VIBS 684 Professional Internship

Credits 1 to 4. 1 to 4 Other Hours. A directed internship in an organization to provide students with on-the-job training with professionals in settings appropriate to the student's professional objectives. **Prerequisite:** Approval by committee chair.

VIBS 685 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Research problem in one of the department's areas of specialization (anatomy, cellular and molecular biology, epidemiology, food safety, genetics, informatics, neuroscience, public health concepts, reproduction/developmental biology, toxicology, zoonoses, science and technology journalism).

VIBS 688 Epidemiological Modeling of Infectious Diseases

Credits 3. 2 Lecture Hours. 2 Lab Hours. Concepts of mathematical modeling of infectious diseases; steps and methods for the development and analysis of models. **Prerequisite:** Graduate classification.

VIBS 689 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours. Selected topics in one of the department's areas of specialization (anatomy, cellular and molecular biology, epidemiology, food safety, genetics, informatics, neuroscience, public health concepts, reproduction/developmental biology, toxicology, zoonoses, science and technology journalism).

VIBS 690 Theory of Research

Credits 3. 3 Lecture Hours. Theory and design of research related to current biomedical problems especially those involving study of animal disease; philosophical perspectives underlying historical advances in research pertaining to the study, prevention and treatment of disease. Must be taken on a satisfactory/unsatisfactory basis. **Prerequisite:** Graduate classification. **Cross Listing:** NRSC 690 and VTPP 690.

VIBS 691 Research

Credits 1 to 23. 1 to 23 Other Hours. Research reported by writing of thesis or dissertation as partial requirement for MS or PhD degree. **Prerequisite:** Approval of department head.

VIBS 698 Gene, Cell, and Molecular Therapies

Credits 3. 3 Lecture Hours. Introduction to types of therapies including gene replacement, exon skipping, stop codon readthrough, gene editing, and stem cell therapy; use of monogenic, neuromuscular disorders for the application of these types of treatments; basic principles of gene, cell, and molecular therapy and the application to research projects, where applicable; presentation of peer-reviewed journal articles pertaining to the course content. **Prerequisites:** Graduate classification.

VIBS 910 Small Animal Anatomy

Credits 4. 2 Lecture Hours. 6 Lab Hours. Nomenclature, structures and principles of functional anatomy of dogs and cats; emphasis on topographical, radiographic and functional anatomy of structures with clinical importance. **Prerequisite:** Enrollment in first year of professional DVM curriculum.

VIBS 911 Histology

Credit 1.5. 1.5 Lecture Hour. Clinical application of histological content; basic tissues and major organ systems of common domestic species; normal microscopic appearance of cells, tissues and organs with the introduction of normal tissue and organ cytology; content correlates gross anatomy, microscopic anatomy and the physiological state of common domestic species. **Prerequisite:** Enrollment in first year of professional DVM curriculum.

VIBS 912 Clinical Anatomy of Large Animals

Credits 3. 2 Lecture Hours. 4 Lab Hours. Gross and topographical anatomy of domestic livestock including equine, ruminant, porcine and avian gross anatomy through use of cadavers, models and images; emphasis on structures of clinical importance, relationships to common medical and surgical procedures and functions in the animal body. **Prerequisite:** Enrollment in first year of professional DVM curriculum.

VIBS 913 Microscopic Anatomy II

Credits 4. 2 Lecture Hours. 6 Lab Hours. Developmental anatomy of domestic animals with special emphasis on structural congenital defects; functional neuroanatomy and clinical neurology of domestic animals; essential clinical skills for the theory and practice of veterinary neurology. **Prerequisite:** Enrollment in first year of professional curriculum.

VIBS 914 Professional & Clinical Skills II

Credits 3. 1 Lecture Hour. 6 Lab Hours. Professional & Clinical Skills II. Integration and reinforcement of foundational knowledge offered in concurrent courses through critical thinking exercises, professional skills application activities (ethics/contextual decision-making, leadership, skills for well-being, personal/practice financial literacy, core communication skills) and application of technical skills; opportunities for learning include didactic, hands-on, and case-based interactions utilizing simulation, models, animals, actors and case scenarios; part II of a VI part series. **Prerequisites:** Enrollment in the first year of professional DVM curriculum.

VIBS 926 Introduction to Public Health Concepts

Credit 1. 1 Lecture Hour. Basic concepts and issues of public health as they relate to the veterinary medical profession. **Prerequisite:** Enrollment in first year of the professional curriculum.

