Study Guide

Course Work & Research

Anatomy Department

Rawalpindi Medical University

Message from Vice Chancellor

I am delighted to announce the commencement of the PhD Anatomy Program at Rawalpindi Medical University (RMU). This marks a significant milestone in our journey to further enhance our academic offerings and research capabilities.

Anatomy is a foundational discipline in medical education, and this addition of the PhD program will not only strengthen our academic portfolio but also contribute to the advancement of anatomical research in our region. This program will provide a platform for aspiring researchers to delve deeper into the intricacies of the human body and make meaningful contributions to the field.

I would like to extend my gratitude to the faculty and staff who have worked tirelessly to develop this program and ensure its successful launch. Your dedication and commitment are truly commendable. I exhort the students to seize this opportunity to pursue your passion for anatomy and contribute to the advancement of medical science. Your journey in this program will be challenging but immensely rewarding, and I am confident that you will emerge as leaders in the field of anatomy.

I look forward to witnessing the accomplishments of our PhD Anatomy students and the positive impact they will have in the field of medicine.

Prof. Muhammad Umar (Sitara-e-Imtiaz)

(MBBS, MCPS, FCPS, FACG, FRCP (Lon),

FRCP (Glassgow), AGAF)

Vice Chancellor, RMU

Introduction to our Program

After successful launch of FCPS/MD/MS/PhD programs in different disciplines at RMU, by the grace of Allah we have planned to commence PhD Anatomy program at RMU. Professor Dr Umar (VC RMU) is very enthusiastic and makes us work hard to get the PhD in Anatomy program at RMU a successful program. PhD in Anatomy is very rare in Pakistan and Prof Umar's initiative in this regard is commendable.

Anatomy PhD program represents a significant step forward in our commitment to advancing anatomical research and education. Our PhD program is designed to provide students with a comprehensive understanding of human anatomy, coupled with advanced research skills that will enable them to contribute meaningfully to the field. Our curriculum covers a wide range of topics, including gross anatomy, histology, embryology, and neuroanatomy, ensuring that our students receive a well-rounded education in anatomy. Additionally, students will have the opportunity to engage in cutting-edge research projects that address key anatomical questions and challenges

The Graduates from this program will not only be a Subject Specialist but will also be a scientific researcher, educator, effective communicator and collaborator. Elaborate Curriculum has been designed with great care to equip the scholars for all these important roles. We will try our best to help our PhD scholars not only attain academic & research competence but also imbue in them the spirit to maintain the highest possible levels of ethical and professional conduct along with personal and professional growth & excellence in their future lives.

I am confident that our PhD Anatomy Program will not only equip students with the knowledge and skills they need to succeed but also foster a passion for inquiry and acquisition of knowledge that will drive them to make significant contributions in the field of anatomical research.

Prof Dr Saima Naz,

PhD Program Director, RMU

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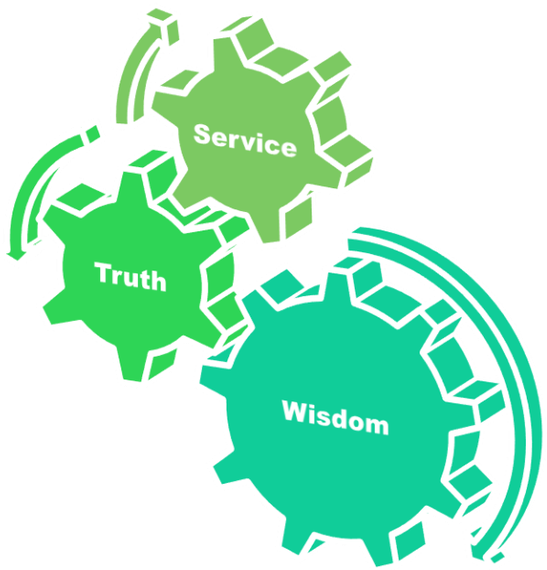
RMU Motto



Program Mission Statement

• To impart evidence-based research oriented medical education in the field of Anatomy and associated subspecialties.

• To cultivate a community of scholars dedicated to advancing knowledge in field of anatomy through rigorous research, interdisciplinary collaboration, and innovation.

• To inculcate the values of mutual respect and ethical practice of medicine.

• To meet the requirements of Higher Education Commission (HEC) and Pakistan Medical and Dental Council (PM&DC) up to the level of satisfaction with accuracy & transparency.

Program Vision and Values

• Highly recognized and accredited center of excellence in Medical Education, using evidence-based training techniques for the development of highly competent health professionals.

• To overcome deficiency and enhance standards of faculty in the field of Anatomy by establishing Anatomy Department of RMU as a number one seat of learning Anatomy in Pakistan and through it ,make available Anatomy faculty; which can act as a change agent for bringing up the standards of graduate as well as undergraduate Medical and Dentistry programs of Pakistan in general and Punjab in particular and make this program one of the best in Pakistan, covering all aspects of the specialty of Anatomy.

• To establish RMU as the Centre of Excellence in Pakistan for research in the field of Anatomy and its sub-specialties.

SECTION- I GENERAL OVERVIEW

Goals of PhD Anatomy Program

1. To expedite the academic growth and development in undergraduate medical education by providing properly qualified and trained basic sciences teachers.
2. To institutionalize research by producing more PhDs, particularly in the emerging fields of basic medical sciences.
3. Better educated and trained health care professionals engaged as academicians, researchers and field practitioners will revamp the health care delivery system and replenish the academia in the medical education set up. The community will be the ultimate beneficiary due to better health facilities.
4. To improve health standards of the community in this underdeveloped region of the world, the focus of research will be on regional medical issues.
5. Trained human resources will successfully execute and streamline the operations of the Institute and will fill the vacuum in the growing medical institutions and industry.
6. Development of human resources, research and technology at RMU will ultimately help in the development of the national economy.

Aims / Objectives of Course

At the completion of the required period of training, the PG-trainee of Anatomy will be able to:

- Prove competency & clarity of concepts in Anatomy and Allied disciplines of the subject
- Enhance postgraduate learning experience of the students through inculcation of research interest and promoting high quality postgraduate and research activities.
- Contribute to improvement of the quality of undergraduate program.

- Identify and manage common laboratory work problems.
- Provide better research opportunities to the undergraduate students for in-depth study.
- Impart contemporary teaching and communication skills in the students.
- Inculcate critical thinking in the students and make them self-directed life-long learners.
- Equip graduates with high level of scholarly competence in the field of Anatomy as well as the associated enabling Analytical, IT & AI skills to compete with the very best in the contemporary world.
- Inculcate in them an attitude of professional excellence and responsibility for ethical behavior and civic responsibility towards humanity in general and Pakistan in particular
- Provide strong leadership in the field of Research and Medical Education.

Alignment of Program Objectives with University Mission Statement

Objectives have been defined in the light of RMU Mission statement that requires output (health professional) as competent and ethically sound. This is achieved through a predefined set of course content, availability of requisite facilities and feedback & evaluation of the program for continuous improvement.

Curriculum Design

Therefore, besides academic Anatomy, training and developing of the scholars in following will be integrated into the curriculum design:

- Research skills and methodology
- Analytical skills to conduct quality and credible research
- Educators capable of teaching medical anatomical discipline
- IT & AI skills to benefit from the tremendous resources
- Ethics & Responsibility
- Leadership
- Professionalism

Flow Chart for PhD Anatomy Scholars

Admission as per HEC/PMDC PhD Policy

⇓

Admission Documentation in Respective Department

⇓

Approval of Admission Dean's office/BASAR/Vice Chancellor

⇓

Issuance of Registration No. in Registrar Office and Display of List of Registered Candidates

⇓

Allocation of Academic Advisor/Supervisor/Co-Supervisor in the Department for each Candidate

⇓

Academic and Research Supervisory Committee for each Candidate

⇓

Start of Academic and Research Activities

⇓

S #	Academic Activity	Research Activity*
Semester 01	• Course work (9-12 CHrs) • Mid-Semester/End-Semester Exams (GPA ≥2.5 in each course and GPA ≥3.0/4.0 in Semester mandatory)	□ Research Topic Finalization and approval from Departmental Academic and Research Supervisory Committee
Semester 02	Course work (9-12 CHrs) Mid-Semester/End-Semester Exams (GPA ≥2.5 in each course and GPA ≥3.0/4.0 in Semester mandatory)	Synopsis Writing and Approval from RB and BASAR Arrangement for Research Funding

