

**110. Fundamentals of Design**

*Fall. 4(2-4)*

Analysis and application of elements and principles of design in two and three dimensional expressions to abstract and spatial design compositions for environmental requirements.

**120. Graphic Communication**

*Fall. 4(2-4)*

Technical skills for graphic communication, freehand, mechanical drafting and lettering, sketching and perspective drawing; use of graphic symbols, diagrams, matrices and charts; rendering media, techniques, presentation and reproduction methods.

**201. Site Planning**

*Fall. 3(3-0)*

Elements, principles and concepts for site development, including use area organization, orientation and siting of buildings, circulation and parking systems, spatial definitions, and detail design considerations.

**230. Landform Design**

*Winter. 4(2-4) Provisional majors; or approval of school.*

Elements and principles of site grading, relief visualization, contour interpretation, land form units, surface drainage, slope calculations, and earthwork quality determinations.

**233. Site Construction**

*(L A 333.) Winter. 4(2-4) Provisional majors.*

Materials and methods for construction of landscape developments, including details, layouts, construction drawings, specifications and cost estimating procedures.

**240. Landscape Design Methods**

*Winter. 3(2-2) Provisional majors; or approval of school.*

Considerations and techniques of landscape design, including natural, cultural and perceptual inventories, site and program analyses, development of design concepts, with verbal and graphic expressions. Field trips required.

**243. Basic Site Design**

*(341.) Spring. 4(2-4) Provisional majors; or approval of school.*

Applications of site planning theory and landscape design methods to representative site development projects involving buildings, use areas, land, water and plant forms, with verbal and graphic expressions. Field trips required.

**321. Advanced Graphic Communication**

*Winter. 4(1-6) Junior majors.*

Development of proficiency in landscape delineation and rendering techniques, including specialized media and formats for visual presentations of design concepts, analyses and perceptions.

**332. Site Engineering**

*(432.) Fall. 3(2-2) Majors.*

Principles and procedures for design of site development systems, horizontal and vertical road alignments, storm and sanitary sewers, site utilities and computer applications for preparation of site construction drawings.

**342. Recreation Site Design**

*Fall. 4(2-4) L A 240, Landscape Architecture majors or approval of school.*

Ecological and cultural considerations, resource characteristics, activity requirements, recreation systems and site design standards; with applications of design process to representative recreation site developments, parks and special use areas.

**346. Housing Site Design**

*Winter. 4(2-4) Landscape Architecture or Urban Planning majors; or approval of school.*

Application of site planning principles and landscape design methods to representative site development projects, with emphasis on housing requirements and opportunities.

**348. Community Projects Design**

*Spring. 4(2-4) L A 346.*

Application of site planning principles and landscape design methods to comprehensive site development projects, with emphasis on public and institutional requirements and opportunities.

**350. Planting Design Theory**

*(L A 250.) Fall. 4(2-4) HRT 212, Junior majors; or approval of school.*

Principles of and procedures for arrangement of plant compositions, emphasizing the perceptual characteristics of plants by means of models, sketches and plans, and potential applications to landscape developments. Field trips required.

**353. Planting Plans**

*Spring. 3(2-2) Junior majors.*

Principles and procedures for selection and arrangement of plant materials for specific uses, including climate modification, spatial definition, circulation control, and soil and water conservation, as expressed by planting plans and specifications.

**370. History of Environmental Development**

*Spring. 3(2-2)*

Significant natural conditions and cultural events which have influenced attempts to organize and design the physical environment, as expressed in historic landscape development styles and movements.

**390. Landscape Architecture Field Studies**

*Fall, Winter, Spring. 2 to 4 credits. May reenroll for a maximum of 8 credits. Approval of school.*

Field trips to contemporary and historical site and regional zones within or outside the United States. Prior and post study required.

**401. Environmental Land Planning**

*Winter. 3(3-0)*

Principles and methods of ecologically based land planning, stressing management and natural resources in relationship to growth and development; includes current environmental planning and development at local and state levels.

**401A. Environmental Planning Application**

*Winter. 1(0-2) L A 401 concurrently.*

Sample design exercises applying environmental land planning theory from L A 401 to select landscapes.

**403. Urban Design Theory**

*Spring. 3(3-0)*

Concepts and procedures for the organization, design and development of public and private urban forms and spaces, including survey of urban elements, cultural, ecological and aesthetic considerations, and interdisciplinary collaboration.

