COURSE OF STUDIES

for

Doctor of Philosophy

in

Anatomy

UNIVERSITY OF HEALTH SCIENCES, LAHORE PAKISTAN

Program Rationale:

This postgraduate degree will introduce students to the main issues, theories, debates and research methods in Higher Education from a multidisciplinary perspective. The program offers the students the opportunity to interact with a wide range of other clinical professionals, thereby deepening their knowledge and analytical skills necessary for understanding Anatomy from a broad perspective and contributing effectively within their specific area of higher education & research practice.

Mission Statement:

The Department of Anatomy aims to provide high-quality teaching of anatomical sciences to postgraduate and undergraduate medical & allied students. We strive to prepare the next generation of scientists by conducting need based basic and applied research.

Program Educational Objectives:

The salient objectives of this program are to:

1. Develop an in-depth understanding of Gross Anatomy, Developmental, Microanatomy, Neuroanatomy Statistics, and other graduate-level elective topics through successful completion of course work.
2. Develop proficiency in didactic skills in the context of the teaching in basic medical sciences
3. Acquire proficiency in scientific data acquisition and analysis through mentored research.

4. Develop an understanding of the professional skills (including an ability to read and interpret scientific literature) required of biomedical scientists and educators
5. Obtain expertise to interpret scientific findings of their laboratory research study through the development of a written, publication-quality thesis

Program Learning Outcomes:

By the end of this program students shall have an ability to

- demonstrate a critical understanding of the key concepts used in general and advanced gross anatomy, microscopic anatomy, neuroanatomy and developmental anatomy influencing Anatomy education at the present time
- critically analyze and interpret their own professional practice in light of these key concepts, theories and debates
- understand the standards to judge the quality of teaching and research in their Anatomy practice
- critically analyze and carry out research in an area of interest relevant to their practice
- demonstrate excellent written communication skills appropriate to the development of grant proposal, thesis and article writing with an appropriate balance of text and graphic materials.
- Demonstrate oral communication skills that is appropriate for the audience and occasion using clear language, pronunciation and physical behaviors that support the verbal message for the audience and occasion and able to use visual aids appropriate for technical presentation and ability to answer audience questions.

SCHEME OF STUDIES (3-Year)

PhD Anatomy

Semester #	Course code	Course title	Credit hours		
			Theory	Practical	Total
1	RM-801	Research Methodology	2	0	02
	AB-801	Advance Biostatistics	2	0	02
	GANAT-803 NANAT-803	Clinically Oriented Human Anatomy Neuroanatomy	1.5 1.5	1 1	05
2	ALT-801	Advanced Laboratory Techniques	1	1	02
	MANAT-803 DANAT-803	Microanatomy Developmental Anatomy	2 2	2 1	07
3	Research (thesis)		30		30
(Total: 48)					

Course Title Clinically Oriented Human Anatomy

Contact Hours: 72	Credit Hours: 2.5
Theory = 24	Theory = 1.5
Practical = 48	Practical = 1
Total = 72	Total = 2.5

Course Objectives & Learning Outcome:

Recall the anatomical structure and neurovascular control of limbs in relation to applied and clinical anatomy

Compare the upper and lower limbs with reference to developmental and neurovascular differences

Demonstrate the functional anatomy and biomechanics of limbs along with the clinical correlates

Understand the clinical aspects of anatomy of back, vertebral column, thoracic cage and mediastinum

Demonstrate the structure and neurovascular control of vital organs of thorax with applied aspects

Understand the anatomy of abdomen and pelvis and relations of various organs while clinically correlating them

Demonstrate the applied aspects of neurovascular supply of abdomen and pelvis

Understand the anatomy of head & neck with clinical relevance of its structures and relations

Demonstrate the applied aspects of neurovascular supply of head & neck

Mode of Learning:

1. Multimedia presentations and white board

2. Interactive discussions & small group discussions

3. Journal clubs & Lab meetings

5. Self-directed learning

Practical:

Practical work shall include

1. **Surgical Anatomy:** Practical sessions focusing on surgical anatomy can help students understand the anatomical basis of surgical procedures. This may involve observing surgeries, practicing surgical techniques on cadavers or simulators, and discussing anatomical considerations in surgical planning.
2. **Teaching Experience:** Providing opportunities for PhD students to teach anatomy to undergraduate students can be a valuable practical experience. Teaching not only reinforces their own understanding of the subject but also develops their communication and mentoring skills.
3. **Virtual Anatomy Tools:** Virtual anatomy software for practice and exploration, this will be useful for supplementing traditional cadaver-based learning, allowing students to visualize structures in 3D and interact with them digitally

Recommended Books: Grays Anatomy, Snell Clinical Anatomy, Keith L Moore Clinical Oriented Anatomy, Lasts Anatomy, Netters Atlas

Course Title Neuroanatomy

Contact Hours:72	Credit Hours: 2.5
Theory = 24	Theory = 1.5
Practical = 48	Practical = 1
Total =72	Total = 2.5

Course Objectives & Learning Outcome:

Demonstrate the General Organization of Nervous Tissue

Compare basic differences in CNS and PNS

Understand the components and pathways involved in sensory perception

Understand mechanism of neural control of pain and its role in therapeutics

Integrate core knowledge in virtual clinical scenarios

Understand the neuroanatomy of the execution of a balanced and coordinated motor action

Demonstrate motor pathways and related disorders

Demonstrate the anatomical basis of abnormal movements

Integrate core knowledge in virtual clinical scenarios

Understand the grey and white matter distribution in brain stem

Understand the cranial nerves anatomy and palsies

Demonstrate the location and Functions of ANS

Understand the anatomy of autonomic control of body functions

Understand the neuroanatomy of emotional behavior and its clinical application

Understand the anatomy of circulation in central nervous system

Demonstrate the functional and clinical correlation of circulatory changes

Mode of Learning:

1. Multimedia presentations and white board

2. Interactive discussions & small group discussions

3. Journal clubs & Lab meetings

5. Self-directed learning

Practical:

Practical work shall include

Neuroanatomical Dissection: Cadaveric/animal brain dissections focusing on the central nervous system (CNS) and peripheral nervous system (PNS) to provide detailed understanding of neuroanatomical structures.

Teaching Experience: Providing opportunities for PhD students to teach anatomy to undergraduate students can be a valuable practical experience. Teaching not only reinforces their own understanding of the subject but also develops their communication and mentoring skills.

Neuroanatomical Atlas Interpretation: Training in the interpretation of neuroanatomical atlases and brain maps is crucial for PhD students to navigate and understand the complex organization of the nervous system. Practical activities may involve hands-on exploration of neuroanatomical atlases and digital brain atlases.

Recommended Books:

Snells Neuroanatomy, Grays Clinical neuroanatomy

Course Title Microanatomy

Contact Hours: 96	Credit Hours: 4
Theory = 48	Theory = 2
Practical = 48	Practical = 02
Total = 96	Total = 4

Course Objective & Learning Outcome:

Understand cell structure and function: Cell cytoplasm, Cell Nucleus, Cellular Mechanisms of Disease: Cell, death, Mitochondrial and DNA damage

Define, classify & demonstrate epithelium & connective tissue

Demonstrate microstructure of cerebral cortex, cerebellum, peripheral nerve, ganglion, age related changes in brain tissue

Demonstrate the Microstructure of Muscle, Compare types of muscle fibers, Histological procedures for fixation and staining muscle, Histological changes in muscle secondary to myopathies

Classify and demonstrate bone & cartilage on basis of microstructure

Define microscopic changes in bone and cartilage secondary to common bone disorders and explain age related histological changes

Handle bone tissue, identify staining characteristics of bone

Classify glands on the basis of microstructure, and compare basic structure of glands with their functional correlates

Demonstrate & compare microstructure of thymus, lymph node, spleen and tonsils

Understand and compare the microstructure of whole gastrointestinal tract and their associated organs and identify the staining properties of gastric mucosa.