VIBS 928 Public Health, Epidemiology and Evidence-Based Medicine

Credits 3. 3 Lecture Hours. Basic principles of epidemiology, public health, zoonoses and introduction to evidence-based medicine methodology, its application in clinical decision making; emphasis on synthesis of basic principles; application of evidence-based medicine; and epidemiological skills within the context of private and public veterinary practice. **Prerequisites:** Enrollment in the second year of professional curriculum.

VIBS 930 Public Health

Credits 4. 4 Lecture Hours. Principles and applications of epidemiology in veterinary medicine and the literature; history, epidemiology, symptoms, prevention and control of diseases transmitted between animals and humans; emphasis on emerging zoonotic diseases presenting occupational hazards for veterinary medicine; safety of foods of animal origin including foodborne illnesses. **Prerequisite:** Enrollment in third year of professional curriculum or enrollment in graduate studies with approval of instructor.

VIBS 936 Veterinarians in Society

Credit 1.5. 1.5 Lecture Hour. The breadth of career opportunities in veterinary medicine; the diversity of roles that veterinarians play in society including companion animal practice, large animal practice, public health, biomedical research, conservation medicine, emergency response and shelter medicine. **Prerequisite:** Enrollment in first year of professional DVM curriculum.

VIBS 948 Didactic Electives in Veterinary Anatomy

Credits 1 to 12. 1 to 12 Lecture Hours. Elective course in veterinary anatomy (with emphasis on neuroscience, cell biology, genetics, reproduction, developmental biology, marine mammal anatomy) for professional students who wish to supplement required curriculum. May be repeated for credit. **Prerequisite:** Enrollment in third year of professional curriculum.

VIBS 985 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Directed individual study of a selected problem in veterinary anatomy (with emphasis on neuroscience, cell biology, genetics, reproductive biology, developmental biology, or marine mammal anatomy) or directed individual study of advanced topics in veterinary public health or epidemiology (with emphasis on food safety, toxicology, informatics, or zoonoses). May be repeated for credit. **Prerequisite:** Matriculation in veterinary professional curriculum.

VIBS 988 Veterinary Medicine and Surgery Selective

Credits 2. 2 Lecture Hours. In-depth study of public health and regulatory associated processes in veterinary medicine. **Prerequisites:** Third year classification in veterinary medicine and in good standing. May be taken for credit up to eight hours.

VIBS 989 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of veterinary anatomy (with emphasis on neuroscience, cell biology, genetics, reproductive biology, developmental biology or marine mammal anatomy) or selected topics in veterinary public health, epidemiology, zoonoses, food hygiene and food toxicology. **Prerequisite:** Matriculation in veterinary professional curriculum.

VIZA - Visualization

VIZA 611 Concepts of Visual Communications I

Credits 3. 2 Lecture Hours. 2 Lab Hours. Theory and practice of visual communication using a variety of media to explore perception, form-making, color, and historic and personal sources of creativity. **Prerequisite:** Graduate classification in visualization or approval of instructor.

VIZA 612 Concepts of Visual Communications II

Credits 3. 2 Lecture Hours. 2 Lab Hours. Exploration of perception, vision and self-expression for communication through visual images; image-making processes include conventional and digital media. **Prerequisite:** Graduate classification or approval of instructor.

VIZA 613 3-D Modeling and Animation

Credits 3. 2 Lecture Hours. 2 Lab Hours. Principles of 3-D computer animation with an emphasis in aesthetics and techniques for 3-D modeling, color, texture, lighting, motion control and rendering. **Prerequisite:** Graduate classification in Visualization or approval of instructor.

VIZA 614 Form/Installation/Environment

Credits 3. 2 Lecture Hours. 3 Lab Hours. Aesthetic and functional concerns involving public spaces; interdisciplinary investigation of audible, visual and form potential of environmental space utilizing models and electronic imaging technology; ethical responsibilities regarding the environment and its use. **Prerequisite:** Graduate classification or approval of instructor.

VIZA 615 Computer Animation

Credits 4. 3 Lecture Hours. 2 Lab Hours. Intermediate level computer animation--focusing on production of three dimensional computer generated animation which may or may not integrate video and photographic elements. **Prerequisite:** VIZA 613 or approval of instructor.

VIZA 616 Rendering and Shading

Credits 3. 2 Lecture Hours. 2 Lab Hours. Exploration of advanced rendering and shading techniques for the attainment of a desired visual effect; topics may include shading languages, attainment of visual realism, integration of rendering and modeling tools, and non-photorealistic rendering. **Prerequisite:** VIZA 613 or approval of instructor.