**403A. Urban Design Applications**

*Spring. 1(0-2) L A 403 concurrently.*

Sample design exercises applying urban design theory from L A 403 to select urban landscapes.

**423. Professional Graphics**

*Spring. 4(1-6) L A 321.*

Applications of advanced sketching, perspective and rendering techniques for typical professional presentations, including prints, reproductions, photography and multi-media audio-visual communications.

**437. Design Implementation**

*Winter. 4(1-6) Senior majors, L A 480 concurrently; CPS 115 or CPS 120.*

Preparation of a complete package of contract documents including the use of computer technology for a representative site development project including typical construction drawings, specifications and cost estimates.

**471. History of Landscape Architecture**

*Winter. 3(2-2)*

Environmental design concepts and projects from 1850 to the present time, with emphasis on the development of the profession and practice of landscape architecture in the United States.

**480. Professional Practice**

*Winter. 4(3-2) Senior majors, L A 437 concurrently.*

Principles and procedures of professional office practice, including ethics, client relations, registration, inter-professional collaboration project management and marketing of professional services.

**483. Landscape Architecture Seminar**

*Spring. 3(2-2) Senior majors.*

Research presentation and discussion of significant current issues, trends, events and opportunities relating to contemporary theories and practices of landscape architecture.

**489. Landscape Architecture Internship**

*Fall, Winter, Spring, Summer. 2(0-8) or 3(0-12) or 4(0-16) May reenroll for a maximum of 8 credits. Juniors, approval of school.*

Supervised experience in approved public agencies and professional offices. Bi-weekly conferences.

**490. Special Problems**

*Fall, Winter, Spring, Summer. 2 to 5 credits. May reenroll for a maximum of 12 credits. Approval of school.*

Investigation, for advanced undergraduate students in landscape architecture, developed from special interest areas.

**499. Landscape Architecture Design Thesis**

*Fall. 4(1-6) Senior majors; or approval of school.*

Demonstration of analytical, creative and technical competencies in the development of methods and/or concepts leading to design solutions for contemporary landscape architecture problems for public service projects.

**VETERINARY MEDICINE V M  
(COLLEGE OF)**

**511. Introduction to Veterinary Medicine I**

*Fall. 2(2-0) First-term Veterinary Medicine students.*

Species and breed identification, predisposition for specific diseases, basic care and feeding, restraint and handling of small domestic animals, unusual pets, and laboratory animals.

