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BMS
INSTITUTE OF BASIC MEDICAL SCIENCES

It is essential that we train medical educators capable of conducting successful biomedical research in addition to educating medical and allied health professionals.

MPhil Oral Biology

Institute of Basic Medical Sciences

MPhil Oral Biology

Curriculum Document

Institute of Basic Medical Sciences, Khyber Medical University, Peshawar

Section I

Introduction

Program Details

COURSE TITLE	MPhil
SPECIALTY	Basic Medical Sciences (Anatomy, Physiology, Biochemistry, Histopathology, Haematology, Microbiology, Pharmacology, Molecular biology and genetics, Human Nutrition, Dental materials, Oral Biology)
COURSE DURATION	Two years
TYPE OF STUDY	Full time

STUDY SYSTEM	Semesters system
	• 4 Regular Semester
	  ○ 2 semesters for coursework
	  ○ 2 semesters for research work

TOTAL CREDIT HOURS	• Total Credit hours 36
	  ○ 24 Credit hours Course Work
	  ○ 12 credit Hours Research work

DISTRIBUTION OF COURSES AND CREDIT HOURS	• 1st semester (12 Credit hours)
	  ○ 3 Compulsory courses (6 Credit hours)
	  ○ Specialty courses (4 credit hours)
	  ○ One Elective course (2 credit hours)
	• 2nd semester (12 Credit hours)
	  ○ 1 compulsory course (2 credit hours)
	  ○ Specialty Courses (8 Credit Hours)
	  ○ 1 Optional Course (2 Credit hours)
	• 3rd semester (6 credit hours)
	  ○ Research (6 Credit hours)
	4th Semester (6 credit hours)
	  ○ Research (6 credits)

DEGREE AWARDING INSTITUTION	Khyber Medical University Peshawar
TEACHING INSTITUTION	Institute of Basic Medical Sciences (IBMS) Khyber Medical University Peshawar
ADMISSION CRITERIA	**For Anatomy & Physiology**: MBBS, BDS or equivalent medical qualification or DPT OR MSPT/MNEURO fully recognized/ registered by the PM&DC or their corresponding councils **For Biochemistry:** (MBBS, BDS or equivalent medical qualification fully recognized/ registered by the PM&DC) OR, BS (4years), OR MSc in Biochemistry and Human Nutrition

	For Molecular biology and genetics: MBBS, BDS or equivalent medical qualification registered by the PM&DC or BS 4yrs OR MSc biological sciences **For Dental Materials:** BDS or equivalent qualification fully recognized/ registered by the PM&DC or their corresponding councils OR MS / MSc in Biomedical engineering, Polymer chemistry, Material sciences, Biomaterials, Tissue engineering, Biotechnology and Biochemistry. **For Human Nutrition:** MBBS, BDS or equivalent medical qualification recognized by Pakistan Medical and Dental Council or BS Nutrition/Human Nutrition/Food Science & Nutrition/Food Science & Technology/Biochemistry from HEC recognized institute **For Oral Biology:** BDS or equivalent qualification fully recognized/ registered by the PM&DC

MPhil Oral Biology

1.Introduction:

Oral and Dental disease is a world-wide problem, often leading to loss of quality of life. This course offers in depth knowledge of Oral Biology, including disease mechanisms, understanding of the complex interplay between host and microorganisms driving pathology, as well as current approaches to tissue repair and regeneration.

Oral Biology is a significant subject area that is integral to undergraduate and postgraduate dental training worldwide. The scope of Oral Biology includes a range of basic and applied sciences that support the practice of dentistry.

These subjects include: oral and dental anatomy; craniofacial and dental development; oral physiology; oral neuroscience; oral microbiology. These subjects will be integrated with the relevant disease processes, for example, craniofacial anomalies, dental caries and tooth surface loss.

The MPhil course is built largely on new modules supported by semester 1 compulsory courses run conjointly with all IBMS MPhil programs.

2.Objectives

- Gain an in-depth understanding of oral biology in health and disease
- Develop ability to conduct independent research in oral biology.
- Integrate basic science with clinical dentistry.
- Enhance skills in research methodology and biostatistics.
- Promote critical evaluation of scientific literature.
- Ensure adherence to ethical and professional standards in research.
- Insight into modern therapeutic approaches.
- Students will develop critical analysis, presentation and laboratory research skills.

3.Careers

The MPhil Oral Biology is aimed at dental graduates who are either early in their careers or wish to establish themselves as oral biologists within dental schools.

Oral Biology is a recognized discipline in many dental schools worldwide. Graduates will have gained sufficient knowledge and skills to enable them to be teachers, innovators and educational leaders in the field.

In addition, successful graduates will be well placed to undertake further postgraduate study at PhD level.

4. Vision

To be the global leader in health sciences academics and research for efficient and compassionate health care."

- **Global Leadership in Academics:**
  The program is structured according to international standards in health sciences education. It equips students to publish in peer-reviewed journals, present at conferences, and pursue PhDs globally, elevating KMU's academic reputation.
- **Research Excellence:**
  Research is a core component. MPhil scholars undertake thesis work on contemporary oral health challenges, biomaterials, and oral-systemic health links, contributing to local and global scientific advancement.
- **Compassionate Health Care:**
  Emphasis on ethics, community engagement, and evidence-based knowledge ensures that graduates not only excel academically but also serve with empathy and social responsibility.

5. Mission

"To promote professional competence through learning and innovation for providing comprehensive quality health care to the nation."

- **Professional Competence:**
  The MPhil Oral Biology program cultivates an advanced understanding of oral and craniofacial structures, pathology, and biomaterials. Students engage in critical thinking, scientific writing, and laboratory techniques essential for becoming expert dental educators and researchers.
- **Learning and Innovation:**
  With modern teaching methodologies, hands-on lab work, and interdisciplinary learning, the program fosters innovation. Students are encouraged to undertake research projects that address local oral health issues, thereby contributing to evidence-based practices.
- **Quality Health Care:**
  By training graduates in both theory and applied oral biology, the program helps bridge the gap between basic science and clinical dentistry. This ensures that graduates contribute to better diagnosis, prevention, and management of oral diseases—improving the overall healthcare system.

6. Overview

This is a two-year course that shall include both *taught courses* as well as *research*. In the first semester students shall complete the core courses required by the MPhil Oral Biology program as well as completing research rotations whereby selecting a research supervisor and mentor. They shall complete a qualifying exam at the end. In the second semester the remaining courses in MPhil Oral Biology will be undertaken. In the third to fourth semesters they shall complete a research project, dissertation writing and defending their thesis.

7. Outcomes

The Graduate of MPhil Oral Biology will have the attributes of a Subject specialist, scientific researcher, Educator, Effective communicator and Collaborator. By the end of the course students should have achieved the required level of,

- Subject based knowledge and skills
- Relevant basic as well as applied research in biomedical sciences
- Quality and credible research
- Presentation and communication skills
- Capability of teaching medical disciplines

8. Core Values

- Perform integrated interdisciplinary teaching and research with the highest level of ethics and professionalism, to meet the needs of stakeholders; and be responsive to changing global trends.
- Promote and defend the freedom of thought, academic enquiry, expression and association.
- Demonstrate sensitivity to student welfare and staff needs, and to practice environmental stewardship to the highest standards.

9. Core Activities

- The institute instructs in the *biomedical sciences* related to Basic Medical Sciences.
- The institute trains postgraduate scholars in basic medical sciences in the degree programs leading to *Masters of Philosophy (MPhil)* in basic medical sciences, and *Doctor of Philosophy (PhD)* in basic medical sciences.
- In addition, the institute also invests in preparing active future basic medical science researchers and teachers.
- It engages its students in activities ranging from optimization of laboratory protocols and animal handling to poster & oral presentations and critical reviews.
- The institute arranges research days and conferences throughout the year, in which the new inductees are given an opportunity to develop an orientation regarding the core activities and structure of the department while the current students present their posters and critical reviews and receive feedback from the faculty members of different departments.
- Furthermore, students assessed for their understanding and application of knowledge through both formative and summative assessments.