VIZA 617 Advanced Animation

Credits 3. 2 Lecture Hours. 2 Lab Hours. Development of advanced three-dimensional computer animation with emphasis on successful storytelling and visual communication; may include story development, expressive character design, motivation, acting, speech animation, choreography, stage lighting, storyboards, soundtracks, story reels, production efficiency, and successive refinement. **Prerequisite:** VIZA 613 or VIZA 615; or approval of instructor.

VIZA 618 Facial Modeling and Animation

Credits 3. 2 Lecture Hours. 2 Lab Hours. Design and analysis of articulated 3D models for creating facial animation; includes designing expressive 3D faces, exaggerations, facial expressions and facial animation techniques. **Prerequisite:** VIZA 613 or approval of instructor.

VIZA 619 Motion Capture Animation

Credits 3. 2 Lecture Hours. 2 Lab Hours. Overview of motion capture technology, history, and techniques; application of motion-captured data to animate digital characters and props, including capture, cleaning and retargeting data for use. **Prerequisites:** VIZA 613 or VIZA 615; or approval of instructor.

VIZA 621 Virtual and Tangible Sculpture

Credits 3. 2 Lecture Hours. 2 Lab Hours. Study in digital modeling in virtual and physical space with emphasis on digital modeling and sculpting; digital fabrication processes in combination with traditional and experimental processes; topics covered may include digital sculpting, digital modeling, preparing designs for fabrication, post-processing of digitally fabricated parts, and the integration of traditional sculpting processes with digital fabrication processes. **Prerequisites:** Graduate classification in Visualization or approval of instructor.

VIZA 622 Design Communications I

Credits 3. 2 Lecture Hours. 2 Lab Hours. Theory and practice of visual communication employing a variety of digital and conventional media; emphasis on creating effective, self-expressive images employing the combined use of a variety of media. **Prerequisites:** VIZA 465 or VIZA 611 or equivalent; graduate classification or approval of instructor.

VIZA 623 Design Communication II

Credits 3. 1 Lecture Hour. 4 Lab Hours. Development of concepts and forms in visual communications; organization of complex problems in production; synthesis of skills, information tools and methodology. **Prerequisite:** VIZA 622 or approval of instructor.

VIZA 624 Interactive Virtual Environments

Credits 3. 3 Lecture Hours. Languages and techniques useful for the creation of real time virtual environments; definition of formal scene description structures; modeling and transformation techniques; simulation techniques; behaviors and message passing; user interaction and animation; multi-user environments; creating virtual interfaces; scripting techniques. **Prerequisites:** Graduate classification in visualization or approval of instructor.

VIZA 625 Multi-Media Web Design

Credits 3. 2 Lecture Hours. 2 Lab Hours. Examination of aesthetic, narrative, technical strategies; multi-media content on the web; methods of integrating imagery, animation, sound; non-linear multi-media narration. Application of multi-media techniques for navigation, interaction, animation, vector drawing, video, audio. **Prerequisite:** Graduate classification in visualization or approval of instructor.

VIZA 626 Generative Art and Design

Credits 3. 1 Lecture Hour. 4 Lab Hours. Theory and creative application of generative systems in studio art practice; chance based systems include random numbers and noise; biologically inspired systems include genetic algorithms, L-systems, and artificial life; systems drawn from complexity theory include, cellular automata, fractals, finite state machines, catastrophe theory, reaction diffusion systems, and chaos. May be taken 2 times for credit. **Prerequisite:** Graduate classification in visualization or approval of instructor.

VIZA 627 Design Communication III

Credits 3. 2 Lecture Hours. 2 Lab Hours. Advanced methods in video, photography and/or animation production; application of image strategies used in contemporary media. May be taken twice. **Prerequisites:** VIZA 613 or VIZA 622 or VIZA 643; approval of instructor.

VIZA 628 Computational Design

Credits 3. 2 Lecture Hours. 2 Lab Hours. Introduction to visual programming, otherwise known as node-based programming; exploration of static and generative forms of algorithmic design based on single operation and/or time; topics include designing objects and motion graphics using node-based mesh modeling, databases, image processing, and physics simulations. **Prerequisites:** Graduate classification or approval of instructor.

VIZA 629 Digital Media: Inspiration and Process

Credits 3. 2 Lecture Hours. 2 Lab Hours. Exploration of artwork and literature that has informed contemporary creativity provides a broad basis for discovery through reading, writing, studio projects; demonstrate a knowledge of creative strategies including, but not limited to mapping, database, allegory, sampling, and generative systems. **Prerequisite:** Graduate classification or approval of instructor.