## Descriptions — Veterinary Medicine

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### Courses

- 517. Perspectives in Veterinary Medicine**  
*Fall. 1(1-0) First-term Veterinary Medicine students.*  
Ethical principles, historical background and organization of the veterinary profession.
- 521. Introduction to Veterinary Medicine II**  
*Spring. 4(3-4) Third-term Veterinary Medicine students.*  
Restraint, physical examination and diagnostic procedures in food animals and horses. Fundamentals of equine conformation, gaits, shoeing and routine medical care.
- 531. Animal Behavior**  
*Spring. 3(3-0) Third-term Veterinary Medicine students.*  
Emphasis on behavior of animals relating to disease prevention and treatment. Lectures, discussions and demonstrations on veterinary ethology including animal communications, reproduction, restraint, handling, housing and feeding habits.
- 540. Metabolic Diseases and Endocrinology**  
*(503.) Winter. 2(2-0) Fifth-term Veterinary Medicine students.*  
Biochemical and physiological basis of metabolic and endocrine diseases of animals including diagnosis, treatment and management.
- 542. Principles of Radiology**  
*Fall. 2(2-0) Fourth-term Veterinary Medicine students.*  
Fundamentals of veterinary radiography. Normal radiographic anatomy. Principles of radiographic interpretation. Radiation safety.
- 544. Veterinary Epidemiology**  
*Fall. 4(4-0) Fourth-term Veterinary Medicine students.*  
Meaning and relevancy of biostatistics in veterinary medicine. Descriptive and inferential statistics. Study design and critical literature review. Disease determinants, ecology, distribution and populations at risk. Analytic-clinical investigative epidemiology.
- 550. Preventive Veterinary Medicine and Public Health**  
*(520.) Winter. 4(4-0) Fifth-term Veterinary Medicine students.*  
Public health aspects of veterinary medicine. Preventive and regulatory medicine including meat and milk hygiene, water supply and treatment, solid and liquid waste treatment and disposal and zoonosis.
- 560. Urinary System**  
*(507.) Spring. 3(3-0) Sixth-term Veterinary Medicine students.*  
Normal and abnormal structure and function, diagnostic methods, and the medical and surgical manipulation of the urinary system.
- 561. Core of Medicine Laboratories I**  
*Spring. 2(0-6) Sixth-term Veterinary Medicine students.*  
Classification diagnosis and treatment of diseases of the urinary, hematopoietic, nervous, integumentary and visual systems of animals.
- 562. Hematopoietic System**  
*(509.) Spring. 2(2-0) Sixth-term Veterinary Medicine students.*  
Normal structure and function of the hematopoietic system and pathophysiologic effects of hematopoietic diseases. Clinical manifestations, laboratory evaluation and medical management.
- 563. Visual System**  
*(532.) Spring. 2(2-0) Sixth-term Veterinary Medicine students.*  
Methods of examination, diagnosis, and treatment of ocular diseases.
- 564. Survey of Infectious Agents**  
*(510.) Spring. 4(4-0) Sixth-term Veterinary Medicine students.*  
Host-microorganism relationship in diseases of animals; laboratory diagnosis, treatment, control, and public health significance.
- 566. Nervous System**  
*(512.) Spring. 3(3-0) Sixth-term Veterinary Medicine students.*  
Normal and abnormal neural structure and function in animals with emphasis on clinical neurology and neuropathology.
- 568. Integumentary System**  
*(524.) Spring. 3(3-0) Sixth-term Veterinary Medicine students.*  
Diseases of the integumentary system of animals with emphasis on laboratory examinations, interpretations of pathological features, diagnosis and treatment.
- 570. Principles of Anesthesia**  
*Fall. 2(2-0) Seventh-term Veterinary Medicine students.*  
Principles and techniques of administering anesthetic agents. Supportive care including fluid therapy. Emergency procedures. Euthanasia agents.
- 571. Core of Medicine Laboratories II**  
*Fall. 1(0-3) Seventh-term Veterinary Medicine students.*  
Classification, diagnosis and treatment of diseases of the cardiovascular, respiratory and digestive systems of animals. Preanesthetic and anesthetic procedures and skills.
- 572. Cardiovascular System**  
*(513.) Fall. 3(3-0) Seventh-term Veterinary Medicine students.*  
Pathogenesis, diagnosis, and management of cardiovascular diseases of animals. Anatomical, physiological, pathological and pharmacological principles providing basis for medical and surgical treatment. Diagnostic and surgical procedures and radiologic interpretation.
- 574. Respiratory System**  
*(515.) Winter. 4(4-0) Eighth-term Veterinary Medicine students.*  
Pathogenesis, diagnosis, and management of respiratory diseases of animals; anatomical, physiological and surgical treatments. Diagnostic and surgical procedures and radiologic interpretation.
- 576. Digestive System I**  
*(522.) Fall. 4(4-0) Seventh-term Veterinary Medicine students.*  
Pathogenesis, diagnosis, and treatment of diseases of the alimentary tract and digestive organs of small animals.
- 578. Principles of Surgery I**  
*Fall. 3(2-3) Seventh-term Veterinary Medicine students.*  
Fundamentals of surgery. Common procedures used in soft tissue surgery with small animals.
- 580. Theriogenology**  
*(516.) Fall. 6(5-3) Seventh-term Veterinary Medicine students.*  
Reproductive function and diseases of animals' genital structure and function and endocrine controls. Examination, diagnosis and treatment of the mammary gland and reproductive tract.
- 581. Core of Medicine Laboratories III**  
*Winter. 3(0-9) Eighth-term Veterinary Medicine students.*  
Diagnosis and treatment of diseases of the reproductive, digestive and musculoskeletal systems.
- 582. Musculoskeletal System I**  
*(526.) Winter. 3(3-0) Eighth-term Veterinary Medicine students.*  
Diagnosis and treatment of musculoskeletal diseases of animals with emphasis on pathological changes, radiological techniques, and interpretation of radiographs.
- 586. Digestive System II**  
*Winter. 4(4-0) Eighth-term Veterinary Medicine students.*  
Pathogenesis, diagnosis and treatment of diseases of the alimentary tract and digestive organs of food animals and horses.
- 588. Principles of Surgery II**  
*Winter. 3(2-3) Eighth-term Veterinary Medicine students.*  
Fundamental large animal surgery. Surgical techniques and management of animals before, during and after surgery.
- 590. Client Communication and Jurisprudence**  
*(501.) Spring. 2(2-0) Ninth-term Veterinary Medicine students.*  
Communication and interviewing skills for effective client relations. Communication aspects of medical records and their use in medical problem solving. Legal responsibilities of the veterinary medical profession.
- 591. Core of Medicine Laboratories IV**  
*Spring. 2(0-6) Ninth-term Veterinary Medicine students.*  
Diagnosis and treatment of common toxicologic conditions, musculoskeletal disorders and orthopedic conditions in animals.
- 592. Musculoskeletal System II**  
*(534.) Spring. 4(4-0) Eighth-term Veterinary Medicine students.*  
Diagnosis, prognosis and management of musculoskeletal diseases of large animals. Anatomical relationships of normal to abnormal function. Surgical procedures applicable to the equine and ruminant. Radiographic diagnosis and interpretation of various lameness conditions.
- 594. Veterinary Toxicology**  
*(530.) Spring. 4(4-0) Ninth-term Veterinary Medicine students.*  
Pharmacological basis and pathological features of diseases of animals caused by common toxic chemicals with emphasis on clinical manifestations, diagnosis, prevention, and treatment.
- 596. Diseases of Bones and Joints**  
*(536.) Spring. 3(3-0) Ninth-term Veterinary Medicine students.*  
Anatomy and pathophysiology of diseases of bones and joints. Diagnosis, prognosis and treatment of abnormalities involving bones and joints.

