REVISED DVM CURRICULUM- 2020

In two meetings of **PVMC- HEC National Curriculum Revision Committee** held in the month of February 2020, a revised DVM curriculum was prepared by the relevant expert subcommittees on each subject. Here are some salient features of the proposed curriculum:

1. The revised curriculum has been aligned with the **global format of curriculum development**.
2. Each course has been described as per the format: **Title, Number, Duration, Credit Hours, Description, Pre-requisites: Goals and Performance Objectives, Contents, Detailed Outline for Theory and Practical, Teaching Learning Strategies, Class Work Policies, and Assessment Strategies.**
3. A textbook has been added for each course.
4. Recommended books have been **updated** for their newer editions or new books have been added.
5. The core curriculum recommendations of **OIE-Day 1 Competencies for veterinary graduates**, **UN One Health Concept**, **Animal Welfare**, and **Global Biorisk Management** curriculum have been included.
6. The courses of Holy Quran Translation and Ethics (for non-Muslim students) have been developed, vetted by relevant faculty in UVAS, and added to the curriculum.

SCHEME OF STUDIES

SR. #	COURSE CODE	COURSE TITLE	CREDIT HOURS	PAGE #
		SEMESTER ONE		
1	ANAT	Veterinary Anatomy-I	3 (1-2)	
2	ANAT	General Veterinary Histology	2 (1-1)	
3	PHYS	Veterinary Physiology-I	3 (2-1)	
4	BIOC	Biochemistry	4 (3-1)	
5	MATH	Mathematics	2 (2-0)	
6	ENGL	English-I (Functional English)	2 (2-0)	
7	SOSC	Islamic Studies/ Ethics	1 (1-0)	
8	LPRO	Animal Welfare and Ethics	2 (2-0)	
9	SOSC	Holy Quran Translation-I/ Ethics-I	1 (1-0)	
		TOTAL	**30**	
		SEMESTER TWO		
1	ANAT	Veterinary Anatomy-II	3 (1-2)	
2	ANAT	Systemic Veterinary Histology and Embryology	3 (2-1)	
3	PHYS	Veterinary Physiology-II	4 (3-1)	
4	ENGL	English-II (Communication Skills)	2 (2-0)	
5	MICR	General Veterinary Microbiology	3 (2-1)	
6	PPRO	Introduction to Poultry Production	1 (1-0)	
7	LPRO	Fundamentals of Livestock Production	2 (1-1)	
8	SOSC	Pakistan Studies	1 (1-0)	
		TOTAL	**31**	
		SEMESTER THREE		
1	NUTR	Principles of Animal Nutrition	3 (2-1)	
2	PHRM	General and Systemic Pharmacology	4 (3-1)	
3	PATH	General Veterinary Pathology	3 (2-1)	
4	PARA	General Veterinary Parasitology and Protozoology	3 (2–1)	
5	MICR	Veterinary Immunology	2 (1-1)	
6	BIOL	Molecular Biology	2 (1-1)	

7	ZOOL	Lab and Zoo Animal Management	1 (0-1)	
8	SOSC	Anthropology	1 (1-0)	
9	SOSC	Holy Quran Translation-II/ Ethics-II	1 (1-0)	
		TOTAL	**34**	
		SEMESTER FOUR		
1	NUTR	Livestock Feed Resources and Forage Conservation	3 (2-1)	
2	PHRM	Veterinary Chemotherapy and Toxicology	4 (3-1)	
3	MICR	Veterinary Bacteriology and Mycology	3 (2-1)	
4	PATH	Systemic Veterinary Pathology	3 (2-1)	
5	PARA	Veterinary Helminthology	4 (3–1)	
6	LPRO	Animal Breeding and Genetics-I	2 (1-1)	
		TOTAL	**31**	
		SEMESTER FIVE		
1	NUTR	Poultry Nutrition and Feed Technology	2 (1-1)	
2	LPRO	Animal Breeding and Genetics-II	3 (2-1)	
3	PATH	Veterinary Clinical Pathology	1 (0-1)	
4	PARA	Veterinary Entomology and Acarology	3 (2–1)	
5	MICR	Veterinary Virology	3 (2-1)	
6	MICR	Biorisk Management (BRM)	2 (1-1)	
7	THER	Veterinary Reproductive Physiology	3 (2-1)	
8	MEDI	Veterinary Internal Medicine-I	3 (3-0)	
9	SOSC	Holy Quran Translation-III/ Ethics-III	1 (1-0)	
		TOTAL	**35**	
		SEMESTER SIX		
1	EPID	Zoonosis and Food Safety	3 (2-1)	
2	LPRO	Principles of Dairy Production	3 (2-1)	
3	MEDI	Veterinary Internal Medicine-II	3 (3-0)	
4	PATH/APTC	Meat Inspection and Necropsy Practice	3 (2-1)	
5	SURG	Diagnostic Imaging	2 (1-1)	
6	THER	Obstetrics and Genital Diseases	3 (2-1)	
7	MEDI	Medicine Clinic-I	1 (0-1)	
8	SURG	Surgery Clinic-I	1 (0-1)	
9	THER	Theriogenology Clinic-I	1 (0-1)	
		TOTAL	**36**	
		SEMESTER SEVEN		
1	LPRO	Beef and Mutton Production	2 (1-1)	
2	MEDI	Veterinary Internal Medicine-III	3 (3-0)	
3	SURG	Anaesthesiology and Intensive Care	1 (0-1)	
4	THER	Reproductive Biotechnology	2 (2-0)	
5	PPRO	Commercial Poultry Production	2 (1-1)	
6	STAT	Bio-statistics	3 (2-1)	
7	MEDI	Medicine Clinic-II	1 (0-1)	
8	SURG	Surgery Clinic-II	1 (0-1)	
9	THER	Theriogenology Clinic-II	1 (0-1)	
10	SOSC	Holy Quran Translation-IV/ Ethics-IV	1 (1-0)	
		TOTAL	**31**	
		SEMESTER EIGHT		
1	PPRO	Breeder and Hatchery Management	3 (2-1)	
2	EPID	Veterinary Epidemiology and Public Health	3 (2-1)	

3	SURG	Small Animal Surgery	3 (2-1)	
4	AQUA	Fisheries and Aquaculture	1 (0-1)	
5	MEDI	Medicine Clinic-III	2 (0-2)	
6	SURG	Surgery Clinic-III	2 (0-2)	
7	THER	Theriogenology Clinic-III	2 (0-2)	
8	EXT	Livestock Extension Education	2 (2-0)	
		TOTAL	**38**	
		SEMESTER NINE		
1	LEBM	Entrepreneurship	1 (0-1)	
2	DTECH	Dairy Technology	2 (1-1)	
3	PATH	Poultry Pathology	3 (2-1)	
4	SURG	Large Animal Surgery and Shoeing	4 (3-1)	
5	MEDI	Medicine Clinic-IV	2 (0-2)	
6	SURG	Surgery Clinic-IV	2 (0-2)	
7	THER	Theriogenology Clinic-IV	2 (0-2)	
		TOTAL	**36**	
		SEMESTER TEN		
1	ENGL	English- III (Technical Report Writing and Presentation)	2 (2-0)	
2	LEBM	Livestock Economics and Business Management	2 (2-0)	
		INTERNSHIP		
		TOTAL	**4 (4-0)**	
		GRAND TOTAL	**306**	

Note: Institutions can add up to 15 credit hour courses to match their circumstances and strengths.

SEMESTER-I

Course Title: Veterinary Anatomy-I
Course Number: ANAT 02101
Course Duration: 1 semester (16 weeks)
Credit Hours: 3(1-2)

Course Description:

The course includes the anatomical description of components of skeletal systems followed by the demonstration of muscular system. It also includes the description of some of the higher concepts such as the description of components of joints, integumentary system, lymphatic system, endocrine system, and special senses. It will also impart the understanding of the relationship of different components of musculoskeletal system to the surface of the body of an animal.

Course Pre-requisites:

FSc. Pre Medical

Course Goals and Performance Objectives:

Goal 1: Understanding of the anatomical terminology and nomenclature.
Objective: Define and describe directional terms and bone surface modifications

Goal 2: Understanding of the structural components of an animal**.**
Objective 1: Describe structure and relationship of bones, joints, muscles, nerves and blood vessels of forelimb and hindlimb (Practical only).
Objective 2: Describe structure of components of common integument, lymphatic system, endocrine system, nervous system and sense organs.

Goal 3: Understanding of the location of components of musculoskeletal system on the body surface.
Objective: Indicate topographical location of components of musculoskeletal system on live animals (Practical only).
Course Contents:

Theory:
Introduction to anatomy; definitions and branches, body points; general body points of ox, horse, and dog (add animals of regional importance), anatomical terminology; directional terms, planes, bone surface modifications, Osteology; structure of bone, classes of bones and comparative aspects, myology; types, structure, naming conventions of muscles and associated structures, and comparative aspects, arthrology; structural and functional classification of joints, structure of synovial joints, gait mechanics; statics and dynamics, types of natural gaits and comparative aspects, integumentary system; Skin and its modifications, mammary apparatus, hoof, claw, digital pads, horn & hair, lymphatic system; lymph centers, lymph nodes and lymphatic channels, CNS; brain and spinal cord, PNS; ganglia, nerves, autonomic nervous system, special senses; ear and eye. Emphasis on species; name the animal not just the species

Practical:
Introduction to anatomy, branches of anatomy, terminology, anatomical planes and directional terms, comparative anatomy of forelimb region (equine, ruminant, canine): osteology of forelimb, arthrology of forelimb, myology of shoulder, brachium, antebrachium and digital regions; blood vessels of the forelimb, their scheme and identification; nerves of the forelimb, their scheme and identification, comparative anatomy of hind limb region (equine, ruminant, canine): osteology of hind limb, arthrology of forelimb, myology: myology of croup, thigh and leg regions; blood vessels of the hind limb, their scheme and identification; nerves of the hind limb, their scheme and identification, anatomy of equine distal limb, comparative anatomy of skull (equine, ruminant, canine), brain and spinal cord, udder, hoof & horn, topography/surface anatomy of forelimb and hind limb regions.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Introduction to anatomy	Introduction to Anatomy, Branches of Anatomy
2	Body points	Anatomical Planes, Directional Terms and Bony Marking
3	Terminology	Clavicle & Scapula
4	Osteology I	Humerus
5	Osteology II	Radius + Ulna
6	Myology I	Carpals
7	Myology II	Metacarpals + Phalanges
8	Arthrology	Forelimb arthrology
9	Gait mechanics	Myology of Shoulder Region
10	Common Integument I	Myology of Brachium Region
11	Common Integument II	Myology of Antebrachium Region
12	Lymphatic system	Blood Vessels of the Forelimb (Scheme+ Identification)
13	CNS	Nerves of the Forelimb (Scheme+ Identification)
14	PNS	Stage 1 Evaluation (Entire forelimb)
15	Sense Organs	Anatomy of Pelvic girdle (OsCoxae)
16	Endocrine System	Anatomy of Femur
17		Anatomy of Tibia & Fibula
18		Anatomy of Tarsals
19		Anatomy of Metatarsals
20		Joints of Hind limb
21		Myology of Croup Region
22		Myology of Thigh Region

23		Myology of Hind leg Region	
24		Blood Vessels of the Hind limb (Scheme+ Identification)	
25		Nerves of the Hind limb (Scheme+ Identification)	
26		Anatomy of Equine Distal Limb	
27		Anatomy of Skull (Dorsal & Lateral Surface)	
28		Anatomy of Skull (Occipital &Ventral Surface)	
29		Anatomy of Hoof and Horn	
30		Ear, Eye, Horn	
31		Brain, Spinal cord, Udder	
32		Topography (Osteology)	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Assignments	Presentations
Quiz	Group Discussions
	Assignments

Class Work Policies:

- Equal opportunity
- Intellectual honesty
- Regularity and punctuality
- Adherence to deadlines
- Fairness
- Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50%	50%	

Textbook:

1. Koenig, H. E. and H-G. Liebich, 2020. Veterinary Anatomy of Domestic Animals, Text book and Colour Atlas. 7th edition. Thieme, .

Recommended Books/Readings:

1. Pasquini C. T. Spurgeon, and S. Pasquini, 2007. Anatomy of Domestic Animals –Systemic and Regional approach. 11th edition. Soudz, U.S.A.
2. Getty, R., S. Sisson and J. D. Grossman, 1986. The Anatomy of the Domestic Animals. W.B. Saunders Co. Philadelphia, U.S.A.
3. Miller, M.E., 2000. Guide to the dissection of the Dog. Edwards Brothers, Ithaca, New York, U.S.A.
4. Philiph, G.D., 1988. Guide to Ruminant Anatomy Based on the Dissection of the Goat. Iowa State University Press. Ames, U.S.A.
5. Haward. E. and D. Alexander, 2000. Guide to the Dissection of the Dog. W.B. Saunders Co. U.S.A.

Course Title: General Veterinary Histology
Course Number: ANAT 02102
Course Duration: 1 semester (16 weeks)
Credit Hours: 2 (1-1)

Course Description:
This course is aimed at understanding the microarchitecture of the tissues building up the animal body. It begins with detailed description of the organelles in an animal cell with a particular focus that how these organelles are contributing to the appearance of the tissues in H&E stained tissue sections. Moving further the learners are told about the detailed microarchitecture of four basic tissues of animal body including epithelium, connective, muscular and nervous tissue. The course will enable students to understand the microarchitecture of the systems and their physiology and will also provide a basis for understanding the pathology in the forthcoming semesters.

Course prerequisites:
F.Sc. Pre Medical or equivalent

Course Goals and Performance Objectives:

Goal 1: To understand the basics of cytology

Objective 1: Student will be able to describe the organelles/ultrastructure of an animal cell in detail.
Objective 2: Student will be able to describe that how does the inner architecture of a particular cell type contribute to the appearance of tissue sections under microscope.

Goal 2: To understand the microarchitecture of basic tissue in an animal body.

Objective 1: Identify the histological features of four basic tissues of animal body.
Objective 2: Describe the histological features of four basic tissues of animal body.
Objective 3: Development of comparison amongst the four basic tissues of body on the basis of their histological features.

Course Contents:

Theory:
Ultrastructure of cell, epithelial tissue: morphology and classification of types of surface epithelia and glandular epithelia, connective and supportive tissue: cells and fibers of connective tissue, microscopic study of different types of supportive connective tissue, light microscopic study of avian and mammalian blood, muscular tissue: light and fine microscopic structure of skeletal, cardiac, smooth muscle fibers, nervous tissue: light and fine microscopic structure of nervous tissue cells, neuron, ganglion and nerve.

Practical:
Microscopy: different parts of microscope and practical use of microscope, slide preparation: practical demonstration of tissue processing techniques and staining procedures. Identification of different cell organelles in electron micrographs, epithelium: identification of different types of surface and glandular epithelium, connective tissue: identification of different types of cells, fibers of connective tissue and different types of proper and supportive connective tissue, blood: identification of different types of blood cells, muscular tissue: identification of different tissue sections of skeletal, cardiac and smooth muscle fibers under light microscope, nervous system: identification of neuron, neuroglia, central and peripheral nervous system: brain, spinal cord and peripheral nerves.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Introduction to histology, its different branches and its applications. Cytology; Ultrastructure of cell; a general overview of Cell membrane,	Microscope

	nucleus, nuclear envelope, nucleoplasm, nucleoli		
2	Cytology; Rough and smooth endoplasmic reticulum, Ribosomes, Golgi complex, Lysosomes, mitochondria, peroxisomes.	Tissue Processing Techniques; (Fixation till sectioning)	
3	Cytology; Cytoskeleton microtubules, microfilaments, intermediate filaments, inclusion bodies, cell division.	Tissue Processing Techniques; H&E Staining and interpretation of H&E stained tissue sections	
4	Epithelial tissue; histological features and classification of simple epithelia (squamous, cuboidal, columnar), Pseudostratified columnar epithelium, transitional epithelium.	Surface Epithelium (Simple epithelia)	
5	Epithelial tissue; histological features and classification of stratified epithelia (stratified squamous, stratified cuboidal, stratified columnar epithelium)	Surface Epithelium (Stratified epithelia)	
6	Epithelial tissue; morphology and classification of glands (classification based on morphology, secretions and mode of secretion)	Glandular Epithelium	
7	Cell Junctions (Definition, Classification (Desmosomes, Gap junction and tight junction)	Evaluation	
8	Connective tissue; CT cells, fibres, ground substance, Classification; Loose CT, Dense CT, Adipose tissue, Reticular, Embryonal	Proper Connective Tissue (Loose, Dense Connective Tissue)	
9	Connective tissue; Blood; formed elements (Platelets, RBCs, and Leukocytes)	Specialized Connective Tissue (Cartilage)	
10	Connective tissue; (Cartilage) Histology, classification and chondrogenesis	Specialized Connective Tissue (Bone)	
11	Connective tissue; (Bone) Histology, classification, Osteogenesis	Specialized Connective Tissue (Ossification)	
12	Muscular Tissue; Light and electron microscopic features of skeletal smooth and cardiac muscles, mechanism of contraction in muscles, red, and white muscle fibers	Specialized Connective Tissue (Blood)	
13	Muscular Tissue; Light and electron microscopic features of smooth and cardiac muscles	Muscular tissue	
14	Nervous tissue, light and electron microscopic features of neuron and its classification. Microscopic feature of neurons, nerve fibers, ganglia, synapse and neuroglial cells.	Nervous tissue	
15	Nervous system, central nervous system (light microscopic features of brain and spinal cord) peripheral nervous system (longitudinal and transverse section of peripheral nerve)	Nervous tissue	
16	Four Basic Types of Body Tissues (Quiz + Revision)	Evaluation	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Assignments	Group Discussions/Activities

Quiz	Assignments

Class Work Policies:

- Equal opportunity
- Intellectual honesty
- Regularity and punctuality
- Adherence to deadlines
- Fairness
- Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	2	6	12	20	10	10	20

Text book:

1. Eurell, J. A., and B. L. Frappier, 2020. Dellmann's Textbook of Veterinary Histology, 7th edition, Wiley-Blackwell, UK.

Recommended books:

1. Samuelson, D.A., 2007. Textbook of Veterinary Histology, Saunders Elseviers, USA.
2. Bacha, W.J. and L.M. Bacha, 2012. Color Atlas of Veterinary Histology, 3rd Ed., Wiley Blackwell, USA.
3. Qureshi, A. S. and M.N. Chaudhry, 2007. Illustrated Vet. Histology, MAS Publishers, Faisalabad.
4. McGaedy, T.A., P.J. Quinn, E.S. Fitzpatrick, and M.T. Ryan, 2006. Veterinary Embryology, Blackwell Publishing, UK.
5. Kuehnel, W., 2003. Color Atlas of Cytology, Histology and Microscopic Anatomy, 4th Ed., Thieme Stuttgart, New York.
6. Eroschenko, V.P., 2012. diFiore's Atlas of Histology: with Functional Correlations, 12th Ed., Lippincott Williams & Wilkins, USA.

Course Title: Veterinary Physiology-I
Course Number: PHYS 02104
Course Duration: 1 Semester
Credit Hours: 3 (2-1)

Course Description

The course is describing the physiological anatomy and physiological mechanisms of homeostasis, feedback control, cardiovascular and circulatory system as well as respiratory system in domestic animals along with clinical correlations of selected problems in domestic animals.

Course Pre-requisites

FSc. (Pre-Medical)

Course Goals and Performance Objectives

Goal: To familiarize the students with the functioning of homeostatic and feedback mechanisms with special reference to cardiovascular, circulatory and respiratory systems
Objective 1: To describe the components of cardiovascular system and its functioning
Objective 2: To describe the components of blood and its functioning
Objective 3: To describe the components of nervous system and its functioning

Objective 4: To describe the components of respiratory system and its functioning
Objective 5: To describe the pathophysiology of common disorders of domestic animals

Course Contents

Theory:
Homeostasis and Feedback control: Cell and cell membrane transport system, Neuron, Action potential, Synapse and synaptic transmission, Neurotransmitters, Neurophysiology of skeletal and smooth muscles, Excitation-contraction coupling mechanism, Nervous system: Central and peripheral nervous systems, Upper and lower motor neurons, Physiology of Reflex Arc, Autonomic nervous system; Parasympathetic and sympathetic divisions, Types of receptors and their properties, Anatomical divisions of brain and functions of each part.
Cardiovascular System: Blood composition, blood cells genesis and differentiation, Structure and synthesis of hemoglobin, its types and iron metabolism, Functions of Neutrophils, Basophils, Eosinophils, Monocyte-Macrophage system and their role against infection, Reticulo-endothelial system, Resistance of body to infection, Lymphocytes and immunity (Humoral and Cell-mediated immunity), Blood groups, Blood transfusion and its complications, Mechanism of blood coagulation, Fibrinolytic system, Clinical correlations (Anemia, polycythemia, allergy and hypersensitivity, jaundice, hemophilia).
Circulatory Physiology: Circulation and its characteristics, Biophysics of hemodynamics, Circulation: General; systemic and regional circulation; Coronary, skeletal muscle, splenic, Fetal and Pulmonary Circulation, Microcirculation and fluid exchange. Blood Pressure, neural and hormonal control of blood pressure and blood volume, Local control of blood pressure and flow. Physiology of Lymphatic system channel of body, formation of lymph; Role of lymphatic system in controlling interstitial fluid protein, volume and pressure. Cardiac cell properties and energy requirements, physiological basis of cardiac cycle; Relationship of heart sounds to heart pumping, Regulation of cardiac activity. Rhythmical excitation of heart; electrophysiology of heart; Characteristics of normal electrocardiogram. Clinical correlations (edema formation, circulatory shock, electrocardiographic interpretation of cardiac muscle and coronary blood flow abnormalities)**.**
Respiratory system: Functional anatomy of respiratory system, Mechanism of pulmonary ventilation, Pulmonary volume and capacities, Physical principles of gas exchange, Respiratory membrane and diffusion of different gases through it, Fetal gas exchange, Factors affecting rate of gas diffusion, Role of surfactants, Pleural cavity, Regulation of transport of Oxygen and Carbon Dioxide in blood, lungs and tissues, Neural and hormonal control of respiration. Clinical correlations (pulmonary edema, emphysema and hypertension, CO poisoning, hypoxia).

Practical:
Methods of handling and restraining of different animals for blood collection, body temperature, pulse. Sites of Blood collection in different animal species, precautions while blood collection. Blood Collection. Different type of anticoagulants used routinely and their mechanisms of action. Practical demonstration of measurement of body temperature, pulse, respiration rate in different domestic animals. Determination of Total Red Blood Cell count (animal or human source). Determination of Total White Blood Cell count (animal source). Determination of Packed Cell Volume, Haemoglobin concentration, Coagulation and bleeding time, Erythrocyte Sedimentation Rate, Differential Leukocyte Count, Blood Groups. Determination of lung capacities and volumes. Identification of reflexes in frog, Pithing and stunning of frog, Nerve muscle preparation.

Detailed Course Outline

No	Theory Lecture Split	Practical Session Split
1	Blood composition, blood cells genesis and differentiation, Structure and synthesis of hemoglobin, its types and iron metabolism	Physiology laboratory basics
2	Functions of Neutrophils, Basophils, Eosinophils, Monocyte-Macrophage system	Methods of handling and restraining of different animals for blood collection, body temperature,

	and their role against infection, Reticulo-endothelial system	pulse. Sites of Blood collection in different animal species, precautions while blood collection
3	Resistance of body to infection, Lymphocytes and immunity (Humoral and Cell-mediated immunity)	Different type of anticoagulants used routinely and their mechanism of actions. Determination of Total Red Blood Cell count (animal or human source).
4	Blood groups, Blood transfusion and its complications, Mechanism of blood coagulation	Determination of Total White Blood Cell count (animal source).
5	Fibrinolytic system, Clinical correlations (Anemia, polycythemia, allergy and hypersensitivity, jaundice, hemophilia)	Determination of Packed Cell Volume
6	Circulation and its characteristics, Biophysics of hemodynamics	Haemoglobin concentration
7	Circulation: General; systemic and regional circulation; Coronary, skeletal muscle, splenic, Fetal and Pulmonary Circulation	Coagulation and bleeding time
8	Microcirculation and fluid exchange	Erythrocyte Sedimentation Rate
9	Blood Pressure, neural and hormonal control of blood pressure and blood volume, Local control of blood pressure and flow	Differential Leukocyte Count
10	Physiology of Lymphatic system channel of body, formation of lymph; Role of lymphatic system in controlling interstitial fluid protein, volume and pressure	Blood Groups
11	Cardiac cell properties and energy requirements	Erythrocyte Sedimentation Rate
12	Physiological basis of cardiac cycle; Relationship of heart sounds to heart pumping, Regulation of cardiac activity	Interpretation of CBC clinical cases
13	Rhythmical excitation of heart	Determination of lung capacities and volumes
14	Electrophysiology of heart; Characteristics of normal electrocardiogram	Ocular Reflexes
15	Clinical correlations (edema formation, circulatory shock, electrocardiographic interpretation of cardiac muscle)	Identification of reflexes in frog
16	Midterm	Pithing and stunning of frog ; Nerve muscle preparation
17	Cell and cell membrane transport system	
18	Neuron, Action potential, Synapse and synaptic transmission, Neurotransmitters	
19	Neurophysiology of skeletal and smooth muscles	
20	Excitation-contraction coupling mechanism	
21	Nervous system: Central and peripheral nervous systems, Upper and lower motor	

	neurons	
22	Physiology of Reflex Arc	
23	Autonomic nervous system; Parasympathetic and sympathetic divisions, Types of receptors and their properties	
24	Anatomical divisions of brain and functions of each part	
25	Functional anatomy of respiratory system	
26	Mechanism of Pulmonary ventilation, Pulmonary volume and capacities	
27	Physical principles of gas exchange Respiratory membrane and diffusion of different gases through it, Fetal gas exchange	
28	Factors affecting rate of gas diffusion, Role of surfactants, Pleural cavity	
29	Regulation of transport of Oxygen and Carbon Dioxide in blood, lungs and tissues	
30	Neural control of respiration	
31	Hormonal control of respiration	
32	Clinical correlations (pulmonary edema, emphysema and hypertension, CO poisoning, hypoxia)	

Teaching Learning Strategies

Theory:	**Practical**
Lectures	Performance
Presentations	Group Discussions
Assignments	Assignments
Quiz	

Class Work Policies

- Equal opportunity
- Intellectual honesty
- Adherence to deadlines
- Fairness

Assessment Strategies

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	04	12	24	40	10 (Class performance + evaluation + viva)	10	20

Textbook

1. Cunningham, J.G. and B. G. Klein, 2018. Textbook of Veterinary Physiology. 6th Edition. WB Saunders Company, USA.

Recommended Books/Readings

1. Dukes, H.H., M.J. Swenson and W.O. Reece, 2004. Duke's Physiology of Domestic Animals. 12th Edition, Comstock Publishing, USA.
2. Costanzo, L., 2008. Physiology. 4th Edition, Elsevier Publishing, USA.

3. Guyton, A.C. and J.E. Hall., 2006. Textbook of Medical Physiology. 11th Edition. WB Saunders Company, USA.
4. Barreet, K.E., S.M. Barman, S. Boitano and H.L. Brooks, 2006. Ganong's Review of Medical Physiology. 23rd Edition. Appleton and Lange, USA.
5. Sjaasted, O.V., K. Hove, O. Sand, 2003. Physiology of Domestic Animals. Ist Edition.

Course Title: Bio-risk Safety and Management
Course Number: MICR 02105
Course Duration: 1 Semester
Credit Hours: 2 (1-1)

Course Description

The course is describing the basics of biorisks. It introduces DVM students to the principles of identification and mitigation of biorisks in laboratory and field settings.

Course Pre-requisites

FSc. (Pre-Medical)

Course Goals and Performance Objectives

Goal: To familiarize the students with the concepts of biorisks, biosecurity, biosafety
Objective 1: To describe the components of biorisk
Objective 2: To describe the components of biosecurity
Objective 3: To describe the components of biosafety
Objective 4: To describe the procedure of biorisk mitigation and management

Coure contents:

Theory:

Introduction to Dual use research of concern, Introduction to Incident Management & Response and Administrative Controls for Biorisk Mitigation, Biorisk Characterization & Evaluation, Biosafety Risk Assessment, Biorisk Mitigation Strategies, Good Laboratory Work Practices & Personal Protective Equipment. Laboratory Biosecurity, Field Biosecurity: Best practices for biosecurity at poultry and livestock facilities, Trans-boundary diseases, Trans-boundary incursion of infectious disease pathogens under field conditions and decontamination procedures, Fundamentals of Facility Operations and Facility Maintenance, Developing and Validating Standard Operating Procedures (SOPs), The main transmission routes for toxins, pathogens, and resistance genes; Human-animal-plant-environmental routes of exposures to toxins, pathogens, and resistance genes, as well as vector-borne, water-borne and airborne cycles, Characterizing the etiology, evolution, and ecology of infectious disease agents of people, animals, and plants that are of importance to health, Basic understanding of pre- and post- production food safety, Writing & Communicating Biorisk Management Policy, Identifying Legal Requirements that Impact Biorisk Management, Epidemiologic principles used to characterize problems that involve human, animal, plant and environmental component

Practical:

Establishing Work Program Review & Approval, Establishing Goals, Objectives, Roles, & Responsibilities in Biorisk Management, Managing Human Performance in the Biorisk Management Workforce, Establishing & Maintaining Worker Health Programs, Understanding & Maintaining Facilities & Equipment for Biorisk Management, Basic Features & Maintenance for Physical and Information Security Measures, Building and managing a trans-disciplinary team and apply principles to conduct ethical, scientifically sound research that will inform policy, Developing a plan to translate research findings and new discoveries into health policies, community programs, interventions, and public education in a manner that is sustainable, culturally relevant, and economically feasible, Incident Response: Developing action plan and its Preparation, Incident Response: after action reporting, Evaluation & Improvement, Developing, Conducting, and Maintaining a Hazard

Inventory, Measurement and Analysis of Biorisk Management System Performance, Conducting Audits, and inspections to Assess Biorisk Management Performance, Laboratory Building Systems: Laboratory Design Best Practices, Laboratory Design Process and Programming and Pre-Design, Laboratory Operations and Maintenance Support Systems- Using the Tools of Operations, Sampling procedures for highly infectious pathogens of concern under field conditions, Practical exercise on use of PPE and decontamination procedures under field conditions.

Detalied Course contents:

No	Theory Lecture Split	Practical Session Split
1.	Introduction to Dual use research of concern	Establishing Work Program Review & Approval
2.	Introduction to Incident Management & Response and Administrative Controls for Biorisk Mitigation	Establishing Goals, Objectives, Roles, & Responsibilities in Biorisk Management
3.	Biorisk Characterization & Evaluation, Biosafety Risk Assessment, Biorisk Mitigation Strategies	Managing Human Performance in the Biorisk Management Workforce
4.	Good Laboratory Work Practices & Personal Protective Equipment. Laboratory Biosecurity	Establishing & Maintaining Worker Health Programs
5.	Field Biosecurity: Best practices for biosecurity at poultry and livestock facilities	Understanding & Maintaining Facilities & Equipment for Biorisk Management
6.	Trans-boundary diseases	Basic Features & Maintenance for Physical and Information Security Measures
7.	Trans-boundary incursion of infectious disease pathogens under field conditions and decontamination procedures	Building and managing a trans-disciplinary team and apply principles to conduct ethical, scientifically sound research that will inform policy
8.	Fundamentals of Facility Operations and Facility Maintenance	Developing a plan to translate research findings and new discoveries into health policies, community programs, interventions, and public education in a manner that is sustainable, culturally relevant, and economically feasible
9.	Developing and Validating Standard Operating Procedures (SOPs)	Incident Response: Developing action plan and its Preparation
10.	Hazard & Risk Communication in the Laboratory. Biological Waste Disposal	Incident Response: after action reporting, Evaluation & Improvement
11	The main transmission routes for toxins, pathogens, and resistance genes; Human-animal-plant-environmental routes of exposures to toxins, pathogens, and resistance genes, as well as vector-borne, water-borne and airborne cycles	Developing, Conducting, and Maintaining a Hazard Inventory
12	Characterizing the etiology, evolution, and ecology of infectious disease agents of people, animals, and plants that are of importance to health	Measurement and Analysis of Biorisk Management System Performance, Conducting Audits, and inspections to Assess Biorisk Management Performance
13	Basic understanding of pre- and post-production food safety	Laboratory Building Systems: Laboratory Design Best Practices, Laboratory Design Process and Programming and Pre-Design
14	Writing & Communicating Biorisk Management Policy	Laboratory Operations and Maintenance Support Systems- Using the Tools of Operations

15	Identifying Legal Requirements that Impact Biorisk Management	Sampling procedures for highly infectious pathogens of concern under field conditions
16	Epidemiologic principles used to characterize problems that involve human, animal, plant and environmental component	Practical exercise on use of PPE and decontamination procedures under field conditions

Text Book:

1. **The Global Biorisk Management Curriculum*, Sandia National Laboratories, New Mexico, USA 2017.**

Recommended Books:

1. CWA 15793:2011* – Laboratory biorisk management standard (+ CWA 16393* guidance)
2. World Health Organization Laboratory Biosafety Manual*
3. World Health Organization Laboratory Biosecurity Manual*
4. OECD Best Practice Guidelines for Biological Resource Centres*
5. Guidelines for Biosafety Laboratory Competency (MMWR Supplement Vol. 60)*
6. U.S. Biosafety in Microbiological and Biomedical Laboratories*
7. The world health report 2007 - A safer future: global public health security in the 21st century*
8. Local guidelines & regulations

*publically available.

Course Title: Biochemistry
Course Number: BIOC-02106
Course Duration: 1 semester (16 weeks)
Credit Hours: 4 (3-1)

Course Description:

This is a basic introductory course of Biochemistry for the DVM students. The purpose of this course is to explain what Biochemistry is about and to appreciate its role in life sciences.

Course Pre-requisites:

FSc (Pre-Medical)

Course Goals and Performance Objectives:

Goal: The course aims to provide the basic understanding of the core principles and to understand the relationship of Biochemistry to health and disease

Objective: The students will be able to define, describe and comprehend the basic biochemical reactions pathways, cycles and their relationship with one another and homeostasis of the organisms.

Course Contents:

Theory:

The pH & its importance, Buffer, Henderson-Hasselbalch equation, **Carbohydrates:** Introduction to carbohydrates, Classification of carbohydrates, Glycosidic linkages & Glycosides, Isomers, Optical activity & rotations, Chemical properties of monosaccharides, structure and functions of important monosaccharide, Homopoly saccharide, Heteropoly saccharides, **Proteins**: Introduction to Proteins, Classification of proteins, Structure and Classification of amino acids, Amphoteric properties of amino acids, Concept of Isoelectric pH, Peptide Linkage, Primary, Secondary, Tertiary and Quaternary structure of proteins, **Enzymes;** General Characteristics and classification of enzyme, Enzyme Kinetics **Lipids**: Introduction to Lipids, structure & classification of fatty acids, nomenclature of fatty acids, Physical properties of fatty acids and triglycerides, Chemical Properties of fatty acids and triglycerides, Sterols and cholesterol, Prostaglandin and their physical

role, **Carbohydrate metabolism**: Glycolysis, regulation, energy production, Kreb's Cycle, regulation, energy production, Electron Transport Chain, Pentose phosphate shunt, Gluconeogenesis, **Protein metabolism**: Degradation of Proteins and amino acids, Urea cycle and its importance, Urea toxicity, Regulation of urea cycle, Bioenergetics of protein metabolism, **Lipid metabolism:** Beta oxidation of even and odd chain fatty acids, Biosynthesis of fatty acids, Biosynthesis of triglycerides, Biosynthesis of Cholesterol, Biosynthesis of Ketone bodies, **DNA metabolism:** Biosynthesis and Degradation of nucleic acids, Comparative features among animal species of particular relevance, metabolism of mono-gastric and poly-gastric animals, and comparison of metabolism of mono and poly-gastric animals.

Practical:

Preparation of solutions: Preparation of Percentage, Molar and Normal solutions, Preparation of Buffer, Carbohydrate Analysis: Group Identification Test, Identification of mono, di and polysaccharides, Identification of reducing sugars, Identification of ketose sugar and their confirmation by phenylhydrazine test, Identification scheme for carbohydrates, Estimation of glucose in blood sample by glucose oxidase method, Estimation of amino acids by spectrophotometry, Biuret Test and Ninhydrin Test, Precipitation tests of proteins: Precipitation of casein at isoelectric point, salt saturation tests, Serum protein fractionation by electrophoresis, Separation of the colour pigments of Berseem/ alfaalfa by paper chromatography, Identification of lipids, Salkowiski's test

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Aqueous environment of cell, Hydrolysis of water pH scale, Physiological pH of various biological fluids.	Preparation and standardization of percent, molar and normal solutions
2	Buffer, Buffering capacity and important buffers of mammalian system	Prepration and standardization of buffer systems (phosphate, tris, etc.)
3	Henderson – Hassalbach Equation	Colored reactions of Carbohydrates: Identification of mono-, di- and polysaccharides
4	Carbohydrates introduction	Colored reactions of Carbohydrates: Identificaiton of reducing, ketone sugars and their confirmation by phenyl hydrazine test
5	Classification of carbohydrates	Hydrolysis of starch
6	Important mono-, di- and poly- saccharides	Liquid and Gas Chromatography
7	Carbohydrates of ruminants	Thin-Layer Chromatography
8	Properties of Carbohydrates	Paper Chromatography
9	Reactions of Carbohydrates	Saponification and Iodine Value
10	Carbohydrate metabolism, Glycolysis	Calculating lambda max and drawing standard curve
11	Pentose-phosphate pathway	Estimation of unknown concentration of different solutions
12	Fermentation	Estimation of unknown concentration of different solutions
13	Kreb cycle	Estimation of Glucose in blood
14	Glycogenesis	Electrolyte estimation in body fluids
15	Gluconeogenesis	Protein purification by Salting in and out
16	Pyruvate-Alanine and Cori's cycle	Ethanol production by fermentation
17	Regulation of carbohydrate metabolism	
18	Bioenergetics of carbohydrate metabolism	
19	MID TERM	
20	Enzymes and their Classification	
21	Enzyme Kinetics	

22	Factors effecting enzymes	
23	Amino acids and Proteins	
24	Amino acids classification	
25	Protein structural hierarchy	
26	Protein structural hierarchy	
27	Amino acids and Protein catabolism	
28	Urea cycle	
29	Degradation of Carbon skeleton of amino acids	
30	Specialized products of amino acid degradation	
31	Essential and non-essential amino acids	
32	Synthesis of non-essential amino acids	
33	Lipids and their classification	
34	Fatty acids and triglycerides	
35	Fatty acid oxidation	
36	Beta-oxidation	
37	Ketone Bodies	
38	Lipid transport and storage	
39	Biosynthesis of fatty acids	
40	Biosynthesis of cholesterol	
41	Synthesis and role of bile acids and salt	
42	Cellular membranes and lipids	
43	Role of eicosanoids	
44	Role of eicosanoids	
45	Nucleotides structure and Function	
46	Metabolism of purines	
47	Metabolism of pyrimidine	
48	Metabolic errors	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	

Class Work Policies:

- Equal opportunity
- Intellectual honesty
- Regularity and punctuality
- Adherence to deadlines
- Fairness
- Conformity to discipline

Assessment Strategies:

	Theory (60)				**Practical (20)**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10% **(06)**	30% **(18)**	60% **(36)**	**60**	50% (Mini project + Class performance + Visits)	50% **(10)**	**20**

					(10)		

Textbook:

1. Nelson, D.L. and M.M. Cox., 2021. Lehninger Principles of Biochemistry, 8th Edition, W. H. Freeman & Company, New York, USA.

Recommended Books/Readings:

1. Boyer, R.F., 2014. Modern Experimental Biochemistry. 3rd Edition. The Benjamin / Cummings Publishing Co., USA
2. Stryer, L., 2012. Biochemistry, 7th Edition, W. H. Freeman and Co.
3. Nigram, A., Ayyagari, A. 2008. Lab Manual in Biochemistry, Immunology and Biotechnology, McGraw-Hill Publishing Company Limited, New Delhi, India
4. Murray, R., Bender, D., Botham, K.M., Kennelly, P.J., Rodwell, V., P.A. Weil, 2012. Harper's Illustrated Biochemistry, 29th Edi. The McGraw-Hill companies Inc. USA.
5. Voet D. and J.G. Voet 2004. Biochemistry 3rd Edition John Wiley & Sons. USA.

Course Title: Mathematics
Course Number: STCS-02405
Course Duration: 4th semester (16 weeks)
Credit Hours: 2 (2-0)

Course Description:

This course is designed to develop the topics of Equations and differential calculus. At the end of this course and following completion of an appropriate amount of independent study, students will be able to apply basic principles of Algebra and differentiation techniques in their respective disciplines.

Course Pre-requisites:
College Algebra, Pre-calculus

Course Goals and Performance Objectives:

Goal 1: Student should be able to understand the basics of Mathematics
Objective 1: Introduction to Mathematics
Objective 2: Basic Notations of Mathematics
Objective 3: Elementary concept of real number systems

Goal 2: Student should be able to understand the fundamental concept of Equations
Objective 1: Concept of Polynomials
Objective 2: Concept of Linear Equations
Objective 3: Concept of Quadratic Equations
Goal 3: Student should be able to understand the Concept of Exponential and Logarithmic functions
Objective 1:Exponential functions
Objective 2:Logarithmic functions and Scales
Objective 3:Exponential growth and decay

Goal 4: Student should be able to understand the concept of Matrices
Objective 1: Definitions of Matrices
Objective 2: Concept of Matrix Algebra
Objective 3: Concept of Determinants

Goal 5: Student should be able to understand the concept of Differentiation
Objective 1: Concept of Rate of Change
Objective 2: Basic idea of Secant and Tangent line
Objective 3: Different Rules to find the derivatives

Goal 6: Student should be able to understand the concept of Integration.
Objective 1: Concept of Area under the curve
Objective 2: Different rules to find the integration
Objective 3: Concept of Integration by Parts

Course Contents:

Elementary Concepts: Real numbers and subsets of real numbers, real line, BODMAS, Equations and their solutions: Quadratic equations and their solutions by factorization, completing squares and quadratic formula, Exponential and Logarithmic functions Matrices and Determinants: Matrix Algebra of matrices, determinants, expansion of determinants, Cramer's Rule, Two dimensional coordinate system and graphs, Differentiation: Basic formulas of differentiations, theorems on differentiation (sum, difference, product and quotient rules without derivations), Chain rule, derivative of six basic trigonometric functions, Integration: Formulas of integration, theorem of integration (sum, difference, exponent and logarithms without derivations), integration by substitution, integration by parts (simple applications).

Detailed Course Outline:

No	Theory
1	Preliminary concepts of Algebra
2	Sets and Real Number systems
3	Concept of Polynomials
4	Concept of Equations
5	Linear and Absolute value equation
6	Linear equation and their solutions
7	Quadratic equations
8	Solutions of Quadratic equations
9	Exponential Functions and their Applications in Life sciences
10	Logarithmic Functions and their Applications
11	Logarithmic Scales
12	Matrices
13	Concepts of Matrix algebra
14	Multiplication of two matrices
15	Determinant and inverse of 2x2 matrices
16	Determinant of 3x3 matrix
17	Solve the systems of equations by Cramer's Rule
18	Solve the systems of equations by Inverse Method
19	Cartesian Coordinate systems
20	Distance, Mid points and Circles
21	Concept of Differentiation and Slope of Tangent Line
22	Solve differentiation by definition
23	Concepts of Derivatives
24	Rules for finding derivatives
25	Power rules of derivatives and its examples

26	Sum and difference rules of derivatives and its examples
27	Product and Quotient rules of derivatives and its examples
28	Derivatives of Trigonometric functions
29	Derivatives by Chain rules and its examples
30	Concept of Integration and Area Under the Curves
31	Integration by Substitution method
32	Integration by Parts

Teaching Learning Strategies:

Theory:
Lectures
Class Participation
Assignments
Quiz's

Class Work Policies:

- Equal opportunity
- Regularity and punctuality
- Adherence to deadlines
- Fairness
- Discipline

Assessment Strategies:

	Theory			
Modality	**Assignment**	**Mid Term**	**Final Term**	**Total**
Max marks	4	12	24	40

Text Book

1. Aufmann, R., Nation, R. 2014. College Algebra and Trigonometry, 8th Edi. Cengage Learning
2. Stewart, J. 2016. Calculus, 8th Edi. Cengage Learning,

Recommended Books/Readings:

1. Swokowski E.W, 1997. Fundamental of Algebra and Trigonometry, 9th Edi., PWS-Kent Company, Boston, USA.
2. Anton, H. 2012. Calculus: Early transcendentals10th Edition. John Wiley & Sons.

Course Title: English I (Functional English)
Course Number: SOSC02107
Course Duration: Ist Semester (16 weeks)
Credits: 2(2-0)

Course Description:

This course is based on developing the language abilities of Students through an integrated approach that provides opportunities to develop their English language skills instead of teaching them grammar in isolation and only at sentence level. With a focus on social interaction, the course draws specific attention to the accurate use of structures, improvement of pronunciation, and development of active vocabulary in professional settings.

Course Pre-requisites:
F.Sc. (Premedical) or equivalent degree\Students of DVM semester I

Course Goals and Performance Objectives:

Goal 1: Students should be able to understand the basics of grammar
Objective 1: What is functional grammar?
Objective 2: Difference between prescriptive & descriptive grammar
Objective 3: Functions of different parts of speech and usage of the articles

Goal 2: Students should be able to understand the syntactic formation of the sentence keeping in view their structure and function
Objective 1: What are functional type of sentences & structural type of sentences?
Objective 2: Change of narration Active to Passive voice
Goal 3: Students should be able to understand the importance of punctuation, spellings and capital rules
Objective 1: Punctuation its definition and its role in forming a sensible syntactical structure
Objective 2: Role of spellings in word formation
Objective 3: Use of capital letters and their principles

Goal 4: Students would be able to understand about a phrase
Objective 1: Difference between a phrase and a clause
Objective 2: Function of different phrases
Objective 3: Students would differentiate adjectives, noun and adverbs, and to change them in to phrases

Goal 5: Students should be able to understand clauses
Objective 1: Definition of clause and its functions
Objective 2: would recognize different clauses in a sentence

Goal 6: Students should be able to understand the basics of paragraph
Objective 1: Parts of a paragraph qualities and functions
Objective 2: would differentiate types of a paragraph

Goal 7: Students should be able to make out the paragraphs and larger texts
Objective 1: skimming and scanning

Goal 8: Students should be able to deliver a professional like presentation
Objective 1: definition and kinds of presentation
Objective 2: different strategies to be used for effective presentation
Objective 3: Role of AV Aids in presentation

Course Contents:

Theory:

Basics of Grammar, What is functional grammar,Prescrptive vs Descriptive grammar, Parts of speech and use of articles, Sentence structure, Functional type of sentences vs structural type of sentences, active and passive voice, Transitive and intransitive verbs, Punctuation and spelling Rules, And capital letters, Analysis of phrase, types of phrases (Adjective phrase, Adverb phrase & noun phrase), Analysis of clause, types of clauses (Adverb clause, Adjective clause & Noun clause), Introduction to Paragraph writing & parts of a paragraph, Dos and Dont's of paragraph, Types of paragraph, Practice in a unified and symmetric paragraph, Translation skills Urdu to English, Reading Comprehension Answers to questions on a given text, Reading Skills: Intensive And Extensive reading, Presentation Skills: Definition, Kinds of oral presentations, Strategies for Successful Speaking, Strategies for using an effective oral delivery, Strategies for effective non-verbal delivery, Steps for preparing effective oral delivery, Three M's, Using Visual Aids, Presentation sessions

Detailed Course Contents:

Sr#	Theory
1	Introduction to course and course objective
2	Basics of Grammar: What is functional grammar?
3	Prescriptive vs Descriptive grammar
4	Parts of speech
5	Use of articles
6	Sentence structure: Functional type of sentences vs structural type of sentences
7	Active and passive voice
8	Transitive and intransitive verbs
9	Punctuation Rules & capital letters
10	Spelling Rules
11	Phrase: definition of phrase
12	Adjective phrase
13	Adverb phrase
14	Noun phrase
15	Clause: Definition of a clause & Adverb clause
16	Adjective clause
17	Noun clause
18	Introduction to Paragraph writing, Parts of a paragraph
19	Dos and Don'ts of paragraph writing & Types of paragraph
20	Practice in a unified and symmetric paragraph
21	Translation skills, Urdu to English (Selected paragraphs)
22	Reading Comprehension: Answers to questions on a given text
23	Reading Skills: Intensive And Extensive reading
24	Presentation Skills: Definition & kinds of oral presentation
25	Strategies for Successful Speaking, Strategies for using an effective oral delivery
26	Strategies for effective non-verbal delivery
27	Steps for preparing effective oral delivery
28	Three M's
29	Using Visual Aids
30	Mock Presentation session
31	Presentation Session I
32	Presentation Session II

Teaching Learning Strategies:

Theory:

Lectures
Interactive & collaborative learning
Brainstorming
Assignments\Presentations
Quiz

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory			
	Assignment/presentation	**Mid Term**	**Final Term**	**Total**
Max marks	10%	30%	60%	
40	**4**	**12**	**24**	**40**

Books Recommended:

1. Functional English
   a) Grammar
1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
   2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

Reading/Comprehension

1. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.
   Speaking

Course Title: Holy Quran Translation-I
Course Number: SOSC 02107
Course Duration: 1 semester (16 weeks)
Credits: 1(1-0)

YEAR-1
LEARNING OUTCOMES:
After the successful completion of the course, the students would be able to describe and explain the saying of Allah Almighty regarding:

1. Characteristics of a good Muslim and of an evil doer.
2. Interfaith Harmony & unity of Muslim Ummah.
3. The purpose of the life of a Muslim.
4. Namaz, Zakat and Social issues.
5. Social equality and Justice.
6. Usury and Patience.