10.Teaching and Learning

Students will experience a wide variety of teaching and learning methods from expert staff including tutorials, lectures, seminars, workshops, small group discussions, problem based learning, and laboratory sessions. As such the students will develop a wide range of skills useful in basic and applied environment. These skills will aid in teamwork, scientific exploration, problem solving and identifying relevant laboratory protocols.

11. Methods

Students will be assessed both *formatively and combatively*. Throughout the year formative assessment in the form of class tests, presentations and assignments along with the feedback will be carried out. Summative assessment will include end of the course terminal exam featuring multiple-choice questions. The practical aspects will be assessed using viva and Objective structured Practical examination (OSPE).

12.Compulsory Courses

The MPhil basic medical sciences scholars are required to undertake a total of 4 Compulsory courses consisting of 8 credit hours in the first semester. In addition 2 compulsory courses of health

professions education and health research of 3 credit hours each are taught in the third semester to all MPhil scholars.

13.Speciality Courses

These courses are designed for the in-depth study of Oral Biology Subjects. The basic knowledge will be learned to a level to teach postgraduate students and professions allied to dentistry. This part of the course is largely self-directed, with regular tutorials and laboratory sessions and taught by respective faculty. The related specialty courses of each specialty are mentioned in their corresponding sections.

14.Optional Courses

An elective course is one chosen by a student from several optional subjects or courses in a curriculum, as opposed to a compulsory and speciality courses, which the student must take. Multiple optional courses will be available for students to select from. All the students will be required to select and undertake a maximum of two optional courses (4 credit hours in total). This will be done after the recommendation and approval from their respective supervisors/ departments. A faculty meeting prior to every semester will decide on the optional courses offered for that semester.

15. Registration in the University

- A scholar for MPhil degree program shall be registered in teaching department/ institution of the University.
- Registrar of the university shall maintain a register of MPhil research scholars and assign a registration number to each scholar at the time of provisional admission.
- A "notification of registration" for each candidate approved /allowed for admission to MPhil program shall be issued by the University.
- Registration may be renewed on payment of the prescribed fee if a scholar is re-admitted within a year after having been struck off the rolls for any valid reason.
- A person registered for the MPhil degree program shall be called MPhil research scholar. Each student so selected shall be required to register and pay the dues within 30 days from the date of issuance of the notification of registration, failing which the admission of the selected candidate shall be deemed as cancelled. The university shall determine the tuition fee and other dues from time to time.

16. Mentors:

The students shall select their teaching mentor in the first and research mentor at the end of second semester. The coordinator shall serve as mentor before selection of mentors.

17.Student Faculty Ratio:

The student–faculty ratio shall be maintained in accordance with the guidelines prescribed by the Pakistan Medical and Dental Council (PMDC) and the Higher Education Commission (HEC). The institution ensures an appropriate number of full-time, qualified faculty members to support effective teaching, supervision, clinical training, and research activities. The student–faculty ratio is maintained at a level that allows adequate academic interaction,

mentorship, and assessment, thereby ensuring quality education and compliance with PMDC and HEC standards.

18. Student Assessment Methods

a. Class quiz	to assess continuous learning process
b. Terminal Examination	to assess learning outcomes
c. Presentations	to assess communication skills
d. Assignments	to assess writing skills

19.Weightage of Assessment 100 Marks Total

Midterm exam		25
Terminal examination	40	
Oral/practical examination	10	
Semester work (presentations)	05	
Other types of assessment (assignments)	05	
Poster presentations	15	
Total	**100**	

20.Assessment Mapping & Table of Specification (ToS)

20.1 Course Learning Outcomes (CLOs)

- **CLO-1: Explain advanced concepts of oral embryology, histology, and physiology.**
- **CLO-2: Analyze molecular, cellular, and genetic mechanisms involved in oral tissues and diseases.**
- **CLO-3: Critically appraise current research literature in oral biology.**
- **CLO-4: Apply laboratory and research techniques relevant to oral biology.**
- **CLO-5: Demonstrate ethical conduct, scientific communication, and independent learning skills.**

Assessment-CLO Mapping

Assessment Tool		CLO-1	CLO-2	CLO-3	CLO-4	CLO-5
Written Examination		✓	✓	✓	-	-
Assignments		✓	✓	✓	-	✓
Journal Club / Literature Review		-	✓	✓	-	✓
Seminar / Presentation		✓	✓	✓	-	✓
Practical / Laboratory Assessment		-	✓	-	✓	-

Research Proposal / Mini-Project		-	✓	✓	✓	✓
Viva Voce		✓	✓	✓	✓	✓

20.2 Table of Specification (Cognitive Domain)

Content Area	Knowledge	Analysis	Evaluation	Total %
Oral Embryology & Development	8%	5%	2%	15%
Oral Histology & Pathology	8%	7%	5%	20%
Oral Physiology and Saliva	6%	7%	7%	20%
Tissue engineering	5%	8%	7%	20%
Recent Advances & Research Trends	3%	6%	6%	15%
Total	30%	33%	27%	90%

21.Review Process

Year 1

The scholar shall clear End of semester qualifying exams to progress to next semester.

After successfully clearing two ends of semester exams, the student shall proceed to Year 2 of MPhil. The first review will include submission of MPhil student review form (Annexure I) and allocation of supervisors to the each MPhil student.

Year 2

21.1 0-3 Month

The student shall submit a review of the literature for the potential project (1500 Words minimum, 2000 Words maximum) in the form of a scientific report.

The student should submit an MPhil Proposal to his/her supervisor for initial review. The supervisor will then assess the project and identify training needs if required.

The student should now accommodate supervisor comments, re-check from supervisor and submit research proposal to IBMS Graduate Study Committee. This should be followed by submission of "MPhil Student Review Form" (Annexure 1), literature review and defense of research proposal in the annual review meeting of the Advanced Studies Review Board (ASRB) and Ethical approval.

21.2 6th Months (Review 2)

The review process of Year 2 includes,

- Bi-annual presentation# in the Department at the end of 6th and 9th month organized by the Head of the Department followed by submission of "MPhil Student review form"
- Scientific report*

The student should be working on collecting data, optimize experiments, establish collaborations and develop experimental/research plan for successful completion of MPhil project. In addition the student shall submit a scientific report of maximum of 1500-2000 words.

Students and supervisors should complete the Bi-annual review process by stipulated dates of the year. Any student starting late will normally be permitted to delay submission of their annual report as decided by departmental head.

Two reviewers assigned by supervisor at the beginning of year 2 will assess the progress of student. The progress made by the student will then be communicated to the relevant supervisor and head of the department.

21.3 6th-9th Months (Review 3)

At this point the students shall be doing the write up of their research projects and present it to their respective supervisors, who will review them as a part of bi annual research days.

21.3.1*Scientific report

A scientific report preferably in the style of a journal article (6 to 10 pages maximum is recommended) summarizing progress made in the last year. It may therefore contain an abstract, introduction, materials and methods, results and discussion. In addition, there should be a 1500-2000 word section at the end of the report detailing the following year's work (Future plans). To be sent to supervisor for assessment and comment (half a page maximum) and subsequently submitted to the reviewers.

21.3.2 Presentation

All MPhil students are required to deliver oral presentation in the meeting, especially organized for them. This is followed by discussion, including minimum of two subject experts. The decision will then be take decision regarding the registration of student for the next session.

21.3.3 Thesis pending period

Final 9-month interview - Students at absolute thesis submission deadline will be interviewed specifically on their progress in the review meeting. For thesis writing guidelines see annexure II.