	Passing Comprehensive Exam (60% pass marks)	
Semester 03	Workshops Conferences Visits/Training in other Institutions	• Start of Research including pilot study • Phase I: up to 30% of Research) ○ Procurement of Required materials ○ Sample Collection and Processing
Semester 04	• Workshops • Conferences • Visits/Training/Collaboration in other Institutions	• Phase II: up to 70% of Research) • Sample Collection and Processing • Experimental Work • Data Collection and organization
Semester 05	• Collaborative work in other Departments/Institutions • Preparation of Research Publication	• Phase III: Completion of Research • Experimental Work • Data Collection and organization • Data Analysis
Semester 06	Research Publication	□ Thesis Writing and submission

PROGRAM SPECIFICATION– PhD Anatomy

Duration of Program:

The PhD program at RMU will be minimum three (03) years duration and maximum Eight (08) years duration.
(Annex 3.12 of HEC policy *)

Credit Hours:

The student shall complete coursework of at least 48 credit hours (18credit hours of course work + 30 credit hours of Research & Thesis) (Annex 3.6 of HEC policy *)

a) The PhD Candidate (MPhil/MS degree holders) must undertake eighteen (18) Credit hour of coursework.

b) The coursework components will consist of designated courses that are compulsory within 12 months of enrolment in the program.

c) All PhD courses will be designated a course code of "8". For international comparability purposes the term, 'Doctoral or equivalent level' is used the level 8. (Annex 3.6 of HEC policy *)

- Out of 18 credit hours, four (04) credit hours are compulsory for all PhD students enrolled at RMU.
    - During study, the student can also have the option to specialize in one or more of the sub-disciplines of anatomy by selecting the research topic related to that sub discipline of Anatomy.
    - A student can be registered for a maximum of three to four postgraduate level courses (9-12 Credit Hours) at a time during each semester or as per convenience of the department or the recommendation of the Director PGS/ Supervisor or as determined feasible by the academic council and approved by the syndicate.
    - Each candidate has to attend the mandatory workshops & courses as required by the university.

- For international comparability purposes, PhD courses are usually designated a course code of "8" representing the highest level of academic achievement. Level 8 includes PhD as defined and mentioned in the National Qualifications Framework. (Annex 3.6 of HEC policy 2023)*/***.Therefore, PhD Anatomy is given a code of ANA 800.

Curriculum Breakdown

Topics **Year 1** **Semester 1**	**Course code**	**Credit Hours 16 weeks/9 credits**
Research Methodology & Medical writing		(1+0)
Biostatistics & Epidemiology		(1+0)
Musculoskeletal (core course)	ANA -801	(2+0)
Splanchnology (study of viscera) (core course)	ANA -802	(2+ 0)
Microscopic Anatomy & Laboratory techniques (core course)	ANA -803	(2+1)
Preparatory leave		2 weeks
Exams		1 week
Semester Break		1 week
Semester 2	**Course code**	**16 weeks/9 credit Hours**
Health Professional Education & Medical Ethics		(1+0)
Advances in Molecular Cell Biology & Bioinformatics		(2+1)
Developmental Anatomy (core course)	ANA -804	(2+1)
Neuro Anatomy (core course)	ANA- 805	(2+0)
Preparatory Leave		2 weeks

End Semester Exam		1 week
Semester break		1 week
Preparatory leave for Comprehensive exam		4 weeks
COMPREHENSIVE EXAM		

SECTION- II COURSE WORK

Mode of Teaching Curriculum

Semester system

Program Delivery Methodology

- Interactive Lectures
- Tutorials
- Short Group Discussions
- Guided Self-study & SDLs
- Practical & OSPE Sessions
- Skill laboratory
- Dissection
- Presentations

The objectives of the training will be achieved through the following modes:

- Assigning responsibilities of teaching the undergraduates (MBBS and M.Phil)
- Seeking information through Journal clubs, library and Internet
- Attending workshops, Seminars, conferences etc.
- Arranging regular quiz sessions for students
- Assignments
- Patient/case-based learning (CBL/PBL)
- Flip classroom technique
- Peer assisted learning (PAL)
- Assisting/Supervising Research projects of undergraduates and M. Phil students.
- Doctoral degree students will also be provided opportunities to rotate in different laboratories during the first two semesters with the intent of learning different methodologies, disciplines, and laboratory experiences before beginning more intensive research, thus encouraging interdisciplinary research and collaboration.
- Attachments with Federal, Provincial and District outlets to acquire technical know-how of laboratory work.

Responsibilities and Competencies of Post graduate trainees (PGTs):

We expect our PGTs to develop the Essential 7 core competencies of a doctor:

- Lifelong learner
- Researcher
- Communicator
- Care Provider
- Manager
- Decision maker
- Leader

- A logbook will be maintained by the student for the academic / basic sciences rotation
- The specialty specific competencies for training, as explained, will be identified by the respective Board of Studies and incorporated into their curriculum.

Teaching and Learning Methodologies / Strategies

1. Interactive Lectures/Session

An interactive lecture is a class where students actively participate in the learning process.

2. Small Group Discussion (SGD)

This format helps students clarify concepts acquire skills and attitudes. Students exchange opinions and apply knowledge gained from lectures and self-study. The facilitator's role is to ask probing questions, summarize and help to clarify the concepts.

Table . Steps of taking Small Group Discussions

Step 1	**Sharing of Learning objectives by using students Study guides**	**First 5 minutes**
Step 2	Asking students pre-planned questions from previous teaching session to develop co-relation (these questions will be standardized)	5minutes
Step 3	Students divided into groups of three and allocation of learning objectives	5minutes
Step 4	ACTIVITY: Students will discuss the learning objectives among themselves	15 minutes
Step 5	Each group of students will present its learning objectives	20 min
Step 6	Discussion of learning content in the main group	30min
Step 7	Clarification of concept by the facilitator by asking structured questions from learning content	15 min
Step 8	Questions on core concepts	
Step 9	Questions on horizontal integration	
Step 10	Questions on vertical integration	
Step 11	Questions on related research article	
Step 12	Questions on related ethics content	
Step 13	Students Assessment on online MS teams (5 MCQs)	5 min
Step 14	Summarization of main points by the facilitator	5 min
Step 15	Students feedback on the SGD and entry into log book	5 min
Step 16	Ending remarks	

3.Self Directed Learning (SDL)

- Self-directed learning is a process where students take primary charge of planning, continuing and evaluating their learning experiences.
- Time Home assignment
- Learning objectives will be defined
- Learning resources will be given to students; Books, Web site
- Assessment: Will be online on LMS

4.Case Based Learning (CBL)

- It's a learner centered model which engages students in discussion of specific scenarios that resemble typically are real world examples.
- Case scenario will be given to the students
- Will engage students in discussion of specific scenarios that resemble or typically are real-world examples.

- Learning objectives will be given to the students and will be based on

i. To provide students with a relevant opportunity to see theory in practice

ii. Require students to analyze data in order to reach a conclusion.

iii. Develop analytic, communicative and collaborative skills along with content knowledge.

5.Problem Based Learning (PBL)

- Problem-based learning (PBL) is a student-centered approach in which students learn about a subject by working in groups to solve an open-ended problem.
- This problem is what drives motivation and the learning.

The 7- Jump-format of PBL (Masstricht medical school)	
Step 7	Syntheise & Report
Step 6	Collect Information from outside
Step 5	Generate learning Issues
Step 4	Discuss and Organise Ideas
Step 3	Brainstorming to Identify Explanations
Step 2	Define the Problem
Step 1	Clarify the Terms and Concepts of the Problem Scenario
Problem- Scenario	

Figure PBL 7 Jumps Model

COURSE DETAILS OF PhD ANATOMY PROGRAM

By the end of the course work, the PhD Anatomy scholar must have acquired a reasonable working knowledge of

Cognitive Domain:

- Knowledge at the frontier of the field of Human Anatomy includes knowledge that constitutes an original contribution.
- Substantial knowledge of research principles and methods applicable to the field.
- An understanding of theoretical knowledge and to reflect critically on the theory and practice of Anatomy.
- Use of intellectual independence to think critically, evaluate existing ideas, undertake systematic investigation and reflect on theory and practice of Anatomy to generate original knowledge.
- Use technology based medical education including Artificial Intelligence.
- Appreciate concepts & importance of Family Medicine, Biomedical Ethics and Research.

Psychomotor Domain

- Expert technical and creative skills applicable to the field of Anatomy.
- Expert skills to search, design, analyse and communicate research that make a significant and original contribution to knowledge and/or professional practice of Anatomy.
- Communication skills to explain and critique theoretical propositions & methodologies to communicate results to peer and the community.
- Communication skills to present a complex investigation of original research for external examination against international standards.