فہرستِ مضامین آیات کریمہ(سال اول)

نمبر	مضمون	سورت و آیت نمبر
1	قرآن کلام اللہ	سورۃ الفاتحہ : 1 تا 7... التوبۃ:6 ...النور: 34... الدہر: 23... الفرقان:...6 الواقعہ:77تا 80... یوسف ابراہیم:1... طٰہٰ:1تا 3...الشوریٰ:7... القمر: 17...
2	مسلمان کا مقصد حیات	المؤمنون: 115... الذاریات: 56تا 58... الاعراف:172تا173... الملک:1-2... الانبیاء:16 تا 18... ص:27 تا 29... القلم :34 تا 40...
3	اسلامی عقیدہ	البقرۃ:21-22- 285... القمر: 49... النمل:59تا66... الانعام:95 تا 108... المؤمنون:78 تا 92... العنکبوت:61 تا 63...
4	قرآن کی حقانیت	البقرۃ :1-2-23- 24... بنی اسرائیل:88... ھود:13- 14 .... یونس:37تا 40... طہ:133 تا 135... الشعراء:192تا195... الانعام:91- 92...
5	منصب رسالت	الحجرات: 1تا6... یونس: 18... الغاشیۃ: 2تا7... الکہف: 102...احزاب: 6-40تا 45... النساء:64تا65... التوبہ:61-80... المجادلۃ:22...
6	نیک لوگوں کی صفات	البقرہ:121-153تا157...الانفال:1تا23... الفرقان: 63تا 77...
7	نماز، زکوۃ	البقرہ:40تا43-83-110-177-277...المائدہ:12..الانعام:141... التوبہ:11-60... الاسراء:26... المومنون:1تا11...فصلت:7...الذاریات:19...المعارج:24تا26...المزمل:20...
8	معاشرتی معاملات	النساء:35-36...النور:19-27تا34-58تا60....آل عمران: 159... البقرۃ:182... النساء: 63... الحشر: 9... الانسان: 8تا9 ...الرعد:22 ...القصص:54 ...الحجرات:13...
9	توبہ و استغفار	النساء:31-106-110-116...ھود:3...یوسف:89تا92-97تا98... الرعد:6... التحریم:8... الفاطر:18-29تا30.... الشوری:30-34.. نوح:3تا4-7-10...
10	اتحاد بین المسلمین	الانبیاء: 92... المئومنون: 52 ...الحجرات: 9-10... آل عمران: 101-103... النساء: 146-175... الحج: 78... التوبہ: 107... طہ: 94... الروم: 32... الشوری: 14-35...
11	منافقین کی صفات	البقرہ:8تا20-204تا206....النساء:39-60تا68-89تا90-138تا 148...
12	جانوروں کے متعلق احکام	النور :45...المئومنون: 21...الغافر: 80-81... الزخرف: 12-13... الاعراف: 176... الکہف: 18-22...

13	صبر	البقرہ:155تا157...ھود:115...الرعد:20تا23....الاحقاف:35.....	
14	قرآنی دعائیں	المومن:60...البقرہ:186...الغافر:6...الاعراف:23....ھود:47....نوح:28...البقرہ:127... ابراہیم:40-41....	
15	سود	البقرہ:275تا281...آل عمران:130تا142...الروم:37تا39...	
16	قرآن کی چھوٹی سورتیں	الکوثر: الکافرون: النصر: اللہب: الاخلاص: الفلق: الناس	

Assessment Strategies:

	Theory			
	Assignment/presentation	**Mid Term**	**Final Term**	**Total**
	Pass / Fail			

Books:

- **Holy Quran**

Course Title: Ethics

Course Number: SOSC
Course Duration: Semester 1 (16 weeks each)
Credits: 1(1-0) per Year

Course Description:

This course in ethics is geared towards equipping students with a sense of the right way of living their daily lives. It does this by establishing rules, principles, and values on which they can base their conduct.

Course Pre-requisites:

Enroll students, who are non-Muslim / foreign / International

Course Goals and Performance Objectives:

Goal 1: Students should be able to understand the basics of ethics
Objective 1: Definition of ethics
Objective 2: Different types and forms ethics (ancient and modern)
Objective 3: Importance and role of good ethics in one's professional, personal, and societal life.

Goal 2: Ethical Teachings and Values in Different Religions
Objective 1: Buddhism, Christianity, Hinduism, Islam, Judaism, Sikhism, Zoroastrianism

Goal 3: Ethical Values
Objective 1: Truthfulness, Trustworthiness, Service to Humanity, Tolerance, Endurance
Objective 2: Respect for others

Course Contents:Theory:

Definition of Ethics, Different concepts of Ethics (Ancient and contemporary), Types of Ethics, Good Ethics, Bad Ethics, Importance of Ethics in Human Life, Individual Life, Family Life, Social Life, Importance of Ethics in Economic Life, Importance of Ethics in Politics, Ethical Teachings and Values in Different Religions, Hinduism, Buddhism, Zoroastrianism, Christianity, Judaism, Sikhism, Islam; Ethical Values of the above Religions, Truthfulness, Trustworthiness, Service to Humanity, Tolerance, Endurance Respect for others Cooperation, Mutual Help, Selflessness, Justice (Social Justice, Economic Justice), Equality, Concept of virtue and evil in different religions; Concept of "Flah" in Different Religions. Attitude towards other Religions.

Detailed Course Contents:

Semester 1

Sr#	Theory
1	Need for Ethics for today's society/ why care about ethics?
2	Definition of Ethics
3	Concepts of Ethics: Nature and Scope
4	Ancient and contemporary
5	Importance & role of Ethics in society
6	Branches of ethics
7	Personal ethics
8	Social ethics
9	Professional ethics
10	Business ethics
11	Importance of Ethics in Economic Life
12	Ethics & Morality
13	Ethics and religion
14	Common ethical characteristics among different religions
15	Respecful attitude towards other Religions: Tolerance and inclusiveness
16	Life & treatment of Prophet Muhammad (PBUH) with non-Muslim

Assessment Strategies:

	Theory			
	Assignment/presentation	Mid Term	Final Term	Total
	Pass / Fail			

Recommended Books:

1- J.S. Mackeuzie, A Manual of Ethics
2- Harold H.Titus, Ethics for Today
3- B.A. Dar, Quranic Ethic
4- Hameedullah, Dr. Introduction to Islam
5- Ameer Ali Syed, The spirit of Islam

SEMESTER-II

Course Title: Veterinary Anatomy-II
Course Number: ANAT 02201
Course Duration: 1 semester (16 weeks)
Credits: 3(1-2)

Course Description:
This course is about the anatomical description of organs of different systems present in the body of a Horse, Ox, Dog, and Poultry birds. The course will enable the students to understand the position, orientation, attachment, structure, and relationships of different organs present in a system, which is the foundation for clinical subjects.

Course Pre-requisites:

FSc. Pre Medical

Course Goals and Performance Objectives:

Goal 1: Understanding of the structure of different organs present in the body.
Objective: Identify and describe anatomical features of Respiratory, Digestive, Urinary, Genital and Endocrine Systems (organs of thoracic, abdominal and pelvic cavities).
Goal 2: Understanding of different components of skeleton system and organs present in a poultry bird.
Objective: Identify and describe anatomical features of skeleton and viscera of domestic chicken.

Goal 3: Knowhow of the location of body organs with respect to the body surface of an animal.
Objective: Indicate topographical location of different body organs on live animals (Practical only).

Course Contents:
Theory:
Comparative Respiratory System (Equine, Ruminant, Canine), nostrils, nasal cavity, nasopharynx, hyoid apparatus, larynx, trachea, lungs, Comparative Cardiovascular System(Equine, Ruminant, Canine); heart, vessels, Comparative Digestive System(Equine, Ruminant, Canine); oral cavity, pharynx, esophagus, stomach, small intestine, large intestine, peritoneum, omentum, liver, pancreas, spleen, Dentition; Teeth eruption and dental markings on equine teeth with age, Urinary System (Equine, Ruminant, Canine); kidneys, ureters, bladder, urethra, Male Genital System (Equine, Ruminant, Canine); descent of testis, scrotum, spermatic cord, testis, penis, prepuce, Female Genital System (Equine, Ruminant, Canine); peritoneal attachments and anatomy of female internal and external genitalia, Endocrine system, Avian anatomy, Topographic anatomy.

Practical:
Comparative Anatomy of Head & Neck Region (Equine, Ruminant, Canine): Osteology: Skull review, Mandible, Vertebrae. Axial Arthrology. Myology of Face, Neck and Trunk. Sagittal section of head and neck: Nasal and Oral cavities, Larynx (cartilages), Trachea, Esophagus, thyroid glands, contents of carotid sheath. Comparative Anatomy of Thorax, Abdomen and Pelvis (Equine, Ruminant, Canine): Osteology: Ribs and sternum. Boundaries and contents of thoracic cavity, Pleura, Mediastinum, Lungs and Bronchial tree, Heart and Blood Vessels cranial to the heart. Introduction to abdominal cavity, Peritoneum, Omentum, Stomach (Simple and Compound), Small and Large Intestine, Biliary System, Liver and Spleen, Abdominal Aorta. Urinary System, Kidneys, Ureters, Urinary bladder and Urethra. Male Genital System; descent of testis, Scrotum, Testes, Duct system, Penis, Prepuce, Accessory glands. Female Genital System; peritoneal attachments and modifications, Internal and External Genitalia, Endocrine Glands, Avian Anatomy (skeleton and organs), Topography of body organs.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Respiratory System	Nasal Cavity and nasopharynx; (Sagittal Section); Vertebral Column
2	Cardiovascular System	Larynx, Hyoid apparatus, Trachea and Bronchi, Ribs and Sternum
3	Cardiovascular System	Introduction to thoracic cavity, Pleura and Mediastinum, Thoracic Muscles
4	Dentitions	Lungs, Abdominal Muscles
5	Body Cavities & Peritoneal Attachments	Heart, Myology of face and neck
6	Digestive System	Blood Vessels cranial to the heart
7	Digestive System	Sagittal section, oral cavity and oropharynx
8	Male Genital System	Introduction to abdominal cavity, Peritoneum
9	Male Genital System	Esophagus and Simple Stomach
10	Mid Term Exam	Compound Stomach
11	Female Genital System	Small Intestine
12	Female Genital System	Large intestine – Dog and Ruminants
13	Urinary System	Large intestine – Horse
14	Avian Anatomy I	Biliary System
15	Avian Anatomy II	Liver and spleen
16	Topography	Abdominal Aorta - Dissection
17		Abdominal Aorta - Demonstration
18		Kidneys, Ureters - Dog
19		Kidneys, Ureters - Horse
20		Kidneys, Ureters - Ruminants
21		Urinary bladder, Urethra
22		Male Genital System – General Overview, Descent of testis
23		Male genital system – Scrotum, testes, duct system
24		Male genital system – Penis, accessory glands
25		Female genital system – General overview, peritoneal attachments and modifications
26		Female genital system – Internal genitalia
27		Female genital system – External genitalia
28		Endocrine Glands
29		Avian Osteology
30		Avian Splanchnology
31		Topography I
32		Topography II

Teaching Learning Strategies:

Theory:	Practical
Lectures	Performance
Assignments	Presentations
Quiz	Group Discussions
	Assignments

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines

Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%	100 %	50%	50%	100 %

Textbook:

1. Koenig, H. E. and H-G. Liebich, 2014. Veterinary Anatomy of Domestic Animals, Textbook and Colour Atlas. Schattauer, Germany.

Recommended Books/Readings:

1. Pasquini C., T. Spurgeon, and S. Pasquini, 2007. Anatomy of Domestic Animals –Systemic and Regional approach. Soudz, U.S.A.
2. Getty, R., S. Sisson and J. D. Grossman, 1986. The Anatomy of the Domestic Animals. W.B. Saunders Co. Philadelphia, U.S.A.
3. Miller, M.E., 2000. Guide to the dissection of the Dog. Edwards Brothers, I thaca, New York, U.S.A.
4. Philiph, G.D., 1988. Guide to Ruminant Anatomy Based on the Dissection of the Goat. Iowa State University Press. Ames, U.S.A.
5. Haward., E. and D. Alexander, 2000. Guide to the Dissection of the Dog. W.B. Saunders Co. U.S.A.

Course Title: Systemic Veterinary Histology & Embryology
Course Number: ANAT-02202
Course Duration: 16 weeks
Credits: 3(2-1)

Course Description:

This course is aimed at understanding the microscopic architecture and features of Integumentary system, cardiovascular system, Digestive system, Lymphatic system, Respiratory system, Urinary system, Endocrine system, Male and Female reproductive systems. The course enables the student to correlate the structural and functional aspects of different domestic animals systems. They become able to identify and describe the microscopic features of different systems of body and their comparative histological features in domestic animals. The learners will get to know about the identification of the different developmental stages of embryo and embryonic origin of each organ. This course will help them understand comparative histological changes during placentation, estrus cycle & also the derivatives of embryonic germ layers.

Course Pre-requisites:

F.Sc. Pre Medical

Course Goals and Performance Objectives:

Goal 1: To describe the Micro-anatomical/Histological features of different body systems in domestic animals

Objective 1: Student will be able toidentify and describe the microscopic features of different systems of body and their comparative histological features in domestic animals.

Goal 2: To correlate the histological features of body organs with their functions

Objective 1: Student will be able to understand the histophysiology

Objective 2: Student will be able to understand the applied micro anatomy

Goal 3: To see the developmental stages of embryo
Objective 1: Student will be able to understand weekly development of embryo from 3rd to 8th week
Objective 2: Student will be able to understand the comparative developmental embryology

Goal 4: Placentation in domestic animals & embryonic origin of each body organs
Objective 1: Student will be able to understand comparative placentation
Objective 2: Student will be able to understand histological changes during heat cycle
Objective 3: Student will be able to understand developmental events of organogenesis

Course Contents:

Theory: Embryology: study of different developmental stages of embryo, Placentation in domestic animals and embryonic origin of each body organ. Integumentary System: Histology of thick and thin skin and epidermal appendages. Cardiovascular System: Histology of Heart and all major types blood vessels. Lymphatic System: Introduction to Lymphoid tissue and histology of Lymph Node, Spleen, Thymus and Tonsils. Digestive System: Histology of all parts of digestive system of Simple and Compound Stomach animals along with accessory glands of Digestive System. Respiratory System: Histology of extra-pulmonary and intra-pulmonary tissues of respiratory system. Urinary System: Histology of Kidney and excretory passage of urinary system. Male Reproductive System: Spermatogenesis. Histology of Testis, its associated ducts, copulatory organ and male accessory glands. Female Reproductive System: Oogenesis. Histology of Ovary, Fallopian Tubes, Uterus, Cervix and Vagina. Endocrine System: Histology of Pituitary Gland, Pineal Gland, Thyroid and Parathyroid Glands, Adrenal Gland.

Practical: Demonstration of light micsopic slides of all above mention organs.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Introduction to systemic histology and organs: Definition of systemic histology and its scope. General histological organization of tubular and parenchymatous organs	Integumentary system, epidermis, dermis and epidermal appendages
2	Embryology; First and Second week of development	Cardiovascular system: Heart, Arteries
3	Embryology ; Third week of development	Cardiovascular system: Veins
4	Embryology; Third week of development	Embryology
5	Embryology; Third to eight week	Digestive system: Tongue, salivary glands, esophagus, simple and compound stomach and small intestine.
6	Embryology; Placentation	Digestive system: large intestine, liver, gall bladder and exocrine pancreas
7	Integumentary system; Epidermis, dermis, cell of the epidermis,Thick and thin skin	Class Evaluation II • Identify the organ/pointed structure in microscopic field or multimedia • Write any two salient features. • Short questions
8	Integumentary system; Histology of epidermal appendages including Hair, sweat, sebaceous glands and mammary glands	Lymphatic system: Spleen, Lymph node, Thymus tonsil and bursa
9	Cardiovascular system	Respiratory system

10	Cardiovascular system; Histological structure of arteries and Veins along with their comparison and classification	Nervous system
11	Cardiovascular system; Histological structure of capillaries along with their classification	Urinary System
12	Cardiovascular system; Histological structure of Heart	Female Reproductive system: Ovary
13	Digestive system; Oral Cavity, Oesophagus, Simple Stomach	Female Reproductive system: Oviduct, uterus, cervix, external genitalia, mammary glands
14	Digestive system; Compound Stomach	Male Reproductive system: Testis, ductus deferens, epididimys, penis, prostate, bulbourethral and vesicular gland
15	Digestive system; Intestines and salivary glands	Endocrine System: Pituitary, Thyroid, parathyroid, Adrenal gland
16	Digestive system; Liver, gall bladder and pancreas	Class Evaluation II: Topics covered (Respiratory system, Nervous system, Urinary system, Reproductive system and Endocrine system)
17	Lymphatic system; Cells of lymphatic system	
18	Lymphatic system; Primary lymphatic organs	
19	Lymphatic system; Secondary lymphatic organs	
20	Lymphatic system; Secondary lymphatic organ	
21	Respiratory system; Upper respiratory tract	
22	Respiratory system; Lower respiratory tract	
23	Urinary system; Kidney	
24	Urinary system; Excretory Passages	
25	Male reproductive system; Testes, Straight Testicular tubules	
26	Male reproductive system; Penis and accessory glands	
27	Female reproductive system; Ovaries	
28	Female reproductive system; Fallopian Tubes, Uterus, Urethra	
29	Female reproductive system; Mammary Glands	
30	Endocrine system; Pituitary Gland	
31	Endocrine system; Thyroid , Parathyroid Gland and Adrenal Gland	
32	Endocrine system; Tissue and cells	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity

Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory (Marks 40)				Practical (Marks 20)		
	Assignment	**Mid Term**	**Final Term**		**Class Evaluation**	**Final Term**	**Total**
Max marks	4	12	24		Class performance 5 Rotation 5	10	60

Textbook:

1. Dellmann, H. D., J. Eurell, and C. Ann. 2012. A Color Atlas of Veterinary Histology 6th edition, William and Wilkins, USA.

Recommended Books/Readings:

1. Aughey, E. nd F. L. Frye. 2000. A Color Handbook of Comparative Veterinary Histology and Clinical Coorelates edition 1st. Iowa State University Press, USA.

2. Bacha, W. J. and L. M. Bacha. 2000. Color Atlas of Veterinary Histology 3rd edition, Lippincott William and Wilkins, USA.
3. Banks, W. J., 1992. Applied Veterinary Histology. 3rd Ed. Williams and Wilkins, Baltimore, USA.

Course Title: Veterinary Physiology-II
Course Number: PHYS 02204
Course Duration: 1 Semester
Credits: 4 (3-1)

Course Description
The course is describing the physiological anatomy and physiological mechanisms of digestive system, lactation, endocrine system, as well as renal system in domestic animals along with clinical correlations of common problems in domestic animals.

Course Pre-requisites
DVM student

Course Goals and Performance Objectives
Goal: To familiarize the students with the functioning of digestive system, lactation, endocrine system and renal system
Objective 1: To describe the components of digestive system and its functioning
Objective 2: To describe the components of mammary glands and its functioning
Objective 3: To describe the components of endocrine system and its functioning
Objective 4: To describe the components of renal system and its functioning
Objective 5: To describe the pathophysiology of common disorders of domestic animals

Course Contents

Theory

Endocrine Physiology: An overview of endocrine system, integration of endocrine and nervous system, Classification and transport of hormones, Hormone-cell interaction and feedback mechanisms, Pituitary gland, its structure, secretions and function, Thyroid gland, its physiological anatomy, synthesis, release, functions of thyroxin and triiodothyronin, Endocrine pancreas; role of insulin and glucagon in regulation of glucose metabolism, Parathyroid gland: Physiological anatomy; synthesis, release, functions and abnormalities of parathormone and calcitonin. **Digestive Physiology:** Introduction to gastrointestinal physiology, Feeding behavior, prehension and mastication, enteric nervous system, Physiological mechanism of deglutition, Saliva secretion, composition and regulation, Eructation mechanism, emesis and its control, Ruminant stomach, anatomy and physiology, concept of functional ruminal epithelium, Esophageal groove and concepts of nutrient-by-pass, Microbial ecosystem of digestion in ruminants, Fermentation of carbohydrates, proteins and fats in rumen, Production and absorption of volatile fatty acids, nitrogen in ruminants, Physiologic anatomy of simple stomach, gastric motility, factors affecting gastric motility, Gastric secretion, composition, regulation, factors influencing the gastric secretion, Digestion and absorption of carbohydrates, proteins, fats, Absorption of vitamins and electrolytes, Role of Pancreas and liver in digestion. Clinical cases like ulcer, ruminal acidosis, urea toxicity, diarrhea; Protected nutrients and enzymes, selected antibiotics in feed, probiotic and prebiotics. **Lactation Physiology:** Functional anatomy of mammary glands, Physiology of mammogenesis, lactogenesis and galactopoesis, Milk synthesis and secretion, Biological functions of milk, its nutritive value, Lactation performance, physiological factors affecting lactation, Mammary biotechnology. **Renal Physiology:** Anatomy and physiology of Nephron, Urine formation, Glomerular filtration, Physiological control and auto-regulation of Glomerular Filtration Rate, Tubular Reabsorption and processing of Glomerular Filtrate, Mechanism of tubular re-absorption and regulation, Regulation of extra-cellular fluid osmolarity, balance of Sodium and Potassium by Kidney, Renal absorption of bivalent ion. Renal blood flow, renal clearance, filtration fraction, regulation of urine volume and concentration, Act of micturition and its regulation, Introduction to acid–base Physiology, Renal mechanisms for maintaining hydrogen ion concentration in body fluids; Regulation of acid–base balance, Clinical correlations (acidosis, alkalosis). Clinical cases related to Endocrine, Digestive, Lactation and Renal Physiology.

Practical

Demonstration of location of endocrine glands in rats and rabbits, Isolation of rat uterus and effect of oxytocin, Glucose tolerance test, Farm visits for observations on rumination and deglutition; Salivary secretion in ruminants, Tests for saliva of different animals, Motility of ruminant stomach, Rumen fistula/cannulation, Biochemical experiments on bile, Determination of composition of milk, Determination of pH and specific gravity of milk, Determination of total solid in milk, Urinalysis.

Detailed Course Outline

No	Theory Lecture Split	Practical Session Split
1	Introduction to gastrointestinal physiology	Qualitative analyses of saliva, detection of specific gravity of saliva and pH of saliva
2	Feeding behavior, prehension and mastication, enteric nervous system	Detection of chloride and thiocynate ions in the saliva
3	Physiological mechanism of deglutition, Saliva secretion, composition and regulation	Detection of Mucin in the saliva and salivary urea index
4	Eructation mechanism, emesis and its control	Detection of calcium in saliva and determination of mg% of calcium in given sample
5	Ruminant stomach, anatomy and physiology, concept of functional ruminal epithelium	Determination of mg% of chloride ions in given sample

6	Esophageal groove and concepts of nutrient-by-pass	Detection of action of salivary amylase
7	Microbial ecosystem of digestion in ruminants, Fermentation of carbohydrates, proteins and fats in rumen	Action of salivary amylase and conformation of production formed by enzymatic reaction and effect of pH and temperature on the action of salivary amylase
8	Production and absorption of volatile fatty acids, nitrogen in ruminants	Demonstrate of reduction in surface tension and emulsification of fat by bile salts, chylomicron test and fecal trypsin test
9	Physiologic anatomy of simple stomach	Determination of pH and specific gravity of milk and determination of total solid in milk and demonstration of curding of milk and peptic digestion
10	Gastric motility, Factors affecting gastric motility, Gastric secretion, composition, regulation, Factors influencing the gastric secretion	Demonstration of location of endocrine glands in rabbits
11	Digestion and absorption of carbohydrates	Isolation of rat uterus and effect of oxytocin
12	Digestion and absorption of proteins	Glucose tolerance test
13	Digestion and absorption of fats	Qualitative tests of urine
14	Absorption of vitamins and electrolytes	Determination of sugar, proteins and ketone bodies in urine
15	Role of Pancreas in digestion	Quantitative analyses of urine using titration method
16	Role of liver in digestion	Quantitative analyses of urine using spectrophotometric method
17	Clinical cases like ulcer and diarrhea	
18	Clinical cases like ruminal acidosis and urea toxicity	
19	Protected nutrients and enzymes, selected antibiotics in feed, probiotic and prebiotics	
20	Functional anatomy of mammary glands, Physiology of mammogenesis	
21	Lactogenesis and galactopoesis	
22	Milk synthesis and secretion, Biological functions of milk, its nutritive value	
23	Lactation performance, physiological factors affecting lactation, Mammary biotechnology	
24	Midterm	
25	An overview of endocrine system	
26	Integration of endocrine and nervous system	
27	Classification and transport of hormones, Hormone-cell interaction and feedback mechanisms	
28	Anterior pituitary Gland, its structure, secretions and function	
29	Posterior pituitary Gland, its structure, secretions and function	
30	Thyroid gland, its physiological anatomy, synthesis, release, functions of thyroxin	

	and triiodothyronin	
31	Endocrine pancreas; role of insulin and glucagon in regulation of glucose metabolism	
32	Parathyroid gland: Physiological anatomy; synthesis, release, functions and abnormalities of parathormone and calcitonin	
33	Adrenal gland: Physiological anatomy; synthesis, release, and functions of mineralo- and gluco-corticoides	
34	Clinical cases of different endocrine abnormalities	
35	Anatomy and physiology of Nephron	
36	Urine formation	
37	Glomerular filtration, Physiological control and auto-regulation of Glomerular Filtration Rate	
38	Tubular Reabsorption and processing of Glomerular Filtrate, Mechanism of tubular re-absorption and regulation	
39	Regulation of extra-cellular fluid osmolarity, balance of Sodium and Potassium by kidney	
40	Renal absorption of bivalent ion	
41	Renal blood flow, renal clearance, filtration fraction	
42	Regulation of urine volume and concentration	
43	Act of micturition and its regulation	
44	Introduction to acid–base Physiology	
45	Renal mechanisms for maintaining hydrogen ion concentration in body fluids	
46	Regulation of acid–base balance	
47	Clinical correlations acidosis	
48	Clinical correlation alkalosis	

Teaching Learning Strategies

Theory	**Practical**
Lectures	Performance
Assignments	Group Discussions
Quiz	Assignments

Class Work Policies

Equal opportunity
Intellectual honesty
Adherence to deadlines
Fairness

Assessment Strategies

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	06	18	36	60	10 (Class performance + evaluation + viva)	10	20

Textbook

1. Cunningham, J.G. and B. G. Klein, 2018. Textbook of Veterinary Physiology. 6th Edition. WB Saunders Company, USA.

Recommended Books/Readings

1. Dukes, H.H., M.J. Swenson and W.O. Reece, 2004. Duke's Physiology of Domestic Animals. 12th Edition, Comstock Publishing, USA.
2. Costanzo, L., 2008. Physiology. 4th Edition, Elsevier Publishing, USA.
3. Guyton, A.C. and J.E. Hall., 2006. Textbook of Medical Physiology. 11th Edition. WB Saunders Company, USA.
4. Barreet, K.E., S.M. Barman, S. Boitano and H.L. Brooks, 2006. Ganong's Review of Medical Physiology. 23rd Edition. Appleton and Lange, USA.
5. Sjaasted, O.V., K. Hove, O. Sand, 2003. Physiology of Domestic Animals. Ist Edition.
6. Jafri, S.A., M. Rabbani and H. Rehman, 2002. Manual of Digestive Physiology. Muktaba-i-Danwasharian, Lahore, Pakistan.
7. Chruch D.C., 1993. The Ruminant Animal: Digestive Physiology and Nutrition. Waveland Press, Inc, USA.

Course Title: ENGLISH II (Communication Skills)
Course Number: SOSC-02207
Course Duration: 2nd Semester (16 weeks)
Credits: 2(2-0)

Course Description:

This course in communication skills is geared towards correspondence and equipping students with oral as well as written communication skills. Further practice will be given to presentation skills and students will be taught how to tackle interviews and prepare themselves well for their job hunts.

Course Pre-requisites:
Students of DVM semester 2nd

Course Goals and Performance Objectives:

Goal 1: Students should be able to understand the basics of communication
Objective 1: Definition of communication
Objective 2: Different types and forms communication
Objective 3: Importance and role of good communication in one's professional life
Goal 2: Students should be able to understand the basics of paragraph
Objective 1: Parts of a paragraph qualities and functions
Objective 2: Students would differentiate types of a paragraph
Objective 3: Students would practice paragraph writing with perfection

Goal 3: Students should be able to understand basics of essay writing
Objective 1: Definition and parts of an essay
Objective 2: Different types of essay writing

Objective 3: Role of editing in essay writing

Goal 4: Students would be able to master the art of CV writing
Objective 1: Students would differentiate traditional and skilled based CV
Objective 2: Students would understand a CV & a Resume
Objective 3: Students would write a covering letter

Goal 5: Students should be able to understand study skills
Objective 1: What is intensive and extensive reading?
Objective 2: Students would comprehend the given text
Objective 3: Students would be able to differentiate a summary and a precise

Goal 6: Students should be able to understand business letters writing
Objective 1: The purpose of business letter & parts of a business letter
Objective 2: Students would know about the different formats of writing a business letter
Objective 3: Students would know and write complaint letters
Objective 4: Students would know and write letter of adjustment

Goal 7: Students should be able to understand about minutes of meeting
Objective 1: Students would know, what are minutes of meeting?
Objective 2: Students would know, what is the importance of agenda in writing minutes of meeting?

Goal 8: Students should be able to deliver a professional presentation
Objective 1: Definition and kinds of presentation
Objective 2: Different strategies to be used for effective presentation
Objective 3: Role of AV Aids in presentation

Course Contents:

Theory:
What is communication? Types and forms, Introduction to Paragraph writing & parts of a paragraph, Dos and Don'ts of paragraph, Types of paragraph, Organization of a paragraph, Practice in a unified and symmetric paragraph, Essay writing: An Introduction, Parts of an Essay, Types of an Essay, Editing, CV writing: Traditional vs Skilled-based CV, Common mistakes, Covering letter, Job application: Parts of application, Dos & Don'ts of Job application, and Qualities of a good job application. Translation skills: Urdu to English, Study skills: Skimming and scanning, intensive and extensive, and speed reading, Study skills: summary, précis writing and reading comprehension, Academic skills: Letter writing, Purpose of a business letter, Parts and formats of business letter, Different types of letter, Minutes of meetings; Academic skills: use of library and internet, Personality development, Memo writing: Elements & types of Memo, Presentation Skills: Definition&, Kinds of oral presentations, Strategies for Successful Speaking, Strategies for using an effective oral delivery, Strategies for effective non-verbal delivery, Steps for preparing effective oral delivery, Three M's, Using Visual Aids, Presentation sessions.

Detailed Course Contents:

Sr#	Theory
1	Communication: Definition, types, forms and significance
2	Introduction to Paragraph writing & parts of a paragraph, Dos and Don'ts of paragraph
3	Types of paragraph, descriptive, narrative and compare and contrast
4	Organization of a paragraph, Practice in a unified and symmetric paragraph
5	Essay writing an introduction: Parts of an Essay
6	Editing
7	Biodata, CV, Resume, Personal statement, etc.

8	Common mistakes & Covering letter
9	Job application: Parts of application, Dos & Don'ts of Job application
10	Qualities of good job application
11	Translation skills: Urdu to English
12	Study skills: Skimming and scanning, intensive and extensive, and speed reading
13	Study skills: Reading comprehension, summary and précis writing
14	Summary and précis writing
15	Academic skills: Letter writing, Purpose of a business letter
16	Academic skills: Parts of a business letter
17	Different formats of a business letter
18	Letter of complaint
19	Letter of adjustment with positive response
20	Letter of adjustment with negative response
21	Academic skills: Minutes of meeting
22	Academic skills: Use of library, internet, etc.
23	Personality development: What type of personality are you? Different types of personalities
24	Personality development to work in diverse environments (Public sector, Rural areas, Corporate sector, etc.) and communities
25	Memo writing: Elements & types of memo
26	Presentation Skills: Definition, Kinds of oral presentations, Strategies for Successful Public Dealing / Speaking
27	Strategies for using an effective oral delivery, Strategies for effective non-verbal delivery, Steps for preparing effective oral delivery
28	Three M's
29	Using Visual Aids
30	Mock Presentation session
31	Presentation Session I
32	Presentation Session II

Teaching Learning Strategies:

Theory:
Lectures
Interactive & collaborative learning
Brainstorming
Assignments\Presentations
Quiz

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory

	Assignment\Presentation	Mid Term	Final Term	Total
Max marks	10%	30%	60%	
40	**4**	**12**	**24**	**40**

Books Recommended:

Communication Skills

a) Grammar
   2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.

b) Writing
   1. Writing. Intermediate by Marie-ChrisitineBoutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).

   2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

c) Reading
   1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
   2. Reading and Study Skills by John Langan
   3. 3. Study Skills by RiachardYorky.

Course Title: General Veterinary Microbiology
Course Number: MICR- 02205
Course Duration: 2nd semester (16 weeks)
Credits: 3(2-1)

Course Description:

This course will inform and educate students various aspects of basics of bacteriology, mycology and virology. At the end of this course, the students will be able to understand various mechanisms of growth of microbes, and ways to control them.

Course Pre-requisites:

F.Sc. (Premedical) or equivalent degree

Course Goals and Performance Objectives:

Goal 1: Students should be able to understand the basics of microbiology
Objective 1: Definition, branches and importance of Microbiology
Objective 2: Historical and recent advancements in Microbiology
Objective 3: Difference between eukaryotes and prokaryotes

Goal 2: Students should be able to understand the requirements for the growth of bacteria
Objective 1: Growth medium and types
Objective 2: Basics of bacterial growth
Objective 3: Physico-chemical requirements

Goal 3: Students should be able to understand basics of microbial genetics
Objective 1: Definition of mutation and its types
Objective 2: Methods for transfer of genetic material in bacteria

Objective 3: Basics of genetic engineering

Goal 4: Students should be able to understand basics of fungi
Objective 1: Difference and classification among fungi, yeast and molds
Objective 2: Growth requirements and modes of replication
Objective 3: Clinical diagnosis and treatment of fungal diseases

Goal 5: Students should be able to understand basics of virology
Objective 1: Properties of Virus, viriod and prion
Objective 2: Bacteriophages and typing
Objective 3: Methods of studying viruses: purification and size-determination

Goal 6: Students should be able to understand fundamentals of viral classification and replication
Objective 1: Viral classification
Objective 2: Viral entry mechanisms and genome replication strategies
Objective 3: Replication of Retroviruses and defective viruses
Goal 7: Students should be able to understand virus-host interactions
Objective 1: Viral effects at cellular level
Objective 2: Animal response to viral infections
Objective 3: Modes of preventing and treating animal viral infections

Course Contents:

Theory:
Introduction of Microbiology, Definition and branches of Microbiology, Historical introduction including works of Pasteur, Koch and Lister etc, Recent developments in microbiology, Prokaryotes v/s Eukaryotes, Growth medium, types of culture media, preparation of the medium in the lab, Bacterial growth and multiplication, Bacterial multiplication and growth curve, Continuous culture, Physico-chemical requirements (pH, temperature and oxidation reduction potential), Physico-chemical requirements (gaseous and nutritional requirements), Bacterial genetics: Mutation and mutagenesis, Transposons, Plasmid in mutation and mutagenesis, Conjugation, Transformation, Transduction, Lysogeny, Introduction to genetic engineering, antibacterials, Introduction to fungi: Molds and yeasts, Growth requirements and mode of replication of molds and yeasts, Isolation and identification of molds and yeasts, Classification of molds and yeasts, Clinical diagnosis of different fungal diseases, antifungal drugs, Fundamental characteristics of viruses (Definition and history of virology), General properties of viruses, viroids and prions, Bacteriophages and its typing, Methods of studying viruses; Purification of viruses and determination of virus size, Virus classification, Virus replication: Adsorption-receptor/ligand, entry mechanisms, Uncoating, Biosynthesis of virus components, Virus transcription, translation, assembly and release, Replication of RNA and DNA viruses and their comparative analysis, Replication of Retroviruses and defective viruses, Properties of animal viruses at cellular levels (infection of cell with multiple viruses), Recombination , Exaltation, Dormancy and reactivation, Interference, Mechanisms of interference, Interferon (Properties, types, mode of action, biological significance, antibodies vs interferon), Haemadsorption and elution, Viral vaccines and factors affecting success/ failure of viral vaccines, Physico-chemical characteristics of viruses, Antiviral agents, Methods for isolation and identification of viruses, algae.
Practical:
Safety in microbiological laboratory, study of principles and application of laboratory equipment, Microscope and microscopy (bright field; dark field; Phase contrast; fluorescent microscopes), Sterilization (moist heat, dry heat, irradiation, filtration), Disinfectants and their efficacy evaluation (how to calculate phenol coefficient against a bacteria), Preparation and demonstration of various bacteriological media (General and Selective, Differential and Enrichment media). Demonstration of staining techniques (negative, simple and Gram's staining, Zeihl-Neelsen and spore staining techniques). Methods of bacterial cultivation and growth measurement, Identification of bacterial characteristics (colony, morphology, shape and arrangement), Biochemical tests, Sugar fermentation tests, Micrometry and motility, Antibiotic susceptibility testing,

Isolation and identification of common fungi and molds, Purification of viruses (ultracentrifugation; precipitation and ultra-filtration), Cultivation of viruses (animal inoculation, egg inoculation), Isolation and enumeration of bacteriophages from sewerage water and calculation of antiviral activity of disinfectants against a virus, Cell culture preparation, Demonstration of cytopathic effects (CPE), Virus identification methods (electron microscopy through simulation and images, serology, precipitation test, virus neutralization test etc.). Virus titration (determination of EID_{50}, LD_{50} and $TCID_{50}$), cultivation and identification of algae.

Detailed Course Contents:

Sr#	Theory	Practicals
1	Introduction of Microbiology; Definition and branches of Microbiology	Safety in microbiological laboratory, Study of principles and application of laboratory equipment
2	Historical introduction including works of Pasteur, Koch and Lister etc,	Sterilization (moist heat, dry heat, irradiation, filtration)
3	Recent developments in microbiology	Preparation and demonstration of various bacteriological media (General and Selective, Differential and Enrichment media)
4	Prokaryotes v/s Eukaryotes	Methods of bacterial cultivation and growth measurement
5	Growth medium, types of culture media, preparation of the medium	Microscope and microscopy (bright field; dark field; Phase contrast; fluorescent microscope)
6	Bacterial growth and multiplication	Demonstration of staining techniques (negative, simple and Gram's staining)
7	Bacterial multiplication and growth curve, continuous culture	Zeihl-Neelsen and spore staining techniques
8	Physico-chemical requirements (pH, temperature and oxidation reduction potential)	Disinfectants and their efficacy evaluation (how to calculate phenol coefficient against a bacteria?)
9	Physico-chemical requirements (gaseous and nutritional requirements)	Antibiotic susceptibility testing
10	Bacterial genetics: Mutation and mutagenesis	Micrometry and motility test
11	Transposons, Plasmid in mutation and mutagenesis	Isolation and identification of common fungi and molds: Aspergillus, etc.
12	Conjugation, Transformation, Transduction, Lysogeny	Purification of viruses (ultracentrifugation; precipitation and ultra-filtration), Cultivation of vaccinal viruses (Animal inoculation, egg inoculation)
13	Introduction to genetic engineering; Antibacterials	Isolation and enumeration of bacteriophage from sewage water and calculation of antiviral activity of disinfectants against a virus
14	Introduction to fungi: Molds and yeasts	Serology: Agglutination and Precipitation reactions, etc.
15	Growth requirements and mode of replication of molds and yeasts	Virus identification methods (electron microscopy through simulation and images)
16	Isolation and identification of molds and yeasts	Cell culture media, Prepration of primary and secondary cell culture
17	Classification of molds and yeasts	

18	Clinical diagnosis of different fungal diseases, antifungal drugs	
19	Fundamental characteristics of viruses (Definition and history of virology)	
20	General properties of viruses, viroid and prions, Bacteriophages and its typing	
21	Purification of viruses and determination of virus size, Virus classification	
22	Virus replication: Adsorption-receptor/ligand, entry mechanisms, uncoating, biosynthesis of virus components	
23	Virus transcription, translation, assembly and release	
24	Replication of RNA and DNA viruses and their comparative analysis	
25	Replication of Retroviruses and defective viruses	
26	Properties of animal viruses at cellular levels (Infection of cell with multiple viruses)	
27	Recombination, Exaltation, dormancy and reactivation	
28	Interference, Mechanisms of interference	
29	Interferon (Properties, types, mode of action, biological significance, antibodies vs interferon)	
30	Haem-adsorption and elution	
31	Viral vaccines and factor affecting success/ failure of viral vaccines	
32	Physico-chemical characteristics of viruses, antiviral agents	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	
60	**4**	**12**	**24**	**40**	**10+10**	**20**	**60**

Textbook:

1. Tortora, G.J.,B.R. Funke and C.L. Case, 2018. Microbiology: An Introduction. 13th Edition. Benjamin Cummings Publisher.

Recommended Books:

1. Quinn, P.J., M.E. Carter, B.K. Markie and G.R. Carter, 1994. Clinical Veterinary Microbiology. Wolf, London. (As practical manual)
2. Anonymous, 1999. A laboratory manual for the isolation and identification of avian pathogens. 6th Ed. American Association of Avian pathologists, Iowa State University Press, Ames, Iowa.
3. Burleson, F.G., T.M. Chanbes and D.I. Wiedranks, 1992. Virology-A laboratory Manual Academic Press, London
4. Castro, A.E. and W.F. Henschele, 1992. Veterinary Diagnostic Virology. Mosby yearbook, Inc., Baltimore.
5. Fenner, F.J., E.P. Gibbs, F.A. Murphy, M.J. Studdert and D.O. White, 1993. Veterinary Virology 2nd Ed., Academic Press London.
6. Merchant, I.A. and R.A. Packer, 1984. Veterinary Bacteriology and Virology. 7th Ed., Iowa State University Press, Ames, Iowa.
7. OIE, 2014. Manual of Standards for diagnostic tests and vaccines. Off. Intl. Des. Epiz., Paris.
8. Rabbani, M. and M.A. Muneer, 2001. Techniques in Virology. 1st Ed., UVAS Press, Lahore
9. Talaro, K. and A. Talaro, 1996. Foundation in Microbiology. 2nd Ed., Win C. Brown Publ., owa.
10. Virella, G., 1997. Microbiology and Infectious Disease. 3rd Ed., Williams and Wilkins, Baltimore.

Course Title: Introduction to Poultry Production
Course Number: PPRO-02203
Course Duration: 1 semester (16 weeks)
Credits: 1 (1-0)

Course Description: This course is designed in such a way that it helps learning about significance of rural farming, its management and different housing / production systems. Basic and technical guidance about organic farming for poultry producers and fanciers. Moreover, methods of disease prevention and its importance in poultry production are also included.

Course Pre-requisites: Basic Poultry Terminologies

Course Goals and Performance Objectives:

Goal 1: Learning about different production systems and housing-types in poultry production
Objective 1: To describe different production systems of broiler and layers
Objective 2: To describe alternative systems of poultry production (unenriched cages, enriched cages and alternative systems)
Goal 2: Learning the strategies to benefit rural poultry producers, hobby farmers/fanciers
Objective 1: To describe technology and programmes for sustainable improvement of rural poultry
Objective 2: To discuss poverty reduction and food security issues; Gender equality and women's

empowerment through poultry production
Objective 3: To discuss the wellbeing of the rural population and environmental sustainability through poultry production

Goal 3: Provide technical guidance about organic farming, non-traditional poultry and companion birds.
Objective 1: To describe the significance of organic farming, consumer preference towards organic meat and egg
Objective 2: To discuss production system and practices of waterfowl, turkey, quails and ostrich management

Goal 4: Basic learning about the methods of disease prevention and their importance in poultry production.
Objective 1: To describe the effect of alternative production systems on disease occurrence and health status of birds
Objective 2: To describe the impact of environment on disease occurrence and bird health
Objective 3: To discuss various aspects of single verses multi-age sites, planed biosecurity
Course Contents:

Theory: Overview of Poultry Industry; Production Systems for broiler and laying hens; Introduction to village and backyard poultry production; Alternative systems of poultry production and its effects on health and disease; Organic and free-range poultry production; Technology and programs for sustainable improvement of rural poultry; Production systems for Waterfowl; Game bird breeding, brooding and rearing: Health and Welfare; Furnished cages for laying hens; Performance, welfare, health and hygiene of laying hens in non-cage systems in comparison with cage systems; Turkey production and management; Alternative systems for meat chickens and turkeys: Quail production; Commercial duck farming; Ostrich farming; Production and management of companion and fancy birds. Laws governing poultry production.

Detailed Course Outline:

No	Theory Lecture Split
1	An overview of Poultry Production in Pakistan and World over (Breeds of poultry)
2	Poultry Production Systems: small scale family poultry (rural and backyard) poultry production
3	Alternative systems of poultry production and its effects on health and disease
4	Organic and free-range / cage-free poultry production
5	Technology and programs for sustainable improvement of rural poultry
6	Game bird breeding, brooding and rearing: Health and Welfare
7	Furnished cages for laying hens
8	Performance, welfare, health and hygiene of laying hens in non-cage systems in comparison with cage systems
9	Turkey production and management
10	Alternative systems for meat chickens and turkeys
11	Commercial duck farming
12	Ostrich Production
13	Ostrich Management
14	Quail and Partridge farming
15	Production and management of companion and fancy birds
16	Laws governing poultry production

Teaching Learning Strategies:

Theory:	Practical

Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline.

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. Sandiland, V. and P. Hocking, 2012. Alternative systems for poultry: health, welfare, and productivity. CAB International, Wallingford, Oxon, U.K.

Recommended Books/Readings:

1. Sreenivasaiah, P.V., 2006. Scientific Poultry Production. 3rd edition. International Book Distributing Co., UP India.
2. Austic, R.E. and M.C. Nesheim, 1990. Poultry Production. 13th edition. Lea and Febiger, Philadelphia, PA, USA.
3. Mack O' North Commercial Chicken Production Manual: Meat and Egg.

Course Title: Fundamentals of Livestock Production
Course Number: LPRO 02105
Course Duration: 1 semester (16 weeks)
Credits: 2(1-1)

Course Description:
Pakistan has been bestowed upon with many breeds of animals. The role of these animals in the uplift of socio-economic pattern is also most important. This course will enable the students to learn about the contribution of these breeds of cattle, buffaloes, camels, horses, donkeys, mules, sheep and goats towards the GDP as well as their share in the agriculture.

Course Goals and Performance Objectives:

1. To understand the potentials and performance of breeds of cattle, buffaloes, sheep, goats, camels, horses, donkeys and mules.
2. To understand the principles of farm animal management and management of different types and

classes of farm animals.

3. To know about the role of horses and mules being used for different purposes.

Course Contents:

Theory

Role of livestock in national economy; Domestication and taxonomy of farm animals; Types and breeds of farm animals; Identification and handling of livestock; Principles of farm animal management; Farm structures and equipment; Management of different types and classes of farm animals; Characteristics, body conformation and capacity of draught animals; Camel as a dairy, meat and draught animal; Common ailments of farm animals; Farm animal vices and their control; Principles of equitation; Welfare of farm animals; Transportation and marketing.

Practical

Regions and body points of meat animals; Approaching, handling and restraining of animals; Identification and use of management tools; Grooming and cleaning; Methods of identification; Body measurements for weight estimation; Maintenance of various farm records; Design and layout plans for livestock building; Demonstration of body conformation and defects; Determining age; Marking camel and horses; Care of foot; Use and care of harness and saddles; Equitation practices.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Role of livestock in national economy	Regions and body points of meat animals
2	Domestication and taxonomy of farm animals	Approaching and handling of animals
3	Types and breeds of farm animals	Restraining of animals
4	Identification of livestock	Identification and use of management tools
5	Handling of livestock	Grooming and cleaning
6	Principles of farm animal management	Methods of identification
7	Farm structures and equipment	Body measurements for weight estimation
8	Management of different types and classes of farm animals	Maintenance of various farm records
9	Characteristics, body conformation and capacity of draught animals	Design and layout plans for livestock building
10	Camel as a dairy, meat and draught animal	Demonstration of body conformation and defects
11	Management of draught animals	Determining age
12	Farm animal vices and their control	Marking camel and horses
13	Principles of equitation	Care of foot
14	Welfare of farm animals	Use and care of harness and saddles
15	Transportation and marketing	Equitation practices

Teaching Learning Strategies:

Theory:	Practical
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity

Intellectual honesty

Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. Banerjee, G.C. 2011. A textbook of Animal Husbandry. 8th edition. Oxford and IBH Publishing Co. New Delhi, India.

Recommended Books/Readings:

1. Verma D.N. 2006. A Textbook of Livestock Production Management in Tropics. Kalyani Publishers, New Delhi, India.
2. Mackintosh, J.B. 1993. Sheep production in Pakistan Agricultural Research Council, Islamabad.
3. Kacker, R.N. and B.S. Panwar. 1996. Textbook of Equine Husbandry. Vikas Pub. Pvt. Ltd, New Delhi. India.
4. Wilson, R.T. 1998, Camels. McMillan Education, London, UK.
5. Khan, B.B., M. Yaqoob, M. Riaz, M. Younas and A. Iqbal. 2004. Livestock Management Manual for Introductory Courses. Dept. of Livestock Management, University of Agriculture, Faisalabad.

Course Title: Pakistan Studies
Course Number: SOCS-02508
Course Duration: 1 semester (16 weeks)
Credits: 1(1-0)

Course Description:

Course Goals and Performance Objectives:

At the end of this course and following completion of an appropriate amount of independent study, students will be able to;

1. Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
2. Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Theory:

Historical Perspective with regard of ideological rationale of Pakistan with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah, Factors leading to Muslim separatism, People and Land, Government and Politics in Pakistan, Political and constitutional phases from 1947 to up-till now, Contemporary Pakistan, Economic institutions and issues, Society and social structure, Ethnicity, Foreign policy of Pakistan and challenges, Futuristic outlook of Pakistan

Detailed Course Contents:

No.	Theory
1.	Introduction and objectives of Pakistan Studies, Aims & Objectives of creation of Pakistan
2.	Ideology of Pakistan & Quaid-e-Azam Muhammad Ali Jinnah & Allama Muhammad Iqbal

3.	Importance of Ideology of Pakistan; Aligarh Movement & Sir Syed Ahmed Khan
4.	Services of Quaid-e- Azam for the establishment of Pakistan
5.	What were the problems faced by the newly-established Pakistan?
6.	Dispute of Kashmir
7.	Constitutional History of Pakistan & Objective Resolution 1949
8.	Constitution 1956, 1962 & 1973
9.	Process of Islamization in Pakistan
10.	Political Phase from 1947 onward
11.	Natural Resources of Pakistan, Agro-Ecological Zones, Range Lands, etc.
12.	Geo-strategic location of Pakistan and its Livestock Wealth
13.	Foreign Policy of Pakistan, Principles, Objectives and Determinants
14.	Relation of Pakistan with rest of the world**;** China Pakistan Economic Corridor (CPEC)
15.	Organization of Islamic Conference (OIC)
16.	Futuristic outlook of Pakistan and Current affairs

Teaching Learning Strategies:

Theory	**Practical**
Lectures	
Presentations	
Group Discussion	
Assignments	
Quiz	

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
Modality	**Assignment**	**Mid Term**	**Final Term**	**Total**	**Class Performance**	**Final**	**Total**
Max marks	02	06	12	20		0	0

Recommended Books:

1. Burki, Shahid Javed. 1980. State & Society in Pakistan. The Macmillan Press Ltd.
2. Akbar, S. Zaidi. 2000. Issue in Pakistan's Economy. Oxford University Press, Karachi.
3. S.M. Burke and Lawrence Ziring. 1993. Pakistan's Foreign Policy: An Historical analysis. Oxford University Press, Karachi.
4. Mehmood, Safdar. 2003. Pakistan Political Roots & Development 1947-1999. Oxford University Press, Lahore.

SEMESTER-III

Course Title: Principles of Animal Nutrition
Course Number: NUTR-02710

Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:
This is an introductory course on Animal Nutrition

Course Pre-requisites:
Courses in Animal Physiology

Course Goals and Performance Objectives:

Goal 1: The goal is for the student to develop a comprehensive knowledge of basics of animal nutrition. The student will become familiar with nutrient classification and functions.
Objective 1: For each of the major nutrient (water, proteins, carbohydrates, fats, minerals and vitamins), list their sources, components and functions.