15. Timeline for MPhil Process

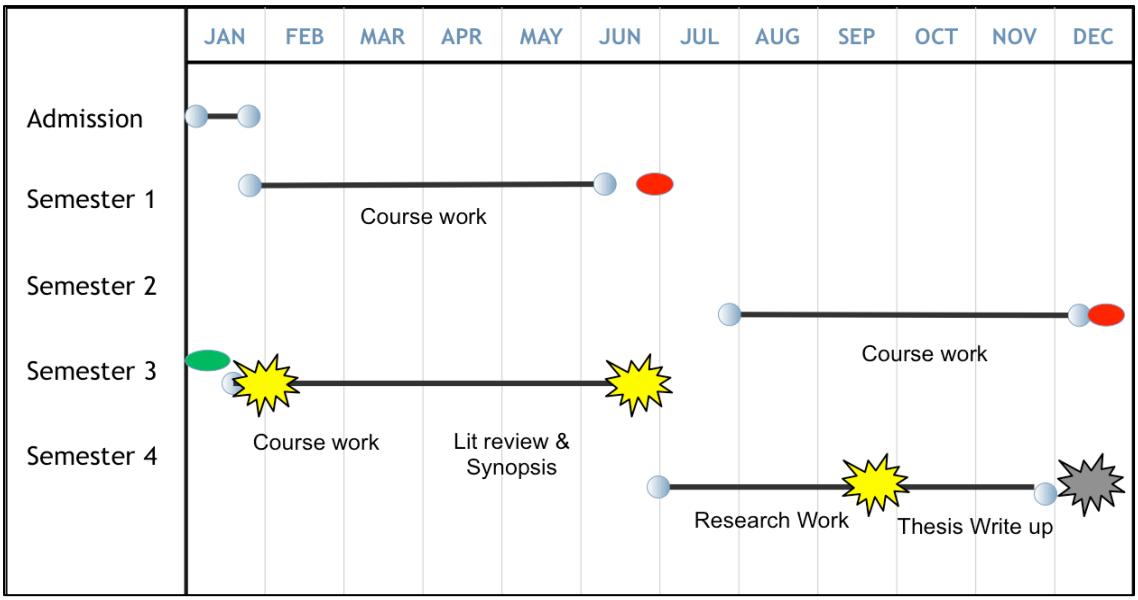


Figure 1Timeline for MPhil Process

=End of semester exam =Review =Allocation of supervisor

=Defense

16. Fellowships

A limited number of fellowships are available to support studies. Fellows will be expected to participate with faculty in the education of medical, professional, and graduate students working in both our teaching laboratories and classrooms. Acceptance into the program does not guarantee the awarding of a fellowship or any other financial assistance. Consideration for a Fellowship will be based on the qualifications of the candidate and the selection of the fellowship award recipient will be made solely by the Director.

17. Application

Students are usually admitted in the beginning of the spring semester. Application requirements include official transcripts, official scores on the Graduate Record Examination, three letters of recommendation, a resume/cv and a goals statement. Materials should be uploaded as part of your online application.

18. Duration of MPhil Degree

A HEC recognized supervisor would supervise the research work and award of degree and co-supervisor from related areas of expertise. Upon admission to MPhil program a supervisor will be allotted to the enrolled student who will guide the student in the selection of his/her area of research along with the development of research proposal and protocol. The supervisor and co-supervisor will also ensure that the student develop essential skills according to his area of research.

The requirements for MPhil degree shall normally be completed within two years from the date of registration. The maximum time for the completion of MPhil degree shall be four years from the date of registration in the MPhil program. Only under exceptional circumstances, to be described in detail by the MPhil candidate and supported by the supervisor, the respective statutory body may allow extension of up to one year beyond the maximum time limit of four years. A total of 48 hours (30 credit hours coursework, 18 hours dissertation research) is required for graduation.

19. Qualifying Examinations and Defense

End of Semester Exam

Upon completion of the core curriculum, the student must prepare for and successfully pass the MPhil qualifying examination at the end of each semester (1 &2) to test their knowledge of basic medical sciences grasp of relevant literature, and the ability to form research hypotheses and experimental design. It shall be a written and oral exam.

20. Submission of thesis

The copies of MPhil Dissertation (both hard and soft) must be submitted to university library for record purposes.

23.1 MPhil Oral Qualifying Examination (Thesis defense)

23.1.1 Prerequisites

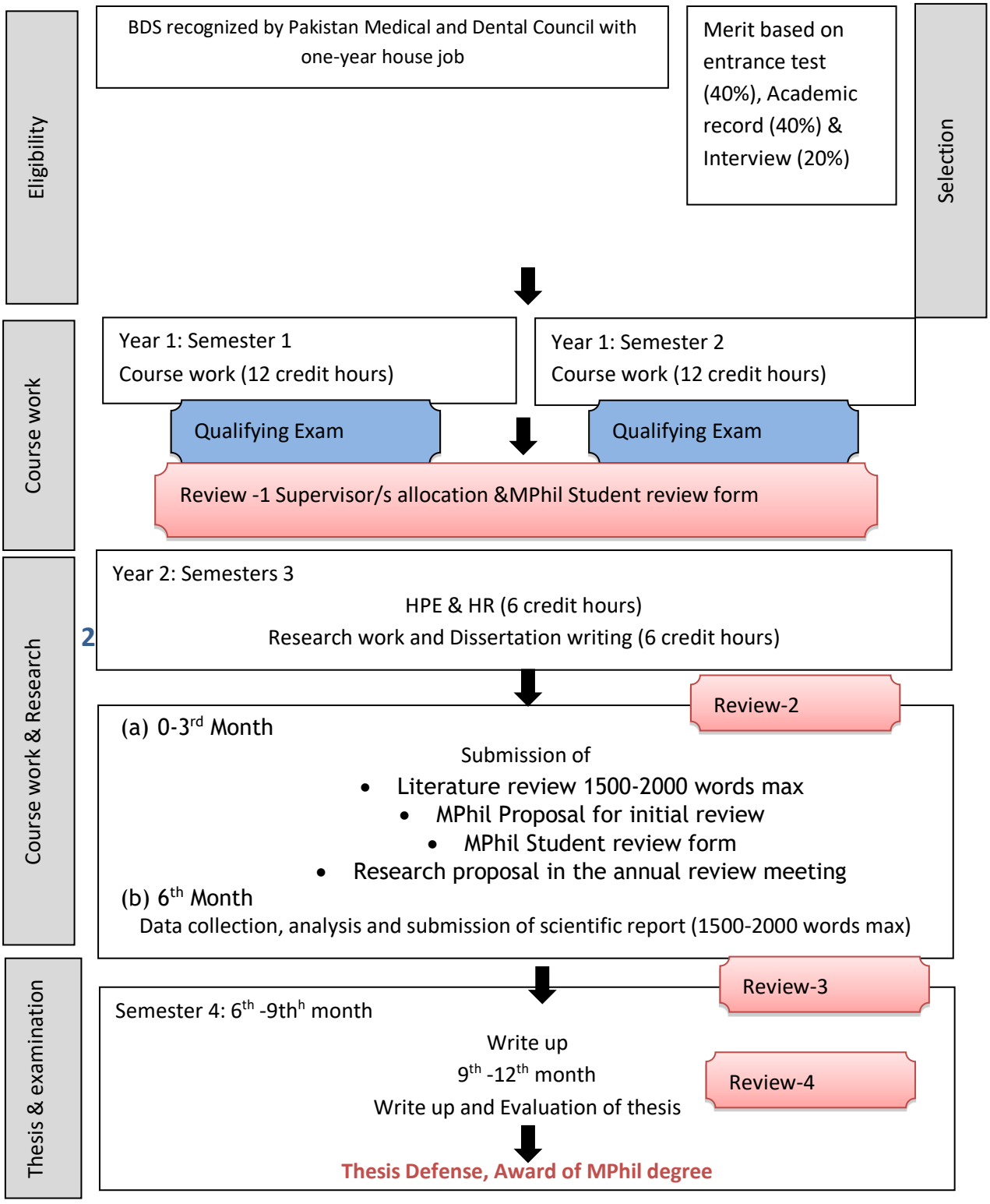
Prior to the MPhil student's request for consideration for the defense, the student must have;

- Completed most of their required course work
- Successfully passed their end of semester exams.
- Submission of their research proposal to Graduate studies, ASRB and ethical board.
- The oral qualifying exam will be scheduled after the student has submitted a detailed dissertation research.
- The Plagiarism test must be conducted on the Dissertation before its submission to the two external reviewers.
- After the approval from the 2 external reviewers, the dissertation will be forwarded to internal and external examiners for deliberation before the defense (See Annexure III).
- The thesis shall be submitted to the internal examiner at time of submission to external examiners.
- The internal examiner preferably has to be the subject specialist but in-case of non-availability an examiner may be selected from other departments in the institute. However the examiner has to have expertise in the field with the pre-approval of Dean Basic Medical Sciences.