Affective Domain

- Intellectual independence.
- Initiative and creativity in new situations and/or for further Learning.
- Full responsibility and accountability for personal outputs
- Plan and execute original research (Project management)
- Life-long learner to generate new knowledge, in the context of professional practice effective medical teacher.
- Demonstrate effective communication skill strategies

FIRST SEMISTER

COMMON COMPULSORY COURSES (For All Specialties with Learning Objectives)

1.RESEARCH METHODOLOGY & MEDICAL WRITING (RMW)

Course Description:

Research Methodology is a hands-on course designed to impart education in the foundational methods and techniques of academic research in social sciences and business management context. Research scholars would examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation. Once equipped with this knowledge, students would be well placed to conduct disciplined research under supervision in an area of their choosing.

Course Objectives:

The primary objective of this course is to develop a research orientation among the scholars and to acquaint them with fundamentals of research methods. Specifically, the course aims at introducing them to the basic concepts used in research and to scientific social research methods and their approach. It includes discussions on sampling techniques, research designs and techniques of analysis. At the end of the course the students should be able to

1. Develop the basic framework of research process
2. Develop an understanding of various research designs and techniques
3. Identify various sources of information for literature review and data collection
4. Elaborate ethical dimensions of conducting applied research
5. Appreciate the components of scholarly writing and evaluate its quality.

Course Contents:

S No	TOPIC
1.	Introduction to research – The role of research, research process overview
2.	Problems and Hypotheses – Defining the research problem, Formulation of the research hypotheses, The importance of problems and hypotheses
3.	Research design – Experimental and Nonexperimental research design, Field research, and Survey research
4.	Methods of data collection – Secondary data Collection methods, qualitative methods of data collection, and Survey methods of data collection
5.	Attitude measurement and scaling – Types of measurement scales; Questionnaire designing – Reliability and Validity
6.	Sampling techniques – The nature of sampling, Probability sampling design, Non-probability sampling design, Determination of sample size
7.	Processing and analysis of data & knowing Ethical issues in conducting research

2.BIO STATISTICS & EPIDEMIOLOGY (BSE)

Course Objectives

Upon completion of the course the students will be able to comprehend basic knowledge of epidemiology and will be able to:

1. Define epidemiology and know the principles of various study designs
2. Know how to design a study and describe the validity and reliability of a study design
3. Know the fundamental concepts and methods of statistics in the areas of medical and biological research
4. Have good command of statistical computer software for data analysis
5. Approaches for data analysis, Parametric, non-parametric and Semi-parametric methods, Qualitative Methodologies and Interpretation of results, validity of conclusions.
6. Identify and prioritize research problems with literature review.
7. Formulation of research objectives
8. Learn Data collection techniques and sampling, planning for data collection, collation and analysis.
9. Planning for pilot study followed by main study along with Budget making and plan for dissemination.
10. Identify and define the basic concepts and procedures required for data analysis and interpretation.
11. Analyse and interpret the data collected for the research project and draw conclusions related to the objectives of your study.
12. Write a clear and concise research report (paper for a peer reviewed journal) and a summary of the major findings and recommendations for each of the different parties interested in the results.
13. Present the major findings and the recommendations of your study to policy-makers managers and to the subjects of your research together with them finalizing the recommendations.
14. Prepare a plan of action for the dissemination, communication and utilization of the findings and (if required) make recommendations for additional research.

Course Contents:

S No.	Topics
1.	Descriptive epidemiology, analytic epidemiology and epidemiological inference
2.	Classification, morbidity and mortality rates, ratios, incidence, prevalence, sampling, screening, epidemiological models
3.	Types of study design; their importance, uses, and limitations, field trials, controlled epidemiological surveys, sources of bias and causal model
4.	Introduction to statistics, types of statistical applications, population and samples, data analysis and presentation, variables, elementary statistical methods, tabulation, chart and diagram preparations, measures of central tendency and dispersion, sampling techniques and sample size estimation, probability and proportions
5.	Tests of significance; normal test, t test, Chi square test etc, correlation and its applications, linear regression and multiple regression, Clinical trials and intervention studies
6.	Measures for developing health statistical indicators: morbidity and mortality statistics, Use of latest statistical computer software for data analysis

Recommended Readings:

1. Gordis, L. Epidemiology. Pennsylvania: W.B. Saunders Company. Latest Ed.

2. Rothman KJ. Modern Epidemiology. Boston: Little, Brown and Company, Latest Ed.
3. Kelsey JL, Thompson WD, Evans AS. Methods in Observational Epidemiology. New York: Oxford University Press, Latest Ed.
4. Kleinbaum DG, Kupper LL, Morgenstern H. Epidemiologic Research: Principles and Quantitative Methods. Belmont, CA: Lifetime Learning Publications, Latest Ed.
5. Lilienfeld DE, Stolley PD. Foundations of Epidemiology. New York: Oxford, Latest Ed.
6. Daniel WW. Biostatistics: A Foundation for Analysis in Health Sciences. Latest Ed. John Wiley & Sons.Inc. New York.
7. Larson R and Farber B. Elementary Statistics: Picturing the World. Latest Ed, Prentice Hall Publications. NewJersey USA.
8. Oliver, M. and Combard MS. Biostatistics for Health Professions. Latest Ed. Prentice Hall Publications, NewJersey USA.
9. Statistical Software: SPSS; EPIINFO; STATA; SAS
10. Material provided as Health Services Course

Journals:

1. Cancer Epidemiology
2. Epidemiologic Reviews
3. Annals of Epidemiology
4. American Journal of Epidemiology
5. International Journal of Epidemiology

CORE COURSES (First Semester)

ANA 801 -MUSCULOSKELETAL (Core Course)

Course Description:

The anatomy of the musculoskeletal system is of paramount importance in research due to its fundamental role in human movement, stability, and overall health. Understanding the intricate structure of bones, muscles, joints, and connective tissues is essential for various areas of research.

Learning Objectives

Upon completion of course, the students should be able to:

1. Understand and interpret the gross structure of various parts of the body
2. Identify the bones, joints, muscles, nerves and blood vessels of the upper limb ,Lower limb, thorax, Head & neck
3. Assess the anatomy of common incisions
4. Apply the knowledge to solve clinical problems related to osteology & muscles of the body

Course Contents

S. NO	Topics
1	Osteology & Joints of upper limb with clinical anatomy
2	Osteology & Joints of lower limb with clinical anatomy
3	Osteology & Joints of Head & neck with clinical anatomy
4	Osteology & Joints of thorax with clinical anatomy
5	Flexor & Extensor compartment of arm & forearm with neurovascular bundle

6	All compartments of thigh & Leg with neurovascular bundle
7	Muscles & Neurovascular bundle of Maxillofacial region
8	Muscles & Neurovascular bundle of Thorax & Abdomen

ANA 802- Splanchnology /Viscerology (CORE COURSE)

Course Description:

The anatomy of Splanchnology/Viscerology is critical in research due to its focus on the internal organs, their structure, function, and interactions. This field plays a crucial role in understanding various diseases, developing treatments, and advancing surgical techniques. Overall, the anatomy of Splanchnology/Viscerology is essential for research in various fields. It provides a foundation for understanding the structure and function of internal organs, which is crucial for advancing our knowledge of health and disease.

Course Objectives

Upon completion of course the students should be able to:

1. Understand and interpret the gross structure of various parts of the body
2. Identify the viscera grossly & in cross sections of the body
3. Assess the anatomy of common incisions
4. Apply the knowledge to solve clinical problems related to Anatomy

Course Contents:

The course contents will include:

S No.	Topics
1	Contents of mediastinum, Lungs, Bronchopulmonary segments
2	Pericardium, heart
3	Anterior abdominal wall(Rectus sheath), Posterior abdominal wall(Thoraco lumbar fascia), Peritoneal dispositions
4	Inguinal canal & hernia, external genitalia
5	Pharynx, Larynx, Esophagus, stomach
6	Small intestine, duodenum, ileum and jejunum
7	Large intestine and appendix, Rectum, Anal canal
8	Liver, Gall bladder and extra biliary apparatus
9	Pancreas, spleen
10	Kidney and supra renal and ureters, Urinary bladder, urethra , Prostate, Seminal vesicles, Vas deferens, ejaculatory duct
11	Pelvic peritoneum, pelvic diaphragm & Perineal pouches
12	Uterus, Uterine supports, Ovary, vagina, Ischio rectal fossa and
13	Thyroid and parathyroid gland
14	Tongue, Soft palate
15	Eyeball, Orbit wall and its content, Eye lid and lacrimal apparatus & Extra ocular muscles
16	Applied Anatomy, Radiograph & Surface marking

Recommended Readings

1. Snell. R.S. Clinical Anatomy for Medical Students. Philadelphia USA Lippincot Williams and Wilkins: Latest Ed.
2. Sinnatamby C.S. Lasts Anatomy Regional and Applied London, Churchill Living Stone Latest Ed.
3. Williams, P.L. Bannister, L.H. Berry, M. B, Collins, P., Dyson M. Ferguson, M.WJ. Gray's Anatomy London. Churchill living stone: Latest Ed.
4. Moore K.L. Clinically Oriented Anatomy. Baltimore, U.S.A. Williams and Wilkins: Latest

Journals:

1. Journal of Anatomy
2. Anatomia, Histologia, Embryologia

ANA 803- MICROSCOPIC ANATOMY & LABORATORY TECHNIQUES (CORE COURSE)

Course Description:

Histology is an essential tool for understanding the function of different tissues and organs in the body. It allows researchers to study the structure and organization of tissues at a microscopic level. Histology is the cornerstone of diagnostic pathology, where it is used to identify and classify diseases based on the microscopic appearance of tissues. The goal of this course is to give the scholar a basic understanding of microscopic Anatomy and to equip them to undertake research in Histopathology.