VIZA 630 Contemporary Art Seminar I

Credits 3. 3 Other Hours. Exploration of theoretical and historical ideas that have shaped contemporary art practices, consideration of the changing roles of art in society, its production, presentation, institutions, and global contexts. **Prerequisites:** Graduate classification and enrollment in the MFA in visualization program or approval of instructor.

VIZA 631 Contemporary Art Seminar II

Credits 3. 0 Lecture Hours. 0 Lab Hours. 3 Other Hours. Exploration of theoretical and historical ideas that have shaped contemporary art practices, consideration of the changing roles of art in society, its production, presentation, institutions, and global contexts. **Prerequisites:** VIZA 630 or approval of instructor.

VIZA 638 Advanced Game Design

Credits 3. 2 Lecture Hours. 2 Lab Hours. Emphasis on the application of game mechanics for different genres of games; developing mechanics for mobile, virtual reality (VR), computers (PC), and console games; prototyping while also deeply engaging in the subject from an analytical perspective. **Prerequisites:** Working knowledge of a game engine and game design principles; graduate classification.

VIZA 641 Visual Storytelling

Credits 3. 2 Lecture Hours. 2 Lab Hours. Exploration of visual storytelling techniques for the attainment of desired storytelling effects; includes character development, using shots, camera, lights, props and background elements, master plots, one and multi-panel cartoons, comics, storyboards, animatics and storyreels. **Prerequisite:** Graduate classification or approval of instructor.

VIZA 643 Time Based Media I

Credits 3. 2 Lecture Hours. 2 Lab Hours. Visual language and cinematic structure explored through time based projects; historical, critical, and practical exploration of the interaction of camera, lighting, sound, editing, special effects, and mis en scene. **Prerequisites:** Graduate classification or approval of instructor.

VIZA 644 Time Based Media II

Credits 3. 1 Lecture Hour. 4 Lab Hours. Advanced theory and production of art forms with motion, tempo, sequencing and duration as integral components; projects may include in-depth creation using a single medium or may emphasize a combination of media such as video, audio, networked communication, animation, performance or installation. May be taken twice. **Prerequisite:** VIZA 643 or approval of instructor.

VIZA 645 Figure Drawing for Narrative and Concept Art

Credits 3. 2 Lecture Hours. 2 Lab Hours. Exploration of contemporary drawing practices and theory as they relate to visual narrative storytelling; investigation into the relationship of drawing with digital media including animation, photography and other technologies; development of personal methods, techniques, and thematic content; creation of an efficient workflow and visual literacy. **Prerequisites:** Graduate classification or approval of instructor.

VIZA 647 Color Photography

Credits 3. 1 Lecture Hour. 4 Lab Hours. Theory and practice of still color photography; appropriate uses of color processes related to digital photography and other graphic media; exploration of vision through the photographic image as a medium of self expression. May be taken two times for credit. **Prerequisite:** Graduate classification or approval of instructor.

VIZA 652 Computing for Visualization I

Credits 3. 2 Lecture Hours. 2 Lab Hours. Introduction to computing and mathematical concepts in computer graphics for graduate students in Visualization; hands-on visually oriented programming assignments; introduction to scripting in a professional animation package and emphasis on problem solving and debugging. **Prerequisites:** Graduate classification.

VIZA 653 Computing for Visualization II

Credits 3. 2 Lecture Hours. 2 Lab Hours. Procedural and mathematical principles underlying computer programming with an emphasis on real-time interaction with visual displays; linear algebra as applied to manipulating digital images, parametric and implicit shapes. **Prerequisites:** Graduate classification in Visualization; VIZA 652, or approval of instructor.

VIZA 654/CSCE 646 Digital Image

Credits 3. 2 Lecture Hours. 2 Lab Hours. Tools and techniques for generation, handling and analysis of two dimensional digital images; image representation and storage; display, media conversion, painting and drawing; warping; color space operations, enhancement, filtering and manipulation. **Prerequisite:** Graduate classification or approval of instructor. **Cross Listing:** CSCE 646/VIZA 654.

VIZA 655 Principles and Practices in Digital Twin Technology

Credits 3. 2 Lecture Hours. 2 Lab Hours. Comprehensive introduction to digital twins and the technologies to make them possible; focus on tools, techniques and interfaces of digital twins, alongside applied Internet of Things (IOT) methodologies. **Prerequisites:** Graduate classification or approval of instructor.