Goal 2: The goal is for the student to develop a comprehensive knowledge of digestive anatomy and regulation of feed intake.
Objective 1: A comparison of digestive anatomy and physiology of ruminants and non-ruminants.
Objective 2: Understanding the regulation of feed intake in ruminants and non-ruminants, with a focus on factors effecting feed intake and nutrient utilization.

Goal 3: The goal is for the student to develop a comprehensive knowledge of feedstuffs used in animal nutrition.
Objective 1: Define and understand the following feed classifications.
a. Roughages
b. Concentrates
c. Supplements
d. Additives
Objective 2: Classify, describe the use and compare the following feedstuffs. Understand how processing affects their nutritional value.
a. Corn and wheat
b. Barley and oats
c. Sorghum grains
d. Green forages
e. Straws
f. Cakes and meals
g. Molasses
h. Urea
i. Brans
j. Silage
k. Haylage
l. Alfalfa hay and pellets

Goal 4: The student will need to be able to discuss protein, carbohydrate, fat metabolism and proximate analysis.
Objective 1: Enlist steps of protein and carbohydrate metabolism and absorption in ruminants and non-ruminants
Objective 2: Discuss the minerals and vitamins, used in animal nutrition. Enlist steps of lipids and volatile fatty acids metabolism and absorption in ruminants and non-ruminants
Objective 3: Discuss the sampling techniques, proximate analysis and the Van Soest procedure for fiber analysis

Course Contents:

Theory:
A brief history and scope of animal nutrition. Comparative digestive anatomy and physiology of ruminants and non-ruminants. Pre-gastric and Post-gastric digestion and absorption of major nutrients. Rumen ecology. Regulation of feed intake in non-ruminants and ruminants. Classification and functions of nutrients. Importance of water in the animal bodies, its sources, requirements and losses. Carbohydrates nutrition: Structure classification, digestion and metabolism. Volatile fatty acids (VFA): production, absorption and metabolism in ruminants. Lipids: classification, structure, digestion and metabolism. Protein and amino acid: classification, structure digestion and metabolism. Introduction to mineral and vitamins in animal nutrition. Laws governing pure feed and food.

Practical:
Identification of feed stuffs and their nutritional composition. Sampling techniques for feed ingredients and forages. Processing of samples for chemical analyses. Proximate analysis: dry matter (DM), ash, crude protein (CP), ether extract (EE) and crude fiber (CF) determination. Sample preparation for mineral analysis.

Detailed Course Outline:

	Theory Lecture Split	**Practical Session Split**
1	A brief history and scope of animal nutrition	Identification of feed stuffs
2	Comparative digestive anatomy of ruminants and non-ruminants	Nutritional composition of feed stuffs
3	Comparative digestive physiology of ruminants and non-ruminants	Seasonal forages
4	Pre-gastric digestion of proteins in non-ruminants	Nutritional composition of forages
5	Digestion of proteins in small intestine in non-ruminants	Sampling techniques for feed ingredients and forages
6	Pre-gastric digestion of proteins in ruminants	Sampling techniques for forages
7	Pre and post -gastric digestion of carbohydrates in non ruminants	Processing of samples for chemical analyses
8	Digestion of carbohydrates in ruminants	Proximate analysis
9	Pre and post -gastric absorption of lipids in non ruminants	Dry matter (DM) calculation
10	Pre and post -gastric absorption of lipids in ruminants	Ash estimation
11	Absorption of nutrients in monogastric animals	Principle of Crude protein (CP) determination
12	Absorption of nutrients in compound stomach animals	Procedure of Crude protein (CP) determination
13	Rumen ecology	Principle of ether extract (EE) estimation
14	Regulation of feed intake in non-ruminants	Procedure of ether extract (EE) estimation
15	Regulation of feed intake in ruminants	Crude fiber (CF) determination
16	Classification of proteins	Sample preparation for mineral analysis
17	Classification of carbohydrates	
18	Classification of lipids	
19	Importance of water in the animal bodies its sources, requirements and losses	
20	Metabolism of Carbohydrates in monogastric animals	

21	Metabolism of Carbohydrates in ruminants animals	
22	Production and fate of VFAs	
23	Metabolism of lipids in non-ruminants	
24	Metabolism of lipids in ruminants	
25	Metabolism of proteins in nonruminants	
26	Metabolism of proteins in ruminants	
27	Classification of vitamins	
28	Importance of fat soluble vitamins for animals	
29	Importance of water soluble vitamins for animals	
30	Introduction to mineral nutrition for animals (macro minerals)	
31	Introduction to mineral nutrition for animals (micro minerals)	
32	Laws governing pure feed and food	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline
Team Work

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. Pond, W.G., D.C. Church and K.R. Pond, 2006. Basic Animal Nutrition and Feeding. 5thEd. John Willey and Sons, New York, USA.

Recommended Books/Readings:

1. McDonald, P., R.A. Edwards, J.F.D. Greenhalgh, C.A. Morgan, L, Sinclair and R. Wilkinson, 2011. Animal Nutrition. 7thed. Benjamin Cummings, USA.
2. Perry, T.W., A.E. Cullision and R.S. Lowery, 2008. Feeds and Feeding.6thEdition. Prentice Hall, New Jersey, USA.

3. Banerjee, G.C., 2005. Feeds and Principles of Animal Nutrition. Oxford, IBH Publishing Co., Pvt. Ltd. New Delhi, India.
4. Sarwar, M. and Zia-ul-Hasan, 2000. Nutrient Metabolism in Ruminants. University of Agriculture Press, Faisalabad.
5. A.O.A.C., 2000. Official Methods of Analysis of the Association of Official Analytical Chemists. Vol2, 17th Ed. Arlington, VA. USA.

Course Title: General and Systemic Pharmacology
Course Number: PHRM-02301
Course Duration: 1 semester (16 weeks)
Credits: 4(3-1)

Course Goals and Performance Objectives:

Goal 1: Describe transport mechanisms, classification, formulation and routes of administration of drugs
Goal 2: Describe pharmacokinetics and pharmacodynamics of drugs of veterinary importance.
Goal 3: Describe drugs acting on body systems and mucous membranes.

Goal 4: Demonstrate preparation of pharmaceutical preparations and effects of various drugs *in vivo* and *in vitro*.

Course Contents:

Theory:
General Pharmacology: Introduction to Pharmacology, Historical perspectives and definitions, Drug sources, Classification of drugs, Nomenclature of drugs and drugs information sources, Drug development and drug regulations, Pharmacokinetic principles and application, Transport of drugs across cell membranes and absorption of drugs, Distribution of drugs, Metabolism of drugs, Elimination of drugs, Pharmacodynamic concepts of drugs and receptors, Structure activity relationship and receptor theories, Dose-response relationship, Graded dose response, quantal dose response, Therapeutic index, Adverse drug reactions and drug resistance/tolerance, Factors modifying the drug effects and drug interactions.
Systemic Pharmacology: Pharmacology of Autonomic Nervous System: Cholinergic and anticholinergic, Adrenergic and antiadrenergic, Neuromuscular blocking agents and ganglionic blocking agents, Pharmacology of central nervous system: Anaesthetics and pre-anaesthetic medication, Analgasics. Narcotic analgasics, Anti-inflamatory drugs, Local anaesthetics, Sedatives, Hypnotics and Tranquilizers, Central nervous system stimulants, Analgesics and anti-inflammatory drugs, Autacoids, Drugs affecting digestive system (simple stomach and ruminants), Drugs affecting respiratory system, Drugs affecting cardiovascular system, Drugs affecting uro-genital system, Electrolytes, Endocrine pharmacology, Drugs for skin and mucous membranes, Comparative pharmacology, Drugs acting on immune system, Nutraceuticals.

Practical:

Weights and measures, Prescription writing and pharmaceutical calculations, Formulations, External and internal dosage forms, Techniques of drug administration in animals and identification of various drugs, Preparation of ointments, Preparation of solutions, Preparation of tinctures, Collection of blood in common laboratory animals, Anaesthesia and euthanasia, Demonstration of techniques of volatile and intravenous anesthetics, General anesthetics and preanaesthetic medication, Effect of drugs on isolated heart of rabbits or guinea pigs, Effect of drugs on isolated intestine of rabbits or guinea pigs, Effect of drugs on intestinal motility on isolated tissue bath, Effect of autonomic drugs on eyes of rabbits, Preparation of stomach powder for ruminants, Preparation of saline electuary for ruminants, Demonstration of diuretic and antidiuretic drugs action in animals, Demonstration of analgesic activity and local anaesthetic effect of drugs in laboratory animals, Visit to pharmaceutical industry.

Detailed Course Outline:

No	Theory	Practical
1	Introduction to Pharmacology	Introduction/Terminologies used in Pharmacology
2	Historical perspectives and definitions	Metrology/Weights and Measures
3	Drug sources	Prescription Writing
4	Classification of drugs	Preparation of commonly used ointments / powders/ solutions/ tonics: Boric acid, BIPP, Sulphur, Boro-glycerine, Zinc oxide, Iodine, Pentasulphate, Phenyl Oil
5	Nomenclature of drugs and drugs information sources	Ethno-veterinay and Country Medicines:
6	Drug development and drug regulations	Preparation of strong/weak/Lugol's iodine solution
7	Pharmacokinetic principles and application	Drug dosage calculation
8	Transport of drugs across cell membranes and absorption of drugs	Preparation of stomach powder and saline electuary
9	Distribution of drugs	Handling of the laboratory animals
10	Metabolism of drugs	The effect of Cholinergic and anticholinergic drugs on the eyes of a rabbit
11	Elimination of drugs	The effect of local anesthetic on the hind limb of a rabbit
12	Pharmacodynamic concepts of drugs and receptors	The effect of General anesthetic on the rabbit
13	Structure activity relationship and receptor theories	The effect of diuretic on the urination time of a rabbit
14	Dose-response relationship	The effect of different drugs *in vivo* and *ex vivo* condition
15	Graded dose response	Introduction and use of to British Pharmacopoeia (Veterinary) and Veterinary Index
16	Quantal dose response	Visit to a Veterinary Medicine Market or Store / Pharama industry
17	Therapeutic index	
18	Adverse drug reactions	
19	Drug Permissible limits, resistance and tolerance	
20	Factors modifying the drug effects and drug interactions	
21	Pharmacology of Autonomic Nervous System	
22	Cholinergic drugs	
23	Anticholinergic drugs	
24	Adrenergic drugs	
25	Antiadrenergic drugs	
26	Neuromuscular blocking agents	
27	Ganglionic blocking agents	
28	Pharmacology of central nervous system	
29	Anesthetics and pre-anesthetic	

	medication	
30	Analgesics	
31	Narcotic analgesics	
32	Anti-inflammatory drugs	
33	Local anesthetics	
34	Sedatives	
35	Hypnotics and tranquilizers	
36	Central nervous system stimulants	
37	Analgesics and anti-inflammatory drugs	
38	Autacoids	
39	Drugs affecting digestive system (simple stomach and ruminants)	
40	Drugs affecting respiratory system	
41	Drugs affecting cardiovascular system	
42	Drugs affecting uro-genital system	
43	Electrolytes	
44	Endocrine pharmacology	
45	Drugs for skin and mucous membranes	
46	Comparative pharmacology	
47	Drugs acting on immune system	
48	Nutraceuticals	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		25% (QUIZ + Class performance)	75%	

Textbook:

Recommended Books:

1. Akhtar, M.S., 2004. Introduction to Veterinary Pharmacology & Therapeutics. 4th Ed. Agri. Livestock Bureau Pakistan, Faisalabad.
2. Sandhu, H.S., 2013. Essentials of Veterinary Pharmacology & Therapeutics. 2nd Ed. Kalyani Publishers,

Ludhiana, India.
3. Hardman, J.G. and L.E. Limbird, 2017. Goodman and Gillman Pharmacology Basis of therapeutics, 13th ed., McGraw-Hill, New York, USA.
4. Clark, M.A., 2001. Lippincott's Illustrated Reviews Pharmacology. 5thEdition.Williams& Wilkins, Philadelphia.
5. Katzung, B.G., 2017. Basic and Clinical Pharmacology.14th Ed., McGraw Hill, New York, USA.
6. The MSD Veterinary Manual. 2019. 11th Ed. Merck Sharp & Dohme Corp., NJ, USA. Available online: https://www.msdvetmanual.com
7. Sandhu, H.S., 2004. Laboratory Manual on Veterinary Pharmacology and Toxicology, Kalyani Publishers, Ludhiana, India.

Course Title: General Veterinary Pathology
Course Number: PATH 02302
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:
This course is aimed at understanding the General Pathology at the depth. General pathology and mechanisms of diseases of all domestic animals will be the focus of this course. The course will provide the fundamental concepts of response of body to various injurious stimuli and will cover different types of cell injury, cellular adaptations, inflammatory process, healing and repair of tissues and mechanism of neoplasia etc.

Course Pre-requisites:
Basic courses of Physiology, Anatomy and Histology

Learning outcomes:

1. Define and explain terminology used in Pathology.
2. Define and describe Pathogenesis and pathophysiological processes.
3. Differentiate and correlate between normal and pathological changes.

Course Goals and Performance Objectives:

Goal 1: To familiarize the learners with the concepts of general pathological process affecting different body tissues.
Objective 1: To identify & describe morphological, biochemical & genetic basis of cellular adaptation, cell injury and death.
Objective 2: To identify & describe morphological, biochemical & molecular changes in inflammation, tissue repair, hemodynamic disorders, immune mediated disorders and disorders of growth.
Objective 2: To identify and interpret gross and microscopic lesions in tissues.
Course Contents:
Theory:
Introduction to Pathology, Terminology used in pathology, adaptations, atrophy, hypertrophy, hyperplasia, dysplasia, aplasia, reversible and irreversible cell injury, cell death, necrosis, disturbances of mineral metabolism and pigmentation, disturbances of circulation, Inflammation, repair and healing of wounds and fractures, neoplasia; causes, pathogenesis, classification, auto-immunity, molecular pathology.

Practical:
Tissue sampling, preservation, processing and staining techniques: Sudan, Periodic Acid Schiff, MT etc. Demonstration of general, gross and microscopic picture of reversible and irreversible cell injury, atrophy, hypertrophy, hyperplasia, dysplasia. Calcification, melanosis, Disturbances of circulation: congestion, hyperemia, edema, Inflammation: acute and chronic, granulation tissue, Neoplasia: epithelial, connective tissue, bone, skin tumors.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Introduction to General Veterinary Pathology	Introduction to practical course, contents & objectives
2	Terminology used in pathology	Tissue sampling and preservation
3	Cell injury	Tissue processing
4	Reversible and irreversible cell injury	Stains and staining techniques
5	Cell death, necrosis	Sudan, Periodic Acid Schiff, MT etc
6	Necrosis	Demonstration of general, gross and microscopic picture of reversible and irreversible cell injury
7	Apoptosis	Demonstration of atrophy, hypertrophy, hyperplasia, dysplasia
8	Adaptations, atrophy, hypertrophy, hyperplasia, dysplasia, aplasia	Calcification
9	Disturbances of circulation	Demonstration of gross and microscopic picture of pigmentations
10	Disturbances of circulation	Disturbances of circulation: congestion, hyperemia, edema
11	Disturbances of circulation	Inflammation: demonstration of microscopic slides. (acute and chronic)
12	Disturbances of mineral metabolism	Granulation tissue, Gross and microscopic picture
13	Inflammation	Neoplasia
14	Types of Inflammation,	Types of Neoplasia
15	Mediators of Inflammation	Demonstration of epithelial, connective tissue, bone, skin tumors
16	Mediators of Inflammation	Quantitative data from microscopic specimens
17	Chronic Inflammation	
18	Cells and mediators of chronic inflammation, outcomes of inflammation	
19	Repair and healing of wounds and fractures	
20	Repair and healing of wounds and fractures	
21	Repair and healing of wounds and fractures	
22	Neoplasia	
23	Neoplasia causes	
24	Neoplasia pathogenesis	
25	Neoplasia classification	
26	Pigmentation	
27	Environmentally produced diseases	
28	Environmentally produced diseases	
29	Autoimmune diseases	
30	Autoimmune diseases	

31	The genetic basis of disease and genetic disorders	
32	The genetic basis of disease and genetic disorders	

OIE day1 competency addressed: Transboundary animal diseases (2.2), zoonosis (2.3), Emerging and reemerging diseases (2.4)

Textbook:

1. Zachary, J.F., and McGavin, 2017. Pathological basis of Veterinary Disease, Expert consult, 6th Ed., Elsevier, USA.

Recommended Books

1. Macfarlane P.S., R. Reid and R. Callander, 2011. Pathology Illustrated, 7th Ed., Churchill Livingstone, Edinburgh, UK.

Slauson, D.O. and B.J. Cooper, 2002. Mechanisms of Disease: A Textbook of Comparative General Pathology. 3rd Ed. Mosby Inc, A Harcourt Sciences Company, St Lousi MO 63146, USA.

Course Title: General Veterinary Parasitology and Protozoology
Course Number: PARA 02303
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:

The course deals with the study of the morphology and biology of parasites from the protozoan group having importance in animal health and welfare, as well as zoonotic and economic importance. The course is designed for the students pursuing the degree of Doctor of Veterinary Medicine to provide them with the knowledge and comprehension about the protozoan parasites causing different diseases in animals, the life cycles of these parasites, the pathogenesis of these infections, different hosts of these parasites, modes of transmission and survival mechanisms of these parasites in the environment, the sites of these parasites in the body of the different animal hosts, the diagnostic, therapeutic and prophylactic approaches for the diagnosis, treatment and control of parasites in general and of these protozoan infections in particular. The course also encompasses laboratory sessions for hands-on training of DVM students on different laboratory techniques used in the parasitology laboratory. The course also provides a platform to propose innovative solutions in order to tackle the existing and emerging challenges posed by protozoans in the veterinary and public health.

Course Pre-requisites:
F. Sc. Premedical

Course Goals and Performance Objectives:

Goal 1: Enabling the students to understand the nomenclature used in parasitology and classification of parasites
Objective 1: Describe the nomenclature used in parasitology and classify parasites
Goal 2: Enabling the students to understand the life cycle, pathogenesis, host-parasite interactions and control of protozoan diseases
Objective 1: Describe life cycle, pathogenesis, host-parasite interactions (immunological and pathophysiological aspects) and control of protozoan diseases

Goal 3: Enabling the students to collect and process biological samples and parasite specimens for identification / diagnosis as well as identification of zoonotic protozoan parasites.
Objective 1: Collect and process biological samples and parasite specimens for identification / diagnosis.
Objective 2: Identify the protozoan parasites of veterinary and public health importance, of economic importance as well as of zoonotic importance

Course Contents:

Theory:
Introduction to parasitology, effects of parasites on their hosts and their economic importance; Basic terminology, Host parasite relationship, Types of parasitism, Tissue and host specificity, Ecology of parasites, General life cycles of different classes of parasites, Types of hosts, Modes of infection of parasites, Nomenclature and classification of parasites, Parasitic zoonosis, Immunity against parasites; General concepts on parasite control strategies. Introduction to protozoology; history and differences from other unicellular organisms; Anatomy and physiology of protozoa; classification, morphology, life cycle, pathogenesis, diagnosis, treatment and control of the important species of the following genera of protozoa: Trypanosoma/Leishmania, Trichomonas and Histomonas, Entamoeba, Giardia, Balantidium, Eimeria, Isospora, Toxoplasma, Sarcocystis, Plasmodium, Haemoproteus, Leucocytozoan, Hepatozoan, Babesia, Theileria, Anaplasma, Cryptosporidium, Ehrlichia, Eperythrozoan, Cyclospora and Neospora; Immunity against protozoan parasites. Chemotherapetic approaches against protozoal infections.

Practical:
Introduction to laboratory ethics; qualitative and quantitative faecal examinations, Interpretation of faecal oocyst / egg count; Methods of blood examination; Quality control for blood examination and pseudoparasites; Examination of urine, genital discharges, sputum, and cerebrospinal fluid for protozoa; Mounting of protozoa; culturing of protozoa; morphological examination of intestinal protozoa, Identification of different protozoa (included in theory course) from field isolates and specimen slides.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Veterinary Parasitology and Its Importance	Introduction to Laboratory ethics and Parasitology Laboratory
2	Effects of Parasites on their host and their economic importance	Types of Samples that can be exploited for parasitological examination
3	Host Parasite association	Morphological Examination of Protozoan and Microscopic Objects using Micrometry
4	Modes of transmission of parasites/ Mode of infection of Parasite	Morphological Examination of Protozoan and Microscopic Objects using Micrometry
5	Parasite Zoonosis	Blood Sample Examination Techniques: Wet Smear from whole blood and buffy coat and Identification of different protozoa
6	Parasite Zoonosis	Blood Sample Examination Techniques: Thin Smear from whole blood and Identification of different protozoa
7	Immunity against parasites: Innate immunity Pathogen recognition and response of nonspecific (Innate immunity) response of the immune system	Blood Sample Examination Techniques: Thin Smear from buffy coat and Identification of different protozoa
8	Cells of the immune system and DCs for antigen presentation	Faecal Sample Examination Techniques: Direct Smear; a Qualitative Technique and Identification of different protozoa
9	Adaptive immune response	Faecal Sample Examination Techniques:

		Sedimentation Technique; a Qualitative Technique and Identification of different protozoa
10	Role of cytokines in adaptive immune response	Faecal Sample Examination Techniques: Flotation Technique; a Qualitative Technique and Identification of different protozoa
11	Adaptive immunity and antibodies	Faecal Sample Examination Techniques: OPG (Oocyst Per Gram) calculation; a Quantitative Technique
12	Parasite immunity	Faecal Sample Examination Techniques: OPG (Oocyst Per Gram) calculation; a Quantitative Technique
13	Immune evasion by parasites	Examination of other samples
14	Introduction to Protozoology: definition, history and differences from other unicellular organisms	Identification of Intestinal Protozoa
15	Anatomy and physiology of protozoa and classification	Mounting of Protozoa
16	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Eimeria	Culture of Protozoan Parasites
17	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Cryptosporidium, Toxoplasma	
18	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Plasmodium	
19	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Toxoplasma	
20	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Leishmania	
21	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Trypanosomes	
22	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Theileria	
23	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Theileria	
24	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Babesia	
25	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Babesia	
26	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Anaplasma, Ehrlichia. Rickettsia, Eperythrozoon	

27	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Haemoproteus, Leucocytozoan, Hepatozoan, Cytauxzoon	
28	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of and Negleriafowleri and Neosporacaninum	
29	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Giardia, Histomonas and Trichomonias	
30	Classification, Morphology, Life cycle, Pathogenesis, Diagnosis and Control of Isospora, Balantidium, Entamoeba	
31	Protozoan Zoonosis and One Health Concept	
32	Development of Vaccine against Protozoa	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	
	4	12	24	40	10	10	20

Textbook:
1. Schmidt, G.D. and L.S. Roberts, 2013. Foundations of Parasitology. 9thEdition, W.C.B. Company, U.K.

Recommended Books/Readings:
1. Akhtar, M., M.A. Hafeez and C.S. Hayat, 2003. General Parasitology and Protozoology. The Elite Scientific

Publications, Faisalabad, Pakistan.
2. Bowman, D.D. (2013). Georgis' Parasitology for Veterinarians. 10thEd. Saunders Elsevier, USA.
3. Urquhart G.M., J. Armour, J.L. Duncan, A.M. Dunn, F.W. Jennings, 2000. Veterinary Parasitology. Longman Scientific and Technical, U.K.
4. Foreyt, W.J., 2002. Veterinary Parasitology, 5th edition, Reference Manual, Iowa State Press, Blackwell Publishing Company, USA.
5. Zajac, A.M. and G.A. Conboy, 2012. Veterinary Clinical Parasitology 8thEdition. Blackwell Publishing AAVP, USA.
6. Iqbal, Z., M.S. Sajid, A. Jabbar, R.Z. Abbas and M.N. Khan, 2006. Techniques in Parasitology. HEC, Islamabad, Pakistan.
7. Hayat, C.S. and M. Akhtar. 1999. Parasitic Diagnosis. University Grants Commission, Islamabad, Pakistan.

Course Title: Veterinary Immunology

Course Number: MICR-02305

Course Duration: 1 Semester (16 weeks)

Credits: 2(1-1)

Learning Outcomes:

Goal 1: To familiarize the students with the immune system and its importance

Objective 1: Define and describe concepts of immunity
Objective 2: Describe immunogens, their properties and nature of vaccines
Objective 3: Elaborate immunogenesis or fate of vaccine material in the host
Objective 4: Describe and differentiate between immunoglobulins
Objective 5: Describe control of microbial infections through immunity
Objective 6: Describe vaccine reactions
Objective 7: Apply immunotherapy in field viral diseases

Course Pre-requisites:

FSc. Pre Medical

Theory:

Definition, immunity and types of immunity, Innate (non specific) immunity, active and passive immunity, natural and artificial immunity, cell-mediated and humoral immunity, autoimmunity, hypersensitivity etc. Non-specific resistance and natural barriers of defense such as sweat sebaceous, skin, mucus membranes, saliva, secretions, phagocytic cells, complement, inflammation, fever, Phagocytosis, (mechanism of phagocytosis and microbicidal activity, evasion of phagocytosis and bactericidal activity, survival of bacteria in macrophages, Immune response: Primary response, booster or secondary response, differences between the both, Immune system: primary lymphoid organs such as bursa of Fabricius and thymus, secondary lymphoid organs such as spleen, lymph nodes, MALT or GALT. Cells of the immune system (birds and animals): B and T lymphocytes, Immunocytes, types of lymphocytes, Th lymphocytes or Th cells, B lymphocytes / B cells, natural killer cells. Vaccines, types of vaccines, antigens/immunogens: Essential features of antigens/ immunogen, antigenic epitopes, adjuvant, HACCP, SOP, protocols, BMR, labels, vaccine, types of vaccines, cold chain, routes of vaccination, Immunogenesis: Antigen processing cells for exogenous

and endogenous antigens, Immunogenesis: Fate of foreign antigen/immunogen/vaccine material within the body, Presentation of T cell independent antigens and processing of T cell dependent antigens, Immunoglobulins: structure, chemical nature, classification, and antibody specificity, function; Humoral Immunity: Agglutination, Precipitation, CFT, ELISA, FAT, VN), Cell-mediated immunity (potency/efficacy, MTT assay, Thymidine up-take assay, Cytokine assay). Immunotherapy and its applications in viral diseases, Hypersensitivity and its types, Hypersensitivity type I, Hypersensitivity type II, Hypersensitivity type III and Hypersensitivity type IV.

Practical:

Microscopic examination of mammalian blood cells, Demonstration of organs of immune system, Preparation of HA antigen/bacterial antigen/RBC, Raising antiserum against sheep RBC, calculation of sub-agglutinating titer, sensitization of RBCs, Collection of guinea pig or human serum, its complement titration, mixing of blood from different blood groups, Complement fixation test, HA and HI test demonstration, Calculation of GMT of CFT, HI, bacterial agglutination and precipitation tests and demonstration of results, Bacterial agglutination test, AGPT: Gel preparation and punching of wells, charging of samples, AGPT: Demonstration of results, ELISA test against any virus disease, Skin sensitivity tests (tuberculin test or mallein test), Virus neutralization test (NDV) in chicken embryos, Fluorescent microscopy (Rabies detection), Immunotherapy: treatment of NDV, study tour to Research Institutes / Vaccine Production Unit.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Definition, immunity and types of immunity, Innate (non specific) immunity, active and passive immunity, natural and artificial immunity, cell mediated and humoral immunity, autoimmunity, hypersensitivity etc.	Microscopic examination of mammalian blood cells
2	Non-specific resistance and natural barriers of defense such as sweat, sebum, skin, mucus membranes, saliva, secretions, phagocytic cells, complement, inflammation, fever	Demonstration of organs of immune system
3	Phagocytosis (mechanism of phagocytosis and microbicidal activity, evasion of phagocytosis and bactericidal activity, survival of bacteria in macrophages), mucosal immunity	Preparation of HA antigen/bacterial antigen/ Washing of RBCs
4	Immune response: Primary response, booster or secondary response, differences between the both; Immune system: primary lymphoid organs such as bursa of Fabricius and thymus, secondary lymphoid organs such as spleen, lymph nodes, MALT or GALT, NALT	Calculation of sub-agglutinating titer, sensitization of RBCs
5	Cells and organs of the immune system (birds and animals): B and T lymphocytes, Immunocytes, Types of lymphocytes, Th lymphocytes or Th cells, B lymphocytes/ B cells, Natural Killer cells	Collection of guinea pig or human serum, its complement titration, mixing of blood from different blood groups
6	Vaccines, types of vaccines, antigens/immunogens: Essential features of antigens/ immunogen, antigenic epitopes, adjuvant	Complement fixation test; Raising of antiserum against sheep RBCs for CFT
7	Vaccine Production: HACCP, SOP, protocols, BMR, labels	Bacterial agglutination and precipitation tests and demonstration of results
8	Vaccine, types of vaccines, cold chain, routes of	HA and HI test demonstration, Calculation

	vaccination, vaccine matching	of GMT of CFT, HI
9	Immunogenesis: Fate of foreign antigen/immunogen/vaccine material within the body, presentation of T cell independent antigens and processing of T cell dependent antigens	AGPT: Gel preparation and punching of wells, charging of samples, Demonstration of results
10	Immunoglobulins: structure, chemical nature, classification, and antibody specificity, functions	ELISA test against any viral disease
11	Humoralimmunity: Agglutination, Precipitation, CFT	Fluorescent microscopy (Rabies detection)
12	Humoral immunity: ELISA, ELISPOT, FAT, VN	Preparation and Evaluation of ND vaccine
13	Cell mediated immunity (potency/efficacy, cytokine assay, Macrophage migration assay, Lymphocyte adherence migration inhibition, etc.	Virus neutralization test (NDV) in chicken embryos
14	Immunotherapy and its applications in viral diseases	Prepration of hyperimmune sera for Immunotherapy of NDV / FMDV
15	Hypersensitivity and its types	Skin sensitivity tests (tuberculin test or mallein test)
16	Hypersensitivity and its types	Study tour to Research Institutes / Vaccine Production Unit

Textbook:

1. Tizzard, I. R., 2013. Veterinary Immunology -An Introduction, 6th Ed. W. B. Saunders Co., London.

Recommended Books:

1. Abbas, A. K., H. L. Andrew and S. P. Jordan, 2017. 9th Ed. Cellular and Molecular Immunology. Elsevier. Amsterdam, The Netherlands.
2. Kuby, J., 2013. Immunology. 7nd Edi. W. H. Freeman and Co., New York.
3. Quinn, P. J., 2012. Veterinary Microbiology and Microbial Disease. 2st Edi. Blackwell Science Ltd., USA.
4. Anonymous, 1999. A laboratory manual for the isolation and identification of avian pathogens. 6th Ed. American Association of Avian pathologists, Iowa State University Press, Ames, Iowa. USA.
5. Hay F. C. and O. M.R. Westwood, 2002. Practical Immunology, 4th Edition, Blackwell Science, Oxford, UK

Course Title: Anthropology
Course Number: 02304
Course Duration: (16 weeks)
Credits: 1(1-0)

Course Description:

This course will inform and educate students on various aspects of basics of Anthropology and its basic concepts; Society; Culture and Subcultures; Norms, Values; Socio-cultural processes; Social groups; Human behaviour; Socialization and personality; Social institutions, Marriage and family systems; Village life and status of farmers in society; Social stratification; Social change and factors affecting change process; Role of women and children in rural development; Global social problems. Mindset issues which limit adoption of new technologies. Clinician-client relationship. How to establish a long term relationships between employer and employee?

Course Goals and Performance Objectives:

Students should be able to understand the basics of Anthropology:

1- Define and identify basic concepts of anthropology
2- Explain Pakistani society and culture

3- Differentiate between various social setups and subcultures
4- Describe the contribution of women and children in rural development

Course Contents:

Theory:
Anthropology and its basic concepts; Society; Culture and Subcultures; Norms, Values; Socio-cultural processes; Social groups; Human behaviour; Socialization and personality; Social institutions, Marriage and family systems; Village life and status of farmers in society; Social stratification; Social change and factors affecting change process; Role of women and children in rural development; Global social problems. Mindset issues which limit adoption of new technologies. Clinician-client relationship. How to establish a long term relationships between employer and employee?

Detailed Course Contents:

Sr#	Theory
1	Introduction of Anthropology and its basic concepts
2	Culture and sub-cultures
3	Norms and Values
4	Social groups and human behavior
5	Socio-cultural processes
6	Socialization and personality
7	Social institutions
8	Marriage and family systems
9	Village life and status of farmers in society
10	Social stratification, social change and its factors
11	Role of women and children in rural development
12	Global social problems
13	Mindset issues which limit adoption of new technologies
14	Clinician-client relationship
15	Role and character along with their types
16	How to establish long term relationships between employer and employee?

Teaching Learning Strategies:

Theory:	Practical
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory

	Assignment	Mid Term	Final Term	Total
Max marks	10%	30%	60%	
20	**2**	**6**	**12**	**20**

Textbook:
1. Ember, C.R. and M. Ember, 2011. Cultural Anthropology. 13th edition, Pearson, Prentice Hall, USA.

Recommended Books:
1. Iqbal, C.M., 2002. Sociology. Aziz Publications. Lahore, Pakistan.
2. Singh, M., 2007. Rural Sociology. Anmol Publications. New Delhi, India.
3. Giddens A., 2006. Sociology. 5th Edition. Polity Press, Cambridge, UK.

Course Title: Molecular Biology
Course Number: MICR-02306
Course Duration: 1 Semester (16 weeks)
Credits: 2(1-1)

Course Description:
The course is intended to give an overview of use of molecular biology in veterinary and animal sciences. In this course students are familaized with basics of molecular biolology and they are given a hands-on practice in commonly used techniques in molecular biology with special refence to veterinary and animal sciences.

Course Goals and Performance Objectives:

Goal 1: To familiarize the students with the field of Molecular biology
Objective 1: To describe the structure, function and types of RNA and DNA
Objective 2: To describe the process of manipulation in genome, replication and transcription mechanism, understand the molecular biology of the cellular processes
Objective 3: To describe the genomic libraries
Objective 4: To describe/ Perform protein analysis, DNA and RNA extraction, Run the PCR, gel electrophoresis and detection of bands on gel

Course Pre-requisites:
FSc. Pre Medical

Theory:
Introduction to Molecular Biology, RNA, DNA, Genes and chromosomes, Structure of DNA, Replication of DNA, Expression of genetic information, Endoribonucleases, Ligases, Principle of polymerase chain reaction (PCR), Principles of primer designing for PCR, DNA sequencing: principle and methods, Introducing mutations in DNA, Site-directed mutagenesis in a given gene, Vectors and their uses in molecular biology, Modifications of phage vectors and their uses, DNA modification enzymes, adaptors and their uses, Regulation of gene expression, Restriction fragment length polymorphism (RFLP), Genetically modified organisms/animals. Law of the land governing ethical issues of molecular biology.

Practical:
Good lab practices, Genomic DNA extraction from eukaryotic and prokaryotic cells, Plasmid DNA extraction, RNA extraction, Protein estimation, SDS-PAGE, Staining of gel and its documentation, Estimation of nucleic acids, Western Blotting, Southern Blotting, Northern Blotting and their result interpretations, Reverse Transcription of RNA, PCR, Use of computers for DNA and protein sequence data analysis from world wide web (Bioinformatics).

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Introduction to Molecular Biology, RNA, DNA, Genes and chromosomes	Good lab practices
2	Structure of DNA	Genomic DNA extraction from eukaryotic cells
3	Replication of DNA	Genomic DNA extraction from prokaryotic cells
4	Expression of genetic information	Plasmid DNA extraction
5	Endoribonucleases, Ligases	RNA extraction
6	Principle of polymerase chain reaction (PCR)	Estimation of nucleic acids
7	Principles of primer designing for PCR	Protein estimation
8	DNA sequencing: Principle and methods	SDS-PAGE
9	Introducing mutations in DNA, Site-directed mutagenesis in a given gene	Staining of gel and its documentation
10	Vectors and their uses in molecular biology	Western Blotting
11	Modifications of phage vectors and their uses	Southern Blotting
12	DNA modification enzymes, adaptors and their uses	Northern Blotting and their result interpretation
13	Regulation of gene expression	Polymerase chain reaction (PCR)
14	Restriction fragment length polymorphism (RFLP)	Reverse Transcriptase polymerase chain reaction of RNA
15	Genetically modified organisms/animals and Law of the land governing ethical issues of molecular biology	DNA sequence data analysis from world wide web
16	Genetically modified organisms/animals and Law of the land governing ethical issues of molecular biology	Protein sequence data analysis from world wide web

Teaching Learning Strategies:

Theory:	Practical
Lectures	Performance
Assignments	Presentations
Quiz	Group Discussions
	Assignments

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	Mid Term	Final Term	Total	Daily Evaluations	Final Term	Total
Max marks	10%	30%	60%		50%	50%	

Textbook:

1. Gupta, P.K., 2014. Elements of Biotechnology, 2nd edition. Rastogi Publications, India.

Recommended Book:

1. Green, M.R. and J. Samrook, 2012. Molecular Cloning: A Laboratory Manual, 4th Edition (3 vol. set). Cold Spring Harbor Lab Press, USA.

Course Title: Lab and Zoo Animal Management
Course Number: WECO-02607
Course Duration: 1 Semester (16 weeks)
Credits: 1(0-1)

Course Description: This course highlights basic husbandry practices and requirements of captive animals in the laboratories and zoos. In addition, the course provides useful insights towards behavioral responses of the captive animals, minor surgery procedures and restraining of the wild animals in captivity as well as in the field. The students may have opportunities to interact with various animal species and unique animal health care situations outside the traditional perception of what a veterinarian normally does.

Course Pre-requisites:
F. Sc. Pre-Medical

Course Goals and Performance Objectives:
Goal 1: Primary goal of the subject is to promote humane care of animals in the laboratory and zoos
Objective 1: To understand behavioral responses and management requirements of the animals in captivity.
Objective 2: To learn the techniques that will enhance animal well-being.

Goal 2: Educational requirements of veterinarians entering in the field of captive animals' management
Objective 1: To identify challenges of keeping the animals in captivity.
Objective 2: To understand beneficial aspects of keeping the animals in captivity.

Course Contents:

Theory:
No Theory part.

Practical:
Lab Animals: Introduction to lab animals, Lab animals' facilities designs, Management issues in lab animals, Record keeping procedures, Daily feeding, Husbandry and management practices, Handling of various lab animals, Common infections in laboratory animals, Conduction of minor procedures like anesthesia of laboratory animals, Management of pain, Distress and lasting harm, Observations on behavioral aspects in lab animals.
Zoo Animals: Introduction to zoo animals, Importance of zoos in conservation, Calculations on economics of zoo animals, Feeding requirements, Husbandry practices and management issues, Record keeping procedures and tagging, Enclosure designs, dimensions and housing requirements of various mammalian and avian species in zoos, Visit of museums to observe stuffed animals, Netting/trapping or restraining techniques for multiple species of wild animals in the field.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1		i. Introduction to various lab animal species ii. Zoo design and Zoo visits
2		Animal Welfare: i. Physical environment (Temperature, humidity and Ventilation) ii. Housing and Space management iii. Nutrition

		iv. Health v. Behavior vi. Mental Component
3		i. Occupational safety ii. Structural and social environment iii. Animal activities
4		i. Identification of various lab animal species ii. Genetics and nomenclature iii. Feeding practices iv. Water and bedding requirements v. Sanitation vi. Waste disposal vii. Pest control viii. Vaccination
5		i. Physical restraint ii. Restraint devices iii. Animal care and use protocols
6		i. Behavioral responses and identification of common infections ii. Medication procedures iii. Post-medication monitoring
7		i. Preventive medicines ii. Surveillance, diagnosis, treatment and control of disease iii. Pain, analgesia and anesthesia
8		i. Ethology ii. Behavioral observations iii. Normal and atypical behaviors
9		i. Zoo animal species ii. Naming animals iii. What is a zoo? iv. Human welfare and zoos
10		i. Why bother with conservation? ii. Biodiversity hotspots iii. Extinction iv. Threats to wildlife
11		i. Direct and indirect use values of biodiversity ii. Zoo management and zoo organizations
12		i. The constituents of food ii. Feeding modes and behaviors iii. How should food and water be presented? iv. Feeding by visitors v. Food preparation and storage vi. Nutritional problems
13		i. Marking and identification ii. Record keeping systems iii. Measuring animals
14		i. Enclosure and exhibit design ii. Health and safety iii. Animal enclosure requirements for avian and mammalian species iv. Introducing animals to a new enclosure v. Enclosure design and sustainability

15		i. Muesology and taxidermy ii. Museum exhibits iii. Stuffing techniques for various animal species
16		i. Types of nets and traps ii. Use of nets and traps in the field iii. Restraining techniques for various wild animals

Teaching Learning Strategies

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. Cheeran J.V., 2004. Textbook of Wild and Zoo Animals: Care and Management, 2nd Revised and Enlarged Edition, International Book Distributing Company, India.
2. Robert C. Hubrecht, James Kirkwood, 2010. The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals, 8th Edition, Wiley-Blackwell, USA.

Recommended Books/Readings:

1. Clark. J. D., K. A. Baldwin, M.J. Bayne, G.F. Brown, J.C. Gebhart, J.K. Gonder, M.E. Gwathmey, D.F. Keeling, J.W. Kohn, O.A. Robb and W.J. SmithWhite, 2011. Guide for the Care and Management of Laboratory Animals, 8th Edition. National Research Council, National Academic Press, Washington, D. C., USA.
2. Mathialagan P., 2007. Textbook of Animal Husbandry and Livestock Extension. 3rd Revised and Enlarged Edition Textbook Library Edition. International Book Distributing Company.
3. Hosey, G.,M. Vicky and S. Pankhurst, 2013. Zoo Animals: Behaviour, Management, and Welfare Oxford University Press, UK.
4. Rees, P.A., 2011. An Introduction to Zoo Biology and Management, John Wiley & Sons, USA.
5. Kleiman, D.G., K.V. Thompson and C.K. Baer, 2012. Wild Mammals in Captivity: Principles and Techniques for Zoo Management, 2nd Edition, University of Chicago Press, USA.
6. Miller, E. and E. Murray, 2014. Fowler's Zoo and Wild Animal Medicine: Current Therapy, Elsevier Health Sciences, USA.

Course Title: Holy Quran Translation-II
Course Number: SOSC 02309
Course Duration: 1 semester (16 weeks)
Credits: 1(1-0)

YEAR-II

LEARNING OUTCOMES:

After the successful completion the students would be able to describe and explain the saying of Allah Almighty regarding:

1. Oneness of Allah
2. Obedience of Parents
3. Sunnah Practices
4. Modesty and charity
5. Financial dealings
6. Faith on divine books and prophets

فہرستِ مضامین آیات کریمہ(سال دوم)

نمبر	مضمون	سورت و آیت نمبر
1	توحید	البقرہ:117-185-253....النساء:26تا28...المائدہ:6...18...52...الانعام:73-125.... الانفال:7-67.... التوبہ:55-.85...یونس:107...ھود:34-107.النحل:40...
2	ایمان بالکتب والرسل	البقرہ:2تا5....البقرہ:49تا51....البقرہ:207تا209...البقرہ:285....
3	اللہ عالم الغیب	الانعام:59...ھود:123....الرعد:8تا11-39....النحل:77....طہ:6تا7....لقمان:34.... السجدہ:4تا6...
4	اتباع سنت	النساء:59تا70-80تا81-83....المائدہ:7...الانفال:24تا25....النور:47تا56-62.... الاحزاب:28تا34... محمد:33....فتح:10...التغابن:12....
5	والدین کی اطاعت	الاسراء: 23تا24...لقمان:14تا15...الاحقاف:15...ابراہیم:41...
6	حیا	البقرۃ:26...النور:19-30تا31..القصص:25...الاحزاب:53.. الانفطار:10تا12
7	صدقہ	البقرہ:177-215-245-254-61تا80....
8	معاشی معاملات	البقرۃ: 279تا281... النساء: 11تا12 -29 ...البقرۃ: 188-198... الجمعۃ: 11... آل عمران: 77-188... الاعراف: 85... الرحمن: 8-9... ھود: 48-85... التوبہ: 34-35... الغافر: 58 ...الفاطر: 29...
9	کیفیات قلبی	البقرہ:7-74....الحدید:16....الاسراء:44... الجاثیہ: 23... الحجر: 12... الروم: 59... آل عمران: 151-159.. الاعراف: 101-179... یونس: 73... الحج: 46... الاحزاب: 4... الزمر: 45... الغافر: 35... المحمد: 24... الفتح: 4... ق: 37... النازعات: 8... المطففین: 14....
10	بین المذاہب ہم آہنگی	التوبہ :6 ...المحمد: 4... الانعام: 163... البقرۃ: 136-188-285... آل عمران: 50-51-84... الحج: 40... النساء: 150-151... المائدہ: 46تا48... الصافات:180تا 182... الانعام: 108...
11	شکر	البقرہ:152-172...النحل:78....الاسراء:44....طہ:130.....المومنون:28....النمل:15.... الروم:17تا18.... النصر:1تا3...
12	جانوروں کے متعلق احکام	البقرۃ :173 ...المائدہ: 3... البقرۃ: 65... الاعراف: 166... المائدہ: 31... الغاشیہ: 17 تا 20....
13	نشہ اور جوا	البقرہ:219....المائدہ:90-92 ...النساء:43...البقرۃ :219 ...المائدہ:3- 90تا 92...
14	قرآنی دعائیں	آل عمران:38-53....النمل:19....یونس:85تا86..... الانبیاء:87-89.... القصص:16....الممتحنہ:4-5....
15	قتل	البقرہ:78تا79....النساء:92تا93....المائدہ:27تا32....الانعام:137...الانعام:140...یوسف:9تا10... الاسراء:33...
16	قرآن کی چھوٹی سورتیں	القارعہ...التکاثر....العصر....الھمزۃ...الفیل....القریش...الماعون...

Assessment Strategies:

	Theory			
	Assignment/p	**Mid Term**	**Final**	**Total**

	resentation		**Term**	
	Pass / Fail			

Book:

- **Holy Quran**

Course Title: Ethics

Course Number: SOSC

Course Duration: Semester III (16 weeks each)

Credits: 1(1-0) per Year

Detailed Course Contents:

SEMESTER III:

Sr#	Theory
1	Seven Essential Components of Ethics
2	Ethics, Morals, and Values
3	Applied Ethics in Today's Society: Medicine and Science, Business, the Law, Media Ethics, etc.
4	Why Do We have Rules of Moral Conduct?
5	How to deal with Moral Differences?
6	Science and Ethics
7	Honesty and Integrity
8	Respect of self and others
9	Privacy / Confidentiality (safeguard entrusted information)
10	Professionalism and Responsibility
11	Respectful Communication
12	Obeying the law
13	Types of ethics: Descriptive ethics, Normative ethics, Metaethics, Applied ethics
14	Concept of Virtue and Evil in different religions**.**
15	Concept of "Flah" in Different Religions.
16	Compromise and Tolerance

Assessment Strategies:

	Theory

	Assignment/presentation	Mid Term	Final Term	Total
	Pass / Fail			

Recommended Books:

1- J.S. Mackeuzie, A Manual of Ethics
2- Harold H.Titus, Ethics for Today
3- B.A. Dar, Quranic Ethic
4- Hameedullah, Dr. Introduction to Islam
5- Ameer Ali Syed, The spirit of Islam

SEMESTER-IV

Course Title: Livestock Feed Resources and Forage Conservation
Course Number: NUTR-02807
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:
Introduce feed resources for livestock, methods to conserve forages for ruminants, and nutrient requirements of calf and dairy cattle.

Course Pre-requisites:
F.Sc. Pre-Medical

Course Goals and Performance Objectives:

Goal 1: The goal is for the student to develop a comprehensive knowledge of the various fodders, forages, dry roughages and concentrate feed stuffs according to their class and nutrient profile.
Objective 1: Students identify, know characteristics and nutrient profile of different livestock feed resources.

Goal 2: Students demonstrate knowledge of the traditional and non-traditional forage production systems in Pakistan and the quality of these fodders.
Objective 1: Provide the students, knowledge of the traditional and non-traditional forage production systems and seasonal variations in availability
Objective 2: Provide the students, knowledge of conservation of forages for commercial livestock production

Goal 3: Students understand the requirements and scientific principles of calf and replacement heifer nutrition
Objective 1: Discuss the weaning strategies, products related to calf nutrition.
Objective 2: Describe the replacement heifers rearing methods.

Goal 4: The goal is to develop a knowledge and understanding of ruminant feed formulation.
Objective 1: Students are able to practically understand the strategies of Total Mixed Ration (TMR) making
Objective 2: Students are able to diagnose the metabolic disorders in transition cows
Objective 3: At the end of course, students can understand the basis of report generated by NRC 2001

Course Contents:

Theory: Classification and nutritional composition of feed stuffs for ruminants: fodders, forages, dry roughages and concentrate feed stuffs. Anti-nutritional factors in feed stuffs for ruminants. Improvement of nutritional quality of low quality roughages. Forage production systems in Pakistan and their implications. Lean periods in forage production and methods to overcome shortage in lean period. Strategies and techniques to improve the nutritional quality of low quality roughages. Conservation of forages for commercial livestock production operations; silage and hay making. Ruminant nutrition: calf nutrition, heifer nutrition, dairy nutrition, meat animal nutrition. Feeding systems for commercial dairy, TMR feeding. Feed Additives and performance modifiers for ruminants. Nutritional and metabolic disorders

Practical: Identification of fodders and forages used in conventional and commercial ruminant production systems. Hay and silage preparation. Physical and chemical evaluation of hay and silage samples; Laboratory analysis of fodders and forages (DM, NPN, NDF, ADF, Cellulose, lignin, acid insoluble ash). Interpretation of laboratory analysis report and its implementation. Calculation of nutrient balance. Feed formulation: Pearson square method, Trial and error method, MS Excel based feed formulation. Least cost feed formulation by using computer software. Visit to commercial livestock enterprise.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Classification of fodders	Identification of fodders and forages used in conventional and commercial ruminant production systems
2	Classification of forages and dry roughages	Hay and silage preparation
3	Classification and nutrient composition of concentrated feed stuffs	Physical and chemical evaluation of hay and silage samples
4	Nutritional composition of fodders and forages	Laboratory analysis of fodders and forages
5	Nutritional composition of dry roughages	Determination of dry matter
6	Anti-nutritional factors in feed stuffs (L-1)	Determination of NPN
7	Anti-nutritional factors in feed stuffs (L-2)	Determination of NDF and ADF
8	Improvement of nutritional quality of low quality roughages	Determination of Cellulose
9	Forage production systems in Pakistan	Determination of lignin
10	Use of paradoxical agriculture and non-conventional feed resources	Determination of Acid insoluble ash
11	Methods to overcome shortage in lean period through a smart agriculture such as crop rotation program / multi-cut varities etc.	Calculation of nutrient balance
12	Strategies and techniques to improve the nutritional quality of low quality roughages	Feed formulation
13	Conservation of forages for commercial livestock production operations	Pearson square method, Trial and error method
14	Silage making (L-1)	MS Excel based feed formulation
15	Silage making (L-2)	Least cost feed formulation by using computer softwares
16	Hay making	Visit to commercial livestock enterprise
17	Calf nutrition from birth to weaning: colostrum management	
18	Calf nutrition: Weaning strategies	
19	Calf nutrition: milk, milk replacers, and calf starters	
20	Mammargy gland development and heifers growth	
21	Nutrition of transition cow: hypocalcaemia	
22	Nutrition of transition cow: ketosis	
23	Nutrition of transition cow: acidosis	
24	Nutrient Requirements of lactating cows: Water, dry matter intake	
25	Nutrient Requirements of lactating cows: protein, energy	
26	Nutrient Requirements of lactating cows: nutritional models and interpretation of formulation	
27	Feed additives in dairy nutrition: Lecture 1	
28	Feed additives in dairy nutrition: Lecture 2	
29	Minerals and vitamin requirements for dairy cattle	

30	Effects of nutritional strategies on herd fertility	
31	Conventional feeding strategies: Urea, wheat straw, and other byproducts commonly used	
32	Significant physiological parameters related to nutrition in dairy cattle: BUN, Glucose, TG, BHBHA etc…	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. Perry, T.W., A.E. Cullision and R.S. Lowery, 2008. Feeds and Feeding. 6thEdition. Prentice Hall, New Jersey, USA.