23.1.2 The Defense

- The defense of the dissertation provides an opportunity for the student to formally present their findings to his/her examiners.
- At maximum, Two weeks before the dissertation defense an electronic and print announcement of the date, time, location, and title of the defense will be provided to the student and the supervisor.
- After reviews have been received the student shall make the appropriate changes and submit at minimum two corrected copies on the day of the defence.
- All raw data and slides/samples etc. have to be deposited with the supervisor at or before the time of the defence.
- All external examiners must be from the list of approved examiners by statutory bodies.
- All documentation/ transcript related to the thesis defence shall maintain a chain of secrecy to avoid any mishaps/changes in transcripts.
- The defense will consist of 2 phases; firstly the student will make an oral, PowerPoint presentation of his/her project for no longer than 20minutes, followed by the question answer session by the examiners.
- Once thoroughly evaluated, the examiners will make their final declaration and the MPhil degree will be awarded to the student.

Thesis report and certificates printed by IBMS admin to Dean BMS or Director IBMS, External and Internal examiners fill and sign the reports, resubmitted to Dean BMS or Director IBMS forwarded to controller exams, KMU.



Oral Biology Curriculum outline

First Semester (Spring, 12 CREDITS)

COMPULSORY COURSES

1.	BMS 701 Molecular cell biology	1+0 Credit Hrs
2.	BMS 702 Applied Biostatistics	2+0 Credit Hrs
3.	BMS 703 Communication skills and Academic writing	2+0 Credit Hrs
4.	BMS 704 Bio safety, Bioethics & One Health	2+0 Credit Hrs
5.	BMS 796 Understanding Quran 1	1+0 Credit Hrs
6.	BMS 798 Seminars, Symposia, conferences	Non cedit

No. of credit hours for compulsory courses	8 Credit hrs

SPECIALITY COURSES

1. ORB 701: Introduction to Oral Biology	1+1 Credit Hrs
2. ORB 702: Oral and Craniofacial Development	1+1 Credit Hrs
No. of credit hours for Subject courses	4 Credit hrs
Total no. Of credit hours for Spring semester	12 credit hours

Second Semester (Fall, Credits 8 plus 4)

1. BMS 796 Understanding Quran 1	1+0 Credit Hrs
2. BMS 798: Seminars, Symposia, Conferences	Non Credit

SPECIALITY COURSES

1.	ORB703: Head, Neck, and Oral anatomy	1+1 Credit Hrs
2.	ORB705: Oral Histology and Pathology	2+1 Credit Hrs
3.	ORB707: Oral Physiology and Saliva	2+1 Credit Hrs
No. Credit hours for Specialty courses		8 credit hours

OPTIONAL COURSES (Any Two)

1.	BMS 740: Research Techniques Basic Instrumentation	1+1 Credit Hrs
2.	BMS 754: Biomaterials	1+1 Credit Hrs
3.	BMS 755: Tissue Engineering	1+1 Credit Hrs
Total no. of credit hours for Optional courses		4 credit hours
Total no. of credit hours for fall semester		12 credit hours

Third and 4th Semester (12 Credit Hrs for thesis each)

- BMS 799 Thesis 12 Credit Hrs

Section 2

Compulsory Courses

M.Phil. Compulsory Courses

(Total 36 credit hours)

First Semester (Spring, 12 Credits)

COMPULSORY COURSES (8 credit hours)

1. BMS 701 Molecular cell biology	1+0 Credit Hrs
2. BMS 702 Applied Biostatistics	2+0 Credit Hrs
3. BMS 703 Communication skills and Academic writing	2+0 Credit Hrs
4. BMS 766 Biosafety, Bioethics & One Health	2+0 Credit Hrs
5. BMS 796 Understanding Quran 1	1+0 Credit Hrs
6. BMS 798 Seminars, symposia, conferences	Non credit
No. of credit hours for compulsory courses	8 Credit hours

SPECIALITY COURSES (4 credits)

No. of credit hours for Subject courses	4 Credit Hrs
Total no. Of credit hours for Spring semester	12 credit hours

Fall Semester (Course work Credits 12

1. BMS 796 Understanding Quran 1	1+0 Credit Hrs
2. BMS 798: Seminars, Symposia, Conferences	Non Credit
No. Credit hours for Specialty courses	8 credit hours

OPTIONAL COURSES (4 credit hrs)

No. of credit hours for optional courses	4 Credit Hrs
Total no. of credit hours for Fall semester	12 credit Hours

Third and 4th Semester (12 Credit Hrs)

BMS 799 Thesis	12 Credit Hours

BMS 701: Molecular Cell biology

(1+1 Credit Hrs)

1 Course Objectives:

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

- Cell structure and organization
- DNA replication, transcription, protein synthesis and enzymology
- Molecular genetics like DNA recombination, gene structure, function and regulation as well as cell signaling pathways and cancer
- Molecular cloning and molecular tools for studying genes and gene activity
- DNA structure and function
- The language of genetics and the terminology of molecular biology

Course Contents:

The course contents will include;

Introduction to the study of cell biology, the chemical basis of life, techniques in cell and molecular biology, enzymes and metabolism, mitochondrion and aerobic respiration, the structure and function of the plasma membrane, cytoplasmic membrane systems, interactions between cells and their environment, the nature of the gene and genome, expression of genetic information, cytoskeleton and cell motility, cellular reproduction, cell signaling and cancer. DNA - the Genetic Code, Structure, Replication, and Manipulation of DNA, Transmission Genetics, Basic and Advanced Principles of Heredity, The Chromosomal Basis of Heredity, Gene Linkage and Genetic Mapping, Human Karyotypes and Chromosome Behavior, The Genetics of Bacteria and Viruses, Molecular Mechanisms of Prokaryotic Gene Regulation, Genetic Engineering and Genomics, Mechanisms of Mutation, Cancer, The Basics of Population Genetics

Recommended Readings:

- Hart, D. L. and E. W. Jones. Essential Genetics: A Genomics Perspective. Sudbury, MA: Jones and Bartlett Publishers, Latest Ed.
- Benjamin Pierce. Genetics. W. H. Freeman, Latest Ed. Jeremy W. Dale, Malcolm van Schantz. From Gene to Genome. John Wiley & Sons Ltd, Latest Ed.
- A Miches. Genetic Techniques for Biological Research. John Wiley & Sons Ltd, Latest Ed.
- Leland Hartwell, Leroy Hood, Micheal Goldberg, Ann Reynolds, Lee Silver, Ruth Veres. Genetics: From Genes to Genomes. McGra-Hill Science, Latest Ed.

Journals:

- Biology of the Cell
- Nature Cell Biology
- Cell & Tissue Research
- Journal of Cellular Physiology
- Journal of Cellular Biochemistry
- Journal of Molecular Cell Biology
- Chromosome Research
- Molecular Genetics & Genomics

BMS 702: Applied Biostatistics

(1+1 Credit Hrs)

1 Course Objectives:

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

- Know how to design a study and describe the validity and reliability of a study design
- Know the fundamental concepts and methods of statistics in the areas of medical and biological research
- Have good command on use of statistical computer software for data analysis

Course Contents:

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, 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, Measures for developing health statistical indicators: morbidity and mortality statistics, Use of latest statistical computer software for data analysis.