Course Objectives

Upon completion of course the students should be able to:

1. Illustrate the microscopic structure of all the tissues and organs of the human body
2. Elaborate the functional correlation of the histological structure of clinically important tissues and organs
3. Describe the uses and applications of all types of microscopes.
4. Handle microscopes commonly used in research and histology labs

Course Contents

Part-I (GENERAL HISTOLOGY)

S No	Topics
1.	Introduction to different types of microscopes
2.	Cell, its organelles and cell junctions
3.	Epithelial tissue (classification & surface modifications)
4.	Connective Tissue (Cartilages; Bone, Bone marrow and blood cells)
5.	Muscular tissue
6.	Nervous tissue
7.	Lymphoid Organs
Part-II (SPECIAL HISTOLOGY)	
1.	Digestive system including associated glands
2.	Respiratory System
3.	Urinary System
4.	Reproductive System (Male & Female)
5.	Endocrine System
6.	Circulatory System
7.	Integumentary system
8.	Organs of Special Senses

Recommended Readings:

1. Junqueira, L.C.Cameiro, J. Basic histology. California, U.S.A, Lange Medical publication: Latest Ed.

2. Kelly, D.E, Wood, R.L, Enders, A.C. Bailey's Text Book of Microscopic Anatomy. Baltimore, U.S.A, Williams and Wilkins: Latest Ed.
3. Burkit,H.G, Young, B, Heaith, J.W. Wheater's Functional histology London, Churchill living stone: Latest Ed.
4. Lesson, C, R, Lesson, T. S. Histology. Philadelphia .S.A, W. B. Saunders and Company Latest Ed.
5. Faucett, D.W.A Text Book of Histology. London, Chapman and hall: Latest Ed.
6. Williams, P.L.Bannister, L.H, Berry, M.B, Collins, P., Dysons M Ferguson, M.WJ. Gray's Anatomy .London, Churchill living stone: Latest Ed.

Journals:

1. Clinical Anatomy
2. Archives of Histology and Cytology
3. International Journal of Developmental Biology
4. Anatomia, Histologia, Embryologia

Biosafety & Laboratory techniques

Basic laboratory techniques are fundamental for PhD scholars in various fields. PhD scholar is expected to conduct high level Lab experiments. These techniques provide the foundation for conducting experiments, collecting data, and advancing scientific knowledge. Basic lab techniques include knowledge of safety procedures and practices. PhD scholars must understand how to handle chemicals, biological materials, and equipment safely to protect themselves and others in the lab.

Learning Objectives:

By the end of the course, the PhD scholar should be able to

- Learn and apply basic laboratory safety rules and procedures to ensure personal and environmental safety.
- Become familiar with common laboratory equipment, such as microscopes, balances, pipettes, and microtomes, and understand their functions and proper usage.
- Develop basic laboratory skills, including pipetting, measuring volumes and masses, dilution techniques, and basic calculations.
- Learn proper techniques for handling and preparing various types of samples /sections.
- Understand the phenomenon of fixation, dehydration, clearing, embedding.
- Comprehend the knowledge of sectioning.
- Comprehend the knowledge of indications, procedures and correction of abnormal deviations of various staining methods.

Course Contents:

The course contents will include:

S. NO	Topics
1.	Composition, advantages and disadvantages of common fixative
2.	Fixation of tissue
3.	Clearing agents
4.	Paraffin Embedding process
5.	Sectioning Process, freezing sections of fresh tissues
6.	Microtomes and knives, their types and uses
7.	Staining Procedure: uses and interpretation of Routine Hematoxylin and Eosin, Cresyl Violet for Nissl substance, Sudan Black B for Lipids, Mallory's connective tissue stain, Gomor's Aldehyde Fuchsin Stain for pancreas, Feulgen method for DNA, Periodic Acid Schiff (PAS) for glycogen, Modified Halmi's method for Pituitary gland, Some latest techniques.
8.	Mounting; Vital and supravital dyes and study of cell
9.	Microscopes; Components, phenomenon and uses of Simple and compound optical microscopes, Florescent microscope, Polarizing microscope, Dark field microscope, Electron microscope; Micrometry; Microphotography; Maintenance of microscopes.

Recommended Readings

1. Biological micro technique by Sanderson
2. Handbook of basic micro technique
3. Animal micrology
4. Micro technique by Bancroft

Journals

Botanical micro technique

SEMISTER II

COMPULSORY COURSES (For All Specialties)

HEALTH PROFESSIONAL EDUCATION & MEDICAL ETHICS

Course Description of Medical Ethics

The ethics curriculum is designed to provide students with the conceptual tools that they will need to navigate the ethical issues that are commonly encountered in clinical practice. Program helps students to develop skills in critical reasoning and in using the basic concepts of medical ethics it also fosters the habits of critical reflection and discussion about the ethical issues. Thorough exploration of ethics is critical to developing exemplary scholars and teachers. Focusing on discussion, curriculum considers central ethical and legal principles, and research ethics.

Learning Objectives

At the end of the course the student should be able to

- Describe student professionalism, codes of ethics & importance of truth telling
- Discuss ethical dangers of human subject research
- Describe concepts of autonomy
  - Explain justice in clinical practice, Confidentiality, legal responsibility, Adherence and compliance
  - Understand ethical issues regarding handling of research animals
  - Exhibit attitude towards research on human volunteers, experimental animals and ethical aspects

Course Content

S no.	Topic
1.	Professional Responsibilities ➢ Student Responsibilities/ Professionalism ➢ Qualities of a Physician/Codes of Ethics ➢ Should Patients Be Learning Tools
2.	Central Ethical & Legal Principles Duty to Provide Care (Trust & Fiduciary Responsibility) Truth Telling and Informed Consent for Treatment Confidentiality and The Duty to Warn
3.	Research Ethics [Epidemiology] Ethical Dangers of Human Subject Research The Importance of Research and The Development of New Therapies The Common Rule: Requirements for The Ethical Conduct of Research
4.	Justice and Medicine Justice in Clinical Practice The Right to Health Care Allocation of Transplant Organs
5.	The Nature and Value of Autonomy ➢ Concepts of Autonomy ➢ Concept of beneficence ➢ Concept of non-maleficence ➢ Standards for Surrogate Decision Making ➢ Refusal of Treatment and Justified Paternalism ➢ Advance Directives and Proxies

6.	Animal Handling Research ethics ➢ Reproduction and fertility ➢ Genetics and the human ➢ Animal rights in experimentation ➢ Animal preparation and experiments of laboratory ➢ Maintenance of animal house. ➢ Routine physiology experiments on animals

Recommended Readings

- Beauchamp, J.
- Principles of Biomedical Ethics.
- World Medical Association. http://www.wma.net. Principal features of medical ethics [archived 4 March 2016; Retrieved 3 November 2015].

Journals

- British Medical Journal.
- The Medical Journal of Australia

HEALTH PROFESSIONAL EDUCATION (HPE)

Course Goal:

The course is endeavors to train post graduate students (basic medical sciences) in basics of health profession education to produce competent health profession teacher

Outcomes of Course:

By the end of the course the students will be able to:

- Adept in basic knowledge and its application in the core areas of medical education i.e. educational environment & students, teaching and learning, curriculum development including educational strategies & curriculum themes, Students assessment and Program evaluation.
- Acquire knowledge, skills and attitude requires for a competent health profession educator by understanding & applying the theoretical and empirical literature in medical education
- Critically examine the preparation requires for their role as educators of their profession through enhancing students understanding and implementation of principles of adult learning and teaching in relation to their target group.
- Apply the educational theories and cognitive psychology in support of their role as an educator in practice.
- Use knowledge and skills require for Designing & developing an integrated curriculum/Module at an undergraduate level.
- Understand and apply the fundamentals of educational methodologies (Learning and Teaching) while “Teaching to learn and learning to teach”.
- Understand and apply the fundamental principles in ‘Assessment’ while designing an assessment plan and assessment tools.
- Design a plan with tools for evaluating a teaching program.
- Demonstrate effective communication skills (active participation, Pro-activeness, professionalism, group dynamics, team building, conflict resolution, negotiation skills, leadership skills etc) while working in the group/team tasks.