VIZA 656/CSCE 647 Image Synthesis

Credits 3. 2 Lecture Hours. 2 Lab Hours. Principles of image synthesis from 3-D scene descriptions; topics may include local and global illumination, shading, shadow determination, hidden surface elimination, texturing, raster graphics algorithms, transformations and projections. **Prerequisites:** Graduate classification in Visualization; VIZA 652, or approval of instructor. **Cross Listing:** CSCE 647/VIZA 656.

VIZA 657/CSCE 648 Computer Aided Sculpting

Credits 3. 2 Lecture Hours. 3 Lab Hours. Mathematical and artistic principles of 3-D modeling and sculpting; includes proportions, skeletal foundation, expression and posture, line of action; curves, surfaces and volumes, interpolation and approximation, parametric and rational parametric polynomials, constructive solid geometry, and implicit representations. **Prerequisite:** Approval of instructor. **Cross Listing:** CSCE 648/VIZA 657.

VIZA 658 Experimental Visual Techniques

Credits 3. 2 Lecture Hours. 2 Lab Hours. Theory and experimental techniques for computer graphics, animation, video, and other forms of electronic visualization including innovative hardware and software systems, artificial life, virtual reality, volume methods and hypermedia. May be taken twice. **Prerequisite:** Graduate classification or approval of instructor.

VIZA 659/CSCE 649 Physically-Based Modeling

Credits 3. 2 Lecture Hours. 2 Lab Hours. Physical simulation as used in choreography, geometric modeling, and the creation of special effects in computer graphics; a variety of problems and techniques are explored which may include particle-methods, modeling and simulation of flexible materials, kinematics and constraint systems. **Prerequisite:** Approval of instructor. **Cross Listing:** CSCE 649/VIZA 659.

VIZA 661 Interaction Design

Credits 3. 3 Lecture Hours. Concepts, theories and methods in interaction design and interaction; dimensions of interaction design; data gathering methods and evaluation; task analysis; aesthetics and the sensory experience; prototyping, and workflow. **Prerequisites:** Graduate classification or approval of instructor.

VIZA 662 Physical Computing for Art and Design

Credits 3. 1 Lecture Hour. 4 Lab Hours. Theory and creative application of digital technology in studio art and design practice to create dynamic environments, interactive objects, and tangible interfaces in the physical world; technologies involved include microcontrollers, basic electronics, sensors, actuators, motors, wireless and internet data communication, light, sound, and wearable devices. May be taken 2 times for credit. **Prerequisites:** Graduate classification in Visualization or approval of instructor.

VIZA 665 Digital Compositing

Credits 3. 2 Lecture Hours. 2 Lab Hours. Principles of digital compositing including image based lighting and modeling, camera calibration, shape reconstruction, reconstruction of transparency and specularity and digital compositing of computer generated animations with video images. **Prerequisites:** VIZA 613 or approval of instructor.

VIZA 668 Emergent Research in Visual Computing and Interactive Media

Credits 3. 3 Lecture Hours. Exploration of important recent research developments and directions in visual computing and interactive media; presentations and critiques of key papers, and hands-on experience in attempting to replicate and validate research results of others. May be repeated for credit. **Prerequisites:** Graduate classification or approval of instructor.

VIZA 669 Introduction to Deep Learning for Visual Computing and Interactive Media

Credits 3. 3 Lecture Hours. Introduction to deep learning and its application to visual computing and interactive media; basic concepts and programming of deep learning, computer vision, graphics, and interactive media; hands-on experience developing and training AI tools and models through programming assignments and projects. **Prerequisites:** Graduate classification; two semesters of calculus, linear algebra, programming in Python recommended.

VIZA 670/CSCE 620 Computational Geometry

Credits 3. 3 Lecture Hours. Design and analysis of algorithms for solving geometrical problems; includes convex hull problems, Voronoi diagrams, range searching and proximity problems. **Prerequisite:** CSCE 311 or approval of instructor. **Cross Listing:** CSCE 620/VIZA 670.

VIZA 671 Generative Artificial Intelligence for Visual Data

Credits 3. 2 Lecture Hours. 2 Lab Hours. Comprehensive introduction to deep learning-based generative techniques and models for generating, synthesizing, and manipulating visual data; establishment of a sequence of concepts that will develop mastery through real-world hands-on projects; survey of numerous applications in visualization, data science, computer science, and the arts; aimed at interest in data science, computer science, and related engineering programs. **Prerequisites:** Graduate classification; two semesters of calculus, linear algebra, and Python programming recommended.

VIZA 672/CSCE 641 Computer Graphics

Credits 3. 3 Lecture Hours. Representation of 3-dimensional objects, including polyhedral objects, curved surfaces, volumetric representations and CSG models; techniques for hidden surface/edge removal and volume rendering; illumination and shading; antialiasing; ray tracing; radiosity; animation; practical experience with state-of-the-art graphics hardware and software. **Prerequisite:** CSCE 441 or approval of instructor. **Cross Listing:** CSCE 641/VIZA 672.