Recommended Readings:

- Gordis, L. Epidemiology. Pennsylvania: W.B. Saunders Company. Latest Ed.
- Rothman KJ. Modern Epidemiology. Boston: Little, Brown and Company, Latest Ed.
- Kelsey JL, Thompson WD, Evans AS. Methods in Observational Epidemiology. New York: Oxford University Press, Latest Ed.
- Kleinbaum DG, Kupper LL, Morgenstern H. Epidemiologic Research: Principles and Quantitative Methods. Belmont, CA: Lifetime Learning Publications, Latest Ed.
- Larson R and Farber B. Elementary Statistics: Picturing the World. Latest Ed, Prentice Hall Publications. New Jersey USA.
- Oliver, M. and Combard MS. Biostatistics for Health Professions. Latest Ed. Prentice Hall Publications, New Jersey USA.
- Statistical Software: SPSS; EPIINFO; STATA; SAS

Journals:

- Cancer Epidemiology
- Epidemiologic Reviews
- Annals of Epidemiology
- American Journal of Epidemiology
- International Journal of Epidemiology

BMS 703: Communication Skills & Academic writing

(1+1 Credit Hrs)

2 Course Objectives:

Upon completion of course the students will be able to:

- Learn the basics of Clinical and research communication skills
- Learn face to face and interpersonal communication, class room communication skills, meeting with the supervisor, email communication and interview skills,
- Present and communicate research articles/data in conferences and symposia.
- Critically analyse data, design a project and write up research proposals.
- Design experiments in the field of biological sciences.
- Collect information from the available resources, Prepare a presentation on a given topic, Deliver a lecture and manage a question-answer session
- Distinguish different types of research, their audiences and how research material might be effectively presented
- Format documents and presentations to optimize their visual appeal
- Effectively use features of Microsoft Office to create eye-catching professional documents and presentations.
- Effectively use features of Microsoft Word, Power point, and Excel to create professional looking tables, graphs and figures.
- Accept constructive criticism and use reviewers' comments to improve quality and clarity of written reports and presentations
- Work as a productive member of a task force

Course Contents:

The course contents of this subject include: Basic communication skills for doctors and researchers, Interpersonal communication skills, e-communication skills including emails and e-conferencing/teleconferencing, Interview skills and presentation methodologies, Classroom communication skills and teaching methodology,

Methods in research include basic of academic writing, study designing and synopsis writing, research techniques as well as problem analysis, observations, data compilation and questionnaire designing. Academic essay writing, reading skills and critical appraisal of research articles, Writing quality literature reviews and research articles, Completion of research project and thesis writing. Theoretical knowledge of the students will be supplemented by hands on practical training in the formulation of research project designing, and completion of the project successfully. Academic writing will include learning of some bibliographic software like Endnote and data analysis softwares.

Recommended Readings:

- Clinical communication skills by Richard Fielding
- Communication skills Magic EG Sebastian
- Interpersonal communication by Marco Tapia

- Arifullah, Shahnaz, and Bhatti K.M Research process simplified, Peshawar Latest Ed.
- Introduction to Academic Writing by Alice Oshima, Ann Hugue
- Academic Writing, A handbook for International students by Stephen baily
- W.H.O. Training manual on health research methodology Latest Ed.
- Research Methods and Statistics by Sherri L Jackson
- .

Journals:

- Journal of Communication
- Journal of Communication Theory
- European Journal of Communication
- Journal of Developing Effective Communication Skills
- International Journal of Business Communication (Sage Journals)
- Journal of Telematics and Informatics
- Journal of Written Communication
- Methods and Protocols
- Journal of Academic Writing (Coventry University)
- Journal of Academic Writing (Publon)
- Journal of Writing Research
- Journal of English for Academic Purposes
- Journal of Critical Reviews - Innovare Academic Sciences
- BMJ Evidence Based Medicine

BMS 704: Bioethics, Biosafety & one health

(1+1 Credit Hrs)

1 Course Objectives:

- To empower students with the skills, tools, and confidence on sustainable bio-risk management.
- To enable them to apply principles of biosafety and biosecurity in facilities.
- To reduce/eliminate the risk of infection in laboratory setting.
- Comprehend basics of research in light of the modern ethics
- Comprehend basic knowledge of the ethical issues in biomedical research
- Select and design research project and critically analyze and communicate scientific data
- Analyze literature critically and comprehend the foundations of Bioethics theories
- how to deal with patients within the boundaries of biomedical ethics
- how to improve the basic health care services on ethical grounds
- Understand the value of the One Health approach in tackling difficult public health problems
- Understand the etiologic, environmental, and host factors important to infectious disease epidemiology;
- Understand the value of epidemiological principles and methods in the identification and control of infectious disease;
- Develop skills needed to apply epidemiological principles and methods in solving problems related to infectious diseases and including identifying surveillance and control measures given a specific infectious disease outbreak.

Course Contents:

1. BRM introduction, scope & importance
2. Terminology
3. AMP Model – brief introduction
4. Biorisk assessment
    a. Hazards & threat identification & analysis (frequency and magnitude)
    b. Levels of biological risks
    c. Likelihood & consequences evaluation
5. Biorisk mitigation – introduction/ brief account of a-e
    a. Elimination & substitution
    b. Engineering control
    c. Administrative control
    d. Practices & procedures
    e. PPE
6. Performance – introduction
    a. Key elements of performance
    b. Control (monitoring protocols)
    c. Assurance
    d. Improvement
7. **Biosafety** – Introduction, purpose, requirement

   a. Biosafety Levels – brief description of levels 1 – 4
   b. BSL-1
   c. BSL-2
   d. BSL-3
   e. BSL-4
   f. Laboratory Design & Facilities
8. GLWPs - importance
   a. Responsibility for enforcing GLWPs
   b. Barriers to glwps
   c. Lab equipment calibration & validation
9. PPE,**Biosecurity** – introduction, principles, history, objective
   a. Key pillars of biosecurity
      - Physical security
      - Personal management
      - Information security
      - Transport security
      - Material control & accountability
   b. Incident Management:Scope
   c. Incident response system
   d. Incident reporting
10. Waste management: Collection, segregation, transportation, storage & disposal
11. Decontamination
12. Introduction to medical/bioethics
13. Ethical Theories
14. Historic perspective of bioethics in the development of vaccines and medicine and clinical trials, The Four Basic Principles of bioethics and their importance in research,Ethical justification and scientific validity of biomedical research involving human subjects
15. Ethical review committees. Ethical review of externally sponsored research,
16. Obtaining informed consent: Essential information for prospective research subjects, Inducement to participate in research, Benefits and risks of study participation
17. Ethical justification of research involving individuals who are not capable of giving informed consent, Children, mentally retarded, behavioural disorders, Choice of control in clinical trials, and Research involving vulnerable persons, children, women and pregnant women.
18. Safeguarding confidentiality, Bioethical research involving animals and research misconduct.
19. **One Health: Introduction to the One Health Approach** - Tointroduce students to the principles of employing the One Health approach in preventing and controlling infectious diseases. It includes a practical overview of host factors, environmental factors, and microbiological factors that influence this dynamic field of study. Through lectures and exercises, students will be introduced to infectious disease surveillance, diagnostic tools, outbreak investigations, vaccine trials, public health interventions, biodefense, emerging infectious diseases and analytical approaches as they pertain to infectious disease prevention and control.

20. **One Health: Public Health Laboratory Techniques** - Tointroduce students to public health laboratory methods. A special emphasis will be placed upon respiratory virus work, especially influenza.

21. **One Health: An Introduction to Entomology, Zoonotic Diseases, and Food Safety** -Tointroduce students to the epidemiology and control of entomological, zoonotic, and food-borne diseases. Each day there will be 3 hours of lecture and 3 or more hours of field activity. The course is comprised of readings, lectures, field studies, laboratory exercises, and a term paper. Zoonoses endemic to the Southeastern United States are emphasized.

22. **One Health: An Introduction to Environmental Health** - Toexamine sources, routes, media, and health outcomes associated with biological, chemical, and physical agents in the environment. Effects of agents on a disease, water quality, air quality, food safety, and land resources are reviewed, as well as legal frameworks, policies, and practices associated with environmental health and intended to improve public health.