Course Overview:

The whole course is based on principles of constructive cognitive philosophy and follows the FAIR criteria to improve learning. According to constructive philosophy the teacher is more than a transmitter of information and has a responsibility for managing the student's learning. The reflective teacher understands the principles of learning. Hence, this course has four key features identified for effective learning – the FAIR criteria:

F	**F**eedback to the learner as to progress
A	**A**ctive rather than passive learning
I	**I**nterest or motivation of the learner
R	**R**elevance to the perceived and real needs of the learner

This course is designed for the post gradates medical students to develop them as an effective team member and effective teacher in an Integrated Curriculum development, its implementation and evaluation. The students will understand and apply the basic core concepts in medical education while working as Task Force member, conducting an integrated session for instance 'Problem based Learning Sessions' etc and assessing the students.

Course Content

The essential Core area in medical education in which students will be trained are;

1) Educational environment & students

2) Teaching and learning strategies

3) Curriculum development including educational strategies & curriculum themes,

4) Students' assessment

5) Program evaluation

Learning Resources:

- A practical Guide for Medical Teacher by John A. Dent & Ronald M. Harden. (4th edition, A Book)
- Journal Articles will be provided from the latest medical education journals.
- Other reading materials from the renowned author's books and research work, some good websites.

ADVANCES IN MOLECULAR BIOLOGY & BIOINFORMATICS

Course Description of Molecular Biology:

A course in molecular biology typically covers the study of biological processes at the molecular level, focusing on the structure and function of biomolecules such as DNA, RNA, proteins, and lipids. The course usually includes topics such as:

Nucleic Acids: The structure and function of DNA and RNA, including replication, transcription, and translation processes, as well as the role of nucleic acids in inheritance and gene expression.

Genetics: The principles of inheritance, including Mendelian genetics, genetic variation, and the molecular basis of genetic disorders.

Gene Expression: The regulation of gene expression, including the mechanisms of transcriptional and posttranscriptional control, and the role of epigenetics in gene regulation.

Protein Structure and Function: The structure and function of proteins, including protein synthesis, folding, and post-translational modifications, as well as the role of proteins in cellular processes and signaling pathways. Recombinant DNA Technology: Techniques used in molecular biology research, such as cloning, PCR (polymerase chain reaction), DNA sequencing, and genetic engineering.

Genomics and Proteomics: The study of entire genomes and proteomes, including genome sequencing, annotation, and comparative genomics.

Molecular Evolution: The processes of molecular evolution, including genetic variation, mutation.

Applications of Molecular Biology: The practical applications of molecular biology in fields such as medicine & Biotechnology**.**

Ethical and Social Issues: The ethical, legal, and social implications of advances in molecular biology, including issues related to genetic testing, gene therapy, and biotechnology.

Laboratory techniques

The course may also include laboratory work to provide hands-on experience with molecular biology techniques and experiments. It provides a basis for understanding the molecular basis of life and the applications of molecular biology in various scientific disciplines.

- PCR
- Gel electrophoresis
- Restriction fragment length polymorphism (RFLP)
- Blotting Techniques (Sothern, Western and Northern Blotting)

Bioinformatics

Course Description

- This course introduces fundamental concepts and methods for bioinformatics and advanced applications. Topics covered include
- Bioinformatics database

- Sequence and Structure alignments
- Protein folding and Protein structure prediction

Learning Objectives

- Learn about bioinformatics and gain understanding of lab and research techniques using molecular biology methods.
- Understand the error, limitations, and costs/sample for each technology.
- Understand methods for producing and using SNP arrays, Compare and contrast exome sequencing to whole genome and SNP sequencing, including their limitations
- Gain familiarity with computational methods in order to address problems in molecular biology.
- Become knowledgeable about the storage, retrieval, sharing and use of biological data, information, and tools

Course Contents:

- Gene ontology and gene annotations
- Databases of human genes
- Gene Expression Patterns
- Profiling of micro RNA mRNA Proteins and disease genes by various Browsers
- Statistical correlations between Entities in a Database,
- Utilization and exploitation of NCBI, UCSC, ENSEMBL and BioGPS genomic browsers in Genomics and Proteomics research.

Recommended Readings:

- Evolutionary Computation in Bioinformatics Fogel, G.B. and Corne, D.W.
- Pierre Baldi and Soren Brunak, Bioinformatics: The Machine Learning Approach.
- Introduction to Bioinformatics. (A Theoretical and Practical Approach). A. Krawetz and D. Womble. 2002.

- Introduction to Bioinformatics. Lesk, A.M. 2002 Oxford University Press. A collection of relevant review and research articles will also be distributed in class as required reading.

CORE COURSES OF SECOND SEMESTER

ANA 804 DEVELOPMENTAL ANATOMY/ EMBRYOLOGY

Course Description:

Research in embryology is crucial for understanding the processes that govern development, including cell differentiation, tissue formation, and organogenesis. Embryology plays a key role in stem cell research, which explores the potential of stem cells to develop into different cell types. By understanding the factors that control stem cell fate during embryonic development, researchers can better harness the therapeutic potential of stem cells. The goal of this course to give the scholar a basic understanding of human development & to equip them to undertake research in embryology.

Course Objectives:

Upon completion of course, the students should be able to:

1.Describe and interpret general aspects of normal human development
2.Identify critical periods of growth
3.Discuss the development of all systems of body
4.Discuss the mechanism, pathogenesis and clinical aspects of common congenital anomalies
5.Discuss the mechanism through which various environmental agents can affect these developmental processes
6. Discuss Various diagnostic procedures which can be used to assess fetal well being
7.Elaborate methods of In Vitro Fertilization and Cloning

Course Contents

The course contents will include:

Part I (GENERAL EMBRYOLOGY)

S No.	Topics
1.	Various terms of life span, Cell cycle, cell division & chromosomal abnormalities
2.	Gametogenesis (Oogenesis & spermatogenesis)
3.	Fertilization, Implantation, ectopic Pregnancies, contraception, IVF & Cloning including religious and legal aspects
4.	Reproductive cycles
5.	Embryonic period (Organogenesis)
6.	Fetal period, Fetal membranes & Placenta
7.	Parturition & Multiple pregnancies
8.	Birth defects & pre-natal diagnosis
	Part II (SPECIAL EMBRYOLOGY)
1.	Development of Musculoskeletal system
2.	Body Cavities, Mesenteries and Diaphragm
3.	Development of Cardiovascular System
4.	Development of Respiratory System
5.	Development of Digestive System
6.	Development of Urogenital System
7.	Development of Head& Neck and pharyngeal apparatus
8.	Development of Nervous System
9.	Development of Eye & Ear

Recommended Readings

1. Moore and Persuad. The Developing Human. Philadelphia, U.S.A, W.B. Saunders and company, Latest Ed.

2. Saddler T.W. Langman's Medical Embryology. Philadelphia, U.S.A, Lippincott Williams & Wilkins, Latest Ed.
3. Williams, P.L. Bannister, L.H, Berry, M.B, Collins, P, Dyson M, Ferguson, M.W.J. Gray's Anatomy. London, Churchill Living stone: Latest Ed.

Journals

1. Congenital Anomalies
2. Anatomy and Embryology
3. Mechanisms of Development
4. Anatomia, Histologia, Embryologia
5. Development, Growth and Differentiation
6. International Journal of Developmental Biology
7. Birth Defects Research Part A: Clinical and Molecular Teratology
8. Birth Defects Research Part A: Developmental and Reproductive
9. Toxicology

ANA 805- NEUROANATOMY (CORE COURSE)

Course Description:

Neuroanatomy is a fascinating field that involves the study of the structure and function of the nervous system. Research in neuroanatomy covers a wide range of topics, from basic anatomical studies of the nervous system to more complex investigations into neurological disorders and brain function. Researchers in this field use various techniques, such as neuroimaging, histology, and molecular biology, to explore the structure and function of the nervous system at different levels of organization.