Recommended Books/Readings:

1. Ensminger, M. E., J.E. Old Field and W. W. Heinemann, 1990. Feeds and Nutrition Digestion. The Ensminger Publishing Co. Clovis, California, USA.
2. Pond, W.G., D.C. Church and K.R. Pond, 2006. Basic Animal Nutrition and Feeding. 5thEd. John Willey and Sons, New York, USA.
3. Preston, T.R. and R.A. Leng, 1987. Matching Ruminants Production Systems with Available Feed Resources in the Tropics and Subtropics. Penambul Books, Armidale, Australia.
4. Renard, C., 1997. Crop Residues in "Sustainable Mixed Crop/ Livestock Farming Systems. CAB International, UK.
5. Dennis, J. M., 1990. Forage in Ruminant Nutrition. Academic Press Inc, Harcourt Brace Jovanovich Publishers, USA.
6. NRC. 2001. Nutrient Requirements of Dairy Cattle. 7th Revised Edition. National Academy Press, Washington, USA.
7. NRC. 1985. Nutrient Requirements of Sheep. 6th Revised Edition. National Academy Press, Washington, USA.

8. Van Soest P.J., 1994. Nutritional ecology of the ruminant. Cornell University Pr, Ithaca, New York, USA.
9. Lander, P.E., 2001. The Feeding of Farm Animals in India. Biotech Books, New Delhi, India
10. A.O.A.C., 2000. Official Methods of Analysis of the Association of Official Analytical Chemists. Vol2, 17th Ed. Arlington, VA.

Course Title: Veterinary Chemotherapy and Toxicology
Course Number: PHRM 2401
Course Duration: 1 semester (16 weeks)
Credits: 4(3-1)

Course Description: This course is aimed at understanding the basic concepts of chemotherapy and toxicology. The learners will learn about antimicrobial resistance, tissue residual problems and classification of antimicrobial agents including antimicrobials, antifungal agents, antiprotozoal drugs, anthelmintics, drugs against ectoparasites, antiseptics and disinfectants, antiviral agents, anticancer drugs. The learners will also get to know about the general concepts of toxicology, scope and terminology, sources of toxicity, toxicokinetics, toxicodynamics and factors affecting toxicosis, diagnosis of toxicity and its management. The course will enable students to learn about different types of toxicosis.

Course Pre-requisites:
Undergraduate course of Pharmacology PHRM-2301

Course Goals and Performance Objectives:
Goal 1: To introduce the learners to the basic concepts of chemotherapy.
Objective 1: To describe the general consideration of chemotherapy and definitions, principles of chemotherapy.

Goal 2: To introduce the learners to the antimicrobial resistance, tissue residual problems and classification of antimicrobial agents
Objective 1: To describe the antimicrobial drug resistance and tissue residue problem of antimicrobial agents
Objective 2: To describe the classification of antimicrobial agents including cell wall synthesis inhibitors, aminoglycosides, tetracyclines, amphenicols, macrolide, lincosamides, fluoroquinolones, sulphonamides and miscellaneous antimicrobial agents.

Goal 3: To introduce the learners to the effects of chemotherapeutic agents on fungus, protozoa, helminthes, virus and cancerous cells
Objective 1: To describe the antifungal agents, antiprotozoal drugs, anthelmintics, drugs against ectoparasites, antiseptics and disinfectants, antiviral agents, anticancer drugs.

Goal 4: To understand the basic concepts in toxicology, kinetics of toxicants in body, their diagnosis and their management
Objective 1: To describe the general concepts of toxicology, scope and terminology, sources of toxicity, toxicokinetics, toxicodynamics and factors affecting toxicosis.
Objective 2: To describe how to diagnose a case of poisoning, how to take correct sample and handling of cases of toxicology.

Goal 5: To introduce the learners with different types of toxicosis.
Objective 1: To describe heavy metal toxicosis, house hold toxicosis, pesticides (insecticides, fungicides etc.), urea toxicity, cyanide poisoning, nitrate/nitrite poisoning, mycotoxins, poisonous plants, poisonous animals, environmental pollutants, toxicity caused by feed additives, radiation hazards and toxicity, toxicology of therapeutic agents.

Course Contents:

Theory:

Chemotherapy: Introduction and general consideration of chemotherapy and definitions, principles of chemotherapy and classification of chemotherapeutic agents, antimicrobial drug resistance and tissue residue problem, antimicrobial agents: cell wall synthesis inhibitors, aminoglycosides, tetracyclines, amphenicols (chloramphenicol, thiamphenicol, florfenicol), macrolide antibiotics and lincosamides, fluroquinolones, sulphonamides and dihydropyrimidines, miscellaneous antimicrobial agents, antifungal agents, antiprotozoal drugs, anthelmintics, drugs against ectoparasites, antiseptics and disinfectants, antiviral agents, anticancer drugs. **Toxicology:** General concepts, scope and terminology, sources of toxicity, toxicokinetics, toxicodynamics, factors affecting toxicosis, diagnosis of poisoning, handling of cases of toxicology, heavy metal toxicosis, house hold toxicosis, pesticides (insecticides, fungicides etc.), urea toxicity, cyanide poisoning, nitrate/nitrite poisoning, mycotoxins, poisonous plants, poisonous animals, environmental pollutants, toxicity caused by feed additives, radiation hazards and toxicity, toxicology of therapeutic agents.

Practical:

Toxicological terms, Calculations in toxicology, Collection of samples for laboratory analysis, Laboratory diagnostic procedures, Experiment for identification of chemical poisons, Experiment for the detection of heavy metals, Experiment for detection of barbiturates from given sample, Experiment for detection of chloral hydrate from given sample, Experiment to study the toxicity of cyanide in rat, Live animal swab test and swab test on premises, The antibiotic culture sensitivity testing, Experiment to study the toxicity of organophosphate insecticide in rat, Experiment for estimation of sulphonamides in sample, Experiment for estimation of oxytetracycline in sample, Experiment for determination of LD_{50} of a given drug. Visit to Pharmaceutical Industry.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Introduction, definitions and general consideration in chemotherapy	Definitions and terminology of toxicology and chemotherapy.
2	Antimicrobial resistance (AMR)	Toxicological calculations.
3	Antibiotic tissue residue problem	Laboratory diagnostic procedures: Qualitative and quantitative.
4	Classification of chemotherapeutic agents	Collection, preservation and dispatching of samples for toxicological examinations
5	Cell wall synthesis inhibitors, Penicillins	Qualitative tests for cyanide determination in forage sample
6	Cephalosporins	Qualitative tests for nitrate determination in forage sample
7	Carbapenems, Monobactams	Qualitative tests for heavy metals determination in forage sample
8	Aminoglycosides: Streptomycin	Detection of barbiturates from given samples
9	Aminoglycosides: Gentamycin, Kanamycin, Neomycin, Tobramycin	Demonstration of organophosphate and strychnine toxicity in rabbit
10	Tetracyclines	Quantitative methods for drug quantification from biological samples
11	Amphenicols (chloramphenicol)	Animal swab test and swab test on premises
12	Thiamphenicol, florfenicol	Antibiotics culture sensitivity test.
13	Macrolide antibiotics	Quantitative measurement of oxytetracycline through spectrophotometric analysis
14	Lincosamides	Quantitative measurement of sulphonamide through spectrophotometric analysis

15	Fluoroquinolones	Determination of LD_{50} of a given drug
16	Sulphonamides	Visit to Pharmaceutical industry/ experiment for identification of chemical poisons
17	Potentiated Sulpha	
18	Miscellaneous antimicrobial agents, Natural and Semi-synthetic	
19	Miscellaneous antimicrobial agents, Synthetic agents	
20	Antifungal agents	
21	Antiprotozoal drugs	
22	Anthelmintics (drugs against round worms)	
23	Anthelmintics (drugs against tape worms)	
24	Anthelmintics (drugs against hook worms)	
25	Drugs used against ectoparasites	
26	Antiseptics and disinfectants	
27	Antiviral agents	
28	Anticancer drugs	
29	General concepts and scope of Toxicology	
30	Terminology used in Toxicology	
31	Sources of toxicity	
32	Toxicokinetics	
33	Toxicodynamics	
34	Factors affecting toxicosis	
35	Diagnosis of poisoning	
36	Handling of cases of toxicity	
37	Heavy metal toxicosis	
38	House hold toxicosis	
39	Pesticides (insecticides, fungicides etc.)	
40	Urea toxicity	
41	Cyanide poisoning	
42	Nitrate/nitrite poisoning	
43	Mycotoxins	
44	Poisonous plants and poisonous animals	
45	Environmental pollutants	
46	Toxicity caused by feed additives	
47	Radiation hazards and toxicity	
48	Toxicology of therapeutic agents	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	

Class Work Policies:
Equal opportunity
Intellectual honesty

Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
Max marks	**Assignment**	**Mid Term**	**Final Term**	**Total**	**Class Evaluations**	**Final Term**	**Total**
80 Marks	6 Marks	18 Marks	36 Marks	60 Marks	10 Marks	10 Marks	20 Marks

Textbook:

1. 1. Sandhu, H.S., 2013. Essentials of Veterinary Pharmacology & Therapeutics. 2nd Ed. Kalyani Publishers, Ludhiana, India.

Recommended Books/Readings:

1. RiviereJ.E. and M.G. Papich, 2017.Veterinary Pharmacology and Therapeutics, 10th Edition. Wiley-Blackwell, USA.
2. The MSD Veterinary Manual. 2019. 11th Ed. Merck Sharp & Dohme Corp., NJ, USA. Available online: https://www.msdvetmanual.com
3. Laurence B. B.A. Chabner, B. Knollman, 2017. Goodman and Gillman Pharmacology Basis of therapeutics, 12th ed., McGraw-Hill, New York, USA.
4. Clark, M.A., 2001. Lippincott's Illustrated Reviews Pharmacology. 5th Edition. Williams & Wilkins, Philadelphia, USA.
5. Katzung, B.G., 2017. Basic and Clinical Pharmacology.14th Ed., McGraw Hill, New York, USA.
6. Sandhu, H.S., 2004. Laboratory Manual on Veterinary Pharmacology and Toxicology, Kalyani Publishers, Ludhiana, India.
7. Osweiler, G. D., 1996. Toxicology. Williams and Wilkins, Philadephia, USA.
8. Stine, K.E. and T.M. Brown, 2015. Principles of Toxicology. 3rd Edition. CRC Press Taylor and Francis group. USA.

Course Title: Veterinary Bacteriology and Mycology
Course Number: MICR 02404
Course Duration: 4th semester (16 weeks)
Credits: 3(2-1)

Course Description:

This course will provide the students description of important veterinary bacterial and fungal disease. The students should be able to differentiate among various bacterial and fungal diseases of animals.

Course Pre-requisites:
F.Sc. (Premedical) or equivalent degree

Course Goals and Performance Objectives:

Goal 1: Students should be able to differentiate among important bacterial diseases of animals.
Objective 1: Pathogenesis, diagnosis, prevention and control of diseases caused by Gram-positive cocci bacteria
Objective 2: Pathogenesis, diagnosis, prevention and control of diseases caused by Gram-negative bacilli bacteria
Objective 3: Pathogenesis, diagnosis, prevention and control of diseases caused by Gram-positive bacilli

bacteria
Objective 4: Pathogenesis, diagnosis, prevention and control of diseases caused by Acid-Fast-positive bacilli bacteria
Objective 5: Pathogenesis, diagnosis, prevention and control of diseases caused by Miscellaneous bacteria

Goal 2: Students should be able to differentiate among important fungal diseases of animals.
Objective 1: Pathogenesis, diagnosis, prevention and control of diseases caused by pathogenic fungi
Objective 2: Pathogenesis, diagnosis, prevention and control of diseases caused by opportunistic fungi
Objective 3: Pathogenesis, diagnosis, prevention and control of diseases caused by mycotoxins

Goal 3: Students should be able to perform clinical diagnosis of important bacterial and fungal diseases
Objective 1: Collection, transportation and processing of samples for bacterial isolation and identification of Gram-positive bacteria of veterinary importance
Objective 2: Collection, transportation and processing of samples for bacterial isolation and identification of Gram-negative bacteria of veterinary importance
Objective 3: Collection, transportation and processing of samples for bacterial isolation and identification of Acid-Fast-positive bacteria of veterinary importance
Objective 4: Collection, transportation and processing of samples for fungal isolation and identification of fungal diseases of veterinary importance

Course Contents:
Theory:
General sketch of exclusion studies for diagnosis of bacterial diseases of veterinary importance including *Staphylococcus spp.* (Mastitis), *Streptococcus spp.* (Mastitis, Strangles), *Escherichia spp.* (Colibacillosis), *Salmonella spp.* (Pulloram, Fowl typhoid, Salmonellosis: livestock), *Pasteurella spp.* (Haemorrhagic septicaemia), *Pasteurella spp.* (Shipping fever), *Brucella spp.* (Brucellosis), *Pseudomonas spp.* (Pyogenic infections), *Burkhulderia spp.* (Glanders), *Listeria spp.* (Listeriosis), *Bacillus spp.* (Anthrax), Neurotoxic *Clostridium spp.* (Tetanus), Histotoxic *Clostridium spp.* (Black quarter), Enterotoxic *Clostridium spp.* (Enterotoxaemia), *Corynebacterium spp.* (Lymphadenitis, Mastitis), *Mycobacterium spp.* (Bovine tuberculosis), *Actinobacillus spp.* (Wooden tongue), *Actinomyces spp.* (Lumpy jaw), *Nocardia spp.* (Nocardiosis), *Leptospira spp.* (Leptospirosis), *Borellia/ Treponema spp.* (Tick fever), *Compylobacter spp.* (Campylobacter infections), *Mycoplasma spp.* (CCPP, CBPP), *Mycoplasma spp.* (Avian mycoplasmosis: CRD), *Aspergillus spp.* (Brooding pneumonia--poultry), Opportunistic fungi (Thrush, Mastitis), *Trichophyton spp.* (Dermatophytosis), *Microsporum spp.* (Dermatophytosis), Dimorphic fungi (Systemic mycoses), Mycotoxins, and Mycotoxicosis.

Practical:
Collection, transportation and processing of samples for bacterial isolation and identification, Staphylococcus spp. (Coagulase test), Streptococcus spp. (CAMP test, Catalase test), *E. coli*, (IMVIC), Salmonella spp., (Bacterial agglutination tests, SAT), Bacillus spp., (Ascoli test), Pasteurella spp., (Animal inoculation test), Mycobacterium spp., (Tuberculin test), Clostridium spp, (Nagler reaction, Stormy fermentation), Mycoplasma spp, (SAT, ELISA), Burkholderia spp. (Mallein tests), Quality control of bacterial vaccines, Monitoring of vaccinated animals, CFT test for Glanders, Serodiagnosis (AGPT, FAT), Isolation and identification of fungal contaminants.

Detailed Course Contents:

Sr#	Theory	Practicals
1	General sketch of exclusion studies for diagnosis of bacterial diseases of veterinary importance	Collection, transportation and processing of samples for bacterial isolation and identification,

2	*Staphylococcus spp.* (Mastitis)	Preparation of culture media: medium composition, types and preparation
3	*Streptococcus spp.* (Mastitis, Strangles)	Biochemical tests including Catalase, oxidase, Urease, Coagulase, Mannitol fermentation Indole, MR, VP, Citrate, Lactose fermentation, Protein, starch and gelatin hydrolysis, blood hemolysis and Nitrate reduction
4	*Escherichia spp.* (Colibacillosis)	Isolation and identification of *Staphylococcus* species (Gram staining, coagulase, Catalase, Glucose and Mannitol fermentation, Blood hemolysis, Novobiocin activity)
5	*Salmonella spp.* (Pulloram, Fowl typhoid, Salmonellosis: livestock)	*Streptococcus* species (Gram staining, CAMP test, catalase, Blood hemolysis, Optochin activity)
6	*Pasteurella spp.* (Haemorrhagicsepticaemia)	*E. coli*, Gram staining, IMViC, Lactose fermentation, Identification of pathogenic *E. coli:* Congo Red / Loop ligation
7	*Pasteurella spp.* (Shipping fever)	*Salmonella* spp, (Gram staining, IMViC, Lactose fermentation, H_2S Production, growth on Selenite broth, bacterial agglutination tests: SAT)
8	*Brucella spp.* (Brucellosis)	*Bacillus* species, (Gram and spore staining, Oxidase, catalase, VP, Citrate utilization, Nitrate reduction, starch hydrolysis and Ascoli test)
9	*Pseudomonas spp.* (Pyogenic infections)	*Pasteurella* species, (Gram and capsular staining, IMViC, Oxidase, growth on CSY agar and rabbit inoculation)
10	*Burkhulderia spp.* (Glanders)	*Mycobacterium* species, (Gram and Acid fast staining, Urease, catalase, nitrate reduction test, niacin production, growth on LJ slants with sodium Pyruvate and glycerol, Tuberculin test)
11	*Listeria spp.* (Listeriosis)	*Clostridium* spp, (Gram and spore staining, Lecithinase test, Growth on RCM, Oxidase, catalase, sucrose fermentation, Nagler reaction, Stormy fermentation)
12	*Bacillus spp.* (Anthrax)	*Mycoplasma* spp, (SAT, ELISA), *Burkholderia* species (Mallein test)
13	Neurotoxic *Clostridium spp.* (Tetanus)	Quality control of bacterial vaccines, Monitoring of vaccinated animals
14	Histotoxic*Clostridiumspp.* (Black quarter)	Dermatophytes: Microscopic characters by KOH, Dermatophyte agar
15	Enterotoxic*Clostridium spp.* (Enterotoxaemia)	Mold, growth on SDA, (Macroscopic and microscopic characters)
16	*Corynebacterium spp.* (Lymphadenitis, Mastitis)	Mycotoxin; Extraction and Detection by TLC
17	*Mycobacterium spp.* (Bovine tuberculosis)	
18	*Actinobacillus spp.* (Wooden tongue)	
19	*Actinomyces spp.* (Lumpy jaw)	
20	*Nocardia spp.* (Nocardiosis)	
21	*Leptospira spp.* (Leptospirosis)	
22	*Borellia/ Treponema spp.* (Tick fever)	
23	*Compylobacter spp.* (Campylobacter	

	infections)	
24	*Mycoplasma spp.* (CCPP, CBPP)	
25	*Mycoplasma spp.* (Avian mycoplasmosis: CRD)	
26	*Aspergillus spp.* (Brooding pneumonia-poultry)	
27	Opportunistic fungi (Thrush, Mastitis)	
28	*Trichophyton spp.* (Dermatophytosis)	
29	*Microsporum spp.* (Dermatophytosis)	
30	Dimorphic fungi (Systemic mycoses)	
31	Mycotoxins, Mycotoxicosis	
32	Mycotoxins, Mycotoxicosis	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	
60	**4**	**12**	**24**	**40**	**10+10**	**20**	**60**

Textbook:

P. J. Quinn, B. K. Markey, F. C. Leonard, P. Hartigan, S. Fanning, E. S. Fitzpatrick, 2011. ClinialVeterinary Microbiology. Wiley-Blackwell.

Recommended Books:

1. Cottral, G. E., 1978. Manual of Standardized Methods for Veterinary Microbiology, Comstock Publishing Associates: A Division of Cornell University Press, Ithaca and London, UK.
2. Merchant, I.A. and R.A. Packer, 1984. Veterinary Bacteriology and Virology. 7th Ed., Iowa State University Press, Ames, Iowa. .
3. OIE, 2000. Manual of Standards for Diagnostic Tests and Vaccines. Off. Intl. Des. Epiz., Paris. France
4. Buxton and Fraser, 1977. Animal Microbiology, Volume 1, Black Well Scientific, Publications Limited
5. Seeley, Vandemark and Lee, 1991. Microbes in Action: A laboratory manual of Microbiology, 4th edition, WH Freeman and Co. New York, USA
6. Talaro, K. and A. Talaro, 2017. Foundation in Microbiology. 10th Ed., McGraw-Hill Higher Education

Publications.
7. Virella, G., 1997. Microbiology and Infectious Disease. 3rd Ed., Williams and Wilkins, Baltimore.

Course Title: Systemic Veterinary Pathology
Course Number: PATH 02402
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:
This course is designed to describe the mechanism of disease development in various systems of the body and to conduct the postmortem examination of small and large animals and interpretation of the findings.

Course Pre-requisites:
Basic physiological courses and anatomy courses. Histology of various organs

Course Goals and Performance Objectives:
Goal 1: To familiarize the learner with basic concept of different diseases problems affecting different animal species**.**
Objective 1: To describe the etiology and pathogenesis of different diseases affecting animal species.

Objective 2: To identify the abnormalities in different organs due to different problems and to aid in diagnosis for live animals

Objective 3: to interpret the findings / results of gross and histopathology in connection with clinical condition to give a diagnosis of a dead animal.

Course Contents:

Theory:
Pathology of important diseases of body systems: digestive, urinary, respiratory, circulatory, lymphatic, reproductive, nervous, musculo-skeletal, skin & appendages and sense organs. Pathology of metabolic diseases and nutritional deficiencies.

Practical:
Postmortem examination of small and large animals. Demonstration of histopathological slides of various systems. Visits to abattoirs and examination of different pathological conditions.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Introduction to systemic veterinary Pathology	Introduction to practical course, contents & objectives
2	Digestive system	Introduction to necropsy, Death & modes of death
3	Digestive system	Demonstration of histopathological slides of Skin
4	Digestive system	Demonstration of histopathological slides of GIT.
5	Digestive system	Demonstration of histopathological slides of Liver
6	Respiratory System	Postmortem & Wounds and types of wounds
7	Respiratory System	Postmortem and post-mortem changes.
8	Respiratory System	Demonstration of histopathological slides of Respiratory system.
9	Male Reproductive system	Non-infectious causes of death.
10	Male Reproductive system	Demonstration of histopathological slides of Male

		Reproductive system
11	Female reproductive system	Demonstration of histopathological slides of Female reproductive system
12	Female reproductive system	Demonstration of histopathological slides of Cardiovascular system
13	Muscular system	Demonstration of histopathological slides of Renal system
14	Muscular system	Postmortem & Disposal of carcass
15	Muscular system	Neoplastic conditions
16	Skeletal system	Postmortem demonstration
17	Skeletal system	
18	Skeletal system	
19	Haemopoitic system	
20	Haemopoitic system	
21	Haemopoitic system	
22	Nervous system	
23	Nervous system	
24	Cardiovascular system	
25	Cardiovascular system	
26	Endocrine system	
27	Endocrine system	
28	Integumentary system	
29	Metabolic diseases	
30	Sensory organs & Lymphoid system	
31	Nutritional deficiencies in animals	
32	Nutritional deficiencies in animals	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

OIE day1 competency addressedTransboundary animal diseases (2.2), zoonosis (2.3), Emerging and reemerging diseases (2.4)

Textbook:

1. Zachary, J.F., and McGavin, 2017. Pathological basis of Veterinary Disease Expert consult, 6th Ed., Elsevier, USA

Recommended Books/Readings:

1. Jubb, K.V.F., P.C. Kennedy and N. Palmer, 2015. Pathology of Domestic Animals, 6th Ed., Saunders Ltd. (3 vol. set).
2. Andrews, J.J. (Ed), 1986. Necropsy Techniques. The Veterinary Clinics of North America, 2(1): 1-2002.

Course Title: Veterinary Helminthology
Course Number: PARA 02403
Course Duration: 1 semester (16 weeks)
Credits: 4(3-1)

Course Description:
The course deals with the study of the morphology and biology of parasites from the helminths group having importance in animal welfare and health, as well as zoonotic and economic importance.
The course is designed for the students pursuing the degree of Doctor of Veterinary Medicine to provide them with the knowledge and comprehension about the helminthic parasites causing different diseases in animals, the life cycles of these parasites, the pathogenesis of these infections, different hosts of these parasites, modes of transmission and survival mechanisms of these parasites in the environment, the sites of these parasites in the body of the different animal hosts, the diagnostic, therapeutic and prophylactic approaches for the diagnosis, treatment and control of these helminthic infections. The course also encompasses laboratory sessions for hands-on training of DVM students on different laboratory techniques used in the parasitology laboratory. The course also provides a platform to propose innovative solutions in order to tackle the existing and emerging challenges posed by helminths in the veterinary and public health.

Course Pre-requisites:
FSc Premedical
Desirable: Basic knowledge of Parasitology and General Veterinary Parasitology

Course Goals and Performance Objectives:

Goal 1: Enabling the students to understand the life cycle, pathogenesis, host-parasite interactions and control of helminth diseases

Objective 1:

Describe life cycle, pathogenesis, host-parasite interactions (immunological and pathophysiological aspects) and control of helminth diseases

Goal 2:

Enabling students to collect and process helminth samples and parasite specimens for identification / diagnosis, and interventions

Objective 1:

Collect and process helminth samples and parasite specimens for identification / diagnosis

Objective 2:

Identification and Diagnosis of parasite specimens of veterinary and public health importance, of economic importance as well as of zoonotic importance

Objective 3:

Estimation of GIT parasite load/worm load for *in-vivo* evaluation of anthelmintics

Course Contents:

Theory:

Introduction to helminthology; Classification, morphology, life cycle, pathogenesis, diagnosis and control of the species of the following genera of trematodes: Dicrocoelium, Eurytrema, Opisthorchis, Clonorchis, Nanophyetus, Fasciola, Fasciolopsis, Fascioloides, Echinostoma, Metagonimus, Paragonimus, Prosthogonimus, Paramphistomum, Cotylophoran, Gastrothylax, Gastrodiscus and Schistosoma. Classification, morphology, life cycle, pathogenesis, diagnosis and control of the species of the following genera of cestodes: Anoplocephala, Paranoplocephala, Moniezia, Avitellina, Stilesia, Thysanosoma, Davainea, Raillietina, Amoebotaenia, Choanotaenia, Dipylidium, Hymenolepis, Taenia, Echinococcus, Mesocestoides, Diphyllobothrium and Spirometra. Classification, morphology, life cycle, pathogenesis, diagnosis and control of the species of the following genera of nematodes: Ostertagia, Cooperia, Haemonchus, Trichostrongylus, Bunostomum, Chabertia, Oesophagostomum, Ascaris, Parascaris, Toxascaris, Toxocara, Heterakis, Ascaridia, Strongylus, Dictyocaulus, Metastrongylus, Protostrongylus, Meulleruis, Rhabditis, Stephanurus, Thelazia, Spirocerca, Gongylonema, Tetrameres, Angiostrongylus, Habronema, Ancylostoma, Necator, Uncinaria, Oxyuris, Enterobius, Subulura, Strongyloides, Gnathostoma, Dirofilaria, Wuchereria, Loa, Parafilaria, Setaria, Dipetalonema, Onchocerca, Dracunculus, Trichinella, Trichuris, Capillaria, Dioctophyma, Acanthocephala, Macrocanthorhynchus, Annelida and Hirudo. Zoonoses in helminthes; Concepts on formulating/designing the effective control strategies against helminth parasites with special reference to cestodes and trematodes

Practical:

Methods for collection, transportation, fixation and preservation of helminthes; Methods for collection and examination of faeces, urine and sputum for the presence of eggs/larvae of cestodes, nematodes and trematodes; Methods for examination and staining of blood film for helminthes; Identification of trematodes, cestodes, nematodes, interpretation of result reports; Field visit at livestock and poultry farms for collection and identification of endoparasites including cestodes, nematodes and trematodes.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Introduction to Veterinary Helminthology What is veterinary helminthology? What are different types of helmiths? Why we study veterinary helminthology?	Methods for collection, transportation, fixation and preservation of helminthes
2	Introduction to Platyhelminthes	Methods for sample collection, transportation,

	(Trematodes) General Classification General Characteristics of trematodes	fixation and preservation of faeces, urine and sputum for the presence of eggs / larvae of cestodes, nematodes and trematodes
3	General Life cycle of trematodes	Sample Collection for Diagnosis of Helminthic Infections
4	Trematodes of Ruminants *Fasciola hepatica*	Coprological Examination (Direct smear) and Preparation and interpretation of result/reports
5	Trematodes of Ruminants *F. gigantica*	Indirect Examination (Flotation & Sedimentation Technique) and Preparation and interpretation of result/reports
6	Trematodes of Ruminants Fasciolopsis, Fascioloides	Indirect Examination (Flotation & Sedimentation Technique) and Preparation and interpretation of result/reports
7	Trematodes of Ruminants Dicrocoelium	Identification of Trematodes of Veterinary Importance
8	Eurytrema	Identification of Trematodes of Veterinary Importance
9	Trematodes of Ruminants (Blood) Schistosoma	Identification of Cestodes of Veterinary importance
10	Paramphistomum	Identification of Cestodes of Veterinary importance
11	Cotylophoron, Explanatum (Gigantocotyle) Gastrodiscus, Homalogaster	Quantitative Fecal examination and Preparation and interpretation of result/reports
12	Trematodes of Dogs and Cats (Liver) Clonorchis, Opisthorchis, Metorchis	Identification of Nematodes of Veterinary Importance
13	Trematodes of Dogs and Cats (Lungs and GIT) Paragonimus, , Nanophyetus, Platynosomum	Identification of Nematodes of Veterinary Importance
14	Introduction to Platyhelminthes (Cestodes) General Classification, General Characteristics of cestodes, General Life cycle of cestodes. What are Cestode& their larval stages / intermediate stages?	Field visit at livestock and poultry farms for collection and identification of endoparasites including cestodes, nematodes and trematodes.
15	Family Taeniidiae: Taeniasis in humans & animals.	Isolation and Identification of Nematode Larvae (Baermann's Technique)
16	Taenia sagginata	Methods for examination and staining of blood film for helminthes; Isolation and Identification of microfilariae (Knott's Modified Technique)
17	Taeniasolium, T. hydatigena	
18	Taenia multiceps, T. serialis	
19	T. ovis Taeniahyaenae T. pisiformis T. taeniaeformis	
20	Echinococcus granulosus and Echinococcus multilocularis	
21	Family Dilepididae Dipylidiumcaninum	
22	Diphyllobothriumlatum, Spirometramansoni	
23	Tapeworms of horses. Familly Anoploccephalidae, genera Anoplocephala & Paranopoccphala,	

24	Monieziaexpensa, M. benedeni, Avitellinacentripunctata, Stilesiaglobipunctata, Thysanosomaactinoides	
25	Hymenolepis nana, Davaineaproglottina, Raillietinatetragona	
26	Nematodes Round Worms: Introduction, General Classification, General Characteristics of nematodes, General Life cycle of nematodes	
27	Haemonchus: Barber's Pole Worm	
28	Ostertagia	
29	Hook worms	
30	Ascariasis in Canines and Felines	
31	Visceral Larval Migrans	
32	Ascariasis in Ruminants	
33	Ascariasis in Equines	
34	Round worms of poultry: Heterakis, Ascaridia	
35	Anisakis	
36	Oxyuroidea: Oxyuris, Pin worm infection	
37	Spiruroidea: Spirocercalupi	
38	Habronema, Draschia	
39	Thelazia, Gnathostoma	
40	Filarial worms: Wuchereria, Brugia, Dirofilaria, Setaria, Onchoccra	
41	Dipetalonema, Loa, Parafilaria	
42	Trichuroidea, Trichuris	
43	Capillaria	
44	Trichinella, Dioctophyma	
45	Immune modulation of helminth parasites	
46	Control measures against parasites	
47	Anthelmintic Resistance	
48	Helminth Zoonoses	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	
	6	18	36	60	10	10	20

Textbook:

1. Urquhart G.M., J. Armour, J.L. Duncan, A.M. Dunn, F.W. Jennings, 2000. Veterinary Parasitology. Longman Scientific and Technical, U.K.

Recommended Books/Readings:

1. Schmidt G.D. and L.S. Roberts, 2013. Foundations of Parasitology. 9th Edition, W.C.B. Company, U.K.
2. Bowman D.D., 2013. Georgi's Parasitology for Veterinarians. Saunders Elsevier, 10th Ed.
3. Soulsby, E.J.L., 2006. Helminths, Arthropods and Protozoa of Domesticated Animals. The English Language Book Society BailliereTindall, London
4. Foreyt, W.J., 2002. Veterinary Parasitology, 5th edition, Reference Manual Iowa State Press, Blackwell Publishing Company.
5. Zajac, A.M. and G.A. Conboy, 2012. Veterinary Clinical Parasitology 8th Edition. Blackwell Publishing AAVP.
6. Iqbal, Z., Z.D. Sandhu and A. Jabbar, 2004. Manual of Veterinary Helminthology. Friends Science Publishers, Faisalabad.

Course Title: Livestock Extension Education
Course Number: CEDU-02308
Course Duration: 3rd semester (16 weeks)
Credits: 2(2-0)

Course Description:

This course will educate students various aspects of extension education, communication, extension methods, communication skills, diffusion of innovations, etc. At the end of this course, the students will be able to understand and use various extension methods, communication skills and tools, audio-visual aids to disseminate the latest information and technology to farmers in an effective manner.

Course Pre-requisites: F.Sc. (Premedical) or equivalent degree

Course Goals and Performance Objectives:

Goal 1: Students should be able to understand the basics of extension
Objective 1: Definitions and importance of extension education
Objective 2: Philosophy and objectives of extension
Objective 3: Role of extension in increasing livestock productivity

Goal 2: Students should be able to understand the process of communication
Objective 1: Definitions, process and elements of communication
Objective 2: Speaking and writing skills of communication
Objective 3: Possible communication barriers and how to avoid them

Goal 3: Students should be able to understand basics of attitude change
Objective 1: Definitions of and differences between attitude and behaviour
Objective 2: Variables/factors affecting attitude change

Objective 3: Steps in attitude change process

Goal 4: Students should be able to understand and use various extension methods
Objective 1: Understanding various extension methods (individual, group and mass contact)
Objective 2: Benefits and drawbacks of each extension method
Objective 3: Selection of suitable extension methods & steps in extension program planning

Goal 5: Enabling students to understand the process of adoption of livestock innovations
Objective 1: Definitions and models of adoption/diffusion of innovations
Objective 2: Categories of farmers adopting innovations
Objective 3: Factors affecting adoption of innovations

Course Contents:
Theory:
Extension education, its role in enhancing livestock productivity; communication and its application in extension, communication barriers and measure to overcome these barriers, attitude change and factors affecting farmers attitude; extension methods; use of audio-visual aids in extension work; interviewing, writing reports and extension articles for newspapers; use of print and electronic media for extension work; adoption and diffusion of livestock innovations; demand-driven extension strategy through participatory approach; practice of microteaching; extension program development.

Detailed Course Contents:

Sr#	Theory
1	Extension education: Introduction to the course and definitions Philosophy and principles of extension: Attributes of a good extension worker
2	Extension education: Introduction to the course and definitions Philosophy and principles of extension: Attributes of a good extension worker
3	Importance and role of extension in increasing livestock productivity; Objectives of extension education
4	Importance and role of extension in increasing livestock productivity; Objectives of extension education
5	Communication: definitions and process of communication; Forms of communication
6	Communication: definitions and process of communication; Forms of communication
7	Elements of communication, how characteristics of each element affect communication ; Possible communication barriers extension workers face in their extension activities
8	Elements of communication, how characteristics of each element affect communication ; Possible communication barriers extension workers face in their extension activities
9	Various steps to overcome the communication barriers for effective extension work ; Speaking skills for extension; preparing and delivering a speech effectively
10	Various steps to overcome the communication barriers for effective extension work ; Speaking skills for extension; preparing and delivering a speech effectively
11	Writing skills for extension, guidelines/qualities of a good write-up ; Application of communication in extension
12	Writing skills for extension, guidelines/qualities of a good write-up ; Application of communication in extension
13	Attitude definitions; attitude vs behaviour, measurement of attitude ; Factors affecting change in farmers attitude, Steps in attitude change process

14	Attitude definitions; attitude vs behaviour, measurement of attitude ; Factors affecting change in farmers attitude, Steps in attitude change process
15	Extension methods: Individual contact methods; Group contact methods of extension (lecture and discussion meetings, result and method demonstrations, KisanMela/farmers day)
16	Extension methods: Individual contact methods; Group contact methods of extension (lecture and discussion meetings, result and method demonstrations, KisanMela/farmers day)
17	Group contact methods (filed tours/trips, role play/drama, brainstorming and buzz group sessions, etc); Mass contact methods of extension
18	Group contact methods (filed tours/trips, role play/drama, brainstorming and buzz group sessions, etc); Mass contact methods of extension
19	Selection of a suitable extension method (how many factors are involved?); Audio-visual aids used in extension
20	Selection of a suitable extension method (how many factors are involved?); Audio-visual aids used in extension
21	Importance of audio-visual aids and their proper use in extension work; Interviewing: definition, objectives and different forms of interviews
22	Importance of audio-visual aids and their proper use in extension work; Interviewing: definition, objectives and different forms of interviews
23	Writing reports/livestock information stories in newspapers for farmers awareness; Writing extension articles in newspapers for farmers benefit/awareness
24	Writing reports/livestock information stories in newspapers for farmers awareness; Writing extension articles in newspapers for farmers benefit/awareness
25	Use of print and electronic media in extension work; advantages and disadvantages of each medium; Adoption and diffusion of livestock innovations: definitions and models of adoption and diffusion process
26	Use of print and electronic media in extension work; advantages and disadvantages of each medium; Adoption and diffusion of livestock innovations: definitions and models of adoption and diffusion process
27	Categories of adopters (farmers adopting innovations); Factors affecting adoption process (characteristics of innovations and adopters/farmers)
28	Categories of adopters (farmers adopting innovations); Factors affecting adoption process (characteristics of innovations and adopters/farmers)
29	Role of extension worker in innovations adoption process; Demand driven extension strategy—a participatory approach
30	Role of extension worker in innovations adoption process; Demand driven extension strategy—a participatory approach
31	Microteaching practice, its benefits in teaching and extension; Extension programme development/steps in planning an extension programme
32	Microteaching practice, its benefits in teaching and extension; Extension programme development/steps in planning an extension programme

Teaching Learning Strategies:

Theory
Lectures
Discussions/question and answer sessions

Assignments

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory			
	Assignment	**Mid Term**	**Final Term**	**Total**
Max marks	10%	30%	60%	
40	**4**	**12**	**24**	**40**

Textbook:
1. Memon, RA and Bashir, E. 2013. Extension Methods, National Book Foundation. Islamabad, Pakistan.

Recommended Books:
1. De, Dipak and J. Prabhubasava, 2010. A Handbook of Extension Education. Agrobios, Judhpur, India.
2- Muhammad, S., 2005. Agriculture Extension Strategies and Skills. Unitech Communications, Faisalabad, Pakistan.
3- Calvert, P., 1990. The Communicator's Hand Book: Techniques and Technology, Gainesille, USA

Course Title: Animal Breeding and Genetics-I
Course Number: 02708
Course Duration: 1 semester (16 weeks)
Credits: 2(1-1)

Course Description:
This course aims to provide a broad understanding of some of the foundation concepts of genetics. We begin with examining different patterns of inheritance and the nature of genetic linkage, recombination and discuss mutations, the connection between genotype and phenotype. Further topics include the methods of DNA cloning, genetic engineering and their applications.

Course Pre-requisites:

Biology of 12^{th} grade.

Course Goals and Performance Objectives:

Goal 1: Basic concepts of genetics

Objective 1: Readily understand and communicate using appropriate terminology and nomenclature

Goal 2: Principles of inheritance

Objective 1: Explain mode of inheritance of traits based on results of appropriate genetic crosses, and predict or explain classes and ratios of progeny for given genetic situations
Objective 2: Analyze linkage and interpret linkage maps

Goal 3: Genomic techniques and their application

Objective 1: Perform basic molecular techniques, genetic crosses and chromosome spreads.
Objective 2: Obtain hands-on experience in performing fundamental molecular and cellular biology techniques, including working safely and efficiently in a modern laboratory setting.

Course Contents:
Theory:
Genetics; historical development and scope; genetic basis of inheritance: cell, organelles, cell cycle, and cell division, gametogenesis; Mendelism: Mendel's laws, monohybrid and polyhybrid crosses; Probability: concept and laws of probability; Chi-square test and its applications; Modified segregation ratios; Multiple allelomorphism; Genetics of sex: sex determining mechanisms, sex linkage and its variation; Polygenic inheritance; Genes and different gene actions: dominance, recessive, epistasis, additive and non-additive gene action; Pleiotropy; Linkage and crossing over; Gene mutation and chromosomal aberration; Lethal and sub-lethal genes, elimination of lethal from livestock populations and other genetic abnormalities; Polymerase chain reaction (PCR); DNA fingerprinting by using restriction fragment length polymorphism (RFLP), random amplified polymorphic DNA (RAPD), and amplified fragment length polymorphism (AFLP) in biomedical research; Genetic engineering: basic concepts of recombinant DNA technology, gene cloning and manipulation; application and future; Extra-nuclear inheritance.
Practical:
Microscopic studies on the animal cells undergoing mitosis and meiosis; Exercises on Mendelian and modified segregation ratios; Karyotyping and Banding for detecting chromosomal abnormalities; Genomic DNA isolation, purification and separation on gel electrophoresis; Quantification and storage; Primers, Polymerase chain reaction (PCR); DNA fingerprinting by using restriction fragment length polymorphism (RFLP), random amplified polymorphic DNA (RAPD), and amplified fragment length polymorphism (AFLP); DNA sequencing and genotyping; Basic alignment of sequences.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Genetics; historical development and scope; genetic basis of inheritance	Hands on practice of microscope handling, demonstration of different stages of cell division under microscope
2	Gametogenesis and Extra-nuclear inheritance	Exercises on Mendelian and modified segregation ratios
3	Mendelism: Mendel's laws, monohybrid and polyhybrid crosses	Karyotyping and Banding for detecting chromosomal abnormalities
4	Probability: concept and laws of probability; Chi-square test and its applications	Hands on practice of cell culturing, slide preparation, chromosome banding and microscopy
5	Modified segregation ratios	Genomic DNA isolation, storage
6	Multiple allelomorphism	Hands on practice of DNA extraction from blood
7	Genetics of sex: sex determining mechanisms, sex linkage and its variation	Gel electrophoresis
8	Polygenic inheritance; Genes and different gene actions: dominance, recessive, epistasis, additive and non-additive gene action	Hands on practice of Gel electrophoresis and DNA quantification
9	Pleiotropy, Linkage and crossing over	Primer designing by using online software, PCR (Evaluation of QTLs for genetic selection)
10	Gene mutation and chromosomal aberration	Hands on practice of PCR

11	Lethal and sub-lethal genes, elimination of lethal genes from livestock populations and other genetic abnormalities	Hands on practice of loading PCR product on gel, comparison with DNA ladder
12	Polymerase chain reaction (PCR)	Introduction to online genome browsers (NCBI, Ensemble) for gene sequences
13	DNA fingerprinting and use of RFLP, RAPD, AFLP in biomedical research	Hands on practice of RFLP
14	Genetic engineering: basic concepts of recombinant DNA technology	Genotyping
15	Gene cloning and manipulation	DNA sequencing by Sanger's method
16	Application and future	Use of Bioinformatics

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total (20)**	**Daily Evaluations**	**Final Term**	**Total (20)**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

Klug, W. S. 2015. Essentials of Genetics. Pearson Benjamin Cummings, San Francisco, CA. 9th edition. Pearson Publications.

Recommended Books/Readings:

1. Griffiths, A. J. F. 2015. Introduction to Genetic Analysis. 11th edition. W.H. Freeman and Co., New York.
2. Hodge, R. 2009. Genetic Engineering: Manipulating the Mechanisms of Life. Facts on File, New York.
3. Gardener, E. J., M. J. Simmons and D. P. Snustad. 2006. Principles of Genetics. 8th edition. John Wiley and Sons. Inc., New York, U.S.A.
4. Nicholas, F. 2009. Introduction to Veterinary Genetics. 3rd edition. Wiley-Blackwell.

SEMESTER-V

Course Title: Poultry Nutrition and Feed Technology
Course Number: NUTR-02907
Course Duration: 1 semester (16 weeks)
Credits: 2(1-1)

Course Description: The course provides information on nutritional strategies related to poultry and principal of feed manufacturing for livestock.

Course Pre-requisites:

Course Goals and Performance Objectives:
Goal 1: The goal is for the student to develop a comprehensive knowledge of avian digestive system and various feed stuffs being used in poultry feed industry
Objective 1: Students identify, know the characteristics and nutrient profile of different poultry feed resources.

Goal 2: Students understand and demonstrate the knowledge of feeding commercial poultry
Objective 1: Discuss the new concepts of feeding broiler, layer and breeder birds.

Goal 3: The student will be able to understand the principle and practical implications of feed manufacturing in livestock and poultry
Objective 1: Students are able to practically identify, sample and analyze the feed stuffs.
Objective 2: Students are practically aware of handling, storage and quality control management in animal feed production.
Objective 3: At the end of course, students can manufacture the animal feed. They also have basic knowledge of feeding practices at poultry farm.

Course Contents:
Theory: Avian digestive anatomy and physiology. Classification of poultry feed ingredients and their chemical composition. Anti-nutritional factors in feed stuffs for poultry. Feed additives in poultry nutrition. New concepts in poultry feeding. Nutrition of broiler, layer and breeder birds. Nutritional deficiency diseases in poultry. Feed stuff handling and storage at poultry feed mill. Feed stuff processing: grinding, mixing, pelleting and extrusion. Current and future prospects of poultry nutrition

Practical: Identification of poultry feed ingredients. Bulk feed stuff sampling, sample preparation and handling for laboratory analysis. Raw material handling and storage. Feed formulation for different classes of poultry bird: Manual method, MS excel, computer software. Preparation of wholesome feed at farm level. Quality control management in poultry feed production. Feeding practices at poultry farm. Compound animal feed stuff act. Visit to a commercial poultry feed mill.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Current and future perspective of poultry nutrition.	Identification of poultry feed ingredients (L-1)

2	Avian digestive physiology	Identification of poultry feed ingredients (L-2)
3	Classification and chemical and nutrient composition of poultry feed ingredients	Bulk feed stuff sampling
4	Anti-nutritional factors in feed stuffs for poultry	Sample preparation for laboratory analysis
5	Feed additives and enzymes in poultry nutrition	Sample handling for laboratory analysis
6	Nutrition of broilers and nutritional deficiencies	Raw material handling
7	Nutrition of layer and their nutritional deficiencies	Raw material storage
8	Nutrition of breeder birds	Feed formulation for different classes of poultry bird: Manual method
9	Feed milling: Introduction of processing	Feed formulation for different classes of poultry bird: MS excel
10	Raw material handling and storage: Sampling, testing, and Silos Management	Feed formulation for different classes of poultry bird: computer software
11	Methods of Particle Size Reduction	Preparation of wholesome feed at farm level
12	Mixing, Pelleting and extrusion	Quality control management in poultry feed production (L-1)
13	Factors affecting pellet quality: Lecture 1	Quality control management in poultry feed production (L-2)
14	Factors affecting pellet quality: Lecture 2	Feeding practices at poultry farm
15	HACCP in feed milling: Aflatoxin a case study	Compound animal feed stuff act
16	Punjab Act for Compound Feed Manufacturing	Visit to a commercial poultry feed mill

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations

Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:
1. Lesson, S. and J.D. Summers. 2002. Scott's Nutrition of the Chicken. International Book Distributing Co. Guleph, Ontario, Canada.

Recommended Books/Readings:
1. Lesson, S. and J.D. Summers, 2009. Commercial Poultry Nutrition University Books, Guleph, Ontario, Canada.
2. Lesson, S. and J. D. Summers, 2001. Broiler Breeder Production. University Book, Guleph, Ontario, Canada.
3. Nutrient Requirements of Poultry. 1994. National Academy Press, Washington, D.C.

Course Title: Animal Breeding and Genetics-II
Course Number: LPRO-02805
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:
This course aims to provide a broad understanding of some of the foundation concepts related to Animal Breeding Plans and Policies. We begin with role of Animal Breeder and Animal Breeding to improve the livestock employing different breeding strategies. Moreover, we'll cover various systems of breeding, grading up, development of inbred lines and selection methods. We'll also discuss National Breeding policy, breeding act and future of animal breeding.

Course Pre-requisites:
Introduction to Animal Breeding & Genetics-I undergrad course for basic concepts and understanding.

Course Goals and Performance Objectives:

Goal 1: Basic knowledge related to animal breeding
Objective 1: Understanding basic terminologies andmethods being employed in animal breeding

Goal 2: Breeding systems and development of inbred lines
Objective 1: Discussion about inbreeding, linebreeding, crossbreeding and grading through practical examples and case studies.
Objective 2: Methods and strategies involved in the development of inbred lines. Purpose and uses of inbred

lines.

Goal 3: National breeding policy, future and constraints of breeding plans

Objective 1: Comprehensive discussion on national breeding policy and breeding act for the improvement of indigenous livestock.

Objective 2: How to identify animal (animal tagging), animal registration. Role of breed registry and breed associations and future of breed associations in developing countries like Pakistan.

Course Contents:

THEORY

Role of animal breeding. Selection methods and kinds. Various system of breeding; Inbreeding, line breeding, out-breeding, out-crossing, crossbreeding, grading up. Development of inbred lines, selection for best combining abilities, reciprocal recurrent selection. Traits of economic importance in cattle, buffalo, sheep/goat and poultry. Animal genetic resources. National breeding policy. Constraints and future breeding plans. Emerging breeding technologies. Role of breed registry societies/associations in developed countries and its application in Pakistan.