VIZA 673/CSCE 643 Robotics Programming

Credits 3. 3 Lecture Hours. Manipulator dynamics, position control, hybrid position/force control, and impedance controls; advanced topics in manipulator motion planning, assembly planning and grasp planning; cell decomposition; retraction; back projection; hypothesize-and-test; and potential field methods; subassembly stability; task-level and fine motion planning; grasp stability; grasp synthesis; dexterous manipulation. **Prerequisite:** CSCE 452 or approval of instructor. **Cross Listing:** CSCE 643.

VIZA 675/CSCE 645 Geometric Modeling

Credits 3. 3 Lecture Hours. Geometric and solid modeling concepts, Freeform curves and surfaces (splines and Bezier) with their relational, intersectional and global mathematic properties; parametric representation of solids, topology of closed curved surfaces, boundary concepts and Boolean/Euler operators; construction and display of curves and surfaces, and solid models. **Prerequisites:** CSCE 441 and CSCE 442 or equivalent. **Cross Listing:** CSCE 645/VIZA 675.

VIZA 676/CSCE 679 Data Visualization

Credits 3. 3 Lecture Hours. Visual representation and design of data and information; 3D visualization, infographics, data narratives, principles of visual data encoding, and interaction techniques. **Prerequisites:** Graduate classification or approval of instructor. **Cross Listing:** CSCE 679/ VIZA 676.

VIZA 677/CSCE 650 Virtual Reality

Credits 3. 2 Lecture Hours. 2 Lab Hours. Theory and practice of virtual reality (VR); interactive 3D virtual environments, immersive technology, perceptual realism, and embodied interaction experience; overview of VR with topics including input devices, output devices, 3D interaction techniques, augmented reality, the role of realism in VR, navigation techniques, design guidelines, and evaluation methods; hands-on experience designing VR experiences emphasizing application, demonstration, or research purposes. **Prerequisites:** Graduate classification or approval of instructor. **Cross Listing:** CSCE 650/ VIZA 677.

VIZA 678 Augmented Reality

Credits 3. 2 Lecture Hours. 2 Lab Hours. Introductory, hands-on experience to Augmented Reality technologies; fundamental techniques, design and implementation of AR through applied user experience. **Prerequisites:** Graduate classification or approval or instructor.

VIZA 679 Advanced Topics in Physically Based Modeling

Credits 3. 2 Lecture Hours. 2 Lab Hours. Current research and advanced methods in choreographing motion for animation using a physics-based approach; mainstream research literature in animation; theoretical and methodological topics addressed, through both study and implementation. May be taken twice. **Prerequisite:** Graduate classification or approval of instructor.

VIZA 680 Professional Practice in Visualization

Credits 3. 3 Lecture Hours. Preparation of a portfolio, creating an internet presence, use of social media, interviews, negotiation, business practices, and fundamentals of teaching; professional practice in pursuit of career paths for the Master of Fine Arts in Visualization. **Prerequisites:** Graduate classification in visualization or approval of instructor.

VIZA 681 Seminar

Credit 1. 1 Lecture Hour. Survey of visualization-related disciplines, theories, methods, facilities and resources; reports and discussion of current works in progress; review of selected published scholarly articles; presentations on graduate pedagogy and teaching methodology.

VIZA 682 Graduate Capstone

Credits 2. 2 Lecture Hours. 1 Lab Hour. Integration of core methodologies in a focused research problem and/or projects in visualization; communication of research proposal and results; applied documentation of the final project or body of work reflecting aesthetic sophistication and technical expertise and applied design. **Prerequisites:** Graduate classification.

VIZA 684 Professional Internship

Credits 3. 3 Lecture Hours. Practical experience in a studio/museum/gallery setting working with allied professionals; minimum fifteen week internship with a minimum of 600 hours continuous employment; departmental pre-approval through the departmental internship coordinator required; post approval evaluation conducted following the internship. May not be repeated for credit.

VIZA 685 Directed Studies

Credits 1 to 6. 1 to 6 Other Hours. Individual problems involving application of theory and practice in Visualization. May be repeated for credit. **Prerequisites:** Approval of instructor and department head.