Course Objectives

At the end of the course the student should be able to

1. Describe the gross and internal structure of various components of the nervous system including tracts and connections
2. Co-relate the anatomical knowledge of the nervous system with functions
3. Discuss the cross-sectional anatomy of various parts of the central nervous system.
4. Describe basic knowledge of common lesions and diseases related to the nervous system
4. Explain formation, circulation and importance of CSF

5. Appreciate neuronal connections of different parts of CNS
6. Discuss blood supply of different parts of brain and spinal cord
7. Describe applied anatomy of CNS

Course Contents:

The course contents will include:

	TOPICS
	Meninges, Cisterns, Dural venous sinuses
	Spinal cord (Ascending & Descending tracts)
	Base of brain, Circles of willis, Blood supply of brain and venous drainage
	Medulla oblongata, Pons & Cerebellum
	Mid Brain Diencephalon (Thalamus, hypothalamus), Basal Ganglia
	Lateral ventricle ,4th ventricle, 3rd ventricle & Circulation of C.S.F
	Cerebral hemisphere(sulci, gyri, cortical areas)& White matter of cerebrum
	Cranial nerve nuclei & nerves
	Reticular formation & Limbic system
	Applied Anatomy

Recommended Readings

1. Carpenter. M.B. Text book of Neuroanatomy. Baltimore, U.S.A, Williams and Wilkins: Latest Ed.
2. Snell. R.S. Clinical Neuroanatomy for Medical Students. Philadelphia, U.S.A. Lippincott Williams and Wilkins: Latest Ed.

3. Williams, P.L. Bannister, LH, Berry, M.B, Collins, P. Dyson M, Ferguson, M.WJ.
4. Grays Anatomy. London, Churchill Living Stone: Latest Ed.

Journals:

1. Muscle and Nerve
2. Mechanisms of Development
3. Anatomia, Histologia, Embryologia
4. Development Growth and Differentiation
5. International Journal of Developmental Biology

Mandatory Workshops/Conferences

COMPUTER SKILLS (TEACHING STRATEGY – HANDS ON WORKSHOP)

Course Objectives:

Upon completion of course the students will be able to:

1. Develop basic skills in operating computer in the mentioned softwares.

2. Comprehend the basic principles of presenting scientific data at national and international platforms using computer and IT technology

Course Contents:

The course contents will include:

Programme Microsoft:

- Word
- Power point

- Excel

Recommended Readings:

1. Hochreiter, Sepp; Wagner, Roland. Bioinformatics Research and Development. Series Lecture notes in Computer Science, Springer, Latest Ed.
2. Mandoiu, Ion; Narasimhan, Giri; Zhang, Yanqing. Bioinformatics Research and Applications Series: Lecture Notes in Computer Science. Springer, Latest Ed

Journals:

1. Journal of Bioinformatics and Computational Biology (JBCB)
2. BMC Bioinformatics

Journal Club

Course Objectives:

Upon completion of the course the students will be able to:

1. Collect information from the available resources
2. Prepare a presentation on a given topic
3. To read and critique published research articles
4. Present research findings on a forum
5. Write literature review with proper internet search and references
6. Work as a Reviewer

Course Contents:

- The student will attend regular Journal Club Meetings and actively participate with presentations, lectures, discussions, and question-answer sessions;
- The student will prepare all the necessary back ground information, meaning of scientific terminology, methodology used, statistical tests applied and discussion.
- He/she will also discuss limitations of the study.
- The audience including faculty and students will ask questions

Resources:

1. Internet
2. Libraries
3. Peer Advice

ASSESSSMENTS

Program Output Evaluation

Program output is evaluated through:

- **Formative Assessments** (through regular feedback)
- **Summative Assessment** (through Examination)

Assessment Procedure

- Assignments/tests/logbook/portfolio

  (The performance of every student shall be continuously monitored and assessed throughout the semester. During the semester a student's performance shall be evaluated by taking quizzes, assignments, mid-Semester examination, laboratory reports, project presentations etc and will be maintained as "LOG BOOK")
- There will be Continuous Internal Assessments of each candidate during the training period. These Continuous Internal Assessments will include Assessments/Quiz/assigned tasks and supervisor's Review Report.
- There shall be two examinations for each course during each semester. These examinations shall be termed as Mid semester and End semester examination. In addition to these examinations, the instructor may give home assignments, demonstrations and class presentations.

Mid-Semester and End-Semester Assessment

- Mid-semester and End-Semester exams shall also be taken during each semester covering the entire syllabus including theory and practical. The course teacher shall be responsible for the evaluation of work/performance of the students of his class and for the award of grades to them based on such evaluation.

- Mid-semester examination will primarily comprise of theory component comprising of MCQs, SEQs and Essay Questions. Viva voce can also be a component.
- End-semester examination will have theory component comprising of MCQs, SEQs and Essay Questions and practical examination. Viva voce will also be a component.

Evaluation Components /Assessment Type for Semester Course work

a. Theory Course

i) Quizzes/Assignments/Projects/ Presentations:

There shall be an appropriate number of quizzes/ assignments/ course project/ presentations etc. as maintained on logbook dually marked by teacher/instructor.

ii) Mid-Semester Examination

There shall be one mid Semester examination of 2 hours duration for each theory course in a Semester after 8th week of teaching.

iii) End Semester Examination

There shall be separate End-Semester Examination for every subject. The duration of this exam will be 3 hours covering the entire course at the end of each Semester. The examination shall be held in the last 3 weeks of each regular Semester.

iv) Weightage of Evaluation Components /Assessments

The final grades shall depend on the marks obtained in each of the evaluation components listed above. The weightage given to each component is as follows:

Evaluation Component/ Assessment Type	Weightage
Quizzes/Assignments/Projects/ Presentations/Logbook etc.	25%
Mid Semester Examination	25%

End Semester Examination 50%

b. Viva & practical examination

The end Semester viva & practical examination will also be conducted jointly by the course teacher (i.e. Internal Examiner) and External/Neutral Examiner as notified by the relevant Chairman.

C. Combined Theory & Lab

Quizzes/Assignments/ Lab Projects/ Lab Report/Presentations etc. 25%

Mid Semester Examination 25%

End Semester Examination + Practical+ Viva Voce etc. 50%

Re-mid Examination

A student who fails to take his Mid Semester examination due to some unavoidable reasons shall apply in writing to the Chairman/VC for retaking mid Semester examination before the End Semester Examination. In case a student is allowed to retake Mid Semester Examination, the examination will be conducted by the concerned course teacher before the End Semester Examination on the payment of prescribed fee by the student.

Pass Marks

The minimum pass marks for each course shall be 60%/2.5 GPA (Grade C) and GPA ≥3.0/4.0 in Semester.

- Passing Comprehensive Exam (60% pass marks)

- **Failure/Improvement in a Course**

a) A student obtaining less than 60%/2.5 GPA (Grade C) in any course shall be deemed to have failed in that course and will be awarded “F” grade.

b)If a student fails to appear in the final theory examination of a course he/she shall be treated as absent and declared to have failed in that course with “F” grade.

d)The candidate can improve the course already passed with grade “C” or below.

e) A student obtaining “F” grade in core course has to re- register for the course on the advice of Chairman/VC to pass it.

Dismissal from Program

If a student obtains “F” (Failing) grade in more than one courses at the end of first year of enrolment, he will be dropped from the degree program.

Comprehensive Examination

The Comprehensive Exam assesses the student’s competency in the anatomical sub-disciplines and determines if the student is prepared to begin thesis research.

a) Comprehensive Exam must be conducted at the end of one year of enrolment (Annex 3.7 of HEC policy *)

b) To be eligible to appear in comprehensive examination, student must have passed 18 credit hours course work with a CGPA of minimum 3.0 out of 4.0 with evidence.

c) Paper of the comprehensive examination will be set by the Director of post graduate program, in consultation with the course teachers. One External Faculty member expert in the field of study can also be a paper setter who can be from other department of the university or from other university.

A certificate of satisfactory completion of the program by the Supervisor shall be mandatory for the eligibility to sit for course examinations. (Annex part 8 -2a of PMDC policy **)

d)Comprehensive examination will comprise of:

Two theory papers of 100 marks each:

i. Paper A: Major and Minor specific subjects (10 Essay Questions 10 marks each)

ii.Paper B: Major and minor specific subjects (10 Short Essay Questions of 05 marks each and 50 MCQs 01 mark each)

iii.The weightage of courses in the theory paper will be as per credit hours

e) Viva Voce Exam of 100 marks: Major and minor specific subjects. The viva voce exam will comprise of all the courses of major and minor specific subjects studied during the course work. Emphasis will be given to the research aptitude of the scholar.

f) The viva will be conducted by the department through a panel of examiners with at least one examiner from one of the other relevant departments of the University or another University as approved by The Vice Chancellor RMU.

g) Passing marks for PhD Comprehensive examination will be 60%.

h) PhD Candidates will only be allowed a maximum of two chances to clear the comprehensive examination within two years of enrolment in the PhD program as per HEC policy.

i)In case of not qualifying the comprehensive examination in two (02) attempts student will no longer retain the status of “PhD candidate” of the university.

j) The comprehensive examination mentioned for the scholar will be prepared and conducted by PhD Research Monitoring Committee & ARSC .

90% is eligibility criteria for appearing in professional examination.