Demonstrate the microstructure of kidney, bladder and ureter and compare the differences in microanatomy of urinary organs and identify the staining properties of urinary mucosa

Understand the microanatomy of respiratory organs and identify the staining properties

Demonstrate microanatomy of special sense organs

Understand the microanatomy of male and female reproductive organs & correlate histological features with functions and identify the staining properties

Demonstrate microanatomy of skin, structure of skin appendages with their functional correlates

Mode of Learning:

1. Multimedia presentations and white board

2. Interactive discussions & small group discussions

3. Journal clubs & Lab meetings

4. Self-directed learning

Practical:

Histological Techniques: Advanced training in histological techniques is fundamental for studying microanatomy. Practical sessions should cover tissue processing, sectioning (paraffin and frozen sections), staining methods (H&E, special stains, immunohistochemistry), and slide mounting.

Microscopic Observation and Analysis: Hands-on experience with light microscopy and other microscopic imaging techniques for examining the microstructures of tissues. PhD students should learn how to prepare samples, adjust microscope settings, capture images, and analyze microscopic data

Animal Handling & Use of Animal Models: Practical sessions will involve animal handling, tissue collection, histological processing, and microscopic analysis of tissue sections.

Rotations in other labs of the institute or other universities: For exposure to other imaging technology like electron microscopy and techniques like ELISA, PCR immunofluorescence etc

Recommended Books:

Junqueira's Basic Histology: Text and Atlas, Laiq Hussain Histology, Histology - Michael H. Ross, Wojciech Pawlina, diFiore's Atlas of Histology, Wheater's Functional Histology

Course Title Developmental Anatomy

Contact Hours:	Credit Hours: 2
Theory = 32	Theory = 2
Practical = 48	Practical = 1
Total = 76	Total = 3

Course Objectives & Learning Outcome:

Understand the process of growth in germinal period and formation of germinal discs

Understand the process of growth of human conceptus in embryonic and fetal period, and mechanisms involved in teratogenesis, antenatal screening

Understand the tissue origin and differentiation of musculoskeletal system, head and neck and CNS

Demonstrate the anatomical reason for musculoskeletal, urogenital & CNS disorders

Understand the development of gastrointestinal system

Elaborate the process of body folding and cytodifferentiation of intestinal endoderm

Understand the development of CVS and lungs in developing embryo

Understand the role of signaling and molecular regulation in the fetus developmental process

Mode of Learning:

1. Multimedia presentations and white board

2. Interactive discussions & small group discussions

3. Journal clubs & Lab meetings

4. Self-directed learning

Practical:

Other Lab Collaboration: Collaboration with other disciplines such as genetics, bioinformatics, and bioengineering which can provide PhD students with interdisciplinary perspectives and enrich their developmental anatomical training.

3D Anatomy Software: 3D anatomy software applications for interactive 3D models of embryonic structures, to visualize and manipulate anatomical features from different perspectives.

Recommended Books:

Langman's Medical Embryology by Sadler, Keith L. Moore - Embryology, Larsen's Human Embryology

PROFESSIONAL SKILLS DURING 2nd & 3RD YEAR ALONG WITH RESEARCH

Objective:

The objectives of this apprenticeship are to

1. Develop teaching and professional skills for PhD students.
2. Enhance knowledge and understanding of pedagogical approaches and practices.
3. Prepare students for academic and professional careers.

Apprenticeship Structure:

- Professional Skills Component

TASKS

1. **Clinical Rotation** in the following clinical department for 2 weeks each, to understand the clinical correlation of anatomical structures

Radiology Department:

I. Identify different anatomical structures including soft tissues, bones, and viscera by utilizing imaging techniques such as X-rays, Ultrasound, CT scans, and MRI.
II. Ability to differentiate between normal and abnormal findings.