PRACTICAL

Computation of various productive traits in farm animals and poultry. Exercises on the feasibility of pure breeding and crossbreeding in farm animals and poultry. Measurement of coefficient of relationship and inbreeding. Measurement of heterosis. Estimation of genetic changes in performance traits due to various mating system. Evaluation of livestock and poultry on the basis of their own performance, pedigree and progeny. Selection exercises and assessment of genetic gain. Calculation of breeding values from single and repeated records. Use of computer for data handling and analyses. Visit of livestock and poultry breeding farms.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Role of animal breeding	Computation of various productive traits in farm animals and poultry
2	Importance of Breeding Plan	Exercises on the feasibility of pure breeding and crossbreeding in farm animals and poultry
3	Breeding efficiency and factors affecting breeding efficiency	Measurement of coefficient of inbreeding
4	Artificial vs Natural Selection	Measurement of coefficient of relationship; Direct Relationship
5	Basis of Selection; Mass Selection, Family Selection	Measurement of coefficient of relationship; Collateral Relationship
6	Selection methods; Independent culling level	Types of heterosis
7	Selection methods; Tandem selection	Measurement of heterosis
8	Selection methods; Selection Index	Estimation of genetic changes in performance traits due to various mating system
9	Inbreeding; Line breeding	Evaluation of livestock and poultry on the basis of their own performance, pedigree and progeny
10	Out-breeding, out-crossing	Selection exercises
11	Crossbreeding	Assessment of genetic gain
12	Population genetics	Calculation of breeding values from single record
13	Heterosis, hybrid vigor	Calculation of breeding values from repeated records.
14	Crossbreeding programs in Pakistan	Application of Information Technology for handling and analyses of breeding data

15	Grading up	Visit of livestock breeding farms
16	Progeny Testing	Visit of poultry breeding farms
17	Progeny testing programs in Pakistan	
18	Development of inbred lines	
19	selection for best combining abilities	
20	Traits of economic importance in cattle, buffalo, camel and horses	
21	Traits of economic importance in sheep, goat and poultry	
22	Animal genetic resources	
23	Improvement plan and strategies for indigenous genetic resources	
24	National Animal breeding policy	
25	Animal Breeding act	
26	Constraints and future of breeding plans	
27	Natural vs Artificial Insemination	
28	MOET, MPPA, EPRA	
29	Animal Breeding Value Estimation	
30	Genetic Makers, SNP Chips	
31	Role of breed registry	
32	Role of breed associations in developed countries and in developing countries	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total (40)**	**Daily Evaluations**	**Final Term**	**Total (20)**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Recommended Books:

1. Bourdon, R.M. 2000. Understanding Animal Breeding: Prentice-Hall, Inc. Upper Saddle River, New Jersey.

2. Legates, J.E. and E.J. Warwick. 1990. Breeding and Improvement of Farm Animals. McGraw-Hill Publishing Co., New York. .
3. MINFAL. 1991. National Agricultural Policy. Ministry of Food, Agriculture and Cooperatives. Government of Pakistan, Islamabad.
4. Oldenbroek, J.K. 1999. Gene banks and the Conservation of Farm Animal Genetic Resources. DLO Institute for Animal Science and Health, The Netherlands.
5. Willis, M.B. 1998. Dalton‟s Introduction to Practical Animal Breeding. Blackwell, Science Ltd. UK.

Course Title: Clinical Veterinary Pathology
Course Number: PATH 02504
Course Duration: 16 Weeks (01 semester
Credit Hours: 1(0-1)

Learning Outcomes:

1- To perform and interpret the the hematological and biochemical test
2- Pathological report writing
3- To diagnose the hematological disorders based on laboratory tests

Course Description:

This course is aimed at interpreting the hematological and biochemical values. Pet animals and domestic animals will be the focus for this course. The course is particularly designed keeping in view the research requirements of undergraduate students. The students will be familiarized with the hematological, biochemical and urinalysis parameters of different animal species with special emphasis on the interpretation of clinical disease conditions.

Course Pre-requisites:

General Pathology and Systemic Pathology

Course Goals and Performance Objectives:

Goal 1: To familiarize the learners with the basic concept of problem affecting blood and urine abnormalities.

Objective 1: To identify the abnormalities of blood cells, plasma and urine in different domestic and pet animals

Objective 2: To interpret the findings / results in connection with clinical condition of domestic animals.

Objective 3: To interpret the findings / results in connection with clinical condition of pet animals.

Course Contents:

Practical:

Hematological procedures and interpretation of results. Urinalysis and Faecal examination. Impression smears, staining, examination and interpretation. Skin scrapings. Biochemical and functional tests of various organs. Plasma protein profile.

S. No	Practical Contents
1.	Collection, preservation, dispatch and disposal of laboratory specimens.
2.	Haemoglobin abnormalities and estimation
3.	Haematocrit: significance and abnormalities.
4.	TEC and anemia and polycythemia

5.	Reticulocyte count and classification of anemia
6.	TLC (Leukocytes in health and disease) and leukemia
7.	Blood smear examination (DLC) and Giemsa staining
8.	Hemoparasites and RBC abnormalities
9.	CBC report writing and case studies
10.	Erythrocytic indices and their significance.
11.	Erythrocyte sedimentation rate and its interpretation.
12.	Urinalysis.
13.	Faecal examination (Fecal occult blood)
14.	Liver function tests
15.	Kidney function tests.
16.	Hematology analyzer, automation and CBC interpretations

Teaching Learning Strategies:

Theory	Practical
Not applicable	Performance
Not applicable	Presentations
Not applicable	Group Discussions
Not applicable	Assignments
Not applicable	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50%	50%	

OIE day1 competency addressed: Transboundary animal diseases (2.2), zoonosis (2.3), Emerging and reemerging diseases (2.4)

Recommended Books/Readings:

1. Latimer, K.S., E.A. Mahaffey and K.W. Prasse, 2011. Duncan & Prasse's Veterinary Laboratory Medicine Clinical Pathology. 5th Edi., Iowa State Press, Ames, Iowa, USA.

Text Book:

2. Kaneko, J.J., J.W. Harvey and M.L. Bruss, 2008. Clinical Biochemistry of Domestic Animals. 6th Ed. Academic Press, USA.
3. Myer, D.G. and J.W. Harvey 2004. Veterinary Laboratory Medicine Interpretation and Diagnosis. 3rd Ed., W.B. Saunders Company, Philadelphia, USA.

Course Title: Veterinary Entomology and Acarology
Course Number: PARA 02505
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:
The course deals with the study of the morphology and biology of parasites, predominantly ectoparasites from the arthropod group having importance in animal welfare and health, as well as zoonotic and economic importance.The course is designed for the students pursuing the degree of Doctor of Veterinary Medicine to provide them with the knowledge and comprehension about the arthropod parasites causing different diseases in animals, the life cycles of these parasites, the pathogenesis of these infections, different hosts of these parasites, modes of transmission and survival mechanisms of these parasites in the environment, the sites of these parasites on/in the body of the different animal hosts, the diagnostic, therapeutic and prophylactic approaches for the diagnosis, treatment and control of parasites in general and of these arthropod infestations in particular. The course also encompasses laboratory sessions for hands-on training of DVM students on different laboratory techniques used in the parasitology laboratory. The course also provides a platform to propose innovative solutions in order to tackle the existing and emerging challenges posed by arthropod parasites in the veterinary and public health.

Course Pre-requisites:
F. Sc. Premedical

Course Goals and Performance Objectives:

Goal 1: Enabling the students to comprehend and describe life cycle, vector importance/pathogenesis and control of insects and arachnids.
Objective 1: Describe life cycle, vector importance/pathogenesis and control of insects and arachnids.
Goal 2: Enabling the students to collect and process biological samples and parasite specimens for identification / diagnosis
Objective 1: Collect and process biological samples and parasite specimens for identification / diagnosis
Objective 2: Identify different insects having vectorial potential of different diseases transmissible to animals and human beings.
Goal 3: Enabling the students to assess the prevalence, veterinary and public health importance, economic importance of parasitic diseases in an environment.
Objective 1: Assess the prevalence, veterinary health significance, public health significance as well as the economic importance of parasitic diseases in an environment.

Course Contents:
Theory:
General introduction of entomology: arthropods and their economicsignificance; classification of arthropoda; respiratory, digestive, nervous andreproductive systems of arthropods; different types of

mouthparts of insectsand arachnids and their significance in disease transmission; classification, morphology, life cycle, pathogenesis, diagnosis and control of the species ofthe following families of arthropods: Haematopinidae, Linognathidae,Pediculidae, Cimicidae, Reduvidae, Culicidae, Ceratopogonidae, Simulidae,Psychodidae, Tabanidae, Gastrophilidae, Glossinidae, Muscidae, Calliphoridae, Oesteridae, Hypodermatidae, Cuterebridae, Hippoboscidae,Ixodidae, Argasidae, Demodicidae, Sarcoptidae, Psoroptidae, Dermanyssidaeand Cheylotodae, role of insects and arachnids as vector.

Practical:
Methods for collection, fixation and preservation of arthropods; methods for preparation of permanent mounts and pinning of insects and arachnids; examination of skin scrapings for mange; Identification of lice, bugs, fleas,flies, ticks and mites; field visit for practical exposure to ectoparasiticinfestations; demonstration of application of insecticides by arranging visits tolivestock farms.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Entomology; Introduction	Methods for collection, fixation and preservation of arthropods
2	Arthropod Parasites and Their Economic Significance	Methods for preparation of permanent mounts and pinning of insects and arachnids
3	Classification of Arthropod Parasites	Methods forpreparation of permanent mounts and pinning of insects and arachnids
4	Respiratory and Digestive Systems of Arthropods	Examination of skin scrapings for mange
5	Nervous and Reproductive Systems of Arthropods	Identification of lice
6	Morphology, Life Cycle, Pathogenesis, Diagnosis and Control of the following families of arthropods: Phthiraptera: Haematopinidae, Linognathidae	Identification of bugs
7	Pediculidae	Identification of fleas
8	Hemiptera: Cimicidae, Reduvidae	Identification of flies
9	Siphonatpera, Ctenocephalides, Pulex	Identification of flies
10	Spilopsyllus, Xenopsylla, Tunga	Identification of flies
11	Diptera, Culicidae, Ceratopogonidae	Identification of ticks
12	Simulidae, Simulium	Identification of ticks
13	Psychodidae, Phlebotomus	Identification of mites
14	Tabanidae, Tabanus, Haematopota, Chrysops	Identification mites / Examination of clinical cases of mange infestation
15	Gastrophilidae, Gastrophilus	Field / farm visit for practical exposure to ectoparasitic infestations and integrated pest management strategies
16	Glossinidae; Glossina	Demonstration of application of insecticides by arranging visits tolivestock farms / clinics
17	Muscidae Musca, Hydrotea, Stomoxys, Haematobia	
18	Calliphoridae, Blowfly Myiasis	
19	Oestridae, Hypoderma, Oestrus	
20	Cuterebridae, Hippoboscidae, Hippobosca, Melophagus	

21	Arachnida	
22	Acarina	
23	Ixodidae: Ixodes, Dermacenter, Boophilus, Hyalomma, Rhipicephalus	
24	Argasidae, Argas, Otobius, Ornithodoros	
25	Demodicidae, Demodex	
26	Sarcoptidae, Sarcoptes, Notoedres, Knemidocoptes	
27	Psoroptidae, Psoroptes, Chorioptes, Otodectes	
28	Dermanyssidae Dermanyssus, Ornithonyssus	
29	Cheylotidae, Psorergates, Cheyletiella	
30	Pathogens transmitted by Insects and Archnids	
31	Biological and Vaccinal Control of Arthropods	
32	Integrated Pest Management, Sterile Insect Technique, Mode of Action of Insecticides	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	
	4	12	24	40	10	10	20

Textbook:

1. Urquhart G.M., J. Armour, J.L. Duncan, A.M. Dunn, F.W. Jennings, 2000. Veterinary Parasitology. Longman Scientific and Technical, U.K.

Recommended Books/Readings:

1. Schmidt G.D. and L.S. Roberts, 2013. Foundations of Parasitology.9thEdition, W.C.B. Company, U.K.
2. Bowman D.D., 2013. Georgi's Parasitology for Veterinarians. SaundersElsevier, 10th Ed.
3. Foreyt, W.J., 2001. Veterinary Parasitology, Reference Manual Iowa StatePress, Blackwell Publishing

Company.
4. Zajac A.M. and G.A. Conboy, 2006. Veterinary Clinical Parasitology, 7th Edition Blackwell Publishing AAVP
5. Taylor, M.A., L.L. Coop, and R.L. Wall, 2007. Veterinary Parasitology. 3rd Ed. Blackwell Publishing, UK
6. Iqbal, Z., M.N. Khan and A. Jabbar, 2003. An Illustrated Textbook of Veterinary Entomology. Friends Science Publishers, Faisalabad- Pakistan.

Course Title: Veterinary Virology
Course Number: MICR 02505
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:

This course will provide an insight to diagnose and differentiate various viral diseases of animals based on clinical presentation and laboratory diagnosis. At the end of this course student will have a thorough knowledge about diagnosis and control of various viral diseases affecting animals.

Course Goals and Performance Objectives:

Goal 1: Students will be able to understand etiology, pathogenesis, transmission, diagnosis and control of various viral diseases of animals caused by following DNA virus families
Objective 1: Herpesviridae
Objective 2: Papillomaviridae
Objective 3: Adenoviridae
Objective 4: Poxviridae
Objective 5: Parvoviridae
Objective 6: Circoviridae
Objective 7: Asfarviridae
Objective 8: Hepadnavirdae
Goal 2: Students will be able to understand etiology, pathogenesis, transmission, diagnosis and control of various viral diseases of animals caused by following RNA viruses
Objective 1: Picornaviridae
Objective 2: Paramyxoviridae
Objective 3: Orthomyxoviridae
Objective 4: Rhabdoviridae
Objective 5: Birnaviridae
Objective 6: Reoviridae
Goal 3: Students will be able to understand etiology, pathogenesis, transmission, diagnosis and control of various viral diseases of animals caused by following RNA viruses
Objective 7: Coronaviridae
Objective 8: Togaviridae
Objective 9: Flavivirdae
Objective 10: Retroviridae
Objective 11: Prions-BSE
Goal 4: Students will be able to understand etiology, pathogenesis, transmission, diagnosis and control of various viral diseases of animals caused by following RNA viruses
Objective 12: Bunyaviridae
Objective 13: Filoviridae
Objective 14: Bornaviridae
Objective 15: Arteriviridae
Goal 5: For each of the above virus family student should be able to provide description for
Objective 1: Methods of sample collection for submission to veterinary diagnostic labs
Objective 2: Mode entry of viruses into the body of animals, their pathogenesis, excretion and dissemination in the environment

Objective 3: Preventive vaccination, disinfection and other bio-security measures for control of animal viral diseases.

Course Contents:

Theory:

Introduction, etiology, pathogenesis, transmission, diagnosis and control of following DNA containing viral diseases of veterinary importance: Herpesviridae: Infectious bovine rhinotracheitis, Marek's disease, Infectious laryngotracheitis (ILT); Papillomaviridae: Warts- livestock; Adenoviridae: Avian adenovirus-HPS, IBH, EDS, canine adenovirus; Poxviridae: Fowl pox, Cow pox, Capri pox, sheep pox; Parvoviridae: Canine parvovirus, Feline panleucopenia, bovine parvovirus; Circoviridae: Chicken anemia virus. Introduction, etiology, pathogenesis, transmission, diagnosis and control of following RNA containing viral diseases of veterinary importance: Picornaviridae: FMD virus; Paramyxoviridae: Newcastle disease virus, PPRV, RPV, Canine distemper; Orthomyxoviridae: Avian influenza virus; Rhabdoviridae: Rabies, Bovine ephemeral fever; Birnaviridae: Infectious bursal disease; Reoviridae: Blue tongue, Avian tenosynovitis; Coronaviridae: Infectious bronchitis- poultry, Bovine and canine diarrhea; Togaviridae: Eastern, western, venezuelan equine encephalitis; Pestivirus: BVD; Retroviridae: Avian leukosis, Prions-BSE.

Practical:

Sources of sample; sample collection and transportation of samples for virus isolation, Processing of samples for virus isolation, Cultivation of NDV in chicken embryos, Cultivation of AIV in chicken embryos, Establishment of monolayer of BHK-21 cell line, FMD Virus cultivation in BHK-21, PPR Virus cultivation in vero cell line, HPS virus growth in broilers, EM and demonstration of Negri bodies (through simulations & images), Sero-characterization of NDV- HA & HI tests, Virus neutralization test, Sero-characterization of FMD virus by ELISA, Sero-characterization of PPR virus by CFT, Sero-characterization of IBDV by AGPT, Evaluation of attenuated live NDV virus vaccine and Evaluation of killed FMD virus vaccine, study tour of Research Institutes / Biological Production Units.

Sr. #	Theory	Practical
1.	Introduction, etiology, pathogenesis, transmission diagnosis and control of following DNA containing viral diseases of veterinary importance	Sources of sample; sample collection and transportat virus isolation
2.	Herpesviridae: Infectious bovine rhinotracheitis	Processing of samples for virus isolation
3.	Herpesviridae: Marek's disease; Infectious laryngotracheitis (ILT)	Cultivation of NDV in chicken embryos and storage
4.	Papillomaviridae: Warts- livestock (cattle/buffalo/horses), dogs; Asfarviridae	Cultivation of AIV in chicken embryos and storage
5.	Adenoviridae: Avian adenovirus-HPS, IBH, EDS	Establishment of monolayer of BHK-21 cell line
6.	Adenoviridae: Canine adenovirus	FMD Virus cultivation in BHK-21

7.	Poxviridae: Fowl pox, Cow pox	CPE and their types	
8.	Poxviridae: Capri pox, sheep pox, lumpy skin disease	Virus isolation and cultivation using lab animals	
9.	Parvoviridae: Canine parvovirus; Feline panleucopenia	EM and demonstration of Negri bodies (through simulations & images	
10.	Parvoviridae: bovine parvovirus; defective parvovirus	Sero-characterization of NDV- HA & HI tests	
11.	Circoviridae: Chicken anemia virus.	Sero-characterization of NDV- HA & HI tests	
		Methods for virus quantification; Virus neutralization test	
12.	Hepadnaviridae: Hepatitis B virus; Duck hepatitis B virus; Ground squirrel and woodchuck hepatitis viruses; Woolly monkey hepatitis B virus	Sero-characterization of FMD virus by ELISA	
	Introduction, etiology, pathogenesis, transmission, diagnosis and control of following RNA containing viral diseases of veterinary importance	Sero-characterization of PPR virus by CFT	
13.	Picornaviridae: FMD virus	Sero-characterization of IBDV by AGPT	
14.	Picornaviridae: Diagnosis and Control of FMDV	Evaluation of attenuated live NDV virus vaccine	
15.	Paramyxoviridae: Newcastle disease virus; Parainfluenza	Evaluation of killed FMD virus vaccine	
16.	Paramyxoviridae: PPRV; RPV	Study tour of Research Institutes / Biological Production Units	
17.	Paramyxoviridae: Canine distemper		
18.	Orthomyxoviridae: Avian influenza virus		
19.	Rhabdoviridae: Rabies		
20.	Rhabdoviridae: Bovine ephemeral fever		
21.	Birnaviridae: Infectious bursal disease		
22.	Reoviridae: Blue tongue; Avian tenosynovitis		
23.	Coronaviridae: Infectious bronchitis virus (IBV)- poultry		
24.	Coronaviridae: Bovine; Canine		

25.	Togaviridae: Eastern, western equine encephalitis		
26.	Togaviridae: Venezuelan equine encephalitis		
27.	Flaviviridae: BVD		
28.	Retroviridae: Avian leukosis		
29.	Bunyaviridae: Hantaviruses; CCHF, etc.		
30.	Filoviridae; Ebolavirus, Marburg virus		
31.	Bornaviridae: Borna disease virus; Arteriviridae: Equine arteritis virus; Simian hemorrhagic fever virus		
32.	Prions-BSE and Emerging Viruses at Human-Animal-Environment Interface		

Textbook:

1. Quinn, P.J., M.E. Carter, B.K. Markie and G.R. Carter, 2013. Clinical Veterinary Microbiology. Mosby, USA.

Recommended Books:

1. Anonymous, 1999. A laboratory manual for the isolation and identification of avian pathogens. 6th Ed. American Association of Avian pathologists, Iowa State University Press, Ames, Iowa.
2. Castro, A.E. and W.F. Henschele, 1992. Veterinary Diagnostic Virology. Mosby yearbook, Inc., Baltimore.
3. MacLachlan, N.J., E.J. Dubovi, 2011. Veterinary Virology, Fourth Edition., Academic Press (Elsevier), London, UK.
4. OIE, 2012. Manual of standards for diagnostic tests and vaccines. Off. Intl. Des. Epiz., Paris.
5. Talar, K. and A. Talaro, 2017. Foundation in Microbiology. 10th Ed., Win C. Brown Publ., Iowa.
6. Virella, G., 1997. Microbiology and Infectious Disease.3rd Ed., Williams and Wilkins, Baltimore.

Course Title: Veterinary Reproductive Physiology
Course Number: THER-02501
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description: The course is based on learning the basic foundation of reproductive physiology in different domestic animals and hands-on skills regarding male and female reproductive events and semen evaluation.

Course Pre-requisites: Anatomy of male and female reproductive tract.

Course Goals and Performance Objectives:
Goal 1: To familiarize the students with anatomy and physiology of male and female reproductive system
Objective 1: To discuss with the students different parts of female reproductive tract.
Objective 2: To discuss with the students different parts of male reproductive tract.

Goal 2: To familiarize the students with the origin, nature and role of reproductive hormones
Objective 1: To describe to students the classification of reproductive hormones.

Objective 2: To develop insight about roles of reproductive hormones

Goal 3: To familiarize the students with the physiology of important life events such as gestation, parturition and puerperium.
Objective 1: To discuss physiology of gestation, parturition and puerperium.
Objective 2: To discuss endocrinology of gestation, parturition and puerperium.
Goal 4: To familiarize the students with reproductive physiology of other domestic animals
Objective 1: To discuss physiology of equine and camel reproduction.
Objective 2: To discuss physiology of caprine and ovine reproduction.
Objective 3: To discuss physiology of canine and feline reproduction.

Course Contents:
Theory: Anatomy and physiology of male and female reproductive system, Embryogenesis of male and female reproductive system, Neural and neuroendocrine reflexes in reproduction, Classification of reproductive hormones, Mechanisms of action of protein and steroid hormones, Roles of reproductive hormones, Roles of reproductive hormones II, Factors affecting the onset of puberty, Factors influencing reproductive cyclicity, Folliculogenesis and oogenesis, Oocyte maturation and ovulation, Follicular phase of estrous cycle, Luteal phase of estrous cycle, Reproductive behavior in domestic animals, Sequence of spermatogenesis, Factors influencing sperm production, Biochemical composition of semen, Physiology of copulation and ejaculation, Sperm transport in the female reproductive tract, Capacitation and fertilization, Early embryogenesis, Maternal recognition of pregnancy, Implantation and placentation, Sex differentiation, Endocrinology of gestation, Endocrinology of parturition, Physiology of puerperium and lactation, Physiology of buffalo reproduction, Physiology of caprine and ovine reproduction, Physiology of canine and feline reproduction, Physiology of equine reproduction, Physiology of camel reproduction.

Practical: Functional anatomy of the hypothalamus and pituitary gland, Functional anatomy of the female reproductive organs, Histological evaluation of the female reproductive organs, Table palpation of female reproductive organs, Table biometry of female reproductive organs, Functional anatomy of the male reproductive organs, Histological evaluation of the male reproductive organs, Methods of semen collection, Preparation of artificial vagina, Preparation of donor bull, Macroscopic evaluation of fresh semen, Microscopic evaluation of sperm motility, Microscopic evaluation of sperm concentration, Microscopic evaluation of sperm morphology, Preparation of semen extenders, Semen processing and cryopreservation.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Anatomy and physiology of male and female reproductive system	Functional anatomy of the hypothalamus and pituitary gland
2	Embryogenesis of male and female reproductive system	Functional anatomy of the female reproductive organs
3	Neural and neuroendocrine reflexes in reproduction	Histological evaluation of the female reproductive organs
4	Classification of reproductive hormones	Table palpation of female reproductive organs
5	Mechanisms of action of protein and steroid hormones	Table biometry of female reproductive organs
6	Roles of reproductive hormones	Functional anatomy of the male reproductive organs
7	Roles of reproductive hormones II	Histological evaluation of the male reproductive organs

8	Factors affecting the onset of puberty	Methods of semen collection
9	Factors influencing reproductive cyclicity	Preparation of artificial vagina
10	Folliculogenesis and oogenesis	Preparation of donor bull
11	Oocyte maturation and ovulation	Macroscopic evaluation of fresh semen
12	Follicular phase of estrous cycle	Microscopic evaluation of sperm motility
13	Luteal phase of estrous cycle	Microscopic evaluation of sperm concentration
14	Reproductive behavior in domestic animals	Microscopic evaluation of sperm morphology
15	Sequence of spermatogenesis	Preparation of semen extenders
16	Factors influencing sperm production	Semen processing and cryopreservation
17	Biochemical composition of semen	
18	Physiology of copulation and ejaculation	
19	Sperm transport in the female reproductive tract	
20	Capacitation and fertilization	
21	Early embryogenesis	
22	Maternal recognition of pregnancy	
23	Implantation and placentation	
24	Sex differentiation	
25	Endocrinology of gestation	
26	Endocrinology of parturition	
27	Physiology of puerperium and lactation	
28	Physiology of buffalo reproduction	
29	Physiology of caprine and ovine reproduction	
30	Physiology of canine and feline reproduction	
31	Physiology of equine reproduction	
32	Physiology of camel reproduction	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance

Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:
1. Senger, P.L., 2003. Pathways to Pregnancy and Parturition. 2ndEd. Current Conceptions Inc., Pullman, USA.

Recommended Books/Readings:
1. Hafez, E.S.E. and B. Hafez, 2000. Reproduction in Farm Animals. 7th Ed. Lippincott, USA
2. Salisbury, G.W., N.L. Van Demark and J.R. Lodge, 1985.
3. Physiology of Reproduction and AI. 2nd Ed, CBS India
4. Bovine AI Technical Manual. 2ndEd, Ontario, Canada

Course Title: Veterinary Internal Medicine-I
Course Number: CLMS 02502
Course Duration: 1 semester (16 weeks)
Credits: 3(3-0)

Course Description:
Course is considered the foundation of all clinical courses especially medicine as it includes all basic scientific information and concepts of the diseases stated in advanced clinical courses. Course addresses teaching of hands-on clinical skills and clinical reasoning in the anaesthesiology, diagnostic imaging and medicine. Course content provides the veterinary student with access to clinical cases (clients and patients) and instruction so that the student becomes comfortable with and proficient at completing anappropriate physical examination; taking a complete history from a client; using clinical reasoning to develop differential and final diagnoses and diagnostic and treatment plans; and communicating effectively, both verbally and in writing, with clients, colleagues and support staff. Although students will be able to apply these skills to multiple animal species, but the focus is laid on applying these skills to the major animal species of importance.

Course Pre-requisites:
FSc Pre-Medical

Course Goals and Performance Objectives:

Goal 1: Learn animal in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well nourished, safe, able to express innate behaviour, and if it is not suffering from unpleasant states such as pain, fear, and distress. Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter (when relevant), management, nutrition, humane handling, and humane slaughter/killing. Animal welfare refers to the state of the animal; the treatment that an animal receives is covered by other terms such as animal care, animal husbandry, and humane treatment. Learn advocacy of veterinarians for the welfare of all animals, recognizing the key contribution that animals make to human society through food production, companionship, biomedical research and education
Objective 1: Explain animal welfare and the related responsibilities of owners, handlers, veterinarians and others responsible for the care of animals
Objective 2: Demonstrate animal welfare problems and participate in corrective actions
Objective 3: Describe up-to-date and reliable information regarding local, national and international
Objective 4: Describe animal welfare regulations/standards in order to describe humane methods for: animal production, transport, slaughter for human consumption and killing for disease control purposes

Goal 2: Learn Clinical skills as per standards of OIE.
Objective 1: Skill of history taking
Objective 2: Skill of clinical examination
Objective 3: Skill of lab diagnosis

Course Contents

Sr. No.	Theory Lecture Split
1.	Veterinary medicine, specialties, scope and general terminology used in veterinary medicine
2.	General systemic states: Fever, Hyperthermia, Hypothermia
3.	Toxemia
4.	Septicemia, bacteremia, viremia
5.	Disseminated intravascular coagulopathy, multiple organ dysfunction and acute respiratory distress syndrome
6.	Pain and Stress
7.	Shock, Anaphylaxis, Allergies
8.	Diseases of Alimentary system: Stomatitis, Pharyngitis, Esophagitis
9.	Anorexia and constipation
10.	Ruminal acidosis and alkalosis, sub-acute ruminal acidosis
11.	Ruminal tympany/bloat
12.	Hardware disease /Traumatic reticulo-peritonitis
13.	Right and left sided Abomasal displacement
14.	Enteritis, diarrhea
15.	Peritonitis and Ascites
16.	Equine colic (spasmodic, flatulent, impactive)
17.	Equine colic (obstructive, verminous, etc.)
18.	Diseases of liver and pancreas: Hepatitis, Jaundice, Cholilithiasis, Pancreatitis
19.	Diseases of cardiovascular system: General terms related to heart function, myocarditis endocarditis, pericarditis (Traumatic pericarditis), congenital cardiac defects
20.	Acute and congestive heart failure and Peripheral circulatory failure
21.	Diseases of hemopoietic and haemolymphatic and immune system: Anemia and types

22.	Leukocytosis, Leukopenia and leukemia
23.	Diseases of respiratory system: Rhinitis, Laryngitis, Tracheitis, Bronchitis
24.	Pulmonary Congestion and Edema, Emphysema
25.	Pneumonia, Aspiration pneumonia
26.	Hydrothorax, Hemothorax, Pneumothorax, Chylothorax
27.	Pleurisy and Pleuritis
28.	Epistaxis, Hemoptysis
29.	Diseases of renal system: Nephritis, Nephrosis
30.	Pyelonephritis, Cystitis
31.	Urolithiasis, Lower urinary tract disease
32.	Diseases of musculoskeletal system: Myositis, Myopathy
33.	Arthritis, Arthropathy
34.	Osteomalacia, Osteodystrophy, Rickets
35.	Osteomyelitis, Synovitis
36.	Diseases of skin: Common skin lesions (Pustule, vesicle, papule, nodule, scab, crust, papillomas , etc.); Pitryasis, hyperkeratosis, Parakeratosis, leukoderma, Lichenification
37.	Dermatitis, Patchyderma, Seborrhea
38.	Urticarial, Photosensitization
39.	Diseases of eye: Ophthalmic manifestations of systemic diseases, Chemosis, Kerato-conjunctivitis, Uveitis
40.	Exophthalmia, Corneal Opacity, Blindness, Cataract, Glaucoma
41.	Diseases of ear: Otitis (externa, media and interna)
42.	Diseases of nervous system: Meningioencphalitis
43.	Encephalomalacia, Hydrocephalus
44.	Traumatic injuries of brain and spinal cord
45.	Space occupying lesions of brain and spinal cord, Congenital defects of brain
46.	Poisonous animals related emergencies: (Snakebite, honeybee/wasp stinging, Lizards, Scorpion, Poisonous Toad)
47.	Diseases associated with physical agents: Radiation injury, Lightening stroke and electrocution, Drowning, Frostbite
48.	Peripaturient udder edema

Textbook:

1. Constable PD, Hinchcliff KW, Done SH, Grünberg W. 2016. Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats, 11th edition, Volumes 1 and 2. Elsevier Health Sciences.

Recommended Books/Readings:

2. Kelly WR. 1984. Veterinary Clinical Diagnosis. 3rd Ed. Bailliere Tindall & Corsell, London, UK.
3. The MSD Veterinary Manual. 2019. 11th Ed. Merck Sharp & Dohme Corp., NJ, USA. Available online: https://www.msdvetmanual.com
4. Pinsent PJN and Fulle CJ. 1997. Outline of Clinical Diagnosis in Horse. Blackwell Science, Oxford, UK.
5. AndersonDE, Rings DM. 2009. Current Veterinary Therapy, Food Animal Practice. 5th edition. Elsevier Health Sciences.
6. Hungerford TG. 1991. Hungerford's Diseases of Livestock, 9th Ed. McGraw-Hill Book Company, Sydney, Australia.
7. Côté E. 2015. Clinical Veterinary Advisor: Dogs and Cats, 3rd edition. Elsevier Health Sciences.
8. Small animal internal medicine. 1st edi. Lipincott William and Wilkins

Teaching Learning Strategies

Theory:	Practical
Lectures	Clinical Performance/case recording
Presentations	Case Presentations
Group Discussions	Group Discussions
Assignments	Pharmaceutical and markets visits
Quiz	Quiz

Course work policies:

9. Equal opportunity
10. Intellectual honesty
11. Regularity and punctuality
12. Adherence to deadlines
13. Fairness
14. Conformity to discipline
15. Team work

Assessment Strategies

Theory				
	Assignment	**Mid Term**	**Final Term**	**Total**
Max marks	06	18	36	60

Competencies Fulfilled:

16. Veterinary products
17. Animal welfare
18. Communication skills

Inspection and certification procedures

ISLAMIC STUDIES **1(1-0)**

Learning objectives:

This course is aimed at:

Goal 1. To provide Basic information about Islamic Studies

Objectives:

1. Basic Concepts of Holy Quran
2. History of Holy Quran
3. Study of Selected Text of Holy Quran
4. Seerat of Holy Prophet (S.A.W)

Goal 2. To enhance understanding of the students regarding Islamic concept of Tolerance and Civilization

Objectives:

1. Basic concept of Tolerance / Pluralism
2. Need and importance of Tolerance in the society
3. Comparative study of Tolerance in different religions
4. Tolerance and Life of Muhammad (PBUH)
5. Basic Concepts of Islamic Culture & Civilization
6. Characteristics of Islamic Culture & Civilization
7. Islamic Culture & Civilization and Contemporary Issues

Goal 3. To enhance the skill of the students for understanding of issues related to faith and religious life.

Objectives:

1. Basic Concepts of Hadith
2. Kinds of Hadith
3. Legal Position of Hadith & Sunnah
4. Basic Concepts of Islamic Law & Jurisprudence
5. Sources of Islamic Law & Jurisprudence

Goal 4. **To improve Students skill to make them practicing Muslims.**

Theory:

Introduction to Quranic Studies, Study of Selected Text of Holy Quran, Seerat of Holy Prophet (S.A.W)I, Seerat of Holy Prophet (S.A.W)II, Introduction to Hadith & Sunnah, Selected Study from Text of Hadith, Introduction to Islamic Law & Jurisprudence, Islamic Economic System, Tolerance in Islam, Islamic Culture & Civilization.

No.	Theory
1.	Introduction & objective of the course + Basic Concepts & History of Holy Quran.
2.	Translation & Commentary of Verses of Surah Al-Baqra Related to Faith (Verse No.1-5 & 285-286 & Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No.1-13).
3.	Translation & Commentary of Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-74) & Verses of Surah Al-Inam Related to Ihkam (Verse No.151-153).
4.	Translation & Commentary of Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No. 40, 56-58) & Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No-1-7).
5.	Life of Holy Prophet (S.A.W) in Makkah & Important Lessons Derived from the life of Holy Prophet in Makkah
6.	Important Events of Life Holy Prophet in Madina & Important Lessons Derived from the life of Holy Prophet in Madina.
7.	Basic Concepts of Hadith & Kinds of Hadith.

8.	Legal Position of Hadith & Sunnah.
9.	Translation & Commentary of selected Ahadith 1 to 5.
10.	Translation & Commentary of selected Ahadith 6 to 10.
11.	Basic Concepts of Islamic Law & Jurisprudence + Sources of Islamic Law & Jurisprudence.
12.	Basic Concepts of Islamic Economic System & Means of Distribution of wealth in Islamic Economics.
13.	Islamic Concept of Riba.
14.	Basic concept of Tolerance & Tolerance and Life of Muhammad (PBUH).
15.	Basic Concepts & Characteristics of Islamic Culture & Civilization.
16.	Islamic Culture & Civilization and Contemporary Issues.

Teaching Learning Strategies:

Theory	**Practical**
Lectures	
Presentations	
Group Discussion	
Assignments	
Quiz	

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
Modality	**Assignment**	**Mid Term**	**Final Term**	**Total**	**Class Performance**	**Final**	**Total**
Max marks	02	06	12	20		0	0

Recommended books:

1. Hameed ullah Muhammad, “Emergence of Islam” , IRI, Islamabad
2) Hameed ullah Muhammad, “Muslim Conduct of State”
3) Hameed ullah Muhammad, ‘Introduction to Islam
4) Mulana Muhammad Yousaf Islahi, Hussain Hamid Hassan, “An Introduction to the Study of Islamic Law” leaf Publication Islamabad, Pakistan.
5) Ahmad Hasan, “Principles of Islamic Jurisprudence” Islamic Research Institute, International Islamic

University, Islamabad (1993)
6) Mir Waliullah, "Muslim Jrisprudence and the Quranic Law of Crimes" Islamic Book Service (1982)
7) H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989)
8) Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001).

ETHICS

1(1-0)

Learning Outcomes:

At the end of the course, students will be able to:

1. Define ethics and describe ethical teaching of world religions
2. Describe ethics to be followed in business, biomedical, society, and interactions with animal

Theory:

Definition, scope and nature of ethics, development of ethical theory, ethical teachings of world religions, promotion of moral values through family and institutions, general review of moral standard as duty and happiness with reference to Kant and Mill, general review of business ethics, profits and ethics, ethics of stakeholders, general review of biomedical ethics, ethical implications of euthanasia (ethics of care), ethical implications of abortion, general review of ethics and ecology, the right to liveable environment and animals.

Recommended Books:

1. William, L.A., 1982. Introduction to Ethics, Mathuen & Co. Ltd., London, UK.
2. Garewal, S. M., 1985. Pakistan Way of Life and Culture. United Ltd., Lahore, Pakistan
3. Joseph, G., 1984 What the Great Religions Believe, New American Library, New York, USA.

Course Title: Holy Quran Translation-III
Course Number: SOSC 02509
Course Duration: 1 semester (16 weeks)
Credits: 1(1-0)

YEAR-III

LEARNING OUTCOMES:

After the successful completion the students would be able to describe and explain the saying of Allah Almighty regarding:

1. Amar Bil Maroof and Nahi Anil Munkar
2. Associate a partner with Allah (s w t)
3. Knowledge and its supremacy
4. Corruption on earth
5. Death a final fact
6. Faith on Angels
7. Inheritance

فہرستِ مضامین آیات کریمہ(سال سوم)

نمبر	مضمون	سورت و آیت نمبر
1	شرک	البقرة:22-165..آل عمران:64...النسآء:36-48-155...المائدہ:75تا76... الانعام:14-19-40-41-56 -71 -82-88-106-151- الاعراف:3-30-33
2	ایمان بالملائکة	البقرة:30-34-98-161-177-210-285...آل عمران:18-80-123-124... النساء:97-136-172... الانعام:8-9-61-93.. الاعراف:11تا12..
3	امر بالمعروف ونہی عن المنکر	آل عمران:103تا 105-110تا 111... الاعراف:157.. الاعراف:199.. التوبة :71 تا72..لقمان:17 تا19...

4	موت اٹل حقیقت، عالم برزخ اور عذاب قبر	البقرہ:28...البقرہ:80تا82...آل عمران:145...آل عمران:185...النساء:78-97.. المائدۃ:106... . الانعام:60تا61....البقرہ:66تا67-161تا162-174تا175... آل عمران:110-162-185..	
5	فساد فی الارض	البقرۃ:8تا15...المائدۃ:33تا34...الاعراف:56..الرعد:25..الشعراء:49تا55...الروم:41تا42..	
6	علم اور اسکی فضیلت	لقمان:27 ...القلم: 1... العلق: 1تا 5... البقرۃ: 31 تا 33... المائدہ: 109... آل عمران: 7-66... التوبہ: 122... الانفال: 60...طہ: 96- 114 ...النساء: 94...القصص: 78...الزمر: 49... الغافر: 83.	
7	روزہ	البقرۃ:183تا187...القدر:1تا5...	
8	سیاسی معاملات	البقرۃ:113-213...آل عمران:23-26...النساء:141... المائدۃ:1-42-44-49... النحل:124...یونس:9تا10... الرعد:41... الانبیاء:112...الحج:56-69...النور:48-51...	
9	اخلاص	یونس:22... .یونس:105...العنکبوت:65...لقمان:32...الزمر:2تا3...الزمر:11... الغافر:14-65...البینۃ :5...	
10	وراثت کے احکام	النساء:7تا 13-176...المائدۃ:106تا 108...	
11	زبان کی حفاظت	ق:18...الانفطار:10تا12...آل عمران:181...الحجرات: 11-12 ...ابراھیم: 24...الاسراء: 28 ... طہ: 43-44... البقرۃ: 83-263... آل عمران: 159... الحج: 34... الانعام: 68-106... الاعراف: 199... النور: 23-24...	
12	جانوروں کے متعلق احکام	الانعام:38...ھود:6..النحل:5تا9..النحل:66تا69 ...النمل: 18تا 19...	
13	ایثار	الانعام:61تا62...الکوثر:1تا3...	
14	قرآنی دعائیں	البقرۃ:126تا129 -201-284تا186 ...النور:21-40...	
15	زنا	الاعراف:33...الاسراء:32..النور 1تا9...الفرقان67تا75..المائدہ: 5 ...العنکبوت: 28-29... القصص: 4 ...النساء: 15-16-25...الممتحنہ: 12...	
16	قرآن کی چھوٹی سورتیں	اللیل...الضحیٰ...الم نشرح...التین.. العلق...القدر	

Assessment Strategies:

	Theory			
	Assignment/presentation	**Mid Term**	**Final Term**	**Total**
	Pass / Fail			

Books:

- **Holy Quran**

Course Title: Ethics

Course Number: SOSC 02510

Course Duration: Semester V (16 weeks each)

Credits: 1(1-0) per Year

Detailed Course Contents:

Semester V

Sr#	Theory
1	Ethics and social norms
2	Ethical theories: Relativism, Universalism, Cynicism, Altruism, Utilitarianism, advantages disadvantages
3	Consequence based (ultraism), Duty based (deontology), Contract based (rights), Character based (virtue)
4	Code of ethics
5	Principle of integrity
6	Objectivity Principle
7	Competence Principle
8	Fairness Principle
9	Confidentiality and privacy
10	Professionalism Principle
11	Diligence
12	Culture and ethics
13	Ethics in role conflict
14	Work Ethics
15	Social justice, Ethics role in socialization
16	Equality and equality among human beings

Assessment Strategies:

	Theory			
	Assignment/ presentation	**Mid Term**	**Final Term**	**Total**
	Pass / Fail			

Recommended Books:

1- J.S. Mackeuzie, A Manual of Ethics
2- Harold H.Titus, Ethics for Today
3- B.A. Dar, Quranic Ethics
4- Hameedullah, Dr. Introduction to Islam
5- Ameer Ali Syed, The spirit of Islam

SEMESTER-VI

Course Title: Zoonoses and Food Safety

Course Number: EPPH 02407

Course Duration: 1 semester (16 weeks) Credits: 3(2-1)

Course Description:

The course will provide a detailed introduction about epidemiology. It will describe different epidemiological studies designs and their application to control, prevent and eradicate diseases. It will also discuss the standard procedure for outbreak investigation. Disease frequency measures will also be discussed.

Course Pre-requisites:

Students should have basic knowledge of Microbiology, Immunology and Pathology. Knowledge of Medicine will be considered as plus.

Course Goals and Performance Objectives:

Goal 1: To know the importance of zoonoses in food safety
Objective 1: To define and describe the basics of zoonotic diseases, one health and principles of food safety
Objective 2: To describe laws and regulations impacting food animal, processing industries and food consumers
Objective 3: To describe approaches to microbiological and physical food borne hazard identification, testing and sampling; and food borne hazard prevention and control.
Objective 4: To describe the route(s) of transmission of major zoonotic diseases, individual and population prevention and control methods for major zoonotic diseases.

Course Contents:
Theory:
Introduction to zoonoses and its classification, Impact of zoonotic diseases on human health and economy, Global prevalence of zoonotic diseases, Role of veterinarians in preventing zoonotic diseases, Zoonoses: Viral, Bacterial, Parasitic and Fungal, Companion animals and zoonoses, Handling of zoonotic diseases (e.g. wool sorter's diseases), Regulations regarding zoonotic diseases. Food safety as global issue, Foodborne disease surveillance and outbreak investigation, Food safety monitoring, Drug Resistance and food safety, Surveillance and reporting of food-borne illness, Hygienic handling and processing of milk and meat products. Water, Milk and Meat-borne disease, Microbiological standards of water, milk, meat, eggs and their by- products, Intoxications associated with food products of animals origin, Residues in food products of animal origin, WTO standards, Importance and need of Communication with media, Role of national and international agencies in controlling emerging and re-emerging diseases, HACCP certification, ISO 22000 and Global Gap program for food safety.

Practical:
Collection, transportation and bacteriological examination of water, milk, eggs and meat samples, Qualitative standards for food safety certification of milk and meat, Quantitative standards, most probable number (MPN) and plate count (APC), Testing of residues (Antibiotics, heavy metals etc.), Isolation and identification of pathogens from milk products and molecular diagnostic methods for food pathogens, Schematic sketch for isolation and characterization of bacteria, Screening and diagnostisis of brucellosis, Screening and diagnosis of Tuberculosis, Screening and diagnosis of mastitis, Identification of adulteration in milk samples, Visits to Milk processing plant, Visits to Abattoir, Data collection and analysis of food borne

illness.

Detailed Course Outline:

Sr.	Theory Lecture Split	Practical Session Split
1	Introduction to zoonosis and its classification	Collection, transportation and bacteriological examination of water, Milk, Meat and Eggs samples
2	Impact of zoonotic diseases on human health and economy	Identification of adulteration in milk samples I
3	Global prevalence of zoonotic diseases	Identification of adulteration in milk samples II
4	Role of veterinarians in preventing zoonotic diseases	Identification of adulteration in milk samples III
5	One Health concept and Zoonosis	Qualitative standards for food safety certification of milk and meat
6	Viral, Bacterial, Parasitic and Fungal zoonotic diseases	Quantitative standards, most probable number (MPN) and plate count (APC),
7	Companion animals and zoonosis	Testing of Antibiotic residues in Food
8	Handling of zoonotic diseases	Isolation and identification of pathogens from milk products and molecular diagnostic methods for food pathogens
9	Regulations regarding zoonotic diseases	Schematic sketch for isolation and characterization of bacteria
10	Food safety as global issue	Data collection and analysis of food borne illness
11	Food-borne disease surveillance and outbreak investigation	Screening and diagnosis of brucellosis
12	Food safety monitoring, Drug Resistance and food safety	Screening and diagnosis of Tuberculosis
13	Surveillance and reporting of food-borne illness	Screening and diagnosis of mastitis
14	Surveillance and reporting of food-borne illness	Testing of Heavy metals in Food
15	Hygienic handling and processing of milk and meat products.	Visits to Milk processing plant
16	Water, Milk and Meat-borne diseases	Visits to Abattoir
17	Microbiological standards of water, milk, meat, eggs and their by-products	
18	Microbiological standards of water, milk, meat, eggs and their by-products	
19	Intoxications associated with food products of animal-origin	
20	Intoxications associated with food products of animal-origin	
21	Residues in food products of animal-origin	
22	WTO standards for safe food	
23	Importance and need of Communication with media	
24	Role of national agencies in controlling emerging and re-emerging diseases	
25	Role of international agencies in controlling emerging and re-emerging diseases	
26	HACCP certification	

27	ISO 22000 certification	
28	Global Gap program for food safety	
29	Emerging and re-emrging zoonoses	
30	Emerging and re-emrging zoonoses	
31	Bacterial and fungal zoonoses	
32	Viral zoonoses	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. Hartmurt, K., 2009. Zoonoses, 3rd Edition, ASM press, USA

Recommended Books/Readings:

1. Morris, J. G. and M.E. Potter, 2013. Foodborne Infections and Intoxications. 4th ed. Academic Press. USA
2. Rahman, H., L. R. Chatlod and Z.B. Dubal, 2011. Veterinary public health, New trends. Biotech Books, India
3. Pedro, N. A. and S. Boris, 2003. Zoonoses and communicable diseases common to man and animals. 3rd Edition. Pan American Health Organization. USA.

Course Title: Principles of Dairy Production
Course Number: LPRO-2710
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)
Course Description:

Basic course in dairy production. Topics covered include dairy industry of Pakistan, important dairy animals, production systems, management of dairy animals at different stages, mammary gland structure and function, milking management, heat stress management, dairy farm facilities, and farm records.

Course Pre-requisites:
None

Course Goals and Performance Objectives:

Goal 1: Upon successful completion of this course, students will understand the scope of dairy industry
Objectives: The successful students will be able to

1. Explain the dairy animals' population trends
2. Identify different dairy breeds

Goal 2: At the end of this course, students will know the skills needed to successfully raise dairy animals.
Objectives: The successful students will be able to

1. Set performance benchmarks for each class of dairy animals
2. Identify needs of housing and feeding for each class of dairy animals
3. Assess the association of management changes and physiology of dairy animals
4. Apply hands on skills to harvest the potential of dairy animals
5. Recommend housing, feeding and management strategies for each class of dairy animals
6. Identify risk factors for suboptimal performance of dairy animals

Course Contents:

Theory:
Present status of dairy production in Pakistan; Breeds of local, exotic and crossbred dairy animals; Production systems; Principles of profitable dairy farming; management of calves, youngstock, dry, pregnant, transition and lactating animals; feeding management of dairy animals; mammary gland structure and function; lactation curve analysis; milking principles; heat stress management; hygiene and farm waste management; bull management; precision dairy farming; dairy animals welfare.

Practical:
Identification/demonstration of characteristics of local, exotic and crossbred animals; judging and scoring of dairy animals; farm management practices for calves, youngstock, dry and lactating animals; dairy diagnostic tools; feed preparation practices; milking practice and milk analysis; precision dairy tools; cleaning, sanitation and biosecurity measures; record keeping and farm management software; fodder production and conservation practices; preparation of feasibility reports.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Course Introduction and Industry overview	Dairy farm structures
2	Dairy breeds	Demonstration of dairy breeds
3	Dairy production systems	Conformation of Ideal dairy animal
4	Dairy production systems	Judging and Scoring
5	Colostrum management	Calf feeding practices

6	Colostrum management	Colostrum Testing Brix refractometer	
7	Liquid feeding of dairy calves	Dairy diagnostic tools: BCS; cow hygiene score	
8	Dry feeding of dairy calves	Dairy diagnostic tools: Cud chewing index; cow comfort quotient	
9	Housing of dairy calves	Feeding practices for adult animals	
10	Weaning strategies	Milking practices	
11	Heifer management	Milking parlor management	
12	Heifer management	Precision dairy farming tools	
13	Transition cow management: challenges	Record keeping and farm management software	
14	Transition cow management: management strategies	Cleaning, sanitation, and bedding management	
15	Transition cow management: nutritional strategies	Fodder production and conservation practices	
16	Mammary gland of dairy animals	Housing plans and feasibility report	
17	Milk synthesis and secretion		
18	Lactation curve analysis		
19	Milking management I		
20	Milking management II		
21	Feeding management of lactating animals		
22	Feed efficiency and grouping strategies		
23	Heat stress management I		
24	Heat stress management II		
25	Dry period management		
26	Reproductive management		
27	Hygiene and farm waste management		
28	Dairy bull management		

29	Role of DHIA in the development of dairy industry	
30	Precision dairy farming technologies	
31	Dairy animals welfare	
32	Course review	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Assignments	Presentations
Quiz	Group Discussions

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		75% (Class performance)	25%	

Textbook:

1. Beede, D. H. 2017. Large Dairy Herd Management 3rd Edition. American Dairy Science Association, 1800 South Oak Street, Champaign, IL 61820, USA.