23. Advantages of a closer cooperation between human and animal health
24. Trans-disciplinary processes that can solve an everyday One Health problem
25. Shortfalls resulting from poor communication between human doctors and veterinarians
26. Social-ecological perspectives for the improvement of human and animal well-being
27. Fundamental principles of cross-sector human and animal health economics
28. Environmental policy and law that supports food safety
29. Prevention of diseases from livestock to human via food
30. Matrix calculations to describe growth rates of populations
31. Principles of disease transmission dynamics between humans and animals
32. Collection of vaccination coverage data
33. Interpretation of vaccination coverage data

Recommended Readings:

- Good Medical Practice (2013); General Medical Council
- CIOM Guidelines available online
- Beauchamp T, Childress J; Principles of Biomedical Ethics, 7th Edition. Oxford University Press.
- Antoniou SA, Antoniou GA, Granderath FA, et al; Reflections of the Hippocratic Oath in modern medicine. World J Surg. 2010 Dec;34(12):3075-9. doi: 10.1007/s00268-010-0604-3.
- Good Medical Practice - Explanatory Guidance; General Medical Council
- Managing a child or young person with suspected maltreatment; NICE CKS, March 2014 (UK access only)
- Confidentiality and information sharing; National Treatment Agency for substance misuse, 2003
- David L. Heymann, MD, ed., Control of Communicable Diseases Manual (CCDM), 20th edition, 2015, ISBN 978-0-87553-018-5
- Stadtländer CT. One Health: people, animals, and the environment. Infect Ecol Epidemiol. 2015;5:30514. Published 2015 Dec 31. doi:10.3402/iee.v5.30514
- Cork SC,Hall D, Karen L.One Health Case Studies: Addressing Complex Problems in a Changing World. Published 2016/11/15.ISBN: 9781910455555

Journals:

- Applied biosafety
- Journal of Biosafety
- International Journal of Biosafety and Biosecurity
- Bioethics
- Cambridge Quarterly of Healthcare Ethics
- Hastings Center Report
- Journal of Clinical Ethics
- Journal of Medical Ethics
- Journal of Medicine and Philosophy
- Kennedy Institute of Ethics Journal

BMS 705: Health Professions Education

(3+0 Credit Hrs)

This course aims at introducing the basic and applied concepts of medical education to the Pakistani health sciences teachers and improving their skills to perform the basic functions of a teacher in health sciences institutes. HPE course is a teacher friendly program that helps teachers in health sciences to develop their basic teaching skills. All teachers must acquire basic teaching skills if they wish to adopt a teaching career in health sciences.

1 Competencies

The student as a ***"Subject expert", "Communicator"*** and ***"Research Scholar"***. These competencies are then further expanded upon by objectives designed to cover the development of knowledge, skills and behaviour of the students by the time they graduate.

Objectives

By the end of the course, the graduate of MPhil Anatomy must have acquired a reasonable working knowledge of:

Cognitive domain:

1. Of the Dynamics of teaching and learning
2. Planning effective teaching sessions in Physiotherapy
3. Principles and theories of learning to develop educational programs and curricula.
4. Educational psychology for better transfer of knowledge skills and attitudes to students.
5. How to develop skills like critical thinking and problem solving among students and teachers.
6. Teaching and learning strategies to improve the quality of teaching and learning in an educational environment.
7. Guiding students in developing their learning strategies, keeping them motivated and eventually becoming self-directed learners;
8. Challenges and barriers in planning and implementing teaching and learning strategies in diverse and locally unique teaching and learning environment in both clinical and non-clinical setups.
9. E-learning and information technologies to develop and manage computerized teaching and learning solutions.

Affective Domain:

1. Manage time and courses to submit assignments on time

Apply principles of professional conduct in paper submission (plagiarism)

Demonstrate professional behavior by completing all course requirements, including course evaluations, in a timely manner.

Demonstrate responsibility and accountability by attending and being punctual at all required course activities such as laboratory sessions, workshops and exams.

Demonstrate professional behavior by requesting any excused absence from required course activities well ahead of the scheduled date.

Demonstrate professional behavior by responding to direct communication from the course faculty in a timely fashion, particularly in circumstances when a face-to face meeting is requested to discuss issues related to academic performance.

Demonstrate professional and ethical behavior by honestly completing course examinations without attempting to seek an advantage by unfair means; and by reporting any unethical behavior of peers to the course administration.

Research:

1. Critically analyse research articles and develop a literature review.
2. Discuss the research based recent advances in the relevant field.
3. Learn to interpret the findings in the medical literature for future research
4. Improve critical appraisal skills and conduct it effectively
5. Earn skills related to oral and written presentations
6. Comprehend the limitations of the application of evidence
7. Develop an understanding for the principles of a research proposal

Content:

Following are the topics to be included:

	Topic

1.	• Introduction to the course
	• Learning theories& their application
	  ○ Behaviorist
	  ○ Cognitivist
	  ○ Constructivist (including Principles of Adult Learning)
	  ○ Humanist
	• Emotional intelligence

2.	• Learning Approaches /styles
	  ○ VARK model
	  ○ Peer assisted learning (PAL)
	  ○ E-Learning

3.	• Developing resource material • Moodle • Reflective writing
4.	• Bloom's Taxonomy • Competencies and learning objectives • Table of specification (TOS)
5.	• Developing a Lesson plan (Gagne events of instruction) • Learning Situations ○ (Large Group Discussion & Small Group Discussion) • Problem based learning (PBL)

6.	• Learning Situations
	  ○ Tutorials
	  ○ Learning in large groups (Lectures)

	○ Developing a power point presentation (Gagne's principles)
7.	• Principles of Assessment • Tools of assessment
8.	• Designing an Assessment Blueprint • Written Assessments • MCQs, EMQs, SAQ construction
9.	• Teaching psychomotor skill • OSPE, OSCE structure,
10.	• Teaching attitudes and behaviors DOPS. MSF • Mentoring Assessment of behaviors
11.	• Curriculum planning and development • A six step approach The SPICES model • Integrated Curriculum
12.	• Use of study guides to improve student learning • Effective feedback (Microteaching/ OSTE) • Feedback models
13.	• Quality of Assessment: Item analysis • Standard setting • Validity & reliability

Assessment criteria for HPE course:

This course will be evaluated using reflective portfolios and written exams.

Recommended Reading

1. Developing a Pedagogy of Teacher education: Understanding teaching and learning about teaching, John Loughran – 2013m
2. Handbook of Technological pedagogical content knowledge (TPCK) for educators- 2008
3. Language, Culture and community in Teacher education, Maria Estela Brisk – 2013.
4. Studying Teacher Education The Report of the AERA Panel on Research and Teacher Education, Marilyn Cochran-Smith, Kenneth M. Zeichner – 2010
5. Reframing Sociocultural Research on Literacy Identity, Agency, and Power,Cynthia Lewis, Patricia Enciso, Elizabeth B. Moje - 2007
6. Education of the masses: A Quest for Pedagogy
7. Pedagogy and Learning with ICT, Bridget Somekh - 2007
8. Changing Mins: Pedagogy of Hope
9. Treatise on Pedagogy, Edwin Crawford Hewett - 2011
10. Choral Pedagogy, Brenda Smith, Robert Thayer Sataloff - 2013

Journals:

a. Journal of medical education
b. The international journal of medical education

BMS 706: Health Research

(3+0 Credit Hrs)

This course is designed to enable students to develop critical evaluation skills in a practice rather than academic context. This module provides students with an introduction to quantitative and qualitative research methods and to the types of skills necessary for the planning, data gathering and dissemination stages of health-related research. The development of research capacity is also expected to equip the health professionals with knowledge and skills to practice evidence based medicine and evidence based decision-making in health care policy-making and management and public health interventions implementation.

The program will stress upon hands-on training to develop knowledge and skills for research problems identification and prioritization, preparation of research project proposals and protocols, searching for literature, preparation of research plans and budgets, research reports and publications writing and reviewing of research proposals and publications. The program constantly challenges the students to enhance their learning and skills by giving the regular assignments and encouraging guide self-learning. The assignments are specifically aimed at developing writing skills and critical appraisal of published literature. Students are encouraged to learn to systematically develop research questions, identify and apply most appropriate research design ,review research literature, critically evaluate evidence, and apply a range of research approaches relevant to health services and clinical problems.