Orthopedic Department:

I. Recognize various types of fractures and understand their clinical implications on nearby anatomical structures.

II. Identify different musculoskeletal deformities and understand their anatomical characteristics.

Neurosurgery:

I. Identification of various neuroanatomical structures through neuroimaging and surgical procedures to enhance comprehension of practical applications.

Obstetrics & Gynecology:

I. Comprehension of fetal development during pregnancy and the role of Ultrasound in assessing different stages of development.

II. Observe pelvimetry procedures, diagnose types of pelvis, and explore management strategies.

III. Identify various abnormalities and masses within the female pelvis, along with their anatomical considerations.

2. Understand the biosafety levels and the associated practices, equipment, and facilities required for working with different types of biological agents, ranging from BSL-1 (low risk) to BSL-4 (highest risk).

3. Proficiency in risk assessment of practices and equipment and lab safety protocols

4. Perform histological techniques from tissue fixation, processing, embedding and slide preparation

5. Understand and perform staining of H& E & toluidine blue

6. Writing of at least one research grant proposal.

7. Oral & poster presentation in at least two national conferences

8. Development of designated number of MCQ & SEQs in paper setting section.

ASSESSMENT PhD ANATOMY SEMESTER I

Paper Pattern & Marks Distribution of Mid Term I

Course codes	Course Title	Credit Hours	Theory		Total Marks	Practical		Grand Total
			MCQs	SEQs*		OSPE marks	Viva Marks	
RM-001	Research Methodology	2+0	40	08	80	-	-	80
GANAT-003	Clinically oriented gross Anatomy	1.5+1	30	06	60	20	20	100
NANAT-003	Neuroanatomy	1.5+1	30	06	60	20	20	100
MBCG-001	Advanced Biostatics	2+0	40	08	80	-	-	80

Paper Pattern & Marks Distribution of Term I

Course codes	Course Title	Credit Hours	Theory		Total Marks	Practical		Grand Total
			MCQs	SEQs*		OSPE marks	Viva Marks	
RM-001	Research Methodology	2+0	40	08	80	-	-	80
GANAT-003	Clinically oriented gross Anatomy	1.5+1	30	06	60	20	20	100
NANAT-003	Neuroanatomy	1.5+1	30	06	60	20	20	100
MBCG-001	Advanced Biostatics	2+0	40	08	80	-	-	80

ASSESSMENT PhD ANATOMY SEMESTER II

Paper Pattern & Marks Distribution of Mid Term

Course codes	Course Title	Credit Hours	Theory		Total Marks	Practical		Grand Total
			MCQs	SEQs*		OSPE marks	Viva Marks	
ALT-001	Advanced Lab Technique	2+0				-	-	
MANAT-003	Microanatomy	2+2	40	08	80	40	40	160
DANAT-003	Developmental Anatomy	2+1	40	08	80	20	20	120

Paper Pattern & Marks Distribution of Term

Course codes	Course Title	Credit Hours	Theory		Total Marks	Practical		Grand Total
			MCQs	SEQs*		OSPE marks	Viva Marks	
ALT-001	Advanced Lab Technique	2+0				-	-	
MANAT-003	Microanatomy	2+2	40	08	80	40	40	160
DANAT-003	Developmental Anatomy	2+1	40	08	80	20	20	120

Compulsory Teaching Skills

For a thorough evaluation of students' understanding and critical thinking abilities, all PhD students in their respective disciplines will;

1. Design a comprehensive set of 50 Multiple Choice Questions (MCQs) and 25 Short Essay Questions (SEQs) for M. Phil students.

2. Plan 20 observed lectures focusing on key topics.

These assessments will provide Ph.D. students valuable experience in educational design and delivery. These will also enhance their interactive learning with the provision of real-time feedback.

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