Recommended Books/Readings:

1. Noordhuizen J.2012. Dairy Herd Health and Management A guide for veterinarians and dairy professionals. Context Products Ltd, 53 Mill Street, Leicestershire. England.
2. Khan, B.B (Ed.). 2008. Health and Husbandry of Dairy Animals. Pak. T.M. Printers, Faisalabad, Pakistan.
3. Journal of Dairy science. American Dairy Science Association.1800 South Oak Street, Suite 100Champaign, IL 61820, USA
4. Reference website for dairy cattle production. http://articles.extension.org/dairy_cattle

Course Title: Reproductive Biotechnology
Course Number: THER-02701
Course Duration: 1 semester (16 weeks)
Credits: 2(2-0)

Course Description: The course is based on learning about the basic foundation of historical development as well as recent advances in the field of animal reproductive biotechnology.

Course Pre-requisites: Veterinary Reproductive Physiology.

Course Goals and Performance Objectives:
Goal 1: To familiarize the students about the applied aspects of estrus cycle.
Objective 1: To discuss estrus cycle and estrus detection
Objective 2: To discuss basics of estrus synchronization and its application.

Goal 2: To familiarize the students about artificial insemination and progeny testing program.
Objective 1: To discuss cryopreservation and consequences of freezing-thawing.
Objective 2: To discuss history, status and techniques of artificial insemination and progeny testing.

Goal 3: To familiarize the students about the steps involved in embryo transfer technology.
Objective 1: To discuss in-vivo embryo production.
Objective 2: To discuss in-vitro embryo production.

Course Contents:
Theory: History of animal biotechnologies, Development of reproductive biotechnologies, History and status of artificial insemination, Techniques of artificial insemination in different species, Basics of semen cryopreservation, Consequences of freezing-thawing, Basics of reproductive ultrasonography, Application of reproductive ultrasonography, Basics of estrus synchronization, Application of estrus synchronization, Basics of embryo transfer technology, Selection and preparation of donors, Selection and preparation of recipients, Embryo collection, evaluation and transfer, Introduction to *in vitro* technologies, Oocytes collection and grading, *In-vitro* oocyte maturation, *In-vitro* fertilization, *In-vitro* embryo culture, Embryo freezing and vitrification, Parts and functions of micromanipulator, Assisted reproductive technologies, Preimplantation genetic diagnosis, Basics of animal cloning, Application of animal cloning, Gender selection via semen sexing, Gender selection via embryo sexing, Basics of stem cells technology, Application of embryonic stem cells, Basics of therapeutic cloning, Basics of reproductive immunology, Basics of gene editing technology and transgenesis.

Practical:

Nil.

Detailed Course Outline:

No	Theory Lecture Split
1	History of animal biotechnologies
2	Development of reproductive biotechnologies
3	History and status of artificial insemination
4	Techniques of artificial insemination in different species
5	Basics of semen cryopreservation
6	Consequences of freezing-thawing

7	Basics of reproductive ultrasonography
8	Application of reproductive ultrasonography
9	Basics of estrus synchronization
10	Application of estrus synchronization
11	Basics of embryo transfer technology
12	Selection and preparation of donors
13	Selection and preparation of recipients
14	Embryo collection, evaluation and transfer
15	Introduction to *in vitro* technologies
16	Oocytes collection and grading
17	*In-vitro* oocyte maturation
18	*In-vitro* fertilization
19	*In-vitro* embryo culture
20	Embryo freezing and vitrification
21	Parts and functions of micromanipulator
22	Assisted reproductive technologies
23	Preimplantation genetic diagnosis
24	Basics of animal cloning
25	Application of animal cloning
26	Gender selection via semen sexing
27	Gender selection via embryo sexing
28	Basics of stem cells technology

29	Application of embryonic stem cells
30	Basics of therapeutic cloning
31	Basics of reproductive immunology
32	Basics of gene editing technology and transgenesis

Teaching Learning Strategies:

Theory:	Practical
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%	100			

Textbook:

1. Gordon, I., 1996. Controlled reproduction in cattle and buffaloes. Published by CAB International Willingford, UK

Recommended Books/Readings:

1. Meredith, M.J. (Ed), 1995. Animal breeding and infertility. 1st Ed. Blackwell publishers, Berlin, Germany
2. Senger, P.L., 2003. Pathways to pregnancy and parturition. 2nd Ed. Current Conceptions Inc. Pullman USA.

Course Title: Veterinary Internal Medicine-II
Course Number: CLMS 02606
Course Duration: 1 semester (16 weeks)
Credits: 3(3-0)

Course Description:
Course provides the veterinary student with comprehensive knowledge (i.e., pathogenesis, diagnosis, susceptible species, economic and public health impact, prevention and control programs) of specific animal diseases. Focus is given on OIE-listed diseases, zoonotic diseases with serious public health implications, and other important diseases either impacting or with the potential to impact the ruminants and equines. Course includes parasites impacting the health and welfare of ruminants and equines as well as those impacting public health.

Course Pre-requisites:
FSc Pre-Medical

Course Goals and Performance Objectives:

Goal 1: Understand transboundary animal diseases (TADs) and of ruminants and equines
Objective 1: Identify the clinical signs, clinical course, transmission potential (including vectors), andpathogen associated with TADs
Objective 2: Describe the current global distribution of TADs or know where to find up-to-date distributioninformation
Objective 3: Demonstrate the collection and handling of samples and the rationale for the use of appropriate diagnostic and therapeutic tools to prevent and combat TADs and pathogens.
Goal 2: Understand zoonosis having major implications for human health and trade in animals and animal products
Objective 1: Identify the clinical signs, clinical course, transmission potential, and pathogen associated with common zoonotic diseases
Objective 2: Demonstrate the use of current diagnostic and therapeutic tools for common zoonotic and food borne diseases
Objective 3: Describe the implications of common zoonotic and food borne diseases for human health (e.g. how does the disease spread from animals to humans) and up-to-date information
Goal 3: Understand emerging and re-emerging diseases of significant impacts on animal
Objective 1: Define “emerging disease” and “re-emerging disease” and provide contemporary examples in livestock
Objective 2: Demonstrate the detection of suspicious signs and reporting to the relevant veterinary authority
Objective 3: Demonstrate the understanding the reasons/hypotheses to explain the emergence and /re-emergence of diseases
Objective 4: Describe up-to-date and reliable information regarding emerging and re-emerging diseases in livestock.
Goal 4: Learn disease prevention and control programmes including movement controls, vaccination and treatment
Objective 1: Describe established programs for the prevention and control of common diseases or emerging/re-emerging diseases, to include animal identification and traceability and oversight by the relevant veterinary authority
Objective 2: Demonstrate the understanding of the implementation of contingency plans to control transboundarydiseases, including humanely killing animals

Objective 3: Demonstrate the understanding of regular or emergency vaccination campaigns, as well as in regular test-and-cull/treat programmes

Goal 5: Learn veterinary products given to animals to establish a veterinary diagnosis; or to restore, correct or modify organic functions in an animal or group of animals

Objective 1: Demonstrate the common veterinary products in the appropriate manner, including appropriate recordkeeping

Objective 2: Describe the concept of drug withdrawal time as a means to prevent drug residues in products of animal origin meant for human consumption, and up-to-date and reliable information regarding specific withdrawal times

Objective 3: Describe the appropriate use of drugs and biological to ensure the safety of the food chain and the environment (e.g. proper disposal of biological waste

Course Contents:

Prevention and infection control, Transboundary animal diseases (TAD), TAD info, Emerging - Reemerging diseases and Zoonosis (Cow, Buffalo, Sheep and Goat)

Detailed course split:

Sr. No.	Theory Lecture Split
1.	Terminology: Transboundary animal diseases (TAD), TAD info, Emerging, Re-emerging diseases, Zoonosis, Control and Prevention, Prophylaxis and Metaphylaxis
2.	Enterotoxaemia
3.	Infectious necrotic hepatitis, Bacillary hemoglobinuria
4.	Black leg and malignant edema
5.	Tetanus and Botulims
6.	Anthrax
7.	Brucellosis and Q fever
8.	Bovine Leptospirosis, Listeriosis
9.	Tuberculosis
10.	Johne's Disease
11.	Actinomycosis, Actinobacillosis
12.	Hemorrhagic septicemia (Septicemic pasturellosis) and Shipping fever (Pneumonic pasteurellosis)
13.	Colibacillosis and Salmonellosis (undifferentiated diarrhea)
14.	Caseous lymphadenitis
15.	Contagious bovine pleuropneumonia, Contagious Caprine Pleuropneumonia
16.	Mycoplasmal arthritis in cattle, Contagious agalactia in sheep and goats
17.	Contagious bovine pyelonephritis
18.	Infectious bovine keratoconjuntivitis
19.	Oral Necrobacillosis, Bovine digital dermatitis, Infectious foot rot
20.	Contagious Mastitis
21.	Environmental Mastitis
22.	Foot-and-mouth disease
23.	Vesicular stomatitis
24.	Malignant catarrhal fever, Bovine virus diarrhea / Mucosal disease
25.	Viral diarrhea in calves, Winter dysentery in cattle
26.	Peste Des Petits ruminants (KATA)
27.	Contagious ecthyma
28.	Bovine ephemeral fever, Rift valley fever
29.	Infectious Bovine Rhinotracheitis, Bovine respiratory syncytial virus pneumonia

30.	Bovine parainfluenza, Enzootic pneumonia of calves
31.	Bluetongue
32.	Small ruminant lentivirus infection (maedi-visna)
33.	Rabies, Pseudorabies
34.	Pox: Cowpox / Sheep pox / Goat pox
35.	Lumpy skin disease
36.	Prion associated diseases (Scrapie, Bovine spongiform encephalopathy)
37.	Anaplasmosis
38.	Babesiosis, Theileriosis
39.	Tick-borne fever, Trypanosomiasis
40.	Coccidiosis, Neosporosis
41.	Cryptosporidiosis, Toxoplasmosis
42.	Ring worm in ruminants
43.	Mange in ruminants (Sarcoptic mange, Psoroptic mange, Chorioptic mange)
44.	Aspergillosis, Histoplasmosis
45.	Dermatophilosis, Candidiasis
46.	Deg-Nala and aflatoxicosis
47.	Diseases caused by nematodes, trematodes, cestodes
48.	Tick infestation and Stomach bots, Nasal bots, Warble flies

Teaching Learning Strategies:

Class Work Policies: Equal opportunity
Intellectual honesty Regularity and
punctuality Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

Theory:
Lectures
Presentations
Group Discussions
Assignments
Quiz

Theory				
	Assignment	Mid Term	Final Term	Total
Max marks	06	18	36	60

Competencies Fulfilled:

1. Epidemiology
2. Transboundary animal diseases
3. Zoonoses (including food borne diseases)
4. Emerging and re-emerging diseases
5. Disease prevention and control programmes
6. Veterinary products

Management of contagious disease

Textbook:

7. Constable PD, Hinchcliff KW, Done SH, Grünberg W. 2016. Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats, 11th edition, Volumes 1 and 2. Elsevier HealthSciences.
8. Radostits, O.M., C.C. Gay, K.W. Hincheliff and P. D. Constable, 2007. Veterinary Medicine, 10th Ed. Saunders Elsevier, PA, USA.

Recommended Books/Readings:

1. The MSD Veterinary Manual. 2019. 11th Ed. Merck Sharp & Dohme Corp., NJ, USA. Available online: https://www.msdvetmanual.com
2. Martin WB, Aitken ID. 2000. Diseases of Sheep, 3rd Ed. BlackwellScience, Oxford, UK.
3. Anderson DE, Rings DM. 2009. Current Veterinary Therapy, Food Animal Practice. 5th edition. Elsevier Health Sciences.
4. Peek SF, Divers TJ. 2018. Rebhun's Diseases of Dairy Cattle, 3rd edition. Elsevier Health Sciences.
5. Smith BP. 2015. Large Animal Internal Medicine, 5th edition. Elsevier Health Sciences.
6. Hungerford TG. 1991. Hungerford's Diseases of Livestock, 9th Ed.McGraw-Hill Book Company, Sydney, Australia.
7. Morgan, RV. 1997. Handbook of Small Animal Practice. 3rd Ed. WBSaunders Company, PA, USA.
8. Radostits OM, Mayhew IGJ, Houston DM. 2005. Veterinary Clinical Examination and Diagnosis, 1st edition. Elsevier Health Sciences.
9. Small Animal Internal Medicine 1st edi. Lipincott William and Wilkins

Course Title: Meat Inspection and Necropsy Practice
Course Number: PATH/APTC 02601
Course Duration: 16 Weeks (01 semester)
Credit Hours: 3(2-1)

Course Description:

This course is designed to give the undergraduate veterinary students an overview of Halal meat industry, slaughter house management and judging the wholesomeness of meat. Implementation of rules regarding meat quality will be discussed. Various pathological lesions which could render meat unfit for human consumption will be discussed with the students. Moreover, students will be taught how to perform postmortem inspection of the animals and differentiate between lesions caused by a disease and postmortem changes. The course also encompasses the forensic aspects of veterinary pathology and legal framework of necropsy examination.

Course Pre-requisites:

General Pathology and Systemic Pathology

Course Goals and Performance Objectives:

Goal 1: To familiarize the learners with the detailed concepts of meat inspection and slaughter house management and necropsy examination.

Objective 1: To differentiate between meat of different animals
Objective 2: To evaluate meat for wholesomeness.
Objective 3: To describe the cause of death and pathological lesions.
Objective 4: To demonstrate understanding of vetro-legal cases

Theory:

Food animals, slaughter house / abattoir management, Halal meat industry, objectives of meat inspection, antemortem and postmortem examination of animals, non-specific and specific lesions in different organs of body, rigor mortis, conditions rendering meat unwholesome for human consumption, judgment of carcass, disposal of condemned meat, laws regulating meat quality in Pakistan, differentiation of meat of different animals, recognition of contagious and zoonotic diseases associated with abattoirs, differentiation between lesion and postmortem changes, postmortem of large, small, poultry and wild animals, diagnostic features of accidental and infectious causes of death, single and group animal death features, importance of forensic veterinary pathology, laws and rules governing forensic examination of animals and report writing.

Practical:

Meat inspection and certification procedures, wholesomeness of carcass, techniques for differentiation of meat of different species of animals, laboratory tests for evaluation of wholesome meat, examination of live and dead animals in forensic cases, necropsy techniques, safety measures to be observed while performing necropsy, disposal of carcasses suspected to be suffering from contagious and zoonotic diseases, visits to slaughter house / abattoir for examining, processing (meat by-products) and further processing (value addition) technologies.

Detailed Course Outline:

No.	Theory	Practical
1	Introduction and course contents	Introduction to Food Animal Meat inspector
2	Introduction of Meat Industry in Pakistan	Rules and regulation regarding meat inspection
3	Antemortem examination of animals before slaughter	Recognition of various pathological conditions of meat
4	Slaughter of animals and changes in meat after slaughter	Recognition of various pathological conditions of meat
5	Pre-requisites for post-mortem examinations	Recognition of various pathological conditions of edible organs
6	Judgment of bovine carcases in different viral problems	Judgment about wholesomeness of carcass
7	Judgment of bovine carcases in different viral and prion problems (Mad cow, IBR, BMC)	Judgment about wholesomeness of carcass
8	Judgment of bovine carcases in rickettsial problems	Visits to slaughter houses.
9	Meat inspection in different bacterial problems (Black quarter, Botulism)	Laboratory tests for evaluation of meat quality
10	Meat inspection in different bacterial problems (Malignant edema, Tuberculosis, Paratuberculosis)	Techniques for differentiation of meat of different species of animals
11	Meat inspection in different bacterial problems (Calf dipththeria, pyelonephritis, Actinobacillosis, Actinomycosis (Leptospirosis, Anthrax)	Necropsy examination of animals
12	Meat inspection of carcasses suffering from Brucellosis, Salmonellosis, Haemorrhagic	Necropsy examination of animals

	septicaemia, metritis, mastitis, endocarditis and traumatic reticuloperitonitis	
13	Meat inspection of carcasses suffering from Fascioliasis, Lungworm infestation, Pimply gut, Cysticercosis and Hydatidosis	Necropsy examination of animals
14	Meat inspection and judgement of carcasses suffering from lancet fluke infestation, Onchocercosis, Trypanosomiasis, Theileriosis, Gallsickness and Babesiosis	Necropsy examination of animals
15	Meat inspection and judgement of carcasses showing general Pathological conditions	Necropsy examination of animals
16	Contagious and zoonotic diseases associated with abattoir	Carcass disposal
17	Contagious and zoonotic diseases associated with abattoir	
18	Differentiation between lesions and postmortem changes	
19	Postmortem of large animals, small animals, and wild animals	
20	Postmortem of large animals, small animals, and wild animals	
21	Postmortem of Poultry	
22	Diagnostic features of accidental and infectious causes of death	
23	Diagnostic features of accidental and infectious causes of death	
24	Probing the death of single and group of animals	
25	Introduction to forensic veterinary pathology	
26	Rules and laws governing forensic veterinary examination	
27	How to perform postmortem examination of a forensic case	
28	Common veterinary forensic cases and their diagnostic protocols	
29	Common veterinary forensic cases and their diagnostic protocols	
30	Common veterinary forensic cases and their diagnostic protocols	
31	Common veterinary forensic cases and their diagnostic protocols	
32	Report writing	

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Teaching Learning Strategies:

Theory:	Practical
Lectures	Performance
Presentations	Presentations
Assignments	Group Discussions
	Assignments
	Slaughter house visits

Assessment Strategies:

	Theory				Practical		
Modality	**Assignment**	**Mid Term**	**Final Term**	**Total**	**Class Performance**	**Final**	**Total**
Max marks	4	12	24	40	10	10	20

OIE Day1 Competency Addressed: Food Hygiene (2.6)

Textbooks:

1. Gracey, J.F., 2014. Meat Hygiene.11th Edition.The English Language Book Society, Bailliere Tindal, London U.K.
2. Cooper, J.E., M.E. Cooper, 2007. Introduction to Veterinary and Comparative Forensic Medicine. Wiley-Blackwell, USA.

Recommended Books:

1. Herenda, D.C. and D.A. Franco. 1991. Food Animal Pathology and Meat Hygiene. Mosby Year Book. London.
2. FAO, 2000. Manual on meat inspection for developing countries, 2nd Ed., Vol. 119, Food and Agriculture Organization of United Nations, Rome, Italy.
3. Grist, A., 2004. Poultry Inspection: Anatomy, Physiology and Disease condition, 2nd Ed., Nottingham University Press

Course Title: Diagnostic Imaging
Course Number:
Credits: 2(1-1)
Course Description:
Course Pre-requisites: F. Sc. (Pre-medical)
Goal: The goal of this course is to learn advanced diagnostic tools, including imaging techniques.

Objectives:

1. The main objective of this course is to have hands on skills of Diagnostic Imaging.
2. Describe basics of plain and contrast radiographic techniques.
3. Diagnose different medical and surgical ailments through radiographic presentations as seen on radiographs.
4. Demonstrate practical skills in general abdominal sonography.
5. Demonstrate practical skills for performing a survey radiographic exposure and film processing.

Theory

diagnostic imaging in veterinary practice; Radiographic terminology and basic principles to study radiograph production of X-rays; Radiographic image formation; Radiographic hazards and protection; Radiography

system; Plain and Contrast radiography of Urinary System; Plain and Contrast radiography of Gastro-intestinal System; Plain and Contrast radiography of Respiratory System; Principles of Diagnostic Ultrasound including indications and techniques; Ultrasound Artifacts; Sonography of the General Abdomen: Liver, Pancreas, Adrenals and Spleen; Sonographic features of Gastrointestinal Tract; Sonographic features of Urinary Tract & Reproductive Tract; Sonography of Musculoskeletal System; Sonographic features of Eye and Orbit; Imaging of Heart and Doppler Ultrasound; Magnetic Resonance Imaging (MRI); CT Scan.

Practical

X-ray machine and its working; Dark room requirements and maintenance; Exposure factors and processing of films; Contrast Radiography techniques; Examination and evaluation of radiographs; Techniques for radiography of appendicular and axial skeleton; Imaging of the general abdomen; Imaging of liver and spleen; Imaging of gastrointestinal tract and pancreas; Imaging of urinary tract; Imaging of reproductive tract; Imaging of musculoskeletal system; Imaging of head; Imaging of cardiovascular system; Use of ultrasonography equipment; Imaging of clinical cases presented to the clinics of the department.

No.	Theory	Practical
1	Diagnostic imaging in veterinary practice	Radiation protective and protection methods
2	Generation and production of X-rays	Demonstration of X-ray machine (Conventional and digital)
3	X-ray machine and its working	X-ray film, cassettes and accessories; Dark room; processing of exposed films
4	X-ray films & grids	Radiographic quality and artifacts
5	Radiography of musculoskeletal system	Radiographic positioning, examination and evaluation (interpretation) of radiographs
6	Plain and Contrast radiography of Gastro-intestinal System	Demonstration of radiography of musculoskeletal system
7	Plain and Contrast radiography of Urinary System	Demonstration of radiography of GIT
8	Plain radiography of Respiratory System	Demonstration of radiography of urinary System
9	Principles of Diagnostic Ultrasonography	Demonstration of radiography of respiratory System
10	Ultrasound machine and probes	Ultrasound machine and its working
11	Ultrasonography of musculoskeletal system	Demonstration of ultrasonography of musculoskeletal system
12	Ultrasonography of Gastrointestinal system	Demonstration of ultrasonography of GIT
13	Ultrasonography of urinary system	Demonstration of ultrasonography of urinary system
14	Ultrasonography of reproductive system	Demonstration of ultrasonography of reproductive system
15	Fluoroscopy & scintigraphy	Radiographic imaging of clinical cases
16	MRI & CT scan	Ultrasonographic imaging of clinical cases

Textbook:

1. Thrall, D.E., 2002. Textbook of Veterinary Diagnostic Radiology. 4thed. W. B. Saunders Co., Philadelphia, USA.

Recommended Books:

1. Penninck, D., and M-A d'Anju, 2008. Atlas of Small Animal Ultrasonography. Blackwell Publishing Co., Oxford. UK.
2. Mannion, P., 2006. Diagnostic Ultrasound in Small Animal Practice. Blackwell Science Ltd., Oxford, UK.

3. Kealy, J. K., and H. McAllister, 2004. Diagnostic Radiology and Ultrasonography of the Dog and Cat. 4thed. W. B. Saunders Co., Philadelphia, USA
4. Farrow, C. S., 2003. Veterinary Diagnostic Imaging: The Dog and Cat. Mosby Inc., W.B. Saunders Co. Ltd., USA.
5. Cartee, R. E., B. A. Selcer, J. A. Hudson, S.T. Finn-Bodner, M. B. Mahaffey, P. L. Johnson and K. W. Marich, 1995. Practical Veterinary Ultrasound. Williams and Wilkins, Philadelphia, USA.
6. Singh, A. P., and J. Singh. 1995. Veterinary Radiology. CBS Publishers & Distributors, New Delhi, India.

Course Title: Medicine Clinic-I
Course Number: CLMS-02601
Course Duration: 1 semester (16 weeks)
Credits: 1(0-1)

Course Description:
Course addresses teaching of both hands-on clinical skills and clinical reasoning in the anaesthesiology, diagnostic imaging and medicine. Course provides the veterinary student with access to clinical cases (clients and patients) and instruction so that the student becomes comfortable with and proficient at completing an appropriate physical examination; taking a complete history from a client; using clinical reasoning to develop differential and final diagnoses and diagnostic and treatment plans; and communicating effectively, both verbally and in writing, with clients, colleagues and support staff. Although students will be able to apply these skills to multiple animal species, but the focus is laid on applying these skills to the major animal species of importance. Course also provides ample opportunities to veterinary students to apply scientific knowledge during dealing clinical cases in the clinics, farms or fields that includes epidemiology, transboundary animal diseases, zoonoses (including food-borne diseases), emerging and re-emerging diseases, disease prevention and control programmes, veterinary products, animal welfare, communication skills, and management of contagious disease.

Course Pre-requisites:
FSc Pre-Medical

Course Goals and performance objectives:
Goal No. 1: To apply clinical skills in treatment of livestock diseases.
Objective No. 1: Obtain skills of history taking.
Objective No. 2: Obtain skills of clinical examination.
Objective No. 3: Obtain skills of lab diagnosis.

Course Contents:

Practical:
History Taking: The main objective of course is to take history of disease and better communication skills of students. Clinical Examination: comprising of distance examination and specific examination. Evaluation skills: Predisposing factors of disease. Handling of animals: Handling of animals at clinics. Record Keeping: Record Keeping of diseases. Recent advancement: Recent Advances in Animal Health.

	Clinics Session Split
1	Orientation of Veterinary Clinics, Animal restraint (Bovine, ovine, caprine, sheep & goat, Equine , Camelides)
2	History taking
3	General and Physical Examination
4	Animal Behaviour/ Nursing care of sick animals
5	Art of prescription writing / antimicrobial therapy

6	Methods of drug administration
7	Use of Diagnostic instruments/ Medication tools
8	Special examination, clinical manifestations
9	Principles of treatment of alimentary system
10	Principles of treatment Respiratory system
11	Principles of treatment Nervous system
12	Examination of cardiovascular system
13	Musculoskeletal system
14	Renal system
16	Integumentary system
17	Eye, ear and bovine udder.

Teaching Learning Strategies:

1. Performance/case presentation
2. Presentation
3. Group discussions
4. Quiz

Class Work Policies:

5. Equal opportunity
6. Intellectual honesty
7. Regularity and punctuality
8. Adherence to deadlines Fairness
9. Conformity to discipline
10. Team work

Assessment Strategies:

	Practical		
	Daily evaluation	Final Term	Total
Max Marks	10 (class performance + visits)	10	20

Competencies Fulfilled:

11. Epidemiology
12. Transboundary animal diseases
13. Zoonoses (including food borne diseases)
14. Emerging and re-emerging diseases
15. Disease prevention and control programmes
16. Veterinary products
17. Animal welfare
18. Communication skills
19. Management of contagious diseases

Recommended Books/Readings:

1. Constable PD, Hinchcliff KW, Done SH and Grünberg W. 2016. Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats, 11th edition, Volumes 1 and 2. Elsevier Health Sciences.
2. Kelly WR. 1984. Veterinary Clinical Diagnosis. 3rd Ed. Bailliere Tindall & Corsell, London, UK.
3. The MSD Veterinary Manual. 2019. 11th Ed. Merck Sharp & Dohme Corp., NJ, USA. Available online: https://www.msdvetmanual.com
4. Pinsent PJN and Fulle CJ. 1997. Outline of Clinical Diagnosis in Horse. Blackwell Science, Oxford, UK.
5. Anderson DE, Rings DM. 2009. Current Veterinary Therapy, Food Animal Practice. 5th edition.

Elsevier Health Sciences.
6. Hungerford TG. 1991. Hungerford's Diseases of Livestock, 9th Ed. McGraw-Hill Book Company, Sydney, Australia.
7. Smith BP. 2015. Large Animal Internal Medicine, 5th edition. Elsevier Health Sciences.
8. Radostits OM, Mayhew IGJ, Houston DM. 2005. Veterinary Clinical Examination and Diagnosis, 1st edition. Elsevier Health Sciences.
9. Côté E. 2015. Clinical Veterinary Advisor: Dogs and Cats, 3rd edition. Elsevier Health Sciences.
10. Dairy H. Shaw Small animal internal medicine. 1st edi. Lipincott William and Wilkins

Course Title: Surgery Clinic-I
Course Number: CLMS-02602
Credits: 1(0-1)
Course Pre-requisites: F. Sc. (Pre-medical)
Goal: The goal of this course is to understand basic approaches to surgical cases.
Objectives:

1. Perform general examination of the clinical cases of different animals
2. Perform medication of traumatic animals
3. Demonstrate clinical procedures to treat animals.

Clinic

General Examination, Asepsis & Antiseptics, Wound management, Antiseptics used in clinics, Bandages and bandaging techniques, Routes of Drug administration, Animal Chipping.

No.	Clinic
1	General animal behavior
2	History taking and Clinical examination
3	Physical and chemical restraint techniques in small animals
4	Physical and chemical restraint techniques in large animals
5	Hands-on practice of history taking and clinical examination
6	Hands-on practice of physical and chemical restraint in small animals
7	Hands-on practice of physical and chemical restraint in large animals
8	Demonstration for use of Stomach Tube, Probang and Mouth gags
9	Trocarization and catheterization in small and large animals
10	Asepsis and antisepsis
11	Different antiseptics commonly used in veterinary clinics
12	Routes of Drug administration.
13	Bandages and bandaging techniques
14	Wounds and their types
15	Wound management
16	Client education with reference to case

Textbooks:

1. Venugopalan, A. 2000. Essentials of Veterinary Surgery. 8th ed. Oxford and IBH Publishers and Distributors, New Delhi, India.
2. Kumar, A. 2001. Veterinary Surgical Techniques. Vikas Publishing House, New Delhi, India.

Recommended books:

1. Harari, J. 1993. Surgical Complications and Wound Healing in the Small Animal Practice, W. B. Saunders Co., Philadelphia, USA.
2. Kelly, W. R. 1984. Veterinary Clinical Diagnosis. 3rd Ed. Bailliere Tindall, London, UK.

Course Title: Theriogenology Clinic-I
Course Number: THER-02603
Course Duration: 1 semester (16 weeks)
Credits: 1(0-1)

Course Description: The course is based on learning about the handling of reproduction cases in domestic

animals with particular emphasis on table/live palpation of female reproductive tract.
Course Pre-requisites: Physiology of reproduction, obstetrics and genital diseases.

Course Goals and Performance Objectives:
Goal 1: To familiarize the students about handling of clinical case regarding reproduction in domestic animals.
Objective 1: To discuss various steps to identify a clinical case of reproduction.
Objective 2: To discuss approaches and pre-requisites for handling clinical case.

Goal 2: To familiarize the students with the female reproductive system
Objective 1: To describe palpation & identification of female reproductive system.
Objective 2: To describe identification of ovarian structures in live animals

Course Contents:
Theory:

Practical: Basic approach to a theriogenology case, History taking and SOAP note, Principles of prescription writing, Breeding soundness examination of female, Table palpation of normal female reproductive tracts, Table palpation of pathological female reproductive tracts, Table biometry of normal female reproductive system, Rectal palpation in live animal, Identification of cervix in live animals, Identification of uterus in live animals, Identification of ovarian structures in live animals, Determination of estrus cycle stage on palpation table, Estrus detection methods in domestic animals, Pregnancy diagnosis methods in domestic animals, Table palpation of pregnant reproductive tracts, Visit to a dairy farm.

Detailed Course Outline:

No	Practical Session Split
1	Basic approach to a theriogenology case
2	History taking and SOAP note
3	Principles of prescription writing
4	Breeding soundness examination of female
5	Table palpation of normal female reproductive tracts
6	Table palpation of pathological female reproductive tracts
7	Table biometry of normal female reproductive system
8	Rectal palpation in live animals
9	Identification of cervix in live animals
10	Identification of uterus in live animals

11	Identification of ovarian structures in live animals
12	Determination of estrus cycle stage on palpation table
13	Estrus detection methods in domestic animals
14	Pregnancy diagnosis methods in domestic animals
15	Table palpation of pregnant reproductive tracts
16	Visit to a dairy farm

Teaching Learning Strategies:

Practical
Performance
Presentations
Group Discussions
Assignments
Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks					50% (Mini project + Class performance + Visits)	50%	

Recommended Books/Readings:

1. Zemjenis, R., 1970. Diagnostic & Therapeutic Techniques in Animal Reproduction. Williams & Wilkins Company, Baltimore.
2. Morrow, D.A., 1986. Current Therapy in Theriogenology, II. W.B. Saunders Company, Philadelphia.
3. Ahmad, M. and M.A. Saji, 1997. Manual for Breeding Soundness of Dairy Bulls for use in A.I. Livestock and Dairy development Department, 16- Cooper Road, Lahore.

SEMESTER-VII

Course Title: Beef and Mutton Production
Course Number: LPRO-02804
Course Duration: 1 semester (16 weeks)
Credits: 2(1-1)

Course Description: Meat is essential part of human diet due to its composition and taste, red meat is most liked meat in world. In order to ensure food security for ever growing population of country it is dire need to enhance meat production in country. This course will enable the students to learn about meat animal management and meat production according to desires of consumers.

Course Pre-requisites: Introduction to Livestock Management

Course Goals and Performance Objectives:

1. To understand the current situation, constraints, challenges and potential of meat production in Pakistan.
2. Describe the indigenous and exotic breeds, management systems, cost effective feeding systems and processing of meat animals.
3. To run a successful meat production unit through application of modern management techniques and practices.

Course Contents:

Theory: Scope of meat production in Pakistan, current status, issues and potential of meat industry in Pakistan, meat type breeds of farm animals, meat production systems, factors affecting carcass and meat quality; management of meat animals, feeding management for optimum growth, grazing systems, management and supplementary feeding, growth rate and fattening potential of male calves, feed additives, hormones and probiotics for growth, management during inclement weather. Breeding and reproduction of meat animals, modern abattoirs, slaughtering methods and post slaughter changes in carcass, carcass grades and spoilage of meat, meat hygiene, storage and preservation; Establishing commercial beef/mutton farms, record keeping, data handling and feasibility reports, keeping herd/flock healthy.

Practical:

Meat Production Systems, practical demonstrations on early feeding, raising orphan and multiple birth lambs/kids, Creep feeding, dehorning, castration and weaning; preparing beef animals for shows, dentition for age determination; practical tips for housing of beef animals, feasibility reports for beef/mutton production; pre-mortem inspection, Carcass evaluation, Carcass grades and cuts, Beef grades, Shearing and handling wool. Vaccination schedule for meat animals; maintenance of farm records; visit to farms, abattoir and market.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Scope of meat production in Pakistan	Creep feeding
2	Current status, issues and potential of meat industry in Pakistan	Demonstrations on early feeding and weaning
3	Meat type breeds of farm animals	Raising orphan and multiple birth lambs / kids

4	Growth rate and fattening potential of male calves	Dentition for age determination
5	Meat production systems: Quality standards and certification (GAP, HACCP, ISO-9001:2015, ISO-22000 and Halal)	Meat Production Systems: Assessment and interpretation of documentation for various certifications
6	Factors affecting carcass and meat quality	Carcass grades cuts, value chain and cold chain quality for local and international markets
7	Management of meat animals, Management during inclement weather	Practical tips for housing of beef animals
8	Grazing systems	Preparing beef animals for shows
9	Feeding management for optimum growth	Visit to farms, abattoir and market
10	Supplementary feeding, Feed additives, hormones and probiotics for growth	Shearing and handling wool
11	Breeding and reproduction of meat animals	Dehorning and castration
12	Modern abattoirs, slaughtering methods and post slaughter changes in carcass	Beef grades
13	Carcass grades and spoilage of meat, meat hygiene, Storage and preservation	Pre-mortem inspection and Carcass evaluation
14	Feasibility of establishing commercial beef/mutton farms	Feasibility reports for beef/mutton production
15	Record keeping and data handling	Maintenance of farm records
16	Keeping herd/flock healthy	Vaccination schedule for meat animals

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Visit report
Group Discussions	Business plan
Assignments	Assignments
Quiz	Farm duties

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality

Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Class performance + Visits+ Business plan)	50%	
40	2	6	12	20	10 = (3+2+5)	10	20

Textbook:

1. Alvi, A. S. 1991. Meat Production and Technology in Pakistan, Pakistan Agricultural Research Council, Islamabad.

Reference Books:

1. Ensminger, M. E. 1996. Beef Cattle Science. The Interstate Printers and Publisher, Danville, Illinois, USA.
2. Mackintosh, J.B. 1983. Sheep production in Pakistan, PARC, Islamabad.
3. Anwar, A. H. 1996. Meat Hygiene and Inspection. Dept. Veterinary Parasitology, University of Agriculture, Faisalabad.
4. Ensminger, M.E. and R.O. Parker. 1986. Sheep and Goat Science. Interstate Printers and publishers Inc. Danville, Illinois. USA.
5. Steel, M. 1996. Goats. McMillan Education Ltd. London
6. Devendra, C. and George B. McLeroy.1982. Goat and sheep production in the tropics. Longman Group, the University of Wisconsin – Madison, USA.

Course Title: Veterinary Internal Medicine-III
Course Number: CLMS 02705
Course Duration: 1 semester (16 weeks)
Credits: 3(3-0)

Course Description:

Course provides the veterinary student with comprehensive knowledge (i.e., pathogenesis, diagnosis, susceptible species, economic and public health impact, prevention and control methods and programs) of specific transmissible diseases. Focus is given on OIE-listed /zoonotic diseases of equids, camels dog, cats and poultry, and other important parasitic diseases of food animals with serious economic impact on livestock and poultry. Non-infectious diseases/conditions (metabolic and poisoning) impacting health, production and reproduction of all domestic animals are also incorporated.

Course Pre-requisites:

FSc Pre-Medical

Course Goals and Performance Objectives:

Goal 1: Understanding diseases in equine, camel, dogs, cats and poultry

Objective 1: Demonstrate the general principles of descriptive epidemiology, its application to disease control and the ability to access and use appropriate information sources

Goal 2: Understand nutritional/metabolic diseases of production animal

Objective 1: Demonstrate the understanding of an epidemiological inquiry in case of occurrence of a reportable disease, including collection, handling, and transport of appropriate specimens or samples for diagnosis

Course Contents:

Emphasis will be given on etiology and pathogenesis clinical signs, risk factors, diagnosis, differential diagnosis, treatment, control and prevention.

Diseases of equids (Horses, mules and donkeys): Strangles, purpura haemorrhagica, glanders, epizootic lymhangitis, ulcerative lymphangitis, sprorotrichosis Contagious acne of horses; tetantus, salmonellosis, Rhodococcal (R. equi) pneumonia and diarrhea in foals, Equine infectious anemia, African horse sickness, Equine herpes virus infection, Equine viral arteritis, Rheovirus infection, Equine influenza, Horsepox, Encephalomyelitis of horses (EEV, WEE, VEE), Nipha virus, Hendra virus, WNV, Equine granulocytic Anaplasmosis, Potomac horse fever, Piroplasmosis, Surra, Dourine, Strongylosis, Oxyuris equi, Trichuris; Summer sores in horses, Filarial dermatitis.

Diseases of dogs and cats: Leptospirosis, Rabies, Canine distemper, Infectious canine hepatitis, Borreliosis, Parvovirus infection, Feline panleukopenia, Feline calcivirus infection, Ringworms, Ecto and Endo - parasitism, Hemoprotozoan diseases; canine babesiosis, ehrlichiosis, hemobatonellosis (Feline mycoplasmosis), cytauzxzoonosis, Mange.

Diseases of camel: Trypanosomiasis, Filariasis, Mali, Kapauli, Contagious necrosis of skin, Kumree, Vail, Specific peritonitis, Meningitis, Camelpox, PPR, Rabies, Influenza, Epzootic hemorrhagic disease, Hemorrhagic disease, Mange, Ecto and Endo -parasitism

Diseases of poultry: Viral, bacterial and parasitic diseases of poultry along with mycotoxicosis, Metabolic diseases/ poisoning / nutritional deficiencies

Diseses of cattle: Parturient paresis, Downer cow syndrome, Lactation tetany of mares, Hypomagnesemic tetany, Ketosis, Pregnancy toxemia in sheep, Postparturient hemoglobinuria in cattle, Nitrate / nitrite and cyanide poisoning, Copper and lead poisoning, Fog fever of ruminants, Arsenic and organophosphate poisoning, Vitamin and mineral deficiencies in animals

Detailed course split:

Sr. No.	Theory Lecture Split
1	Strangles, Purpura haemorrhagica
2	Glanders
3	Epizootic lymhangitis, sprorotrichosis
4	Ulcerative lymphangitis / pigeon breast
5	Rhodococcal (R. equi) pneumonia and diarrhea in foals
6	Tetanus
7	Salmonellosis
8	Equine infectious anemia
9	Equine viral arteritis
10	Equine herpes virus infection
11	Equine influenza, Reovirus infection
12	African horse sickness
13	Equine encephalomyelitis (EEE, VEE, WNV)
14	Nipha virus, Hendra virus
15	Horsepox
16	Equine babesiosis, ehrlichiosis/anaplasma
17	Borreliosis (Lyme disease)
18	Canine parvovirus infection
19	Infectious canine hepatitis
20	Canine distemper, Canine Rabies
21	Canine Leptospirosis

22	Feline panleukopenia, Feline peritonitis
23	Feline calicivirus infection
24	Canine babesiosis
25	Canine ehrlichiosis/Lahore canine fever
26	Feline Hemobartonellosis (Feline mycoplasmosis), Cytauxzoonosis
27	Trypanosomiasis (Surra)
28	Mali, Kapauli
29	Contagious necrosis of skin, Filariasis
30	Kumree, Vail, Specific peritonitis
31	Influenza and PPR
32	Contagious ecthyma, Camel pox
33	Epzootic hemorrhagic disease
34	Mange in dogs, cats, equines and camel
35	Endoparasites of dogs, cats and equines and camels
36	Ringworm in dogs, cats and horses
37	Parturient paresis (Hypocalcemia)
38	Downer cow syndrome
39	Ketosis and Pregnancy toxaemia
40	Peri-Parturient hemoglobinuria
41	Hypomagnesemic tetany, Eclampsia
42	Nitrate / nitrite and cyanide poisoning
43	Copper and lead poisoning and Fog fever ruminants
44	Arsenic and organophosphate poisoning
45	Vitamin and mineral deficiencies in animals
46	Prevalent viral diseases of poultry (Emphasizing on treatment and control)
47	Prevalent bacterial disease of poultry (Emphasizing on treatment and control)
48	Mycotoxicosis and parasitic disease of poultry (Emphasizing on treatment and control)

Teaching Learning Strategies:

Theory:

Lectures

Presentations

Group Discussions

Assignments

Quiz

Theory				
	Assignment	Mid Term	Final Term	Total
Max marks	06	18	36	60

Class Work Policies:

Equal opportunity Intellectual honesty

Regularity and punctuality

Adherence to deadlines Fairness

Conformity to discipline

Team work

Competencies Fulfilled:

1. Epidemiology

2. Transboundary animal diseases
3. Zoonoses (including food borne diseases)
4. Emerging and re-emerging diseases
   Disease prevention and control
   programmes
5. Veterinary products
6. Management of contagious disease

Textbook:

7. Constable PD, Hinchcliff KW, Done SH, Grünberg W. 2016. Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats, 11th edition, Volumes 1 and 2. Elsevier Health Sciences.

Recommended Books/Readings:

1. The MSD Veterinary Manual. 2019. 11th Ed. Merck Sharp & Dohme Corp., NJ, USA. Available online: https://www.msdvetmanual.com
2. Swayne DE. 2013. Diseases of Poultry. 13th edition. Wiley Blackwell, USA.
3. Martin WB, Aitken ID. 2000. Diseases of Sheep, 3rd Ed. Blackwell Science, Oxford, UK.
4. Iqbal CZ, Akbar SUJ. 2000. The Camel and its Diseases. Al Bayan Printing and Publishing Est. UAE.
5. Anderson DE, Rings DM. 2009. Current Veterinary Therapy, Food Animal Practice. 5th edition. Elsevier Health Sciences.
6. Peek SF, Divers TJ. 2018. Rebhun's Diseases of Dairy Cattle, 3rd edition. Elsevier Health Sciences.
7. Smith BP. 2015. Large Animal Internal Medicine, 5th edition. Elsevier Health Sciences.
8. Hungerford TG. 1991. Hungerford's Diseases of Livestock, 9th Ed. McGraw-Hill Book Company, Sydney, Australia.
9. Tilley LP, Smith FWK Jr. 2015. Blackwell Five-Minute Veterinary Consult: Canine and Feline, 6th edition. Wiley Blackwell.
10. Morgan, RV. 1997. Handbook of Small Animal Practice. 3rd Ed. WB Saunders Company, PA, USA.
11. Radostits OM, Mayhew IGJ, Houston DM. 2005. Veterinary Clinical Examination and Diagnosis, 1st edition. Elsevier Health Sciences.
12. Côté E. 2015. Clinical Veterinary Advisor: Dogs and Cats, 3rd edition. Elsevier Health Sciences.
13. Dairy H. Shaw Small animal internal medicine. 1st edi. Lipincott William and Wilkins.

Course Title: ANAESTHESIOLOGY AND INTENSIVE CARE
Course Number:
Credits: 1(0-1)
Course Description:
Course Pre-requisites: F. Sc. (Pre-medical)

Goal:

1. The goal of this course is to learn the painless surgery by different anesthetic techniques.
2. To understand the steps of combating surgical and anesthetic emergencies.

Objectives:

1. The main objective of this course is to introduce the students to the basics of Veterinary Anesthesiology.
2. Describe different methods of general anaesthesia (injectable and inhalation).
3. Describe different sites and techniques of regional and local anaesthesia.
4. Monitor the surgical patient during intra and post-operative period.
5. Practically demonstrate induction and maintenance of anaesthesia in clinical practice in different anima

Practical

Introduction to Veterinary Anesthesia, including Pre-anaesthetics and Anesthetic agents and their uses;

aesthetic consideration; Types of anesthesia (local, regional and general), and their clinical applications; Epidu Paravertebral anesthesia and their practical demonstration; Local nerve blocks (for dental, eye and horn surgeri their practical demonstration); Local nerve blocks in limbs for lameness diagnosis and their practical demonst Stages of General Anesthesia and patient monitoring during and after anesthesia; Anesthesia under field cond Practical demonstration of anesthetic regimens for small and large animals (including dogs, cats, small rum horses, donkeys, large ruminants and camels); Anesthetic regimens for birds, exotics, and laboratory ar Anesthetic emergencies (cardiac arrest, respiratory failure, shock, acid base imbalance) and their management.

No.	Practical
1.	Introduction to Veterinary Anesthesia and intensive care
2.	Types of anesthesia (general, regional and local)
3.	Stages of General Anesthesia and monitoring
4.	Gas anesthesia machine and its working
5.	Pre-anesthetics agents
6.	Sedatives and tranquilizers
7.	General anesthesia (equines
8.	General anesthesia (ruminants)
9.	General anesthesia; intravenous (pets)
10.	General anesthesia; gaseous (pets)
11.	Epidural and Paravertebral anesthesia
12.	Local nerve blocks (for teeth, eyes and horns)
13.	Local nerve blocks (for limbs)
14.	Anesthetic emergencies (cardiac arrest and respiratory failure)
15.	Anesthesia & Intensive care unit
16.	Use of ventilator and cardiac monitor

Textbooks:

1. Tranquilli, W. J., J. C. Thurmon and K. A. Grimn. 2015. Lumb and Jones' Veterinary Anesthesia and Analgesia. 5th ed. Blackwell Publishing, USA.
2. Aldridge, P. and L. O'Dwyer. 2013. Practical Emergency and Critical Care Veterinary Nursing. John Wiley & Sons, Ltd., UK.

Recommended books:

1. Venugopalan, A. 2000. Essentials of Veterinary Surgery. 8th ed. Oxford, New Delhi.
2. Harrari, J. 1996. Small Animal Surgery. Williams and Wilkins, Baltimore, USA.
3. Thrall, D.E. 1994. Textbook of Veterinary Diagnostic Radiology. 2nd ed. W. B. Saunders Co., Philadelphia, USA.
4. Turner, A. S. and C. W. Mcllwraith. 1989. Techniques in Large Animal Surgery. 2nd ed. Lea & Febiger Philadelphia, USA.
5. Jennings. Jr. P. B. 1984. The Practice of Large Animal Surgery. W.B. Saunders Co., Philadelphia, USA

Course Title: Veterinary Obstetrics and Genital Diseases
Course Number: THER02605
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description: The course is based on learning about reproductive pathology of pregnant and non-pregnant domestic animals and developing skills to handle dystocia and various obstetrical and gynecological diseases.

Course Pre-requisites: Veterinary Reproductive Physiology

Course Goals and Performance Objectives:
Goal 1: To familiarize the students with different factors affecting male and female fertility

Objective 1: To describe to students the effect of climate on male and female fertility
Objective 2: To describe to students the effect of nutrition on male and female fertility

Goal 2: To familiarize the students with different causes and forms of pregnancy losses.
Objective 1: To discuss factors, causes and outcomes of embryonic mortality.
Objective 2: To discuss factors, causes and outcomes of abortion.

Goal 3: To familiarize the students with normal and abnormal mechanisms of parturition.
Objective 1: To discuss normal/abnormal presentation, position and posture
Objective 2: To describe the causes and outcomes of fetal and maternal dystocia

Course Contents:

Theory: Significance of obstetrics and genital diseases, Parameters of fertility and infertility, Effect of climate on male and female fertility, Effect of nutrition on male and female fertility, Effect of genetics on male and female fertility, Early embryonic mortality, Premature birth, stillbirth and abortion, Non-infectious causes of abortion, Bacterial causes of abortion, Viral causes of abortion, Protozoal causes abortion, Fetal mummification and maceration, Dropsy of fetal membranes, Congenital and teratological defects, Uterine torsion, Genital prolapse, Fetal and maternal causes of dystocia, Diseases of peri-parturient period, Diseases of puerperal period, Retention of fetal membranes, Uterine infections, Uterine cultures and treatment, Primary and secondary anestrus, Cystic ovarian diseases, Repeat breeding, Induction of parturition, Termination of pregnancy, Buffalo reproductive disorders, Caprine and ovine reproductive disorders, Equine reproductive disorders, Camel reproductive disorders, Canine and feline reproductive disorders

Practical: Approach to an obstetrical case, Obstetrical anatomy, Obstetrical instruments, Predictive application of pelvimetry, Normal/abnormal presentation, Normal/abnormal position, Normal/abnormal posture, Mutational procedures, Forced extraction procedures, Fetotomy of head, Fetotomy of forelimbs, Fetotomy of trunk, Fetotomy of hindlimbs, Local, epidural and paravertebral anesthesia, Caesarean section, Care of the neonate and dam.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Significance of obstetrics and genital diseases	Approach to an obstetrical case
2	Parameters of fertility and infertility	Obstetrical anatomy
3	Effect of climate on male and female fertility	Obstetrical instruments
4	Effect of nutrition on male and female fertility	Predictive application of pelvimetry
5	Effect of genetics on male and female fertility	Normal/abnormal presentation
6	Early embryonic mortality	Normal/abnormal position
7	Premature birth, stillbirth and abortion	Normal/abnormal posture
8	Non-infectious causes of abortion	Mutational procedures
9	Bacterial causes of abortion	Forced extraction procedures
10	Viral causes of abortion	Fetotomy of head
11	Protozoal causes abortion	Fetotomy of forelimbs

12	Fetal mummification and maceration	Fetotomy of trunk
13	Dropsy of fetal membranes	Fetotomy of hindlimbs
14	Congenital and teratological defects	Local, epidural and paravertebral anesthesia
15	Uterine torsion	Caesarean section
16	Genital prolapse	Care of the neonate and dam
17	Fetal and maternal causes of dystocia	
18	Diseases of peri-parturient period	
19	Diseases of puerperal period	
20	Retention of fetal membranes	
21	Uterine infections	
22	Uterine cultures and treatment	
23	Primary and secondary anestrus	
24	Cystic ovarian diseases	
25	Repeat breeding	
26	Induction of parturition	
27	Termination of pregnancy	
28	Buffalo reproductive disorders	
29	Caprine and ovine reproductive disorders	
30	Equine reproductive disorders	
31	Camel reproductive disorders	
32	Canine and feline reproductive disorders	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. Roberts, S.J., 1986. Veterinary Obstetrics and Genital Diseases. 2nd Ed., Edwards Brothers, Inc., Ann. Arbor, Michigan, USA

Recommended Books/Readings:

1. Morrow, D.A., 1986. Current Therapy in Theriogenology, II. W.B. Saunders Company, Philadelphia
2. Youngquist, R.S. and W. Threlfall, 2007. Current Therapy in Large Animal Theriogenology. W.B. Saunders Company, Philadelphia, USA

Course Title: Commercial Poultry Production
Course Number: PPRO-02706
Course Duration: 1 semester (16 weeks)
Credits: 2(1-1)

Course Description:
The course is based on developing skills for commercial poultry production through learning about different breeds and strains of poultry, their selection criteria, housing requirements and latest management tools for optimum performance of these birds.