2 Competencies

The student as a ***"Subject expert", "Communicator"*** and ***"Research Scholar"***. These competencies are then further expanded upon by objectives designed to cover the development of knowledge, skills and behaviour of the students by the time they graduate.

By the end of the course, the graduate of MPhil Anatomy must have acquired a reasonable working knowledge of:

Cognitive domain:

1. Basic understanding of the underlying principles of quantitative and qualitative research, the links between the two and identify the advantages and disadvantages associated with these designs
2. An appropriate mixed-method research study to answer a health-related research question.
3. The key data generation methods of current use in public health and health-related research
4. Most appropriate research method to address a particular research question
5. A range of quantitative and qualitative approaches to analysis
6. Skills to undertake the design of a health-related research proposal
7. A research proposal suitable for submission to a research funding body.
8. Developing and practicing a range of information and research skills to enable them to initiate and carry out research leading to improvements in their own professional practice and in the quality of patient care.
9. Information and information technology for health research.

Affective Domain:

2. Manage time and courses to submit assignments on time

Apply principles of professional conduct in paper submission (plagiarism)
Demonstrate professional behavior by completing all course requirements, including course evaluations, in a timely manner.
Demonstrate responsibility and accountability by attending and being punctual at all required course activities such as laboratory sessions, workshops and exams.
Demonstrate professional behavior by requesting any excused absence from required course activities well ahead of the scheduled date.
Demonstrate professional behavior by responding to direct communication from the course faculty in a timely fashion, particularly in circumstances when a face-to face meeting is requested to discuss issues related to academic performance.
Demonstrate professional and ethical behavior by honestly completing course examinations without attempting to seek an advantage by unfair means; and by reporting any unethical behavior of peers to the course administration.

Research:

1. Critically analyse research articles and develop a literature review.
2. Discuss the research based recent advances in the relevant field.
3. Learn to interpret the findings in the medical literature for future research
4. Improve critical appraisal skills and conduct it effectively
5. Earn skills related to oral and written presentations
6. Comprehend the limitations of the application of evidence
7. Develop an understanding for the principles of a research proposal

Content

Topics covered include:

1.	▫ Introduction to the course ▫ Brief Introduction to Research, Its significance etc.
2.	▫ Developing a Research Question ▫ Analysis, Problem Statement & Problem ▫ Exercise Selection of Research Topic
3.	▫ Introduction to Literature Search ▫ Systematic review & Meta-analysis
4.	▫ Reference writing ▫ End Note/Mendeley
5.	▫ Study Designs ▫ Sampling techniques
6.	▫ Step by Step Development of Research Proposal: ▫ Introduction, Objectives, Operational Definitions, Hypothesis
7.	▫ Data Types ▫ Measure of location and spread

	▫ Parametric non-parametric tests ▫ Correlations & Regression analysis
8.	▫ How to write a literature Review. ▫ Synopsis
9.	▫ Step by Step Development of Methodology & Analysis Plan
10.	▫ Data Collection Tool ▫ Types of Questionnaire ▫ Blood sampling ▫ Tissue sampling
11.	▫ Sample size calculation & ▫ Piloting ▫ Ethics approval procedure
12.	▫ Types of variables ▫ Types of data ▫ Distributions and analyses
13.	▫ Review of SPSS ▫ Data entry
14.	▫ Presenting a research proposal ▫ Template & requirements for GSC etc.
15.	▫ GSC presentation
16.	▫ GSC presentation

Assessment criteria for HR course:

This course will be evaluated using assignments and synopsis presentation:

1) Literature Review with Hypothesis.

2) Methodology & Analysis Plan.

3) Reflective Portfolio.

Final Assessment: GSC presentation of the research proposal.

BMS 798 Seminars, Symposia, Conferences

Non Credit

This course is to enable students to develop critical evaluation skills in a practice rather than academic context. It introduces the students to attend research work presented by imminent scientists of their fields so as to develop a critical mind and also to learn how to present their work at such meetings.

This course shall be included as part of each semester.

Assessment
A minimum of 75% attendance is mandatory and the course shall be assessed as Pass/Fail. In case of insufficient attendance, the student shall not be allowed to sit in the end of semester exams.

Section 3:

Specialty courses

MPhil Oral Biology Courses

First Semester (Spring, 12 Credits)

COMPULSORY COURSES (8 credit hours)

1. BMS 701 Molecular cell biology	1+0 Credit Hrs
2. BMS 702 Applied Biostatistics	2+0 Credit Hrs
3. BMS 703 Communication skills and Academic writing	2+0 Credit Hrs
4. BMS 766 Biosafety, Bioethics & One Health	2+0 Credit Hrs
5. BMS 796 Understanding Quran 1	1+0 Credit Hrs
6. BMS 798 Seminars, symposia, conferences	Non credit
No. of credit hours for compulsory courses	8 Credit hrs

SPECIALITY COURSES

1. ORB 701: Introduction to Oral Biology	1+1 Credit Hrs
2. ORB 702: Oral and Craniofacial Development	1+1 Credit Hrs
No. of credit hours for Subject courses	4 Credit Hrs

Total no. Of credit hours for Spring semester	12 credit hours

Second Semester (Fall, 12 Credits)

SPECIALITY COURSES

1. ORB703: Head, Neck, and Oral anatomy	1+1 Credit Hrs
2. ORB705: Oral Histology and Pathology	2+1 Credit Hrs
3. ORB707: Oral Physiology and Saliva	2+1 Credit Hrs
4. BMS 796: Understanding Quran 1	1+0 Credit Hrs
5. BMS 798 Seminars, symposia, conferences	Non credit
No. Credit hours for Specialty courses	8 credit hours

OPTIONAL COURSES (Any two: 2 credit hrs)

1. BMS 754: Biomaterials	1+1 Credit Hrs
2. BMS 755: Tissue Engineering	1+1 Credit Hrs
No. of credit hours for optional courses	4 Credit Hrs

Total no. of credit hours for Fall semester	12 credit Hrs

Third and 4th Semester (12 Credit Hrs for thesis each)

BMS 799 Thesis	12 Credit Hrs

ORB 701: Introduction to Oral Biology

(1+1 Credit Hrs)

1. Competencies:

The M.Phil. Oral Biology curriculum is designed to develop students' core competencies as a Subject Expert, a Communicator, and a Research Scholar within the specialized domain of oral and craniofacial sciences.

Subject Expert: Upon completion, students will have a deep, evidence-based understanding of the embryological development of the oral cavity and associated structures. They will be able to apply this knowledge to analyze and interpret the cellular and molecular mechanisms underlying both normal development and congenital anomalies.

Communicator: Students will be proficient in communicating complex scientific concepts related to oral biology, both in written and oral forms, to a diverse range of audiences, including peers, educators, and the broader scientific community. This includes the ability to present research findings clearly and concisely.

Research Scholar: The program will equip students with the skills necessary to critically evaluate scientific literature, formulate research questions, and design and execute original research projects in the field of oral biology. They will be prepared to contribute meaningfully to scientific knowledge and innovation.

• Course Objectives:

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

- Comprehend basic knowledge of oral biology, like biological basis of oral phenomena, whether normal or pathological, cell injuries, death, and various adaptations
- Identify and describe the ultrastructural features of oral tissues.
- Explain how the histological structure of oral tissues relates to their function and maintaining oral health
- Apply the knowledge of current research and ultrastructure of the oral mucosa, epithelial cell renewal and keratinization process, soft tissue wound healing , oral mineralized tissues, microanatomy and ultrastructure of alveolar bone, microanatomy, ultrastructure and innervation of salivary glands to clinical scenarios and case studies.