**602. Veterinary Practice Management**  
Spring. 2(2-0) Ninth-term Veterinary Medicine students, approval of college. Establishment of a veterinary practice.

**610. Veterinary Externship**  
Fall, Winter, Spring, Summer. 8 to 16 credits. May reenroll for a maximum of 16 credits. Veterinary Medicine students; completion of preclinical courses and approval of college. Students may not receive credit in both VM 610 and LSM 674.  
Clinical or research experience in an off-campus setting.

## ZOOLOGY

## ZOL

### College of Human Medicine College of Natural Science

**203. Resource Ecology**  
(IDC 200.) Fall, Winter, Spring, Summer. 3(3-0) Interdepartmental with the departments of Fisheries and Wildlife, Forestry, Geography, and Resource Development. Administered by the Department of Fisheries and Wildlife.  
Basic concepts of ecology which are the unifying basis for resource management, conservation policy and the analysis of environmental quality. Extensive use of guest lecturers.

**301. Nature and Homo Sapiens**  
Spring. 4(2-6) Three terms of natural science; not open to zoology majors.  
Relates humans to their natural environment. Chief emphasis on identifying characteristic animal life in broad areas of nature and how humans fit or misfit into these. Lectures, laboratory and field trips illustrate this relationship.

**302. Vertebrate Life of the Past**  
Fall. 3(3-0) One course in physical or biological science or Juniors. Interdepartmental with and administered by Geology.  
Fossil vertebrates from fish to humans.

**304. Biology, Behavior and Humans**  
Winter. 3(3-0) Juniors; not open to zoology majors.  
Examines philosophical and biological issues which make the study of animal behavior relevant to humans. Emphasizes history of animal behavior, current theories, and experiments relating biological and environmental determinants of adaptive and non-adaptive behavior patterns.

**306. Invertebrate Biology**  
Fall. 4(3-3) B S 212.  
Systematics, morphology, and natural history of invertebrate animals. Laboratory includes identification of live and preserved animals and recognition of morphological characteristics of selected groups.

**307. Vertebrate Biology**  
Winter. 4(3-3) B S 212.  
Systematics, morphology and natural history of vertebrate animals. Laboratory includes identification of live and preserved animals and recognition of morphological characteristics of selected groups.

**313. Animal Behavior**  
(413.) Spring. 4(4-0) B S 211.  
Description of the known behavior of the various vertebrate and invertebrate phyla with emphasis upon adaptive significance. Thus, special attention will be given to mating, defensive, and nutritive behavior. The genetics and ontogeny of behavioral patterns will be presented where known. Behavior will be related to the ecology of various animal populations.

