313

324. **Construction Estimation**
   Fall, Spring. 3(3-0)
   P: BCM 230, BCM 322. R: Open only to Building Construction Management or Civil Engineering majors.
   QP: BCM 217, BCM 412 QA: BCM 416

325. **Construction and Real Estate Finance**
   Fall, Spring. 4(4-0)
   P: EC 201 or EC 202; MTH 116 or MTH 120. R: Open only to Building Construction Management, Civil Engineering, and College of Business majors.
   Financial methods and instruments utilized in construction, rehabilitation, development, and purchase of real estate. Terms, amortization, valuation, brokerage, taxation, risk, and interest rate analysis.
   QP: MTH 100, MTH 111, MTH 111, EC 202; QP: BCM 417, EC 298

340. **Residential Design Evaluation**
   Fall. 3(3-0)
   QP: BCM 286 or JKX 160. R: Not open to freshmen and sophomores.
   Open only to Building Construction Management and Human Environment Design majors.
   Qualitative methods for evaluating residential building designs. Design impacts on building occupants: children, families, singles, handicapped, elderly.
   QP: BCM 215

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