Table of Specification (TOS)/Semester

1. Assignments/tests/log book 30 percent marks
2. Semester Exam:

Viva/practical OSPE 30 percent

Written Examination 40 percent

GPA Calculation as per University rules.

MID SEMESTER/SEMESTER EXAM TOS

Domain		Number	Marks /each	Marks
Course /Subject	MCQs	100	1	100
	SEQs	2	10	20
	SAQS	16	5	80
	Viva	-		100
	Practical/OSPE	-		50
	Int Evolution (log Book,Quiz etc)			150
TOTAL MARKS				500

COMPREHENSIVE EXAM TOS

Domain		Number	Marks/each	Marks	
Course/Subject	MCQS	50	1	50	
	SAQs	10	5	50	
	SEQs	10	10	100	
	Viva			100	
Total				300	

Evaluation Methodologies

- To make sure that residents/students are evaluated fairly, the evaluators will attend workshops on evaluation methodologies.
- There will be structured viva and written assessments. Keys will be provided to evaluators for checking written papers/viva .
- For annual confidential written evaluations of the PGT by the students, Feedback proforma will be designed in which all aspects related to teaching like Knowledge, punctuality, tolerance level, professionalism, communication skills and behaviour with student will be covered.
- To ensure confidentiality students will be asked to fill proforma without showing their identity, different students will be asked to fill proforma at different times.
- All data will be computerized and a, pass code will be generated so only concerned person will be able to access these feedback proforma.
- A confidential letter will be written to PGT in which details of his/her annual Feedback will be told including all positive and negative aspects.
- He /she will be called in Supervisor's office to discuss areas where improvement is required.
- He/she will be encouraged to convert weaknesses into strengths by addressing his/her problems.

Students will be evaluated based on:

- Attendance record (at least seventy-five percent for each year of study).
- Performance of the scheduled / desired activity
- Participation in discussion (tutorial and seminar etc.)
- Efficiency and effort put in the assignment (lectures, demonstration, Computer training, etc.)
- Quiz

- Practical work
- Presentation and Computing skills

Standard of Passing the course work

- Cleared the semester exams
- Cleared the comprehensive exam

SECTION III- RESEARCH WORK (2nd & 3rd Year)

Preparation and Approval of Synopsis by BASAR

a) In consultation with the supervisor/co-supervisor, the candidate will finalize research topic during first semester of the doctoral studies and positively will get it approved from his Academic and Research Supervisory Committee (ARSC)

b) As per approved research topic, the candidate will prepare the synopsis as per format of the university, in consultation with the supervisor/co-supervisor, during second semester of the doctoral studies and positively will get it approved from his Academic and Research Supervisory Committee (ARSC), Ethical Review Board (ERB)and Board of Advanced Study and Research of the university (BASAR).

c) After the completion and passing of course work with CGPA of ≥3.0/4.0 and of scholar, and passing the Comprehensive Examination with 60% marks, the student can start the research work.

Review Article Submission: PhD Scholars of Anatomy program at RMU must write a review article on his/her topic of interest. It provides foundation of knowledge on topic. Review writing helps in Identification of areas of prior importance, gaps in research, conflicts in previous studies, open questions left from other researchers. Also Identify need for additional research.

Registration

To be registered as a "PhD Scholar" with the RMU, candidates must submit following documents to the Dean:

i. Completion of 18 Credit Hour Coursework
ii. Passing the Comprehensive Examination
iii. Approval of Synopsis by ERB & BASAR of the University

Suspension of Registration:

Where a PhD Scholar is unable to continue with their research program because of severe issues like health, family problems and financial reasons, BASAR may suspend their registration for a specified period of maximum up to 1 year. (PMDC policy 2023) **

Migration or transfer of postgraduate trainee:

Migration or transfer of students undergoing PhD shall not be permitted by any university or any authority without prior permission of HEC & PMDC. (PMDC**/HEC policy *2023)

Transfer of credit hours:

- PG can be facilitated for transferring the credit hours on special grounds However, PMDC guidelines are mandatory for all the DAI to follow at the time of transfer.
- No credit hour of a course will be transferred if the grade is less than C. Credit hours may only be transferred between recognized DAI nationally or internationally (PMDC policy 2023) **

Evaluation & Monitoring of the Training Program

Progress Report

a) There will be a bi-annual review of research progress of the PhD Scholar by the Supervisor

b) At the end of every six months after confirmed registration, PhD Scholar would submit a summary of the progress of the research work through the Supervisor to dean.

c) In case of more than two unsatisfactory reports forwarded to the PhD Committee, the scholar will be notified in writing and given reasonable opportunity to respond to the PhD Committee. In Case PhD Scholar fails to satisfy the committee, the committee shall recommend removal of his/her name from university register.

d) There will be a period of 15 days given to the scholar to appeal to the BASAR through the Vice Chancellor against the decision and final decision BASAR will be implemented.

Criteria for Award of PhD Degree

- PhD level course work of at least 18 credit hours followed by course exam and a comprehensive examination, completion of research work along with thesis defense will be essential for the award of PhD degree.
- The thesis must be examined by two foreigner examiners from technologically/academically advanced countries
- Date of defense of the dissertation should be notified.
- At least one Published research paper in an HEC approved W category or 2 in X category journal is essential for the award of PhD degree.

Evaluation & Monitoring of the Training Program

The proposed / suggested evaluation of the training program will be done by:

a. The Students

b. The Faculty members (Program team Members)

c. The Supervisor

d. Self Assessment with External and Internal Evaluators (SAR)

This will be carried out by filling the HEC Program Evaluation Proforma by the concerned member followed by analysis and reporting.

THESIS

Thesis Supervision

a) Supervisor & co-supervisors should be the full-time faculty members of the university and must be from the specialty that the student is enrolled in (Annex 4.4 of HEC policy *)

b) Eligibility of the Supervisor/co-supervisor will be in line with the HEC/PM&DC guidelines.

c)DEAN may also appoint a co-supervisor from any other related department to provide the link if the research is of an interdisciplinary nature or if the research is being undertaken in collaboration with another organization.

Modification /Change of Research Topic

a) A candidate may modify/change the topic of his/her research with the approval of the BASAR by applying, duly supported by the Supervisor, DEAN and recommended by the PhD Committee.

b) The students can perform research/experiments at other HEC recognized universities/multidisciplinary Laboratories, subject to approval by the student supervisor, Dean & VC RMU.

Freezing of Registration/Discontinuation of PhD Research

HEC/PM&DC rules will be followed for termination or freezing of PhD program:

a) Where a PhD Scholar is unable to continue with their research program because of severe issues like health, family problems and financial reasons, BASAR may suspend their registration for a specified period of maximum up to 1 year.

b) The Scholar must be able to satisfy the BASAR of the University that any period of freezing will not adversely affect the viability of the candidate's research after consultation with the Supervisory Committee and DEAN.

c) Any period of freezing will be excluded from the calculation of the final submission date.

d) While registration is suspended, a Scholar is exempted from fees, and is not entitled to any tuition or supervision, or to the use of any other research resources of the University.

Thesis Submission

a. The supervisory committee advises the student throughout the conduct and completion of the doctoral research project, including the writing and defence of a Dissertation.

b. Thesis submission should be done within three to eight years of enrolment in the program.

c) The submitted thesis must accompany the plagiarism report along with all other documents prescribed by the Examination department of RMU

d) At the time of thesis submission, the supervisor would submit a list of the suitable local & foreign examiners that have relevant subject expertise through the DEAN to Controller of examination for approval.

Evaluation OF Thesis

a) The thesis will be presented by the student in Thesis Review Committee (TRC) to be notified by the Dean of Faculty/Director BASAR.

b) After satisfactory report of the TRC, the scholar shall submit seven copies of his/her thesis written on a prescribed format to the Dean's office through Supervisor and Chairman of the Department.

c) External Evaluation is one of the main elements for PhD research work as per HEC policy to get confidence of research work. The PhD thesis must be evaluated by:

At least two external experts who shall be:

i. PhD faculty member from the world top 500 universities ranked by the Times Higher Education or QS World Ranking in the year corresponding to dissertation evaluation year OR

ii. Pakistan-based Distinguished National Professors, from any national university with PhD degree

d) Each examiner will be provided with an electronic copy of the thesis and, acting independently, is required to provide the Controller of Examinations within two months of receipt of the thesis, with a written report on the quality of the thesis. If there is no response from examiner in two months after two reminders, the examiner will be replaced.

e) The examiners can suggest either of the following option:

- To award the degree, subject to satisfactory performance at the oral examination.
- To award the degree after specified "minor corrections" have been made to the thesis, to the satisfaction of the oral examiner, by a specified date, and subject to satisfactory performance at the oral examination.
- To permit the candidate to revise the thesis to incorporate the major changes suggested and resubmit it for examination.

f) In case of recommendations of minor or major corrections, the scholar would be asked to submit the correction within a specific period for further evaluation.

g) The evaluation reports of the examiners would be considered in the BASAR.

h) The scholar would be allowed to proceed to the oral examination if the evaluation reports approve her/his thesis.