Course Pre-requisites:
An introductory course on Poultry Production

Course Goals and Performance Objectives:
Goal 1: To familiarize the students with modern managemental tools in different production systems and housing types
Objective 1: To describe the students how to run different poultry businesses
Objective 2: To discuss with the students how to operate different types of poultry houses

Goal 2: Basic learning about the factors affecting growth and egg production of commercial poultry
Objective 1: To develop insight about factors affecting growth performance
Objective 2: To develop management skills to improve production performance of poultry birds

Goal 3: To familiarize students with poultry processing techniques
Objective 1: To develop skills in students to process poultry and its products

Objective 2: To develop carcass quality and sensory traits evaluation skills
Goal 4: To familiarize participants with biosecurity and management tools for disease prevention
Objective 1: To develop skills regarding basic concepts of biosecurity
Objective 2: To develop insight regarding vaccination types and procedures
Objective 3: To develop management skills to reduce disease incidence

Course Contents:
Theory:
Present status and future scope of commercial poultry farming in Pakistan; Characteristics of different breeds/strains involved in the development of broiler and layers; Housing requirements for broiler and layer production; Selection and procurement of quality chicks; Pre-brooding and brooding requirements for broiler and layer chicks; Feeding and management practices of broiler production; Sex-separated raising of broilers and measuring broiler growing efficiency; Integrated broiler farming; Processing of broilers chicken; Factor affecting growth rate and meat quality in broiler production; Vices and their remedies in layer production; Light and feed manipulation to attain sexual maturity; Management of layer flock during laying; Layer management in cages; Factors affecting egg production; Production standards; Management of the flock in hot and cold environment; Induced molting and its economics; Trouble shooting in commercial poultry farming; Waste disposal; Record keeping.

Practical:
Typical characteristics of poultry birds for meat production; Demonstration of various types of brooders; Sanitary practices on the farm; Selection and culling of birds; Pre-brooding and brooding management; Selection and grading of live birds; Litter management; Feeding strategies for broiler; Monitoring of growth performance of broilers viz. weekly feed consumption, Weekly weight gain, Mortality, Feed to gain ratio and feed conversion ratio; Processing techniques; Carcass measurements and evaluating dressing percentage; Giblet weights; Sensory evaluation of broiler meat quality; Biosecurity and its management; Vaccination and vaccination schedule for common diseases; Calculating economics of broiler production; Debeaking, dubbing and toe clipping; Identification of layer and non-layer; selection and culling procedures; Catching and transportation of birds; Cost benefit ratio of layer enterprises; Induced molting techniques; Managing flock during heat stress; Use of computer in record keeping; Visit to layer farm; Feasibility report of broiler; Feasibility report of 10,000 layer flock; Record keeping.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Present status and future scope of commercial poultry farming in Pakistan, Characteristics of different breeds/strains involved in the development of broiler and layers	Typical characteristics of poultry birds for meat production
2	Housing requirements for broiler and layer production including ventilation	Sanitary practices on the farm, Pre-brooding and brooding management and demonstration of various types of brooders
3	Selection and procurement of quality chicks, Pre-brooding and brooding requirements for broiler and layer chicks	Selection, culling and grading of live birds
4	Sex-separated raising of broilers and measuring broiler growing efficiency	Litter and ventilation management: Calculation of the fan capacity; Air quality monitoring

5	Feeding and management practices of broiler production	Feeding strategies for broiler
6	Factor affecting growth rate and meat quality in broiler production	Monitoring of growth performance of broilers viz. weekly feed consumption, Weekly weight gain, Mortality, Feed-to-gain ratio and feed conversion ratio
7	Integrated broiler farming, Processing of broilers chicken	Catching and transportation of birds; Processing techniques; Carcass measurements and evaluating dressing percentage; Giblet weights; Sensory evaluation of broiler meat quality
8	Vices and their remedies in layer production	Biosecurity and its management; Vaccination and vaccination schedule for common diseases
9	Light and feed manipulation to attain sexual maturity	Identification of layer and non-layer, Selection and culling procedures
10	Management of layer flock during laying; Layer management in cages	Debeaking, dubbing and toe clipping
11	Factors affecting egg production	Cost benefit ratio of layer enterprises; Feasibility report of 10,000 layer flock
12	Management of the flock in hot and cold environment	Managing flock during heat stress
13	Induced molting and its economics	Induced molting techniques
14	Troubleshooting in commercial poultry farming	Calculating economics of broiler production, Feasibility report of broiler
15	Waste disposal	Visit to layer farm
16	Production standards; Record keeping	Use of computer in record keeping; Record keeping

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

2. North, M.O. and D.D. Bell. 2001. Commercial Chicken Production Manual. Van Nostrand Reinhold Co., New York, USA.

Recommended Books/Readings:

1. Ensminger, M.E., 1999. Poultry Science. The Interstate Printers and Publishers Inc., Danville, Illinois, U.S.A.

2. Austic, R.E. and M.C. Nesheim, 1990. Poultry Production. Lea and Febiger, Philadelphia, U.S.A.

3. Vegad, J.L., 2004. Poultry Diseases: A Guide for Farmers and Poultry Professionals. International Book Distributors Co. Lucknow, India.

4. Hurd, L.M., 2003. Modern Poultry Farming. Greenworld Publishers 8/217, Indira Nagar Lucknow-226 016 (UP), India.

5. Charles, T.B. and H.O. Stuart, 2011. Commercial Poultry Farming. 6th edition, Biotech Books, USA.

6. Sreenivasaiah, P.V., 2006. Scientific Poultry Production. 3rd edition. International Book Distributing Co., UP India.

7. Haq, A. and M. Akhtar, 2004. Poultry Farming. Higher Education Commission, H-9, Islamabad, Pakistan.

8. Jadhav, N.V. and M.F. Siddiqi, 1999. Handbook of Poultry Production and Management. Jaypee Brothers, Medical Publishers (P) Ltd. New Delhi.

Course Title: BIO-STATISTICS
Course Number: STCS-02307
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:

This course will provide an insight to the collection of statistical data, presentation of data, analysis of data and the interpretation of data and to reach any decision in the face of uncertainty. At the end of this course students will be able to understand data and able to analyze the collected data using standard statistical methods and formulas.

Course Goals and Performance Objectives:

Goal 1: Students will be able to understand types of data, types of Statistics, graphical representation of data, measures of location and dispersion and probability.

Objective 1: Histogram

Objective 2: Mean, median, mode, Geometric mean, Harmonic mean.

Objective 3: Variance and Standard deviation

Objective 4: Probability

Objective 5: Mutually exclusive. Equally Likely and exhaustive events

Goal 2: Students will be able to understand Sampling and sampling distributions.

Objective 1: Mean estimate, point estimator, interval estimation.

Objective 2: Testing of hypothesis

Objective 3: Regression and Correlation Analysis

Course Contents:

Theory:

Introduction to Statistics and bio-statistics, types of data (scales of measurements), frequency distribution for continuous and discrete data, visual representation of data, stem and leaf display, box and whisker plots; measures of location and variability, moments, skewness, coefficient of skewness and Kurtosis, definitions and laws of probability, Mutually exclusive events, Equally likely events and exhaustive events, independent and dependent events, simple correlation and regression analysis, elementary ideas of sampling, distribution of means and proportions, Test of significance of means, proportion, difference between means and difference between proportions with their confidence Intervals. Experimental Design (Scientific quantitive skills, such as the ability to evaluate experimental design, interpret scientific findings, and develop discussions as well as provide implementable recommendations, Completely Randomized Design, Randomized Complete Block Design), Analysis of variance technique.

Practical:

The statistical packages Minitab and SPSS will be used for Measure of Location, Measure of Dispersion, Graphical Presentation, Regression and Correlation Analysis, Test of significance of Means, Proportion, Differentiate between Two Means, Proportions, CR Design and RCB Design.

Sr. #	Theory
1.	Introduction to Statistics and Bio-statistics
2.	Types of data (scales of measurements)
3.	Frequency distribution for continuous and discrete data
4.	Visual representation of data, stem and leaf display, and variability
5.	Box and whisker plots
6.	Measures of location
7.	Measures of location
8.	Measures of variability
9.	Measures of variability
10.	Moments, skewness, coefficient of skewness and Kurtosis,
11.	Definitions and laws of probability
12.	Mutually exclusive events, Equally likely events and exhaustive events
13.	Binomial Probability Distribution
14.	Distribution of means
15.	Distribution of proportions
16.	Independent and dependent events

17.	Simple correlation
18.	Simple correlation
19.	Regression analysis
20.	Regression analysis
21.	Regression analysis
22.	Elementary ideas of sampling
23.	Test of significance of means
24.	Test of significance of proportion
25.	Difference between means and difference between proportions
26.	Confidence Intervals for mean
27.	Confidence Intervals for Proportion
28.	Experimental Design
29.	Completely Randomized Design (CRD)
30.	Randomized Complete Block Design (RCBD)
31.	Analysis of Variance
32.	Two Way Analysis of Variance

Sr. #	**Practical**
1.	Introduction to Excel
2.	Frequency distribution for continuous and discrete data using Excel
3.	Graphical representation of data using Excel
4.	Stem and leaf display, and box and whisker plots using Excel
5.	Measures of location using Excel
6.	Measures variability using Excel
7.	Moments, skewness, coefficient of skewness and Kurtosis using Excel
8.	Binomial Probability Distribution using Excel

9.	Mean and Variance of Binomial Probability Distribution using Excel
10.	Introduction to SPSS
11.	Descriptive Statistics using SPSS
12.	Correlation and Regression analysis using Excel and SPSS
13.	T and Z tests using Excel and SPSS
14.	Completely Randomized Design Using SPSS
15.	Randomized Complete Block Design Using SPSS
16.	Analysis of Variance using SPSS

Textbook:

1. Zar, J.H., 2003. Biostatistical Analysis, Fourth Edition, Pearson Education (Singapore) Prentice Hall International (UK) Limited. London, UK.

Recommended Books:

1. Chernick, M. R. and R. H. Friis (2003). Introductory biostatistics for the health sciences: modern applications including bootstrap, John Wiley & Sons.
2. Muhammad S. Chaudhry and Kamal S. (2013). Introduction to Statistical Theory Volum I and II, Ilmi Book Depot, Urdu Bazar Lahore.
3. Greasley, P. (2008). Quantitative Data Analysis Using SPSS. Maidenhead Berkshire England, McGraw-Hill Education.
4. Quirk, T. J., et al. (2013). Excel 2013 for Biological and Life Sciences Statistics, Springer.

Course Title: Medicine Clinic-II
Course Number: CLMS 02704
Course Duration: 1 semester (16 weeks)
Credits: 1(0-1)

Course Description:

Course addresses teaching of both hands-on clinical skills and clinical reasoning in the anaesthesiology, diagnostic imaging and medicine. Course provides the veterinary student with access to clinical cases (clients and patients) and instruction so that the student becomes comfortable with and proficient at completing an appropriate physical examination; taking a complete history from a client; using clinical reasoning to develop differential and final diagnoses and diagnostic and treatment plans; and communicating effectively, both verbally and in writing, with clients, colleagues and support staff. Although students will be able to apply these skills to multiple animal species, but the focus is laid on applying these skills to the major animal species of importance. Course also provides ample opportunities to veterinary students to apply scientific knowledge during dealing clinical cases in the clinics, farms or fields that includes epidemiology, transboundary animal diseases, zoonoses (including food-borne diseases), emerging and re-emerging diseases, disease prevention and control programmes, veterinary products, animal welfare, communication skills, and management of contagious disease.

Course Pre-requisites:

FSc Pre-Medical

Course Goals and performance objectives:

Goal No. 1: To apply clinical skills in treatment of livestock diseases.

Objective No. 1: Obtain skills of history taking.

Objective No. 2: Obtain skills of clinical examination.

Objective No. 3: Obtain skills of lab diagnosis.

Goal No. 2: Differential diagnosis of livestock and equines

Objective No. 1: To apply knowledge of differential diagnosis of livestock and equine's diseases.

Course Contents:

Practical:

History Taking: The main objective of course is to take history of disease and better communication skills of students. Clinical Examination: comprising of distance examination and specific examination. Evaluation skills: Predisposing factors of disease. Handling of animals: Handling of animals at clinics. Record Keeping: Record Keeping of diseases. Recent advancement: Recent Advances in Animal Health. Differential diagnosis , dose calculation, cost of medication, maintenance of herd record.

Sr. No.	Theory Lecture Split
1.	History taking of disease and better communication skills
2.	History taking of disease and better communication skills
3.	Clinical Examination comprising of distance examination and specific examination
4.	Evaluation skills Predisposing factors of disease
5.	Handling of animals at clinics.
6.	Handling of animals at clinics.
7.	Record Keeping of diseases.
8.	Recent Advances in Animal Health.
9.	Recent Advances in Animal Health.
10.	Recent Advances in Animal Health.
11.	Differential diagnosis
12.	Differential diagnosis
13.	Differential diagnosis
14.	Dose calculation
15.	Cost of medication
16.	Maintenance of herd record.

Teaching Learning Strategies:

- Performance/case presentation
- Presentation
- Group discussions
- Quiz

Class Work Policies:

- Equal opportunity
- Intellectual honesty
- Regularity and punctuality
- Adherence to deadlines Fairness
- Conformity to discipline
- Team work

Assessment Strategies:

	Practical		
	Daily evaluation	Final Term	Total
Max Marks	10 (class performance + visits)	10	20

Competencies Fulfilled:

Clinical veterinary diagnosis
Disease prevention and control programmes
Veterinary products
Animal welfare
Communication skills
Management of contagious diseases

Recommended Books/Readings:

1. Constable PD, Hinchcliff KW, Done SH and Grünberg W. 2016. Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats, 11th edition, Volumes 1 and 2. Elsevier Health Sciences.
2. Kelly WR. 1984. Veterinary Clinical Diagnosis. 3rd Ed. Bailliere Tindall & Corsell, London, UK.
3. The MSD Veterinary Manual. 2019. 11th Ed. Merck Sharp & Dohme Corp., NJ, USA. Available online: https://www.msdvetmanual.com
4. Pinsent PJN and Fulle CJ. 1997. Outline of Clinical Diagnosis in Horse. Blackwell Science, Oxford, UK.
5. Anderson DE, Rings DM. 2009. Current Veterinary Therapy, Food Animal Practice. 5th edition. Elsevier Health Sciences.
6. Hungerford TG. 1991. Hungerford's Diseases of Livestock, 9th Ed. McGraw-Hill Book Company, Sydney, Australia.
7. Smith BP. 2015. Large Animal Internal Medicine, 5th edition. Elsevier Health Sciences.
8. Radostits OM, Mayhew IGJ, Houston DM. 2005. Veterinary Clinical Examination and Diagnosis, 1st edition. Elsevier Health Sciences.
9. Côté E. 2015. Clinical Veterinary Advisor: Dogs and Cats, 3rd edition. Elsevier Health Sciences.
10. Richard Nelson, R., C. Guillermo Couto, C. 2019. Small Animal Internal Medicine. 6th edi., Elsevier

Course Title: SURGERY CLINIC-II
Course Number: CLMS-02802
Credits: 1(0-1)

Course Description:
Course Pre-requisites: F. Sc. (Pre-medical)

Goal: The goal of this course is to learn handling of animals for examination and treatment of serious injuries and clinicalcases.

Objectives:

1. The main objective of this course is to obtain hand on practices of restraint and SOAP.
2. Perform different techniques for handling of animals for examination and treatment purposes
3. Protect themselves and the animals from serious injuries.
4. Perform different surgical exercises on clinical cases.
5. Perform management during post-operative period.

Clinic

Physical and chemical restraint techniques in horses, ruminants, pets, history taking and clinical examination, routes of drug administration and catheterization in male and female animals, Bandages and bandaging techniques, Preparations used for topical dressing of wounds, management of wounds, galls, ulcers and abscesses, Trocarization in small and large animals, Hospitalization and care of sick animals. Students will be required to record a minimum of10 cases (history taking, clinical findings, laboratory investigation, diagnosis, differential diagnosis treatment and discussion) in each clinical case under the supervision of a teacher.

Sr. #	Clinic
1	Review of different restraint techniques and clinical examination.
2	Art of surgical prescription writing
3	Surgical judgment and risk evaluation
4	Hospitalization and care of surgical patient
5	Antibiotic drugs used in surgery
6	Analgesic drugs used in surgery and post-operative pain management
7	Techniques of local anaesthesia
8	Use of regional anaesthesia techniques
9	Induction of general anaesthesia in field conditions
10	Management of horn affections
11	Management of hoof affections
12	Management of tail affections
13	Demonstration and practice of filling different performas required for clinical case Record
14	Demonstration and practice of clinical cases (history taking, clinical findings and laboratory investigation)
15	Demonstration and practice of clinical cases (history taking, clinical findings and laboratory investigation)
16	Demonstration and practice of clinical cases (history taking, clinical findings and laboratory investigation)

Recommended Books:

1. Venugopalan, A. 2000. Essentials of Veterinary Surgery. 8th ed. Oxford and IBH Publishers and Distributors, New Delhi, India.
2. Kumar, A. 1997. Veterinary Surgical Techniques. Vikas Publishing House, New Delhi, India.
3. Harari, J., 1993. Surgical Complications and Wound Healing in the Small Animal Practice, W. B. Saunders Co., Philadelphia, USA.
4. Kelly, W. R. 1984. Veterinary Clinical Diagnosis. 3rd Ed. BailliereTindall, London, UK.

Course Title: Theriogenology Clinic II
Course Number: THER02702
Course Duration: 1 semester (16 weeks)
Credits: 1(0-1)

Course Description: The course is based on learning about the handling of reproduction cases in domestic animals with particular emphasis on oocyte collection, evaluation and grading and semen collection, evaluation, processing and cryopreservation.

Course Pre-requisites: Veterinary Obstetrics and Genital Diseases, Theriogenology Clinic I

Course Goals and Performance Objectives:
Goal 1: To familiarize the students about handling of clinical case related to reproduction.
Objective 1: To discuss steps to identify a clinical case of reproduction.
Objective 2: To discuss approach and pre-requisites for handling clinical case.

Goal 2: To familiarize the students with various steps of breeding soundness examination
Objective 1: To describe preparation of bull and artificial vagina for semen collection.
Objective 2: To describe methods of semen collection and evaluation.
Objective 3: To describe semen processing and preparation of extenders.

Goal 3: To familiarize the students with female reproductive system.
Objective 1: To describe how to diagnose pregnancy in domestic animals.
Objective 2: To describe rectal palpation and passing of rod for artificial insemination.

Course Contents:
Theory:

Practical: Oocyte collection from abattoir material, Oocyte collection from live animals, Oocyte evaluation and grading, Preparation of embryo transfer assembly, Table flushing of female reproductive tract, Breeding soundness examination of male, Table/live palpation of male reproductive organs, Progeny Testing Program, Sterilization of collection instruments and glassware, Sterilization and biosecurity measures of semen lab, Preparation of bull and artificial vagina, Different methods of semen collection, Eligibility criteria for semen processing, Semen processing and cryopreservation, Handling of liquid and frozen semen under field conditions, Visit to Semen Production Unit.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1		Oocyte collection from abattoir material
2		Oocyte collection from live animals
3		Oocyte evaluation and grading
4		Preparation of embryo transfer assembly
5		Table flushing of female reproductive tract

6		Breeding soundness examination of male
7		Table/live palpation of male reproductive organs
8		Progeny Testing Program
9		Sterilization of collection instruments and glassware
10		Sterilization and biosecurity measures of semen lab
11		Preparation of bull and artificial vagina
12		Different methods of semen collection
13		Eligibility criteria for semen processing
14		Semen processing and cryopreservation
15		Handling of liquid and frozen semen under field conditions
16		Visit to Semen Production Unit

Teaching Learning Strategies:

Practical
Performance
Presentations
Group Discussions
Assignments
Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks					50% (Mini project + Class performance + Visits)	50%	

Recommended Books/Readings:

1. Zemjenis, R., 1970. Diagnostic & Therapeutic Techniques in Animal Reproduction. Williams & Wilkins Company, Baltimore
2. Morrow, D.A., 1986. Current Therapy in Theriogenology, II. W.B. Saunders Company, Philadelphia, USA.
3. Ahmad, M. and M.A. Saji, 1997. Manual for Breeding Soundness of Dairy Bulls for use in A.I. Livestock and Dairy development Department, 16- Cooper Road, Lahore.

Course Title: Holy Quran Translation-IV
Course Number: SOSC 02711
Course Duration: 1 semester (16 weeks)
Credits: 1(1-0)

YEAR-IV

LEARNING OUT COMES:

After the successful completion the students would be able to describe and explain the sayings of Allah Almighty regarding:

1. Faith on destiny
2. Life hereafter
3. Retribution
4. Doomsday (Jannah and Jahannam)
5. Quran & Environment
6. Truthfulness
7. Necromancy

فہرستِ مضامین آیات کریمہ(سال چہارم)

نمبر	مضمون	سورت و آیت نمبر
1	تقدیر پر ایمان	الحج:70...القصص:68...الفرقان:1تا2...القمر:49...الاعلیٰ:1تا3...الدھر:30تا31 .. البلد:10... التغابن:11...الحدید:22...الروم:30تا34...

2	آخرت	البقرة:4-117...النساء:162...التوبة:19-20...النمل:3... السباء:3-21-29تا30... الشوری:7-17-18-47... الزخرف:66-83... الجاثية:26-32...	
3	قصاص وحدود	البقرة:78تا79...النساء:13تا18...المائدة:33تا34-38تا39...النحل:26تا28...الاسراء:33... النور:1تا9	
4	احوال قیامت (جنت وجہنم)	آل عمران:15-132تا133...النساء:13-57... الاعراف:40...التوبة:72...یونس:10-26.. هود:105تا 108...الرعد:20تا22...ابراہیم:48تا52... الحجر:43تا44...مریم:69تا72...	
5	قرآن اور ماحول	الروم 11-41... الدخان 38-39... الحجر 85-86... آل عمران 190... یونس 6...الحدید 3... البقرة 115 ... الفاطر 1... الانعام 59... الغافر 57...الملک 3...	
6	سچائی	الاحزاب:24....المائده:119....النساء:69....التوبه:119....الانعام 115...یونس 2-93... الاسرا 80... مریم 50... الشعرا 84... الزمر 33.... الاحقاف 16... القمر 55...	
7	طہارت (جسمانی، ذہنی، ظاہری باطنی)	المائدة:6..التوبة:108....الفرقان:48...الانفال:11...المدثر:4تا5....	
8	نکاح وطلاق	البقرة:226تا 232...الطلاق:1تا7...البقرة:221...البقرة: 235. .. النساء:3تا4...النور32تا33... الاحزاب:49	
9	جادو	البقره:102....الاعراف:111تا126....یونس:77تا82....طه:57تا70....الفلق 1تا 5 ...	
10	جھوٹی قسم	البقره:225....آل عمران:77...التوبه:6...المائده:89....الواقعه:90تا91...	
11	عدل و انصاف	النساء:5-58...المائدة:1...الانعام:52تا53....الاعراف:19....هود:84تا86...النحل:90تا91... الشعراء:181تا184..المطففين:1تا 4...	
12	قرآن اورسائنس	البقرة: 28-29 ...النساء: 56 ... المؤمنون: 12-17 ... الانبياء: 30تا 35-105 ...النور: 40-41 ... فصلت:52... الذاريات: 47تا 49... الرحمن: 19-20... الحديد: 25 ...النبا: 6-7...	
13	اتحاد امت	آل عمران :103 ...الانعام:108. ...المائدة:3..الحجرات:10. ..الفتح:29.. .انفال:46....الحجرات:11تا12...	
14	قرآنی دعائیں	آل عمران:8-16-26-27-53-147... آل عمران:191تا194...	
15	چوری	المائدة:38...الممتحنه:12...	
16	قرآن کی چھوٹی سورتیں	الطارق...الاعلیٰ...الغاشیه...الفجر...	

Assessment Strategies:

	Theory			
	Assignment/presentation	**Mid Term**	**Final Term**	**Total**
	Pass / Fail			

Books:

- **Holy Quran**

Course Title: Ethics
Course Number: SOSC 02712
Course Duration: Semester VII (16 weeks each)
Credits: 1(1-0) per Year

Detailed Course Contents:

Semester VII

Sr#	Theory
1	Ethics and values
2	Virtues: Peace, Patience, Kindness, Goodness (Generosity), Faithfulness, Gentelness, Self-Control
3	Virtues: Forgivness, Helpfulness, Healthy Competition
4	Environmental ethics: Ethics for flora and fauna and its effect on human life
5	Values conflicts and Beliefs
6	Professional Jealousy
7	Professional ethics: Bio-medical and Biological
8	Veracity
9	Stewardship
10	Creativity
11	Perspective
12	Empathy and sympathy
13	Conflict resolution
14	Respect for cultural sensitivities
15	Interfaith harmony and our responsibility
16	Core and ethos of religion

Assessment Strategies:

	Theory			
	Assignment/presentation	**Mid Term**	**Final Term**	**Total**
	Pass / Fail			

Recommended Books:

1- J.S. Mackeuzie, A Manual of Ethics
2- Harold H.Titus, Ethics for Today
3- B.A. Dar, Quranic Ethic
4- Hameedullah, Dr. Introduction to Islam
5- Ameer Ali Syed, The spirit of Islam

SEMESTER-VIII

Course Title: BREEDER AND HATCHERY MANAGEMENT
Course Number: PPRO -02806
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description: This course is designed to provide advanced knowledge of different commercial, indigenous and exotic poultry breeds, breeding goals and techniques, breeder production and management, care and management of hatching eggs at farm and hatchery, incubation methodologies and modern incubation machines and technologies, production of healthy chicks and their management tools.

Course Pre-requisites: General introduction to poultry production

Course Goals and Performance Objectives:
Goal 1: Advanced learning of poultry breeding systems
Objective 1: To discuss the status and scope of Poultry Breeding Industry in Pakistan/World;
Objective 2: To describe various commercial breeding programs being applied in poultry industry

Goal 2: Major Management concerns of broiler and layer breeder
Objective 1: To discuss the importance and procedures of monitoring body weights during growing and uniformity calculations;
Objective 2: To describe about male management; identification of sexing errors; Separate sex feeding system;
Objective 3: To describe about light and feed management, Production standards of broiler and layer breeders

Goal 3: Working principle of hatchery, hatchery machines and incubation requirements
Objective 1: To describe the layout and design of hatcheries; Types of incubators and their different parts and operations
Objective 2: Incubation requirements, Setting and candling of eggs; Hazard management during incubation;

Goal 4: Learning about the factors affecting fertility, hatchability and chick quality
Objective 1: To describe various causes of poor fertility and hatchability
Objective 2: To discuss the most important factors influencing chick quality

Course Contents:
Theory: Status and scope of Poultry Breeding Industry in Pakistan/World; commercial breeding programs; bio-security; breeder house layout and equipment requirements; environment control vs. open sided housing; care and management during brooding period; light and feed management during growing; monitoring body weights and uniformity during growing; grading and selection during growing period; significance of fleshing, feathering, shank and keel length; transportation or shifting of growing flock to breeding house; pre breeder nutrition; feeding programs for adults; production standards; male management during rear and production; causes of poor fertility and hatchability; major management health concerns with breeders; summer and winter strategies to enhance production; induced molting in the breeder flocks; incubation methods; types of incubators; role of computer in modern hatchery operations; incubation requirements; embryonic development of chick; factors influencing fertility, hatchability and quality of chicks; setting and candling of eggs; taking off the hatch; hatchery sanitation and waste disposal; hazard management during incubation; incubation records; troubleshooting at different stages in the breeder and hatchery operation

Practical:

Demonstration of commercial breeding programs; reproductive systems of male and female; vaccination programs and methods; blood and tissue sampling; environment control housing; ventilation and heating systems; toe clipping, dubbing and beak trimming; monitoring body weights during growing and uniformity calculations; basic practices for male management; identification of sexing errors; separate sex feeding system; male to female ratio; artificial insemination; nest management; egg collection, handling, cleaning; hatching egg fumigation, selection, storage and transportation; summer and winter management; calculating cost of producing hatching eggs and chicks; calculations and conversions; feasibility report of 10,000 broiler and layer breeder flocks; Layout and design of hatcheries; selection, candling and setting of hatching eggs; cleaning of hatching eggs; fumigation; types of incubators and their different parts; operation of incubators; sexing, vaccination, grading; packing and transportation of day-old chicks; hatchery sanitation; disinfection and fumigation of incubators; visits to commercial hatcheries; feasibility report of hatchery, record keeping

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Poultry breeding industry	Demonstration of commercial breeding programs
2	Breeding programs	Reproductive systems of male and female
3	Biosecurity	Vaccination programs and methods; Blood and tissue sampling
4	Breeder House Layout and Equipment	Environment control housing; Ventilation and heating systems, Summer and winter management
5	Environmently-controlled vs open poultry house	Toe clipping, dubbing and beak trimming
6	Care and management during Brooding Phase	Monitoring body weights during growing and uniformity calculations
7	Light and feed management during growing;	Male management; identification of sexing errors; Separate-sex feeding system
8	Monitoring body weights and uniformity during growing	Male to female ratio; Artificial insemination
9	Grading and selection during growing period;	Nest management; Egg collection, handling, cleaning
10	Significance of fleshing, feathering, shank and keel length	Selection, Fumigation, storage, candling and transportation of hatching eggs
11	Transportation or shifting of growing flock to breeding house	Calculating cost of producing hatching eggs and chicks; Feasibility reports
12	Pre breeder nutrition	Calculations and conversions
13	Feeding programs for adults	Layout and design of hatcheries; Types of incubators and their different parts and operations
14	Production standards	Sexing, vaccination, grading and packing, Transportation of day-old chicks
15	Male management during rear and production	Hatchery sanitation; Disinfection and fumigation of incubators
16	Causes of poor fertility and hatchability	Visits to commercial hatcheries
17	Major management health concerns with breeders	
18	Summer and winter strategies to enhance production	
19	Induced molting in the breeder flocks;	
20	Incubation methods	

21	Types of incubators	
22	Role of computer in modern hatchery operations;	
23	Incubation requirements;	
24	Embryonic development of chick;	
25	Factors influencing fertility and hatchability.	
26	Factors affecting chick quality	
27	Setting and candling of eggs;	
28	Taking off the hatch	
29	Hatchery sanitation and waste disposal;	
30	Hazard management during incubation;	
31	Incubation records	
32	Troubleshooting at different stages in the breeder and hatchery operation	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. North, M.O. and D. D. Bell, 2001. Commercial Chicken Production Manual. Van Nostrand Reinhold Co., New York, USA.

Recommended Books/Readings:

1. Taylor, L.W., 2003. Fertility and Hatchability of Chicken and Turkey Egg. International book distributing company, Lucknow, India.
2. Lakhotia, R. L., 2003. Reproduction in Poultry. CAB International, Wallingford, Oxon, U.K.
3. Hocking, P. M., 2009. Biology of breeding poultry. CAB International, Wallingford, Oxon, U.K.
4. Austic and Nesheim, 1990.Poultry Production.13th edition. Lea and Febiger; Philadelphia, Pennsylvania.

Course Title: Veterinary Epidemiology and Public Health
Course Number: EPPH 02507
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:
Students should have basic knowledge of Microbiology, Immunology and Pathology. Knowledge of Medicine will be considered as a plus.

Course Pre-requisites:
The course will provide a detailed introduction about epidemiology. It will describe different epidemiological studies designs and their application to control, prevent and eradicate diseases. It will also discuss the standard procedure for outbreak investigation. Disease frequency measures will also be discussed.

Course Goals and Performance Objectives:
Goal. 1 To prevent disease and promote health
Objective 1: To describe basic principles of epidemiology, including descriptive/analytical epidemiology
Objective 2: To elaborate techniques used to conduct disease outbreak investigations and develop disease prevention programs
Objective 3: To describe causal models, distribution/patterns and control of disease or other health-related events in populations.
Objective 4: To perform epidemiologic data collection, management and analysis, evaluation of analyses and critical evaluation of published information.

Course Contents:
Theory:
Introduction to epidemiology & public health, disease occurrence, Mapping, Causality, Determinants of disease, Diagnostic testing, Transmission and maintenance of infection, Descriptive epidemiology, Analytical epidemiology, Case-control studies, Cohort studies, Experimental epidemiology, Animal disease survey, Types of sampling, Surveillance, Prevention, Control and eradication, Outbreak investigation, National and international disease reporting, Trans-boundary disease of veterinary importance, TAD distribution, mapping, regulatory implications, TAD control, International trade framework.Incident Response Planning and Preparation, Incident Response & Investigation and Incident Response Evaluation & Improvement.

Practical:
Nature of veterinary data: scales of measurement, Data elements, Representation of data: coding numeric codes, symbols, Presentation of numerical data, Measure of disease occurrence, Vital statistics, Collection, handling and transportation of appropriate samples, Methods of data collection, Survey and sample size calculation, Questionnaire development for field visit, Field visit for detection of weather determinants, global positioning system (GPS) and GIS Arc for mapping of important communicable diseases, entry of data collected during survey and its analysis, Epidemic investigation steps, Questionnaire for epidemic investigation of retrospective, cohort and prospective studies.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Introduction to epidemiology & public health	Nature of veterinary data: scales of measurement
2	Disease occurrence and Patterns	Data elements
3	Application of GIS in Disease Mapping	Presentation of numerical data
4	Concept of Causality	Vital statistics
5	Determinants of a disease	Survey and sample size calculation
6	Transmission and maintenance of infection	Questionnaire development for field visit

7	Epidemiological study designs	Collection, handling and transportation of appropriate samples
8	Descriptive epidemiology: Measures of disease morbidity	Methods of data collection
9	Descriptive epidemiology: Disease distribution	Entry of data collected during survey and its analysis
10	Cross-sectional studies	Steps for Epidemic investigation
11	Case-control studies	Analysis for Risk factors Identification: Odds ratio calculations
12	Case-control studies	Analysis of cohort studies data: Relative risk calculations
13	Cohort studies	Sensitivity and specificity calculations
14	Cohort studies	Predictive values calculations
15	Experimental epidemiology	Use of Global positioning system (GPS) for disease forcasting
16	Clinical Trials	Use of ArcGIS for mapping of important communicable diseases
17	Animal disease survey	
18	Diagnostic testing: Serial verses Parallel Diagnostic Approach	
19	Sample size calculation	
20	Sampling strategies	
21	Disease Surveillance	
22	Prevention, control and eradication	
23	Outbreak investigation	
24	National and international disease reporting	
25	Trans-boundary diseases (TAD) of veterinary importance	
26	TAD distribution, mapping, regulatory implications	
27	TAD distribution, mapping, regulatory implications: Pakistan's perspective	
28	TAD of veterinary importance: Foot and Mouth Disease	
29	TAD of veterinary importance: Avian influenza	
30	TAD control: Challenges	
31	TAD control: Success stories	
32	International trade framework including WTO regulations	

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:
Thrusfield M., Christley, R., 2018. Veterinary Epidemiology. 4th Ed. Wiley-Blackwell, UK.
Recommended Books/Readings:

1. Gordis L., 2008. Epidemiology. 4th Edition. Saunders, Elsevier, USA
2. Bonita, R., R. Beagleohole, T. KjellStrom, 2006. Basic Epidemiology. 2nd Edition. WHO
3. Merrill, R. M., 2013. Introduction to Epidemiology, 6th Edition. Jones and Barletta Learning, USA.

Course Title: SMALL ANIMAL SURGERY
Course Number: CLMS-02608
Credits: 3(2-1)

Course Description: The surgical procedures will be demonstrated only on surgical patients
Course Pre-requisites: F. Sc. (Pre-medical)

Goal: The goal of this course is to learn and understand different surgical affections of all the organ system of Small animals.

Objectives:

1. The main objective of this course is to obtain hands on practices of small animal's surgical operations.
2. Correct surgical problems encountered in small animal practice
3. Practice and learn surgical techniques on clinical cases.
4. Practical demonstration of different surgical procedure like castration, Gastrotomy, esophagotomy, tracheotomy, Cystotomy, Nephrotomy and Nephrectomy, Thoracotomy, tail docking, dehorning and Ear cropping etc.

Theory
General surgical considerations, Fluid and electrolyte therapy in small animals, Affections of mouth & teeth, salivary glands, neck, digestive system, Hip and Shoulder Dislocations, Fracture, Affections of respiratory system, skin and its adnexa, ears, urinary system, Male and female genital systems.

Practical
Laparotomy techniques in small animals, Tooth extraction procedure, salivary gland resection, Splenectomy, Gastrotomy, Intestinal end-to-end anastomosis, Castration in dog and cat, Ovariohysterectomy in female dogs and cats, Cystotomy, Nephrostomy and Nephrectomy, Thoracotomy, correction of auricular haematoma, ear cropping, Tail fractures and Dewclaw amputation, Repair of prolapse of eye ball, Approaches to different long bones and use of external and internal fixation devices for fracture repair, Anal sac resection.

No.	Theory	Practical
1.	General surgical considerations in small animal patients	Sterilization and disinfection, Preparation of instruments patient, and the surgical team.
2.	General surgical considerations in small animal patients	Surgical instruments and suturing materials (needles, mono-multi filaments, staples, glue)
3.	Fluid and electrolyte therapy	Suture patterns and knots
4.	Fluid and electrolyte therapy	Procedure for periodontal disease, tooth extraction and salivary glands resection
5.	Introduction to acid-base abnormalities	Laparotomy–gastrotomy
6.	Diagnosis and treatment of acid-base abnormalities	Enterotomy and Intestinal anastomosis
7.	Shock and its management	Splenectomy (partial and complete)
8.	Surgical Biology and wound healing	Nephrotomy and Nephrectomy
9.	Affections of oral cavity and oropharynx (oral tumors and oro-nasal fistula)	Cystotomy
10.	Affections of salivary glands	Castration in dog
11.	Affections of esophagus	Ovariohysterectomy
12.	Affections of stomach	Ear cropping and Lateral ear canal resection
13.	Affections of small intestine	Surgical treatment of tail fractures and dewclaw amputation
14.	Affections of large intestine	Repair of prolapse of eye ball
15.	Affections of kidneys	Demonstration of approaches to long bones
16.	Affections of ureters	Anal sacs resection
17.	Affections of urinary bladder	
18.	Affections of urethra	
19.	Ovariohysterectomy, Cesarean section & pyometra	
20.	Affections of eye	
21.	Affections of ear	
22.	Mammary gland tumors	
23.	Affections of vagina	
24.	Affections of external genetalia	
25.	Affections of male reproductive and genital system	
26.	Debarking and tracheal collapse	
27.	Lung laceration and thoracotomy	
28.	Affections of skin	
29.	Fractures: Introduction and classifications; Dislocations	
30.	External fracture fixation techniques	
31.	Internal fracture fixation techniques	
32.	Fracture healing and complications	

Textbook:

1. Slatter, D. H. (ed.) 1991. Textbook of Small Animal Surgery. 2nd ed. W. B. Saunders Co., Philadelphia, USA.

Recommended Books:

1. Bojrab, M. J. (ed.) 1998. Current Techniques in Small Animal Surgery. 4th ed. Lea and Febiger, Philadelphia, USA.
2. Fossum, T. W. (ed.) 1997. Small Animal Surgery. 3rd ed. Mosby-Year Book, Inc., St. Louis, Missouri, USA.

3. Harvey, C. E., C. D. Newton and A. Schwartz, 1990. Small Animal Surgery. J. B. Lippincott. Philadelphia, USA.
4. Knecht, C. D., A. R. Allen, D. J. Williams and J. H. Johnson, 1987. Fundamental Techniques in Veterinary Surgery. 3rd Ed. W. B. Saunders Co., Philadelphia. USA.
5. Piermattei, D. L., 1993. An Atlas of Surgical Approaches to the Bones and Joints of the Dog and Cat. 3rd ed. W. B. Saunders Co., Philadelphia, USA.
6. Archibald, J. (ed.) 1974. Canine Surgery. 2nd ed. Santa Barbara, American Veterinary Publications, Inc., California, USA.

Course Title: Fisheries and Aquaculture
Course Number:
Course Duration: 1 Semester (16 weeks)
Credits: 1(0-1)

Course Description: This course is designed to educate the students about the basic concepts like identification of various fish species and different types of aquaculture systems. The course also provides useful knowledge regarding modern practices being used in the sector for uplift of economies and sustainable aquaculture.

Course Pre-requisites: F. Sc.

Course Goals and Performance Objectives:
Goal 1: Main goal of the course is to familiarize the students with terminologies and practices in fisheries science.
Objective 1: To understand basic terminologies and concepts in fisheries and aquaculture.
Objective 2: To learn the techniques for sustainable fisheries and aquaculture.

Goal 2: Management practices for better fish production and enhance profitability.
Objective 1: To learn how to prepare economical aqua-feeds' formulations.
Objective 2: To understand common fish diseases and their treatment.

Course Contents:
Theory:
No Theory Part
Practical:
Introduction to fish, fisheries and aquaculture; fish diversity, source and consumers preference; fish identification, morphometric and meristic counts, dissection, anatomy and dressing percentage; construction and components of fish ponds; determination of water quality parameters (physical, chemical and biological-phytoplankton and zooplankton sampling and identification); diagnosis and control of infectious and metabolic fish diseases; formulation and preparation of aqua feed; types of fish hatchery and management; induced fish breeding techniques; ornamental fishes and aquarium making; fishing gears and netting.

Detailed Course Outline:

No	Practical Split	Session Details
1	Introduction to fish, fisheries and aquaculture: National and International Scenarios and trends	iii. Basic concepts related to fish and fisheries iv. Pond construction and designing v. Introduction of extensive, semi-intensive and intensive aquaculture systems vi. Introduction to freshwater and marine fisheries
2	Fish diversity	vii. Fish species in Pakistan viii. Freshwater and marine fish species

		ix. Herbivorous and carnivorous fish species in Pakistan x. Direct and indirect methods for estimation of fish
3	Source and consumers preference	iv. Farmed fish and fish from natural aquatic systems v. Fish consumption and related myths vi. Fish processing and value addition
4	Fish identification, morphometric and meristic counts	ix. Fish sampling x. Morphometric and meristic counts xi. Fish taxonomy xii. Commercial fish species and their identification
5	Dissection	iv. Body parts of fish v. Physical restraining vi. How to dissect and degut the fish
6	Anatomy and dressing percentage	iv. Fish skeleton v. Vertebrae vi. Internal parts of the fish and their functions vii. Immune system of fish viii. Special fish structures like swim bladder ix. Calculation of fish dressing percentage
7	Construction and components of fish ponds	iv. Pre-requisites Selection of site for fish ponds v. Analysis of physical, chemical and biological characteristics vi. Depth of the ponds and light penetration vii. Spring water ponds, earthen ponds, riverine ponds viii. Perennial and seasonal ponds ix. Drainable and non-drainable ponds
8	Determination of water quality parameters	iv. Physical, chemical and biological characteristics of water v. Phytoplankton and zooplankton sampling and identification
9	Diagnosis of infectious and metabolic fish diseases	v. Common signs of diseased fish vi. Common bacterial, viral and fungal diseases of fish vii. Fish parasites viii. Anoxia and gas bubble disease ix. Dietary diseases x. Intoxications
10	Control of infectious and metabolic fish diseases	v. External treatments i.e. vi. Bath treatment vii. Indefinite bath viii. Systematic treatment ix. Parenteral treatment x. General treatment xi. Fish vaccination
11	Formulation and preparation of aqua feed	iii. Nutritional requirements of fish iv. Feeding management v. Types of fish foods vi. Feed formulation vii. Extruded feed and its advantages viii. Feed conversion ratios ix. Feed recommendations for important culturable fish

12	Types of fish hatchery and management	vii. Concept of fish hatcheries and infrastructure viii. Broodstock management ix. Hygienic condition in hatchery x. Aeration system in the hatchery xi. Flow through and recirculation system
13	Induced fish breeding techniques	iv. Identification of male and female fish v. Fish restraining and handling during breeding vi. Introduction of breeding hormones vii. Release and mixing of fish eggs and milt viii. Analysis and maintenance of water quality during breeding ix. Fish fry and fingerlings x. Shifting of fish seed to fish ponds
14	Ornamental fishes	vi. Indigenous and exotic ornamental fish species in Pakistan vii. History of ornamental fish keeping viii. Ornamental fish feed and their management ix. Ornamental fish diseases x. Maintenance of fish in aquaria xi. Breeding of ornamental fish
15	Aquarium making	iv. Material for aquarium making and binding v. Aquarium aeration vi. Control of water temperature vii. Feeding of fish in aquaria viii. Aquarium Lighting ix. Analysis and maintenance of water quality parameters
16	Fishing gears and netting	iv. Types of fish nets v. Gillnets, tangle nets, trammel nets, beach seines nets, trawl nets, lift nets and cast nets. vi. Traps vii. Hooks and anglers viii. Fish attracting devices and materials ix. Visit to a local fish market / hatchery / pond

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. Garg, S. K., A. Bhatnagar, A. Kalla and M.S. Johal, 2002. Experimental Icthyology. CBS Publishers. India.

Recommended Books:

1. Mirza, M. R. and M. Sharif, 1998. Key to the Identification of Fishes of Punjab. Ilmi Publications, Lahore.
2. Ali, S. S., 2001. Fresh Water Fish Biology. Naseem Book Depot, Hyderabad.
3. Shammi, Q. J. and S. Bhatnager, 2002. Applied Fisheries. Agrobios. India.
4. Pillay, T.V.R., 2002. Aquaculture: Principles and Practices. Blackwell Science Ltd.
5. Bhatti, M. N. and M.R. Mirza, 1995. Jadeed Fish Culture. Feroze Sons, Lahore.
6. Bhatti, M. N. and M.R. Mirza, 1993. Pakistan Ki Machlianaur Mahiparwari. Feroze Sons, Lahore.

Course Title: Medicine Clinic-III
Course Number: CLMS 02801
Course Duration: 1 semester (16 weeks)
Credits: 2(0-2)

Course Description:
Course addresses teaching of both hands-on clinical skills and clinical reasoning in medicine. Course provides the veterinary student with access to clinical cases (clients and patients) and instruction so that the student becomes comfortable with and proficient at completing an appropriate physical examination; taking a complete history from a client; using clinical reasoning to develop differential and final diagnoses and diagnostic and treatment plans; and communicating effectively, both verbally and in writing, with clients, colleagues and support staff. Although students will be able to apply these skills to multiple animal species, but the focus is laid on applying these skills to the major animal species of importance. Course also provides ample opportunities to veterinary students to apply scientific knowledge during dealing clinical cases in the clinics, farms or fields that includes epidemiology, transboundary animal diseases, zoonoses (including food borne diseases), emerging and re-emerging diseases, disease prevention and control programmes, veterinary products, animal welfare, communication skills, and management of contagious disease.

Course Pre-requisites:
FSc Pre-Medical

Course Goals and performance objectives:
Goal No. 1: To apply clinical skills in treatment of livestock diseases.
Objective No. 1: Obtain skills of history taking.
Objective No. 2: Obtain skills of clinical examination.
Objective No. 3: Obtain skills of lab diagnosis.

Goal No. 2: Differential diagnosis of livestock and equines
Objective No. 1: apply knowledge of differential diagnosis of livestock and equine's diseases.

Goal No. 3: work independently as clinician/practitioners in handling of livestock.
Objective No. 1: Independent handling of clinical cases.

Objective No. 2: Economics of treatment of livestock diseases.
Objective No. 3: community engagement in control of livestock diseases.
Objective No. 4: diseases forecasting shall develop

Course Contents:
Practical:
History Taking: The main objective of course is to take history of disease and better communication skills of students. Clinical Examination: comprising of distance examination and specific examination. Evaluation skills: Predisposing factors of disease. Handling of animals: Handling of animals at clinics. Record Keeping: Record Keeping of diseases. Recent advancement: Outbreak handling Differential diagnosis , dose calculation, cost of medication. Maintenance of herd record. Presentation working, cost effectiveness of treatment, vaccination, distance management

Sr. No.	Theory Lecture Split
1.	History taking of disease and better communication skills
2.	Clinical Examination comprising of distance examination and specific examination.
3.	Evaluation skills Predisposing factors of disease.
4.	Handling of animals at clinics
5.	Record Keeping of diseases
6.	Outbreak handling
7.	Differential diagnosis
8.	Differential diagnosis
9.	Dose calculation
10.	Cost of medication
11.	Maintenance of herd record
12.	Maintenance of herd record
13.	Presentation working
14.	cost effectiveness of treatment
15.	Vaccination/Deworming
16.	Distance management/ Corporate farm management/Vaccination Deworming

Teaching Learning Strategies:

1. Performance/case presentation
2. Presentation
3. Group discussions
4. Quiz

Class Work Policies:

5. Equal opportunity
6. Intellectual honesty
7. Regularity and punctuality
8. Adherence to deadlines Fairness
9. Conformity to discipline
10. Team work

Assessment Strategies:

	Practical		
	Daily evaluation	Final Term	Total
Max Marks	20 (class performance + visits)	20	20

Competencies Fulfilled:

Epidemiology
Transboundary animal diseases
Zoonoses (including food borne diseases)
Emerging and re-emerging diseases
Disease prevention and control programmes
Veterinary products
Animal welfare
Communication skills
Management of contagious diseases

Recommended Books/Readings:

11. Constable PD, Hinchcliff KW, Done SH and Grünberg W. 2016. Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats, 11th edition, Volumes 1 and 2. Elsevier Health Sciences.
12. Kelly WR. 1984. Veterinary Clinical Diagnosis. 3rd Ed. Bailliere Tindall & Corsell, London, UK.
13. The MSD Veterinary Manual. 2019. 11th Ed. Merck Sharp & Dohme Corp., NJ, USA. Available online: https://www.msdvetmanual.com
14. Pinsent PJN and Fulle CJ. 1997. Outline of Clinical Diagnosis in Horse. Blackwell Science, Oxford, UK.
15. Anderson DE, Rings DM. 2009. Current Veterinary Therapy, Food Animal Practice. 5th edition. Elsevier Health Sciences.
16. Hungerford TG. 1991. Hungerford's Diseases of Livestock, 9th Ed. McGraw-Hill Book Company, Sydney, Australia.
17. Smith BP. 2015. Large Animal Internal Medicine, 5th edition. Elsevier Health Sciences.
18. Radostits OM, Mayhew IGJ, Houston DM. 2005. Veterinary Clinical Examination and Diagnosis, 1st edition. Elsevier Health Sciences.
19. Côté E. 2015. Clinical Veterinary Advisor: Dogs and Cats, 3rd edition. Elsevier Health Sciences.
20. Small animal internal medicine. 1st edi. Lipincott William and Wilkins

Course Title: SURGERY CLINIC-III
Course Number: CLMS-02802
Credits: 2(0-2)
Course Description:
Course Pre-requisites: F. Sc. (Pre-medical)

Goal: The goal of this course is to learn advanced clinical management and treatments.