VIZA 688 Graduate Studio

Credits 3. 2 Lecture Hours. 2 Lab Hours. Focus on individual creative research and practice, precisely aimed at examining the conceptual, aesthetic and technical challenges that emerge from artistic creation; one-on-one instruction, group discussion, critique, studio visits from guest artists, and dedicated studio time. May be repeated for credit. **Prerequisites:** Graduate classification and enrollment in Masters of Fine Art in Visualization or approval of instructor.

VIZA 689 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours. Selected topics in an identified field of design communication and/or electronic media. May be repeated for credit.

VIZA 691 Research

Credits 1 to 23. 1 to 23 Other Hours. Research for preparation of MS thesis. **Prerequisites:** Graduate classification in visualization and approval of instructor.

VIZA 693 Professional Study

Credits 1 to 9. 1 to 9 Other Hours. Research and writing combined with MFA studio projects; prepare and present a public exhibition of a final body of work; submit a related scholarly journal paper as approved by the committee chair. May be repeated for credit. **Prerequisites:** Graduate classification in visualization and approval of instructor.

VIZA 701 Introduction to Research in Visual Computing and Interactive Media

Credits 3. 3 Lecture Hours. Introduction to the conduct of research in Visual Computing and Interactive Media; the Ph.D. program faculty and its research programs, academic integrity, literature review, research strategies, and writing; includes a team-based research project leading to a paper ready to submit for publication. **Prerequisite:** Doctoral classification in Visual Computing and Interactive Media.

VLCS - Vet Large Animal Clin Sc

VLCS 601 Interpreting Clinical Evidence

Credits 2. 2 Lecture Hours. Introduction of skills needed for critical appraisal of clinical evidence from research papers, with emphasis on diagnostic, therapeutic, and prognostic studies. **Prerequisite:** Enrollment in the non-thesis Master of Science in Biomedical Sciences or graduate classification.

VLCS 604 Topics in Agricultural and Veterinary Research

Credits 2. 2 Lecture Hours. Focus on group-oriented discussion and presentation of current developments and research topics in agriculture, animal science, and veterinary biomedicine; improvement of professional and research skill sets through opportunities in, but not limited to, public discussion and presentation, understanding and critical evaluation of research topics, data management, and interpretation. **Prerequisites:** Graduate classification.

VLCS 606 Metagenomic Sequencing Informatics I

Credits 3. 3 Lecture Hours. Exploration of metagenomic sequencing informatics for amplicon sequencing data through participation in lectures, discussion of peer-reviewed literature, and hands-on exercises using real sequence data that will result in manuscript submission to a peer-reviewed journal. **Prerequisites:** Graduate classification.

VLCS 681 Seminar

Credit 1. 1 Lecture Hour. Oral communication of current research and selected topics in large animal veterinary medicine and clinical research methodology to include lectures, presentations, interviews, and discussions. **Prerequisite:** Approval of instructor.

VLCS 685 Directed Studies

Credits 1 to 8. 1 to 8 Other Hours. Original investigations of problems in the field of large animal surgery, therapeutics, preventive veterinary medicine or radiology. May be repeated for credit. **Prerequisites:** Approval of instructor.

VLCS 689 Special Topics In...

Credits 1 to 4. 1 to 4 Other Hours. Special topics in an identified area of large animal medicine, surgery, and agriculture. **Prerequisites:** Graduate classification.

VLCS 691 Research

Credits 1 to 23. 1 to 23 Other Hours. Research for thesis.

VLCS 910 Integrated Animal Care II

Credits 2. 1 Lecture Hour. 2 Lab Hours. Foundation in companion animal and large animal veterinary care; focus on day-one veterinary wellness and preventive care and herd-health concepts; exposure includes companion animal species, common large animal species, pocket pets, reptiles, camelids, miniature pigs and birds; clinical application of topics including neonatal care, husbandry practices, animal behavior, parasite prevention, immunization protocols and healthy animal nutrition. **Prerequisites:** Enrollment in the first year of professional DVM curriculum.

VLCS 924 Diagnostic Imaging & Interpretation I

Credits 2. 1 Lecture Hour. 2 Lab Hours. Diagnostic Imaging & Interpretation I. Fundamentals of diagnostic evaluation of radiographic and ultrasonographic images in companion animals; focus on importance of diagnostic and therapeutic imaging. **Prerequisite:** Enrollment in the second year of professional DVM curriculum.

VLCS 925 Diagnostic Imaging & Interpretation II

Credits 2. 2 Lecture Hours. Diagnostic Imaging & Interpretation II. Fundamentals of diagnostic evaluation of radiographic and ultrasonographic images in small and large animals; focus on importance of diagnostic and therapeutic imaging. **Prerequisite:** Enrollment in the third year of professional DVM curriculum.