**317. Principles of Development**  
Fall, Spring. 3(3-0) B S 212.  
Development of animals, especially vertebrates. Principles are illustrated by modern experimental studies of developmental problems.

**318. Principles of Development Laboratory**  
Fall, Spring. 2(0-6) ZOL 317 or concurrently; B S 212.  
Principles of development illustrated by analysis of the ontogeny of selected organisms.

**337. The Fossil Record of Organic Evolution**  
Spring. 3(3-0) One course in a natural science; Juniors. Interdepartmental with and administered by Geology.  
The direct evidence for organic evolution in the fossil record. Evolution of life from prebiological systems to humans. Impact of fossil discoveries on human thought.

**341. Human Heredity**  
Fall, Winter. 4(4-0) Sophomores. Not open to zoology majors. Students may not receive credit in more than one of the following: ZOL 341, ZOL 441.  
Inheritance of human physiological, and psychological traits. Forces that influence human evolution. Applications of heredity in fields of education, sociology, anthropology, psychology, dentistry, and medicine.

**389. Animal Ecology**  
Winter. 4(3-4) B S 212 or concurrently.  
Animals in relation to their environment. Factors affecting the distribution and abundance of animals. Interrelationships between climate, soils, vegetation, geologic history and animal life. Population characteristics as related to reproduction and mortality factors.

**391. Zoological Problems**  
Fall, Winter, Spring, Summer. 1 to 8 credits. May reenroll for a maximum of 12 credits. Juniors; B S 212; 6 credits in zoology; approval of department.  
Advanced work in morphology, field zoology, genetics, mammalogy, ornithology, or ichthyology.

**400H. Honors Work**  
Fall, Winter, Spring. 1 to 5 credits. May reenroll for a maximum of 15 credits. Juniors; approval of department.

**401. Comparative Physiology I**  
Fall. 4(3-4) PSL 240 or B S 212; CEM 131 or CEM 141. Interdepartmental with and administered by the Department of Physiology.  
A comparison of osmoregulation, digestion, respiration, and other physiological processes in a wide range of organisms.

**402. Comparative Physiology II**  
Winter. 4(4-0) PSL 401 or approval of department. Interdepartmental with the Department of Physiology.  
A comparison of sensory, motor, endocrine and other integrative mechanisms in animals.

**404. Biological and Ecological Concepts for Engineers and Mathematicians**  
Winter. 3(3-0) Approval of department. Interdepartmental with Systems Science.  
Biological and ecological concepts important to formal analysis of living systems, vital properties, processes, and limitations; population dynamics, selection, competition, and predation; ecological community structure and function; industrialized ecosystem.

**405H. Experiments in Zoology I**  
(405.) Fall of even-numbered years. 4(0-12) Approval of instructor.  
An integrated series of selected experiments in the topics of behavior, ecology, morphology and physiology.

**406. Experiments in Zoology II**  
Winter. 4(0-12) Approval of instructor.  
An integrated series of selected experiments in topics of cell biology, embryology and genetics.

**408. Freshwater Ecology**  
Summer. 6 Credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with Biological Science and the Department of Botany and Plant Pathology and administered by Biological Science.  
The ecology of freshwater ecosystems, their biotic structure and the functional interrelationships of environmental variables regulating population dynamics, productivity and community structure. Extensive field investigations.  
Approved through Spring 1985.

**410. Terrestrial Ecology**  
Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with Biological Science and the Department of Botany and Plant Pathology. Administered by Biological Science.  
Extensive field investigations of several types of terrestrial communities. Interrelationship of plants, animals, and environment. Factors determining distribution and abundance.  
Approved through Spring 1985.

**414. Biological Mechanisms of Animal Behavior**  
Winter. 3(3-0) or 5(3-6) ZOL 313 recommended.  
Consideration of neurological and hormonal mechanisms controlling behavior. Emphasis will be upon mammalian systems, and will deal with the assumptions which underlie current concepts in the biology of behavior.

**415. Ecological Aspects of Animal Behavior**  
Fall. 4(4-0) ZOL 313.  
Consideration of orientation, navigation and homing behavior, food preferences, habitat selection, exploration, behavioral periodicity, communication, social organization and the embryology of behavior in both vertebrates and invertebrates.

**417. Advanced Developmental Biology**  
Fall. 3(3-0) ZOL 317.  
Molecular and cellular biology of development.