A copy of PhD Dissertation (both hard and soft) must be submitted to HEC for placing/including in PhD Country Directory and for attestation of the PhD degree by the HEC in future.

Policy for PhD Thesis Writing

The thesis submitted by a PhD candidate shall comply with the following conditions:

a) It shall form a distinct contribution to knowledge and afford evidence of originality, shown by the discovery of new facts, by the exercise of independent critical judgment, and/or by the invention of new methods of investigation.

b) It shall not include research work for which a degree has already been conferred in this or any other university.

c) It shall be written in English and the presentation must be satisfactory for publication.

d) Any part of the thesis which has been published before submission of the thesis may be appended at the end of the thesis.

e) If a student who is re-admitted to PhD program and had previously spent the minimum period of three years as a PhD student, he/she may be allowed to submit the thesis after one year from the date of his/her readmission.

Guidelines for Thesis Format

All thesis presented in typescript for the degree of PhD should comply with the following specifications unless permission to do otherwise is obtained from the relevant authority / body.

- SIZE OF PAPER. A4 size be used, no restriction is placed on drawings and maps.
- PAPER SPECIFICATION. Six copies on good quality paper (minimum 80g) be submitted.
- METHOD OF PRODUCTION. The text must be typewritten in an acceptable type face and the original typescript (or copy of equal quality) must normally be submitted as the first copy. The second and subsequent copies may be produced by means of other acceptable copying methods.

- LAYOUT OF SCRIPT. Typescript should appear on one side only, lines; at least one-and-a-half spaced. Footnotes, quotations, references and photographic captions may be single spaced. Where appropriate, these should contain lists giving the locations of figures and illustrations.
- FONT SIZE Title Page Headings / subheadings, Text, Footnotes, Footnotes be given on the same page where reference is quoted
- TYPE STYLE. Times New Roman / Arial / Courier New
- MARGINS. At least 11⁄4 -11⁄2 inches (3.17-3.81cm) on the left-hand side, 3/4 - 1 inch (2 - 2.54cm) at the top and bottom of the page, and about 1⁄2 - 0.75 inches (1.27 - 1.90cm) at the outer edge. The best position for the page number is at top-centre or top right 1⁄2 inch (1.27 cm) below the edge. Pages containing figures and illustration should be suitable paginated.
- The thesis shall be hard bound with maroon cloth cover and golden lettering on the front and the spine.
- Spine of the thesis should show "PhD thesis" on top across the width of spine, name of the candidate in the middle along the length of spine, and the year of submission across the width at the bottom. Lettering on spine should be in 18 pt. and may be in boldface.

Following is the preferable layout of the Thesis

- Title page
- Abstract / Summary
- Acknowledgements
- Abbreviations
- Contents
  - List of Tables (where applicable)
  - List of Figures (where applicable)
  - Introduction (including literature review)
  - Material and Methods
  - Results May be comprised of one chapter or a number of chapters depending upon the subject matter/ requirements
  - Discussion (including Conclusion(s),
  - Limitations of the study
  - Recommendation(s)
  - References / Bibliography / Literature Cited

- Appendices (where applicable)
- Any other information specific to the respective discipline

- **Title Page.** All thesis must contain a title page giving the title of the thesis, the author's name, the name of the degree for which it is presented, the department in which the author has worked or the faculty to which the work is being presented, and the month and year of submission.
- **Length of Thesis**. Whilst the regulations do not contain a clause relating to the maximum length of theses, it is expected that work presented for the degree of PhD should normally between 40,000 - 120,000 words of text. Candidates wishing to greatly exceed these sizes should discuss the matter with their supervisors.
- **Published Work**. Published/accepted for publication work from the thesis be included as appendix

Thesis Defense

a) There should be a standing list of external examiners for the department consisting of people of eminence in the field of research. The list shall be suggested from time to time by the board of studies of faculty concerned and approved by the research board. External examiners will be requested to critically examine the thesis for its suitability for the award of PhD degree.

b) There shall also be a standing list of local examiners for department consisting of eminent person engaged in research in the field of Anatomy. The list shall be suggested from time to time by the board of studies of faculty concerned and approved by the research board. The local examiners will be requested to conduct the final viva-voce examinations of thesis.

c) The candidate shall in the first instance submit six unbound copies of his/her completed thesis along with an application on prescribed form for the evaluation of his/her thesis, duly forwarded by his/her supervisor and the chairman of the department:

• 03 for external

• 01 for examination section

• 01 for department office

• 01 for the supervisor

After corrections have been incorporated in accordance with the comments of external examiners; two copies of thesis in loose binding, to be sent to viva-voce examiners. After the viva-voce examination; four copies of the final hardbound thesis be submitted

d) The supervisor shall suggest a panel of at least six external examiners from the approved list.

e) The vice-chancellor shall appoint three external examiners from the suggested panel to evaluate the thesis.

f) The reports of the examiners shall be placed before the research board for consideration.

g) If the thesis is adjudged as adequate by two of the three examiners, the research board shall allow the candidate to appear in the viva-voce (thesis defense) examination.

h) If two of the three examiners find that the thesis is wholly inadequate it may be rejected by the research board.

i) If any of the examiners suggests modification/revision of the thesis, the candidate shall be required to resubmit a revised version of the thesis, duly certified by the supervisor, within one year.

j) The revised version of the thesis shall be approved by the same examiner who suggested modification/revision of the thesis.

k) If any of the examiners finds the thesis adequate but suggests minor modifications/revision, this may be incorporated without referring again to the examiner.

l) The viva-voce examination shall be conducted by the two external examiners appointed by the vice-chancellor from the panel approved by the research board, the supervisor and the chairman of the department concerned.

m)The viva-voce examination shall be open to the public, but the evaluation will be done only by the panel of examiners.

n) If the candidate fails to satisfy the examiners in the viva-voce examination, he/she may be given a chance to defend the thesis for the second and final time within a period of six months.

o) A candidate who successfully completes all the requirements shall be awarded, with the approval of the research board and the syndicate, the degree of Ph.D under the seal of the university.

p) The vice-chancellor may approve the recommendations of the research board on behalf of the syndicate regarding the award of Ph.D degree to the candidate. Reports of the examiners shall be placed before the research board for consideration.

Public Defense & Oral Examination

An open defense of Dissertation after positive evaluation of Dissertation is essential part of PhD Program.

a) The Controller of Examinations will arrange thesis examination.

b) Before the Oral examination, thesis will be presented by the scholar for public defense.

c) public defense will be open for the entire faculty and student participation will be compulsory.

d) The examination must be attended by the Candidate, the Oral Examiners, and the DEAN or his Nominee. The main supervisor or co-supervisor will also be present.

e) The examiners will be provided the evaluation report of the thesis by foreign and local examiners.

f) On completion of the oral examination, the DEAN will provide a written report endorsed by the Examiners. The report can include following recommendations:

a. To award the degree, subject to satisfactory performance at the oral examination.

b. To award the degree after specified “minor corrections” have been made to the thesis, to the satisfaction of the oral examiner, by a specified date, and subject to satisfactory performance at the oral examination.

c. To permit the candidate to revise the thesis to incorporate the major changes Suggested and resubmit it for examination.

d. An open defense of the dissertation will be conducted after positive evaluation of the dissertation by the committee members.

e. After considering all the reports of the examiners, the DEAN will make the final decision as to the award of the PhD degree.

RMU PhD Publication Policy:

For award of PhD degree, a PhD researcher shall be required to publish research articles meeting the following criteria: At least:

i. One research article in W category journal or two research articles in X category journals (HEC policy 2023)*
ii. The PhD researcher shall be the first author of these publications. That will be followed by supervisor, cosupervisor and any other contributor.
iii. The research article shall be relevant to the PhD research work of the PhD researcher.
iv. The article shall be published after approval of the research synopsis.
v. The article shall be published in a relevant research journal.

HEC Requirements at completion of Degree:

The following documents will be submitted to the HEC following the completion of studies:

a) A duly filled completion form will be sent to the HEC from the Office of the Controller of Examinations of the university notifying the HEC that the PhD scholar has completed all the requirements for the award of the PhD degree.
b) A Copy of PhD Dissertation for including in PhD Country Directory and for attestation of the PhD degree by the HEC.
c) A duly filled Performa for the PhD Country Directory signed by the Principal Supervisor, Controller of Examination and the Vice Chancellor.

PMDC Requirements at completion of Degree:

All PG students after completing their PhD Anatomy degree shall be registered by the Council (PMDC policy 2023) **