VLCS 926 Professional & Clinical Skills IV

Credits 3. 1 Lecture Hour. 6 Lab Hours. Professional & Clinical Skills IV. Integration and reinforcement of foundational knowledge offered in concurrent courses through critical thinking exercises, professional skills application activities (ethics/contextual decision-making, leadership, skills for well-being, personal/practice financial literacy, core communication skills), and application of technical skills; opportunities for learning include didactic, hands-on and case-based interactions utilizing simulation, models, animals, actors and case scenarios; part IV of a VI part series. **Prerequisite:** Enrollment in the second year of professional DVM curriculum.

VLCS 930 Advanced Equine Medicine and Surgery

Credits 3. 3 Lecture Hours. Advanced diagnostic techniques and management strategies for species specific disorders of horses. **Prerequisite:** Enrollment in the third year of professional curriculum.

VLCS 931 Advanced Ruminant Medicine and Surgery

Credits 2. 2 Lecture Hours. Advanced diagnostic techniques and management strategies for species specific disorders of ruminant species. **Prerequisite:** Enrollment in the third year of professional curriculum.

VLCS 932 Advanced Ruminant Herd Health and Production

Credits 2. 2 Lecture Hours. Principles needed to provide veterinary services to populations of ruminants including preventive health programs, record keeping and approaches to controlling herd/flock disease outbreak or production shortfalls. **Prerequisite:** Third year veterinary student.

VLCS 940 Large Animal Clinics I

Credits 2. 35 Lab Hours. Student participation with clinical cases in the large animal medicine services of the Veterinary Teaching Hospital. Must be taken two times. **Prerequisite:** Fourth year classification in veterinary medicine or approval of department head.

VLCS 941 Large Animal Clinics II

Credits 2. 35 Lab Hours. Student participation with clinical cases in the large animal surgery services of the Veterinary Teaching Hospital. Must be taken two times. **Prerequisite:** Fourth year classification.

VLCS 945 Advanced Large Animal Clinical Elective

Credits 2. 35 Lab Hours. Student participation with clinical cases for advanced study in selected services from the large animal medicine, surgery, theriogenology and field services of the Veterinary Teaching Hospital. May be taken 12 times. **Prerequisite:** Fourth year classification.

VLCS 948 Large Animal Medicine and Surgery Elective

Credits 1 to 12. 1 to 12 Lecture Hours. In-depth study of selected disease processes in the various disciplines of large animal medicine and surgery will be conducted emphasizing management, diagnostics and medical or surgical treatment. May be repeated for credit. **Prerequisite:** Third year classification in veterinary medicine or approval of department head.

VLCS 953 Large Animal Clinical Skills

Credit 1. 4 Lab Hours. Acquisition of basic technical skills useful in the diagnosis and treatment of large animals in general veterinary practice. Modular one month course. **Prerequisite:** Third year classification in veterinary medicine in good standing.

VLCS 954 Large Animal Medicine

Credits 6. 5 Lecture Hours. 4 Lab Hours. Medical disease of large animals; pathophysiology, diagnosis and therapy of diseases in large animals. **Prerequisite:** Third year classification in veterinary medicine in good standing.

VLCS 956 Large Animal Diagnostics & Therapeutics I

Credits 3.5. 3.5 Lecture Hours. Large Animal Diagnostics & Therapeutics I. Foundational content for the diagnosis, treatment and prevention of common diseases and conditions of horses, cattle, sheep, goats, pigs and poultry; promotes successful entry into large animal and rural practice. **Prerequisite:** Enrollment in the third year of professional DVM curriculum.

VLCS 957 Large Animal Diagnostics & Therapeutics II

Credits 3.5. 3.5 Lecture Hours. Large Animal Diagnostics & Therapeutics II. Foundational content for the diagnosis, treatment and prevention of common diseases and conditions of horses, cattle, sheep, goats, pigs and poultry; promotes successful entry into large animal and rural practice. **Prerequisite:** Enrollment in the third year of professional DVM curriculum.

VLCS 958 Career-Focus Tracking I - Food Animal

Credits 2. 2 Lecture Hours. Promote integration of previous and concurrent curricular content to diagram successful approaches to developing herd health plans, investigating and controlling herd production shortfalls and investigating disease outbreaks; opportunities to gain experience in communicating effectively with producers in written and verbal formats; didactic and hands-on observation of production systems on farms to offer interactions with producers and veterinary professionals; primary focus on domestic livestock production system components which may be applied to any species population system. **Prerequisite:** Enrollment in the third year of professional DVM curriculum.