Objectives:

1. Control and handle different animals for the purpose of surgical manipulations.
2. Manage treatment of animals brought to the Surgery clinic.
3. Prepare animals for surgical operations.
4. Manage pre-operative and post-operative requirements of individual patients.
5. Manage and feed admitted cases.

Clinic

Management and treatment of burn wounds, Antibiotics, Analgesics, Anti-inflammatory drugs used in surgery, Lameness in large animals, Nerve block, regional and local anaesthesia in clinical cases, Use of firing and counter irritants in veterinary practices, Induction and maintenance of general anaesthesia in field conditions, Surgical management of horn, hoof and tail affections, Teat surgery (instruments, techniques and complications), Castration of large animals, Visits to animal farms and hospitals.

Sr. #	Clinic
1	Management of burn wounds
2	Review of art of surgical prescription writing
3	Selection of antibiotics for surgical patients
4	Selections of drugs for pain management
5	Selection of life saving and emergency drugs
6	Diagnostic nerve blocking for Lameness in large animals
7	Use of counter irritants in chronic inflammatory conditions.
8	Review of general anesthesia in field condition
9	Review of general anesthesia in operation theaters
10	Teat surgery instruments
11	Management of udder and teat affections
12	Open and closed castration
13	Handling of castration complications
14	Handling anesthetics emergencies
15	Handling of respiratory emergencies in small animals
16	Handling of respiratory emergencies in large animals
17	Thoracocentesis and placement of chest tubes in small animals
18	Thoracocentesis and placement of chest tubes in large animals
19	Abdominocentesis and placement of drains in small animals
20	Abdominocentesis and placement of drains in large animals
21	Review of catherterization and cystocentesis in small animals
22	Management of chocking in small animals
23	Management of chocking in large animals
24	Use of feeding tubes and gastric lavage in small animals
25	Review of passing stomach tube and gastric lavage in large animals
26	Blood transfusion in small and large animals
27	Demonstration and management of cases presented at clinics
28	Demonstration and management of cases presented at clinics
29	Demonstration and management of cases presented at clinics
30	Demonstration and management of cases presented at clinics
31	Demonstration and management of cases presented at clinics
32	Demonstration and management of cases presented at clinics

Recommended books:

1. Crow, S. E. and S. O. Walshaw, 1997. Manual of Clinical Procedures in the Dog, Cat and Rabbit. 2nd Ed. J. B. Lippincott, Philadelphia, USA.
2. Kelly, W. R. 1984. Veterinary Clinical Diagnosis. 3rd Ed. BaillereTindall, London, UK.
3. Kirk, R. W., S. I. Bistner and R. B. Ford, 1985. Kirk and Bisner's Handbook of Veterinary Procedures and Emergency Treatment. 6th ed. W.B. Saunders Co., Philadelphia, USA.
1. Oehme, F.W. and I. E. Prier, 1998. Text book of Large Animal Surgery. 2nd ed. Williams and Wilkins, Baltimore, London, UK.

Course Title: Theriogenology clinic - III
Course Number: THER 2801
Course Duration: 1 semester (16 weeks)
Credits: 2(0-2)

Course Description: The course is based on learning about the handling of reproduction cases in domestic animals with particular emphasis on species specific reproductive management in dog, cat, sheep and goat.

Course Pre-requisites: Veterinary Obstetrics and Genital Diseases, Theriogenology Clinic I, Theriogenology Clinic II

Course Goals and Performance Objectives:

Goal 1: To familiarize the students about clinical case of reproduction.
Objective 1: To discuss steps to identify a clinical case of reproduction.
Objective 2: To discuss approach and pre-requisites for handling clinical case.

Goal 2: To familiarize the students about different reproductive problems
Objective 1: To describe causes and management of repeat breeding, anestrus and prolapse
Objective 2: To describe uterine sample collection for culture sensitivity and endometrial biopsy.

Goal 3: To familiarize the students about handling of semen.
Objective 1: To describe the handling and structure of liquid nitrogen container.
Objective 2: To describe Thawing of frozen semen and preparation of AI gun

Course Contents:
Theory:

Practical: Heat detection in dog, Ovulation detection in dog, Artificial insemination in dog, Pregnancy diagnosis in dog, Pregnancy monitoring in dog, Parturition interventions in dog, Neonatal care in dog, Hormonal interventions in dog, Heat detection in cat, Ovulation detection in cat, Artificial insemination in cat, Pregnancy diagnosis in cat, Pregnancy monitoring in cat, Parturition interventions in cat, Neonatal care in cat, Hormonal interventions in cat, Heat detection in sheep, Ovulation detection in sheep, Artificial insemination in sheep, Pregnancy diagnosis in sheep, Pregnancy monitoring in sheep, Parturition interventions in sheep, Neonatal care in sheep, Hormonal interventions in sheep, Heat detection in goat, Ovulation detection in goat, Artificial insemination in goat, Pregnancy diagnosis in goat, Pregnancy monitoring in goat, Parturition interventions in goat, Neonatal care in goat, Hormonal interventions in goat.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1		Heat detection in dog
2		Ovulation detection in dog
3		Artificial insemination in dog
4		Pregnancy diagnosis in dog

5		Pregnancy monitoring in dog
6		Parturition interventions in dog
7		Neonatal care in dog
8		Hormonal interventions in dog
9		Heat detection in cat
10		Ovulation detection in cat
11		Artificial insemination in cat
12		Pregnancy diagnosis in cat
13		Pregnancy monitoring in cat
14		Parturition interventions in cat
15		Neonatal care in cat
16		Hormonal interventions in cat
17		Heat detection in sheep
18		Ovulation detection in sheep
19		Artificial insemination in sheep
20		Pregnancy diagnosis in sheep
21		Pregnancy monitoring in sheep
22		Parturition interventions in sheep
23		Neonatal care in sheep
24		Hormonal interventions in sheep
25		Heat detection in goat
26		Ovulation detection in goat

27		Artificial insemination in goat
28		Pregnancy diagnosis in goat
29		Pregnancy monitoring in goat
30		Parturition interventions in goat
31		Neonatal care in goat
32		Hormonal interventions in goat

Teaching Learning Strategies:

Practical
Performance
Presentations
Group Discussions
Assignments
Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks					50% (Mini project + Class performance + Visits)	50%	

Recommended Books/Readings:

1. Zemjenis, R., 1970. Diagnostic & Therapeutic Techniques in Animal Reproduction. Williams & Wilkins Company, Baltimore.
2. Morrow, D.A., 1986. Current Therapy in Theriogenology, II. W.B. Saunders Company, Philadelphia.
3. Kahn, W., D. Wolkmann, and R.M. Kenney, 1994. Veterinary Reproductive Ultrasonography, Mosby-Wolfe, London

SEMESTER-IX

Course Title: Entrepreneurship
Course Number:
Course Duration: 1 semester (16 weeks)
Credits: 1(0-1)

Course Description:
This interdisciplinary course is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solutions within community and organizational environments. This course aims to provide a hands-on introduction to the scalable venture creation process for students with a strong interest in entrepreneurship. The course is designed for a variety of student interests. It directly addresses the concerns of students desiring to become entrepreneurs in the near or more distant future. It is also useful to anyone who expects to be interacting with entrepreneurs in their business careers. Finally, this course is useful for anybody with a curious mind and a willingness to combine serious analysis with creative thinking.

Course Pre-requisites: Nil

Course Goals and Performance Objectives:
Goal 1: Educate the students about the theoretical underpinnings of the entrepreneurship subject in connection with practical assignments and projects.
Objective 1: Teaching students basic concepts and principles of entrepreneurial perspective in generic as well as customized concepts related to livestock businesses.
Goal 2: Understand the process nature of entrepreneurship and learn the ways to manage it.
Objective 1: Understanding the business models
Objective 2: Development of business plan
Goal 3: Inspire the students to seek alternative career opportunities and motivate them to become entrepreneur.
Objective 1: Conduct Opportunity analysis
Objective 2: conduct financial gains of entrepreneurship as compare to alternative options

Course Contents:

Detailed Course Outline:

	Pactical Split
1.	Introduction to Entrepreneurship, benefits and pitfalls of entrepreneurship
2.	The four dimensions of venture creation
3.	Case study discussion
4.	Effectual Vs. Causal logic of entrepreneurship
5.	Entrepreneurial Mindset and Models
6.	Presentation on existing livestock business models assigned in the second week
7.	Opportunity Recognition and Feasibility Analysis
8.	Case study session and Group discussion
9.	Difference between opportunity recognition and the pursuit of the opportunity
10.	Exercise 1. Set Priorities for Your Own Idea or Venture Exercise 2. Create Your Own Business Canvas
11.	Role of Feasibility analysis in developing successful business ideas and studying feasibility plans

12.	Business Model Vs. Business Plan, Definition and basic components of business model, Business Model Analysis, what are the essential elements of an effective business plan.
13.	Groups will present and submit their Business Concept Statements according to the format prescribed by the instructor
14.	Submission of Final project reports/Final group presentations
15.	Submission of Final project reports/Final group presentations
16.	Submission of Final project reports/Final group presentations

Teaching Learning Strategies:

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Practical			
	Assignment	**Mid Term**	**Final Term**	**Total**
Max marks	10%	-	90%	100%

Recommended Books/Readings:
Textbook:

1. Entrepreneurship – Successfully Launching New Ventures, Bruce R. Barringer and R. Duane Ireland 3rd Edition, Pearson
2. Entrepreneurship: Theory, Process, and Practice by Donald F. Kuratco (latest Edition)

Case studies:

Dairy Farm as an entrepreneurial set up in USA from David Holt or any other suitable case study deemed appropriate.

Course Title: Animal Welfare and Ethics
Course Number: LPRO 02206
Course Duration: 1 semester (16 weeks)
Credits: 2(2-0)

Course Description:
The role of Society for Prevention of Cruelty to Animals (SPCA) and other Animal Welfare Organizations (AWOs) in minimizing the sufferings of animals which are inflicted by the owners, attendents and general public is important to understand. Therefore, the know how about rules, laws, regulations, policies, principles governing the care and use of animals must be known by the students proceeding to have degrees related to veterinary and animal sciences. This course will enable the students to learn about the codes of practice for domestic poultry, farm, captive, laboratory, companion and wild animals.

Course Goals and Performance Objectives:

1. To understand about the care and welfare of different breeds of animals.
2. To know about Animal Welfare Organizations such as Society for Prevention of Cruelty to Animals in the country and around the world.
3. To know about the standards for evaluation of captive facilities during the conduct of research.

Course Contents:

Theory:

Care and welfare of different animal species, Local Legislation for Animal Welfare, Regulations, policies and principles governing the care and use of animals, Code of practice for domestic poultry, farm, captive, laboratory and companion animals, Hazards (Natural and Man-made) affecting the welfare of animals and their management, Difference between hazard and disaster, Ethics, Animal Welfare Organizations such as Society for Prevention of Cruelty to Animals (SPCA), Challenges to Zoo and wild animal welfare, Setting standards for evaluating of captive facilities.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	Definition of One Welfare; Quality Welfare Domains	
2	Care and welfare of different animal species i.e. Cattle / Buffaloes/ Horses / Camels	
3	Compassionate Animal Handling and Restraining	
4	Care and welfare of different animal species i.e. Draught animals	
5	Local Legislation for Animal Welfare	
6	Regulations governing the care and use of animals	
7	Policies governing the care and use of animals	
8	Principles governing the care and use of animals	
9	Code of practice for domestic poultry	
10	Code of practice for Farm animals	
11	Code of practice for Captive animals	
12	Code of practice for Laboratory animals	
13	Code of practice for Companion animals	
14	Code of practice for Tethering of animals	
15	Difference between hazard and disaster and how to evaluate damages caused by both (e.g. Earthquake of year 2006 and Flood of year 2010 in Pakistan	
16	Hazards (Natural Calamities) affecting the welfare of animals and their management	
17	Hazards (Man-made/ Anthropogenic) affecting the welfare of animals and their management	
18	Ethical role of a veterinarian in animal welfare; Compassionate animal handling	
19	Environmental enrichment (Tools for satisfying behavioral needs of Animals for their happiness) for animal welfare	
20	Legal Framework for Animal Welfare	
21	Animal Welfare Organization like Society for Prevention of Cruelty to Animals (SPCA)	
22	American Animal Welfare Organization like Society for Prevention of Cruelty to Animals (ASPCA)	
23	Worldwide NGOs for Animal Welfare: Brooke Pakistan	
24	NGOs / Societies / Animal Rescue Organizations/ Shelters in Pakistan (Edhi Foundation, etc)	
25	OIE Global Animal Welfare Strategy	
26	Animal Cruelties its types and how to identify and report for legal proceedings	
27	Animal Welfare in various Religions: especially Islamic Concept of Animal Welfare	

28	Challenges to zoo and animal welfare	
29	Setting Standards for the evaluation of captive facilities	
30	Punjab Animal Health Act 2019	
31	Role of Veterinarians giving awareness of Animal Welfare to the Public especially their clients	
32	Role of Ethical Review committee especially in Universities and Research organizations	

Teaching Learning Strategies:

Theory:	
Lectures	
Presentations	
Group Discussions	
Assignments	
Quiz	

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:

1. Fraser, D., 2008. Understanding Animal Welfare: The Science in its Cultural Context. ISBN: 978-1-4051-3695-2 Wiley-Blackwell
2. NAP, 1996 Guide for the care and use of Laboratory Animals, National Research Council, National Academy Press, Washington D.C.
3. Anonymous, 2014. Animal Welfare Act, Government of the Punjab. (www.punjab.gov.pk)
4. Clark. J. D, Baldwin, K. A., Bayne, M. J. Brown, G. F., Gebhart, J. C. Gonder, J. K. Gwathmey, M. E. Keeling, D. F. Kohn, J. W. Robb, O. A. Smith, W. J. White, 1996. Guide for the Care and Management of Laboratory Animals. National Research Council, National Academic Press, Washington, D. C. 6th edition.

Course Title: Dairy Technology
Course Number: DTEC 02905
Course Duration: 1 semester (16 weeks)
Credits: 2(1-1)

Course Description:
The course is structured to equip participants with cutting-edge skills, knowledge and attitude necessary for the development of milk processing industry in line with changing trends in globalization. The competencies needed to be successful in the dairy sector will get due attention. The foundation for the course contents are also called the Competence Profiles. These Competence Profiles describe the professions for which this course is educating:

1. Manager Dairy Farm
2. Manager Milk Processing and
3. Training & Extension Officer Dairy.

The expectation is that the students are even better prepared to play a pivotal role in the development of the dairy sector in their home region.

Course Pre-requisites:
DVM students having basic knowledge of dairy farm management.

Course Goals and Performance Objectives:
1. Describe composition and properties of milk
2. Describe processes involved in production, collection, transportation, processing and marketing of milk and milk products

Goal 1: To develop the skills of evaluating the milk and milk products quality for human consumption
Objective 1: Describe the nutritive value of milk.
Objective 2: Describe the relation nutrition–milk production.
Objective 3: Indicate how milking, milk storage on the farm and milk collection should be carried out (hygiene)

Goal 2: To develop the skills for managing the dairy processing unit
Objective 1: List the financial, economic, technical and environmental pre-condition of a successful dairy processing unit
Objective 2: Analyze the financial, economic and technological performance of a dairy processing unit
Objective 3: Recognize the interdependence of the different sections of the dairy processing unit

Goal 3: To equip students with the knowledge of value added dairy products development
Objective 1: Draw conclusions and give proper advise to improve the performance of the dairy processing plant based upon the analysis:
Objective 2: Carry out most of the work to be done in a small-scale milk processing plant himself including the production of common dairy products
Objective 3: Manage a processing plant on a day to day basis

Course Contents:
Theory:
Mammary system, synthesis of milk, milk composition, milk let down and its inhibition, factors affecting milk production and composition, biotechnology and enhanced milk production, hand and machine milking, physical and chemical properties of milk, hygienic milk production, collection and transportation, processing and marketing of milk, cooling, homogenization and standardization, Thermal processing of milk; thermization, pasteurization, UHT Treatment, one-step technology and spray drying of milk and whey. Manufacturing of value added dairy products; set and fruit yoghurt, butter, ghee, ice cream, mozzarella cheese, cheddar cheese, cottage cheese, whey protein concentrates, isolates, caseinates, whipped cream,

flavored milk etc. Planning, layout, management and auxiliaries for a dairy plant. Emerging trends in dairy products manufacturing; enzymatic modified dairy ingredients, heat stable probiotics and cheese ageing optimization and extended shelf life technology.

Practical:
Manual and machine milking practices, physical and chemical analysis of milk. Detection of common adulterants in milk. Microbiological examination of milk. Antibiotic residues in milk, somatic cell count, alkaline phosphatase test, estimation of casein and whey protein ratio in milk. Determination of solubility index of milk powder. Analysis of butter, ghee, cheese, cream. Sensory/ organoleptic evaluation of milk and dairy products. Economics of milk processing, visit to milk processing plant.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1	To understand the mammary systems of dairy animals	Comparison between manual and machine milking procedures of dairy animals
2	Synthesis of milk process in mammary duct system	To estimate the Protein contents by titration and Kjeldahl apparatus To determinate the specific gravity of milk by Lactometer.
3	Understanding and comparing the milk composition of different dairy animals	Determination fat of milk by Gerber method; Determination of pH and Acidity of milk; Determination of Clot on boiling (COB) and Alcohol precipitation test (APT) for raw milk
4	Learning of milk let down phenomenon along with its promoting and inhibiting factors	Determination of Ash contents of milk; Determination of solids not fat (SNF) and total solid of milk by Hot air oven
5	Learning the factors affecting milk production and composition of dairy animals	Detection of Adulterants in Milk: Urea, Caustic Soda, Detergents
6	Understanding the biotechnological tools for enhanced milk production,	Detection of Adulterants in Milk: Salt, Hydrogen Peroxide, Skim Milk Powder, Sorbitol
7	Hand and machine milking procedures and principals	Determination of Total Plate Count and Coliform Count in Milk
8	Learning the physical and chemical properties of milk	Detection of Antibiotic Residues in Milk
9	Measures to ensure hygienic milk production, during its fresh collection until chilled transport	Determination of Somatic Cell Count in Milk
10	To understand the marketing dynamics of milk along the factors playing their role	To evaluate the Phosphates test for efficiency of pasteurized milk
11	To understand milk pasteurization process	Determination of Casein and Whey Protein Ratio in Milk
12	Learning on standardization and UHT process of milk	Determination of solubility index of milk powder Determination of free fatty acids and peroxide value in cream and ghee
13	Learning of processing the fermented dairy products like yoghurt and Laban	Determination of fat, moisture and non-fat dry matter contents in butter

14	Understanding the production procedure of fat base value added dairy products like butter and ghee	Detection of vegetable fat and whey powder adulteration in milk through sensory evaluation; Use of sensory evaluation protocols and software in individual booths
15	Manufacturing of coagulated dairy products like cheese	Visit to a milk processing plant
16	Planning the layout for efficient management of dairy plants	Calculating the cost of milk processing and losses

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Product development
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				**Practical**		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Textbook:
1. Walstra, P., 2006. Dairy Technology; Principles of Milk Properties and Processes. Marcel Dekker Inc, New York, USA.

Recommended Books:
1. Bath, D.L, F.N. Dickenson and H.A. Tucker, 1985. Dairy Cattle; Principles, Practices, Problems, Profits. Lea &Fabiger, Philadelphia, U.S.A.
2. Davis, J.G., 1994. Milk testing. Agro-Botanical. Publications, India.
3. Larson, B.L., 1985. Lactation. The Iowa State University Press. Iowa.
4. Schmidt, G.H., L.D. Van Vlk and M.F. Hutjens, 1988. Principles of Dairy Science. 2nd Ed. Prentice Hall Inc. Englewood cliffs, New Jersey, U.S.A.

Course Title: Poultry Pathology
Course Number: PATH-2901
Course Duration: 1 semester (16 weeks)
Credits: 3(2-1)

Course Description:
This course is aimed at understanding the poultry diseases of infectious & non-infectious etiologies at depth. The course is particularly designed keeping in view the requirements of undergraduate students. The students will be familiarized with the pathogenesis, etiology and control of the diseases of poultry with special emphasis on the clinical and post-mortem aspects.

Course Pre-requisites: Undergraduate courses of Pathology.

Course Goals: To provide the students with a comprehensive understanding of diseases of the poultry and to be able to diagnose them on the basis of post-mortem lesions and clinical signs.
Objectives 1: To diagnose poultry diseases
Objectives 2: To describe gross and microscopic pathology of different poultry diseases
Objective 3: To explain relationship of environment and nutrition with disease

Course Contents:
Theory:
Pathology of various viral, bacterial, parasitic, fungal and nutritional diseases; environmental and managerial problems, intoxications.

Practical:
Hands-on practice on postmortem of poultry, common laboratory tests in poultry disease diagnosis, investigation of field outbreaks of disease, visits to poultry farms, hatcheries, research institutes and disease diagnostic laboratories.

No	Theory	Practical
1	Introduction to the course; Sharing of learning outcomes	Introduction to the course; sharing of learning outcomes
2	Poultry industry and future goals	Introduction of post-mortem procedure
3	Introduction to avian structure	Diagnostic sampling protocols
4	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Newcastle disease	Post-mortem lesions and diagnosis
5	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Avian Influenza	Post-mortem lesions and diagnosis
6	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Avian influenza High path strain	Post-mortem lesions and diagnosis
7	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Infectious bronchitis	Post-mortem lesions and diagnosis
8	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of IBD	Post-mortem lesions and diagnosis
9	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of IBH	Post-mortem lesions and diagnosis
10	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of EDS	Post-mortem lesions and diagnosis
11	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of HPS	Post-mortem lesions and diagnosis

12	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of ILT	Post-mortem lesions and diagnosis
13	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Fowl pox	Post-mortem lesions and diagnosis
14	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Chicken infectious anemia	Post-mortem lesions and diagnosis
15	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of avian encephalomyelitis	Post-mortem lesions and diagnosis
16	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Avian pneumo virus	Post-mortem lesions and diagnosis
17	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of brooder pneumonia.	
18	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Mareks disease.	
19	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Lymphoid leukosis.	
20	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of lymphoid leucosis-II.	
21	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Sarcomas and ectoparasites	
22	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Mycosis	
23	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of mycotoxicosis	
24	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of clostridial infections	
25	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of collibacillosis.	
26	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of salmonellosis and Pullorum disease	
27	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Fowl typhoid and Fowl para typhoid.	
28	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Fowl cholera.	
29	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of Mycoplasmosis and CRD	
30	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of coccidiosis	
31	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of spirochaetosis	
32	Etiology, Pathogenesis, Clinical signs, diagnosis and postmortem lesions of infectious coryza	

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Teaching Learning Strategies:

Theory:	Practical
Lectures	Performance
Presentations	Presentations
Assignments	Group Discussions
	Assignments
	Farm visits

Assessment Strategies:

	Theory				Practical		
Modality	**Assignment**	**Mid Term**	**Final Term**	**Total**	**Class Performance**	**Final**	**Total**
Max marks	4	12	24	40	10(Post-mortems + Class performance)	10	20

OIE Day1 Competency Addressed: Transboundary animal diseases (2.2), zoonosis (2.3), Emerging and reemerging diseases (2.4)

Textbook

1) Swayne, D.E., J.R. Glisson, L.R. McDougold,L. K. Nolan, D. L. Suarez and V. Nair , 2013. Diseases of Poultry. 13th Edi., Wiley-Blackwell, USA.

Recommended Books/Readings:

1) Boulianne M, M. L. Brash, B.R. Charlton, S.H. Fitz-Coy, R. M. Fulton, R.j. Julian, M.W. Jackwood, D. Ojkic, L.J. Newman, J.E. Sander, H. L. Shivaprasad, E. Wallner-Pendlrton & P.R. Woolcock, 2013. Avian Disease Manual 7th Ed., The American Association of Avian Pathologists, University of Georgia, USA.
2) Vegad, J. L., 2012. Poultry Diseases, a guide for farmers & Poultry Professionals. 2nd Edi., IBDC Publisher, India.
3) Anjum, A. D., 2014. Poultry Diseases.3rd Edi, Pakistan.
4) Jordan, F., M. Pattison D. Alexander and T. Faragher, 2001. Poultry Diseases. 5th Ed. WB Saunders Company Ltd. London.
5) Randall, C. J., 1987. A Colour Atlas of Diseases of the Domestic Fowl and Turkey. ELBS/Wolfe Medical Publications London.
6) Randall, 1995. Colour Atlas of Avian Histopathology. Mosby-Wolfe, London, UK.
7) Poultry disease diagnosis by Ahmed D Anjum and M. Naeem
8) Relevant/Recent Research Papers

Course Title: LARGE ANIMAL SURGERY AND SHOEING
Course Number: CLMS
Credits: 4(3-1)

Course Description:
Goal: The goal of this course is to learn large animal's surgical operations. The different surgical operations of large animals like castration, ruminotomy, esophagotomy, tracheotomy, penile amputation, tail docking, dehorning and disbudding are also included in this course. After completion of this course a

student is able to handle different surgical operations with full of confidence.

Objectives:

1. Surgically correct problems encountered in large animal practice
2. Perform foot care and hoof management
3. Describe and perform procedures of corrective shoeing.

Theory

Scope of large animal surgery, Surgical affections of head, neck, ear, eye, teeth, thorax, claws, horn, tail, teats and udder of large animals. Affections: musculo-skeletal, digestive, urinary, male and female genital systems, integumentary system, Surgical management of colic, history and basic terms in shoeing; the horseshoe and shoe-nails, Hot and cold shoeing, Injuries caused by farrier, shoes, and nails, Affections of the foot, fore and hind limbs and corrective shoeing, blemishes and vices in animals, Dentition of large animals, Soundness.

Practical

Ectropion, entropion and enucleation of eyeball, Various tenectomies and tendon repair and neurectomy, Temporary and Permanent Tracheotomy, and laryngeal diverticulectomy procedure, Oesophagotomy procedure, Oesophagotomy, practical demonstration, Rumenotomy procedure, Castration of farm animals and equine, Penile amputation, Methods of disbudding and dehorning and tail docking in cattle and buffaloes, Shoeing tools, Types of shoes and nails, Hot Shoe preparation, Application of shoes (removal of shoe, preparation of foot), Practices in determination of age from teeth, Soundness certificate writing.

No.	Theory	Practical
1	Surgery and its types and general surgical considerations	Ectropion, entropion, Enucleation of eyeball
2	Inflammation, ulcers, abscesses, hematoma, galls, complete and incomplete fistula	Methods of drainage of sinus, guttural pouch and repair of fistula
3	Perioperative antibiotics and analgesia in large animals	Tail docking
4	Surgical affections of eye	Various tenectomies and tendon repair and neurectomy
	Affections of eye	Temporary and Permanent Tracheotomy, and laryngeal diverticulectomy procedure
4	Affections of ear	Oesophagotomy
5	Affection of oral cavity and salivary glands	Rumenotomy
	Affections of upper respiratory tract	Castration of farm animals and equine
7	Affections of upper respiratory tract	Penile deviation (teaser bull), Penile amputation
8	Affections of lower respiratory tract	Caslik operations and epizeotomy
9	Affections of esophagus	Shoeing tools, Types of shoes and nails
10	Affection of stomach/rumen	Hot Shoe preparation
11	Affection of small intestines	Application of shoes (removal of shoe)
12	Affection of large intestines	Application of shoes (preparation of foot)
13	Affection of recto-vaginal fistula and atresia ani	Practices in determination of age from teeth
14	Affections of teat and udder	Soundness certificate writing
15	Affections of teat and udder	Farriery mentoring frame work
16	Affections of male reproductive system	Blacksmithing and Forging tools
17	Affections of male reproductive system	
18	Affections of female reproductive system	

19	Affections of female reproductive system	
20	Affections of integument and its adnexa	
21	Affections of integument and its adnexa	
22	Affections of integument and its adnexa	
23	Affections of tail	
24	Affections of forelimb	
25	Affections of forelimb	
26	Affections of hindlimb	
27	Affections of hindlimb	
28	Congenital abnormalities	
29	Hernia and its types	
30	Diagnosis and treatment of hernia	
31	Introduction and history of shoeing	
32	Terminology in shoeing	
33	Anatomy and physiology of foot	
34	Horseshoe and shoe-nails	
35	Hot and cold shoeing	
36	Preparation of foot for shoeing	
37	Routine and corrective shoeing	
38	Injuries caused by farrier and blacksmith	
39	Injuries caused by shoes, and nails.	
40	Affections of foot	
41	Affections of the foot	
42	Blemishes and vices in animals	
43	Dentition of large animals	
44	Soundness examination.	
45	Soundness examination and certificate writing	
46	Colors, natural and acquired marking	
47	Gait analysis	
48	Equine behavior	

Textbook:

1. Jennings. Jr. P. B., 1984. The Practice of Large Animal Surgery. W.B. Saunders Co., Philadelphia, USA.

Recommended books:

1. Stashak, T. S. 1987. Adams' Lameness in Horses. 4th ed. Lea and Febiger, Philadelphia, USA.
2. Venugopalan. A., 2000. Essentials of Veterinary Surgery 8th ed. Oxford and IBH Publishers and Distributors New Delhi, India.
3. Auer. J.A., 1999. Equine surgery. 2nd ed. W.B. Saunders Co., Philadelphia. USA.
4. Colahan, P. T., I. G. Mayhew, A. M. Merritt and J. N. Moore, 1999. Equine Medicine and Surgery. 5th ed. (Vol. 1 & 2). Mosby, Philadelphia. USA.
5. Turner, A.S. and C. W. Mcllwraith, 1989. Techniques in Large Animal Surgery. 2nd ed. Lea &Febiger, Philadelphia, USA.
6. Tyagi, R. P. S. and L. Singh, 1993. Ruminant Surgery. C.B.S. Publishers and Distributors, New Delhi, India.
7. Greenough, P. R., F. J. MacCallum and A. D. Weaver, 1997. Lameness in Cattle. 3rd Ed. Wright and Sons. Bristol, UK.
8. Pollitt, C. C., 1995. Colour Atlas of the Horse's Foot. Mosby-Wolfe, London, UK.
9. Emery, L., J. Miller and N. V. Vanhoosen, 1977. Horseshoeing Theory and Hoof Care. Lea and Febiger, Philadelphia, USA.

Course Title: Medicine Clinic-IV
Course Number: CLMS 02901
Course Duration: 1 semester (16 weeks)
Credits: 1(0-1)

Course Description:
Course addresses teaching of both hands-on clinical skills and clinical reasoning in the anaesthesiology, diagnostic imaging and medicine. Course provides the veterinary student with access to clinical cases (clients and patients) and instruction so that the student becomes comfortable with and proficient at completing an appropriate physical examination; taking a complete history from a client; using clinical reasoning to develop differential and final diagnoses and diagnostic and treatment plans; and communicating effectively, both verbally and in writing, with clients, colleagues and support staff. Although students will be able to apply these skills to multiple animal species, but the focus is laid on applying these skills to the major animal species of importance. Course also provides ample opportunities to veterinary students to apply scientific knowledge during dealing clinical cases in the clinics, farms or fields that includes epidemiology, transboundary animal diseases, zoonoses (including food borne diseases), emerging and re-emerging diseases, disease prevention and control programmes, veterinary products, animal welfare, communication skills, and management of contagious disease.

Course Pre-requisites:
FSc Pre-Medical

Course Goals and performance objectives:
Goal No. 1: To apply clinical skills in treatment of livestock diseases.
Objective No. 1: Obtain skills of history taking.
Objective No. 2: Obtain skills of clinical examination.
Objective No. 3: Obtain skills of lab diagnosis.

Goal No. 2: Differential diagnosis of livestock and equines
Objective No. 1: apply knowledge of differential diagnosis of livestock and equine's diseases.

Goal No. 3: work independently as clinician/practitioners in handling of livestock.
Objective No. 1: Independent handling of clinical cases.
Objective No. 2: Economics of treatment of livestock diseases.
Objective No. 3: Community engagement in control of livestock diseases.
Objective No. 4: Diseases forecasting

Goal No. 4: Outbreak handling
Objective No. 1: The control of different disease outbreak

Goal No. 5: learn to develop quarantine unit
Objective No. 1: developing and maintaining quarantine unit.

Course Contents:
Practical:
History Taking: The main objective of course is to take history of disease and better communication skills of students. Clinical Examination: comprising of distance examination and specific examination. Evaluation skills: Predisposing factors of disease. Handling of animals: Handling of animals at clinics. Record Keeping: Record Keeping of diseases. Recent advancement: Recent Advances in Animal Health. Differential diagnosis , dose calculation, cost of medication.

Sr. No.	Theory Lecture Split
1.	History taking of disease and better communication skills
2.	History taking of disease and better communication skills
3.	Clinical Examination comprising of distance examination and specific examination.
4.	Clinical Examination comprising of distance examination and specific examination.
5.	Evaluation skills Predisposing factors of disease. Handling of animals at clinics.
6.	Evaluation skills Predisposing factors of disease. Handling of animals at clinics.
7.	Differential diagnosis, dose calculation, cost of medication
8.	Differential diagnosis, dose calculation, cost of medication
9.	Maintenance of herd record.
10.	Maintenance of herd record.
11.	Maintenance of herd record.
12.	Cost effectiveness of treatment, vaccination,herbal country medicine
13.	Cost effectiveness of treatment, vaccination,herbal country medicine
14.	Distance management/corporate farm management/vaccination/deworming
15.	Distance management/corporate farm management/vaccination/deworming
16.	Learning to handle disease Outbreak
17.	Learning to handle disease Outbreak
18.	Learning to handle disease Outbreak
19.	Learning to develop quarantine unit
20.	Learning to develop quarantine unit
21.	Learning to develop quarantine unit
22.	Record Keeping of diseases.
23.	Record Keeping of diseases.
24.	Record Keeping of diseases.
25.	Record Keeping of diseases.
26.	Recent Advances in Animal Health
27.	Recent Advances in Animal Health
28.	Recent Advances in Animal Health
29.	Recent Advances in Animal Health
30.	Presentation working
31.	Presentation working
32.	Presentation working

Teaching Learning Strategies:

1. Performance/case presentation
2. Presentation
3. Group discussions
4. Quiz

Class Work Policies:

5. Equal opportunity
6. Intellectual honesty
7. Regularity and punctuality
8. Adherence to deadlines Fairness
9. Conformity to discipline
10. Team work

Assessment Strategies:

	Practical		
	Daily evaluation	Final Term	Total
Max Marks	10 (class performance + visits)	10	20

Competencies Fulfilled:

Epidemiology
Transboundary animal diseases
Zoonoses (including food borne diseases)
Emerging and re-emerging diseases
Disease prevention and control programmes
Veterinary products
Animal welfare
Communication skills
Management of contagious diseases

Recommended Books/Readings:

11. Constable PD, Hinchcliff KW, Done SH and Grünberg W. 2016. Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs and Goats, 11th edition, Volumes 1 and 2. Elsevier Health Sciences.
12. Kelly WR. 1984. Veterinary Clinical Diagnosis. 3rd Ed. Bailliere Tindall & Corsell, London, UK.
13. The MSD Veterinary Manual. 2019. 11th Ed. Merck Sharp & Dohme Corp., NJ, USA. Available online: https://www.msdvetmanual.com
14. Pinsent PJN and Fulle CJ. 1997. Outline of Clinical Diagnosis in Horse. Blackwell Science, Oxford, UK.
15. Anderson DE, Rings DM. 2009. Current Veterinary Therapy, Food Animal Practice. 5th edition. Elsevier Health Sciences.
16. Hungerford TG. 1991. Hungerford's Diseases of Livestock, 9th Ed. McGraw-Hill Book Company, Sydney, Australia.
17. Smith BP. 2015. Large Animal Internal Medicine, 5th edition. Elsevier Health Sciences.
18. Radostits OM, Mayhew IGJ, Houston DM. 2005. Veterinary Clinical Examination and Diagnosis, 1st edition. Elsevier Health Sciences.
19. Côté E. 2015. Clinical Veterinary Advisor: Dogs and Cats, 3rd edition. Elsevier Health Sciences.
20. Dairy H. Shaw Small animal internal medicine. 1st edi. Lipincott William and Wilkins

Course Title: SURGERY CLINIC-IV
Course Number: CLMS
Credits: 2(0-2)
Course Description:
Course Pre-requisites: F. Sc. (Pre-medical)
Goal: The goal of this course is to learn surgical emergencies arising during and after anesthesia, surgery and fluid replacement therapy and cardiopulmonary resuscitation as life-saving remedies.
Objectives:

1. Control and handle different animals for the purpose of surgical manipulations
2. Treat different animals brought for treatment
3. Deal with the clients.
4. Handle indoor and outdoor cases.

Clinic
Handling surgical emergency cases, Fluid replacement therapy and blood transfusion in animals, Practice of passing stomach tube and stomach lavage, Back-racking, rectal palpation, Surgical management of choking, colic and grain overload, Management of urine retention cases, Application of plaster casts, Use of radiography and ultrasound as diagnostic tools, Group discussion on cases received at the clinics and case

presentations, Independent handling of surgical cases.

No.	Clinics
1	Review of use of ultrasonograpy as diagnostic tools
2	Review of use of radiology as diagnostic tools
3	Handling of equine surgical colic
4	Handling of ruminal impaction
5	Diagnosis of traumatic pericarditis
6	Interpretation of laboratory reports
7	Interpretation of LFT
8	Interpretation of blood gas analysis
9	Interpretation of hematology profile
10	Interpretation of RFT
11	Interpretation of urine analysis
12	Endoscopy and proctoscopy as diagnostic tool
13	Fluorescent dye studies
14	Application of POP and Robert Johns bandage
15	Application of modified Thomas splint
16	Application of shoulder spica
17	Application of Ehmer sling
18	Surgical management of grain overload
19	Surgical management of equine colic
20	Enema and impaction management
21	Surgical management of abomasal displacement
22	Tooth rasping
23	Tenectomies of forelimb
24	Tenectomies of hindlimb
25	Neurectomies of forelimb
26	Neurectomies of hindlimb
27	Management of different hernias
28	Veterinary documentation and record keeping
29	Group discussion and management of cases received at clinic
30	Group discussion and management of cases received at clinic
31	Group discussion and management of cases received at clinic
32	Group discussion and management of cases received at clinic

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks	10%	30%	60%		50% (Mini project + Class performance + Visits)	50%	

Recommended Books:

1. Speirs, V. C. and R. H. Wrigley, 1997. Clinical Examination of Horses. W. B. Saunders Co., Philadelphia, USA.
2. White II, N. A. and J. N. Moore, 1998. Current Techniques in Equine Surgery and Lameness, 2nd ed. W. B. Saunders Co., Philadelphia, USA.
3. Stashak, T. S. 1987. Adams' Lameness in Horses. 4th ed. Lea and Febiger. Philadelphia, USA.
4. Colahan, P. T., I.G. Mayhew, A. M. Merritt and J. N. Moore, 1999. Equine Medicine and Surgery, 5th ed. (Vol. I & 2) Mosby, Philadelphia, USA.
5. Pollitt, C. C., 1995. Colour Atlas of the Horse's Foot. Mosby-Wolfe, Philadelphia, USA.
6. Kelly, W. R., 1984. Veterinary Clinical Diagnosis. 3rd ed. BaillereTindall, London, UK.

Course Title: Theriogenology clinic - IV
Course Number: THER02903
Course Duration: 1 semester (16 weeks)
Credits: 2(0-2)

Course Description: The course is based on learning about the handling of reproduction cases in domestic animals with particular emphasis on species specific reproductive management in cow, buffalo, mare and camel.

Course Pre-requisites: Veterinary Obstetrics and Genital Diseases, Theriogenology Clinic I, Theriogenology Clinic II, Theriogenology Clinic III.

Course Goals and Performance Objectives:

Goal 1: To familiarize the students about clinical case of reproduction.
Objective 1: To discuss steps to identify a clinical case of reproduction.
Objective 2: To discuss approach and pre-requisites for handling clinical case.

Goal 2: To familiarize the students about different reproductive problems
Objective 1: To describe causes and management of repeat breeding, anestrus and prolapse
Objective 2: To describe uterine sample collection for culture sensitivity and endometrial biopsy.

Goal 3: To familiarize the students about handling of semen.
Objective 1: To describe the handling and structure of liquid nitrogen container.
Objective 2: To describe Thawing of frozen semen and preparation of AI gun
Course Contents:

Theory:

Practical: Heat detection in cow, Ovulation detection in cow, Artificial insemination in cow, Pregnancy diagnosis in cow, Pregnancy monitoring in cow, Parturition interventions in cow, Neonatal care in cow, Hormonal interventions in cow, Heat detection in buffalo, Ovulation detection in buffalo, Artificial

insemination in buffalo, Pregnancy diagnosis in buffalo, Pregnancy monitoring in buffalo, Parturition interventions in buffalo, Neonatal care in buffalo, Hormonal interventions in buffalo, Heat detection in mare, Ovulation detection in mare, Artificial insemination in mare, Pregnancy diagnosis in mare, Pregnancy monitoring in mare, Parturition interventions in mare, Neonatal care in mare, Hormonal interventions in mare, Heat detection in camel, Ovulation detection in camel, Artificial insemination in camel, Pregnancy diagnosis in camel, Pregnancy monitoring in camel, Parturition interventions in goat, Neonatal care in camel, Hormonal interventions in camel.

Detailed Course Outline:

No	Theory Lecture Split	Practical Session Split
1		Heat detection in cow
2		Ovulation detection in cow
3		Artificial insemination in cow
4		Pregnancy diagnosis in cow
5		Pregnancy monitoring in cow
6		Parturition interventions in cow
7		Neonatal care in cow
8		Hormonal interventions in cow
9		Heat detection in buffalo
10		Ovulation detection in buffalo
11		Artificial insemination in buffalo
12		Pregnancy diagnosis in buffalo
13		Pregnancy monitoring in buffalo
14		Parturition interventions in buffalo
15		Neonatal care in buffalo
16		Hormonal interventions in buffalo

17		Heat detection in mare
18		Ovulation detection in mare
19		Artificial insemination in mare
20		Pregnancy diagnosis in mare
21		Pregnancy monitoring in mare
22		Parturition interventions in mare
23		Neonatal care in mare
24		Hormonal interventions in mare
25		Heat detection in camel
26		Ovulation detection in camel
27		Artificial insemination in camel
28		Pregnancy diagnosis in camel
29		Pregnancy monitoring in camel
30		Parturition interventions in camel
31		Neonatal care in camel
32		Hormonal interventions in camel

Teaching Learning Strategies:

Theory:	**Practical**
Lectures	Performance
Presentations	Presentations
Group Discussions	Group Discussions
Assignments	Assignments
Quiz	Mini research projects

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory				Practical		
	Assignment	**Mid Term**	**Final Term**	**Total**	**Daily Evaluations**	**Final Term**	**Total**
Max marks					50% (Mini project + Class performance + Visits)	50%	

Recommended Books/Readings:

1. Zemjenis, R., 1970. Diagnostic & Therapeutic Techniques in Animal Reproduction. Williams & Wilkins Company, Baltimore.
2. Morrow, D.A., 1986. Current Therapy in Theriogenology, II. W.B. Saunders Company, Philadelphia.
3. Kahn, W., D. Wolkmann, and R.M. Kenney, 1994. Veterinary Reproductive Ultrasonography, Mosby-Wolfe, London.

ENGLISH-III Technical Writing and Presentation Skills

Course Number: SOSC210003
Course Duration: 1 semester (16 weeks)
Credits: 2 (2-0)

Course Description:
The course aims to enhance language skills of the students; listening, speaking, reading and writing, in a professional set up. It also provides a strong base for developing critical thinking in students.

Course Pre-requisite: Enrolled undergraduates who are allowed to take up courses: ENGLISH III

Course Goal and Performance Objectives:

Goal: To enable students excel in the use of English language skills

The main objectives of the course are to:

1. Enhance language skills and to develop critical thinking among the students
2. Further mastering of presentation skills
3. Enable students write proposals for a research paper
4. Develop skills in writing emphasizing on style, content, language, form, clarity and consistency
5. Develop fluency in speaking with correct pronunciation
6. Enable students read, understand, analyze and respond to written miscellaneous topics

Course Contents:
Presentation skills. Essay writing: Descriptive, narrative, discursive, argumentative**;** Academic writing: How to write a proposal for research paper/term paper; How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency); Technical Report writing; Progress report writing

Detailed Course Outline:

No	Theory
1	Introduction to the course; sharing of learning outcomes
2	Study Skills: Intensive reading practice 1
3	Intensive reading practice 2
4	Study Skills: Aims of proposals
5	How to write a proposal
6	How to present a proposal for a research paper
7	Vocabulary Building:
8	Vocabulary Exercise 1
9	Vocabulary Exercise 2
10	Presentation Skills: Presentation Session I
11	Presentation Session II
12	Assignment 1: group presentation
13	Academic Skills: Scientific / Research Writing and its structure
14	Sections of Scientific / Research paper & Sample study
15	Reading Skills: Reading Passage 1
16	Reading Passage 2
17	Study Skills: Importance of Report writing at a working place.
18	Progress Report Format
19	Report Writing
20	Creative Writing: Descriptive Writing
21	Narrative Writing
22	Argumentative Writing
23	Writing Skills: Scientific
24	Technical Writing: Reports
25	Technical Writing: Profession-based approach
26	Technical Writing: Choice of vocabulary and style
27	Presentation Skills: Technical Presentation Skills
28	Technical Writing: Techniques of Technical report writing
29	Technical Report Writing Test
30	Writing Skills: Emphasizing on Content
31	Emphasizing on Style and Language
32	Emphasizing on Clarity and Consistency

Teaching/Learning Strategies:

Theory:
Interactive Lectures
Presentations
Group Discussions
Assignments
Quiz

Class Work Policies:

Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory			
Modality	**Assignment**	**Mid Term**	**Final Term**	**Total**
Max marks	**4**	**12**	**24**	**40**

Recommended Books/Readings:

1. White, R. 1992. Writing. Advanced, Oxford Supplementary Skills. Third Impression.
2. Langan, J., 2004. College Writing Skills. McGraw-Hill Higher Education.
3. Kirszner, L.G. and S.R. Mandell. Patterns of College Writing (4th edition), St. Martin's Press.
4. Neulib, J., K.S.Cain, S. Ruffus, and M. Scharton (Ed.). The Mercury Reader. A Custom Publication. Compiled by Northern Illinois University.

Course Title: LIVESTOCK ECONOMICS AND BUSINESS MANAGEMENT
Course Number: LEBM-02406
Course Duration: 1 semester (16 weeks)
Credits: 2(2-0)

Course Description:

The course is aimed to build basic understanding of business management and economics within perspective of livestock businesses for DVM graduates. Furthermore, the course will impart entrepreneurial spirit among DVM students by identifying different entrepreneurial opportunities.

Course Pre-requisites: Nil

Course Goals and Performance Objectives:

Goal 1: To familiarize the students about role of Livestock in national economy

Objective 1: Teaching students economics and business perspective of livestock related businesses and its impact on local community.

Goal 2: Identification of challenges and issues in Livestock sector and pointing out their potential solutions.

Objective 1: Performing SWOT analysis of livestock sector

Objective 2: Development of strategic grid

Goal 3: Orientation towards farm economics

Objective 1: Development of profit-loss statement

Objective 2: Application of farm economics software

Goal 4: Identification of marketing challenges of livestock products

Objective 1: Understanding the supply chain of livestock businesses

Objective 2: Development of marketing strategies for different livestock products

Course Contents:

Theory:

Detailed Course Outline:

	Theory Lecture Split
1.	Definition and Scope of economics for livestock sector
2.	Economic and budgetary indicators related to Livestock sector
3.	Share of livestock in agricultural and national GDP
4.	Introduction to relevant financial institutions and relevant procedures; Economic Survey of Pakistan
5.	Businesses operations of Poultry sector and related production systems
6.	Businesses operations of Dairy sector and related production systems
7.	What is farm economics? Examples of various farming businesses in Livestock sector
8.	Farm economics of various production/farming systems and cost of production of milk and other livestock products
9.	Using farm data for calculating farm economics
10.	How to develop profit loss statement and it`s analysis
11.	Indicators of financial viability of different Livestock projects
12.	Introduction of farm economics software
13.	Application of farm economics software
14.	Case Study Session
15.	Guest speakers/An entrepreneur from industry
16.	Basic concepts related to functional Analysis techniques i.e. SWOT, PESTLE, PEST etc.
17.	SWOT analysis of dairy sector
18.	SWOT analysis of Meat Sector of Pakistan.
19.	Meat export opportunities for Pakistan.
20.	Introduction to marketing
21.	Designing Marketing Mix
22.	Implementation of marketing strategy for various livestock related businesses
23.	Concept of Marketing Growth Strategies
24.	Marketing Growth Strategies for Livestock businesses
25.	Introduction to Marketing Plan related to livestock products
26.	Science and arts of Sales management

27.	Introduction to Integrated marketing communication
28.	Personal selling and key selling skills needed as a sales executive
29.	Supply Chain Management: Basic concepts and its importance in today`s business environment with reference to Livestock Sector.
30.	International Quality Standards for Food related industries
31.	Documentation regarding ISO, HACCP and Halal certifications with particular reference to Meat export industry of Pakistan
32.	Policy related issues of Livestock sector and studying policy papers

Teaching Learning Strategies:

Theory:
Lectures
Case studies
Assignments
Projects
Presentations
Group Discussions
Quiz

Class Work Policies:
Equal opportunity
Intellectual honesty
Regularity and punctuality
Adherence to deadlines
Fairness
Conformity to discipline

Assessment Strategies:

	Theory			
	Assignment	**Mid Term**	**Final Term**	**Total**
Max marks	10%	30%	60%	100%

Recommended Books/Readings:
Textbook:

1. Kotler, P. & Amstrong, G. (2006) *Principles of Marketing*. Prentice-Hall, London.
2. Stanton, W. J., Etzel, M. J., Walker, B. J., Báez, E. P., Martínez, J. F. J. D., Nicolesco, J. D. & Garza, A. C. (2004) Fundamentos de marketing.
3. Anonymous (2020) Pakistan Economic Survey (ed. by Finance Division, G. O. P.). Economic Advisor`s Wing, Islamabad.

Case studies:

4. K&N's: Health and Happiness for Pakistan by David E. Bell, Damien P. McLoughlin and Mary Shelman

INTERNSHIP: As specified by PVMC regulations from time to time