- **Course Contents:**

Week	Topic	Subtopics
1	Overview of Oral Biology	• Definition and scope of oral biology, • Importance in dentistry and medicine, • Relationship with other basic sciences (anatomy, histology, physiology, pathology)
2	Oral Tissues – General Histology	• Classification of oral tissues: epithelial, connective, muscle, and nervous tissue, • Specialized oral mucosa, lining mucosa, and masticatory mucosa, • Basic concepts of cell biology and tissue organization as applied to oral structures
3	Tooth Development (Odontogenesis)	3. Initiation, bud, cap, bell stages, 4. Formation of enamel organ, dental papilla, and dental follicle, 5. Differentiation of ameloblasts, odontoblasts, and cementoblasts, 6. Root formation and Hertwig's epithelial root sheath, 7. Eruption and shedding of teeth

4	Enamel	• Composition and physical properties (hydroxyapatite, prisms/rods), • Amelogenesis: presecretory, secretory, maturation stages • Structure: enamel rods, interrod substance, DEJ (dentino-enamel junction), • Clinical significance: enamel hypoplasia, caries, fluorosis
5	Dentin	• Composition and structure, • Types of dentin: primary, secondary, tertiary, • Dentinogenesis: role of odontoblasts, • Dentin-pulp complex, • Clinical significance: sensitivity, caries progression
6	Dental Pulp	• Composition: cells, extracellular matrix, blood vessels, and nerves, • Functions: nutritive, sensory, defensive, • Age-related changes

7	Cementum	• Types of cementum: acellular, cellular, • Cementogenesis, • Role in tooth support and attachment, • Differences between cementum and bone, • Clinical relevance: cementum resorption and repair
8	Periodontium	• Components: gingiva, periodontal ligament (PDL), cementum, alveolar bone • PDL structure and function, • Gingival fibers and junctional epithelium, • Alveolar bone remodeling, • Periodontal disease
9	Midterm Exam	Written + Practical (spotting/model ID)
10	Oral Mucosa	• Types of oral mucosa: masticatory, lining, and specialized, • Keratinized vs. non-keratinized epithelium, • Tongue structure and papillae, • Clinical relevance: lesions, trauma, infections

11 & 12	Salivary Glands	• Major and minor salivary glands: parotid, submandibular, sublingual • Histology of acini and ducts • Composition and functions of saliva, • Regulation of salivary secretion, • Saliva in diagnostics and oral health
13	Temporomandibular Joint	• Structure and Function
14	Alveolar Bone	• Structure • Function • Clinical Applications
15	Gingiva	• Structure • Function • Gingival health and disease
16	Wound healing	• Principles • Phases of wound healing • Difference between oral and cutaneous wound healing

Table of Specifications:

Learning objectives	Course contentime	Time	MIT	Assessment
• **Identify** the stages of tooth development: initiation, bud, cap, bell, and apposition/maturation. • **Define** key terms related to odontogenesis (e.g., dental lamina, enamel organ, dental papilla, Hertwig's epithelial root sheath). • **Name** the primary tissues and cell types involved in the formation of enamel, dentin, pulp, and cementum • **Describe** the sequence and timing of events during each stage of tooth development. • **Explain** the origin and role of ectodermal and mesenchymal tissues in tooth formation. • **Discuss** the significance of reciprocal induction between ectodermal and mesenchymal components. • **Relate** developmental stages to the	**Introduction to Odontogenesis** • Definition and importance in oral biology • Timeline of tooth development (prenatal and postnatal events) • Overview of involved germ layers: ectoderm, ectomesenchyme (neural crest origin) **Stages of Tooth Development** • Each stage is typically associated with distinct histological and morphological changes. **a. Initiation Stage** **b. Bud Stage** **c. Cap Stage** **d. Bell Stage** **e. Apposition and Maturation** **Root Development** • Function of Hertwig's epithelial root sheath (HERS) • Root dentin and cementum formation	2hrs	SGD +Interactive Lectures + PBL	MCQS

histological appearance of the tooth germ at various stages. • **Interpret** how abnormalities in developmental stages	• Formation of the apical foramen and periodontal ligament (PDL) **Eruption and Exfoliation** • Mechanisms of tooth eruption • Phases: pre-eruptive, eruptive, post-eruptive • Shedding of primary teeth (resorption of roots) **Molecular and Genetic Regulation** • Key signaling molecules: BMP, FGF, Wnt, SHH • Role of homeobox genes (e.g., MSX1, PAX9) in tooth patterning • Genetic mutations linked to dental anomalies **Clinical Correlations** Developmental disorders: • Anodontia / Hypodontia / Supernumerary teeth • Amelogenesis imperfecta, Dentinogenesis imperfect • Enamel hypoplasia			

	• Importance of early detection in pediatric dentistry			
• **List** the components of enamel • **Identify** key structural features of enamel such as enamel rods, interrod substance, and the dentinoenamel junction (DEJ). • **Explain** the stages of amelogenesis, including the role of ameloblasts in each stage (presecretory, secretory, transition, and maturation). • **Describe** the organization of enamel prisms and how they contribute to mechanical strength. • **Discuss** the incremental lines of enamel • **Interpret** histological images of enamel and identify its key microscopic structures. • **Relate** structural features of enamel to its function and susceptibility to wear, caries, and acid attack. • **Analyze** how defects in enamel formation (e.g., amelogenesis imperfecta) can impact tooth appearance and function.	**Introduction to Enamel** • Definition of enamel • Significance as the hardest tissue in the human body • Functional role in mastication and protection of underlying dentin/pulp **Chemical Composition of Enamel** • Inorganic content • Organic content) • Water (~3%) • Comparison to other dental tissues (dentin, bone, cementum) **Physical Properties of Enamel** • Hardness and brittleness • Color and translucency	2hrs	SGD +Interactive Lectures + PBL	MCQS

• **Evaluate** the potential for enamel regeneration or biomimetic enamel substitutes in restorative dentistry. • **Compare** enamel with other hard tissues (e.g., dentin, cementum) in terms of development, structure, and repair capacity	• Thickness variation (incisal edge vs cervical area) **Structure of Enamel** • Enamel rods (prisms) • Enamel sheath • Dentinoenamel junction (DEJ) • Incremental lines **Amelogenesis (Enamel Formation)** • Origin of ameloblasts from inner enamel epithelium • Stages of amelogenesis **Enamel Surface and Post-Eruptive Changes** • Surface enamel: aprismatic enamel • Effects of fluoride incorporation • Demineralization and remineralization processes • Enamel wear and aging **Developmental and Structural Anomalies** • Amelogenesis imperfecta • Enamel hypoplasia			

	• Fluorosis • Molar-incisor hypomineralization (MIH) **Clinical Correlations** • Enamel's role in caries resistance • Limitations of enamel repair (non-vital tissue, no regeneration) • Importance in restorative dentistry (bonding, etching, etc.) • Implications for preventive care (sealants, fluoride therapy			
• **Define** dentin and identify its role in tooth structure and function. • **List** the types of dentin (primary, secondary, tertiary). • **Describe** the composition of dentin (inorganic, organic, and water content • **Explain** the process of dentinogenesis and the role of odontoblasts. • **Describe** the structure of dentinal tubules and their orientation. • **Differentiate** between the types of dentin based on time of	**Introduction to Dentin** • Definition and location in the tooth • Functional significance: support for enamel, protection of the pulp • Comparison with other dental tissues (enamel, cementum, pulp) **Chemical Composition of Dentin**	2hrs	SGD +Interactive Lectures + PBL	MCQS

formation and stimuli (e.g., secondary vs. reparative dentin). • **Interpret** histological images of dentin and identify structural features (e.g., tubules, peritubular dentin, intertubular dentin). • **Relate** the permeability of dentin to clinical concerns such as sensitivity, caries progression, and restorative material selection. • **Analyze** the impact of aging and external stimuli (e.g., trauma, caries) on dentin structure and function.	• Inorganic component • Organic component • Water content (~10%) • Differences from enamel and bone in structure and composition **Physical Properties** • Hardness and elasticity • Permeability and sensitivity • Aging changes and dentin sclerosis **Types of Dentin** • Primary dentin • Secondary dentin • Tertiary (Reparative/Reactive) dentin **Structure of Dentin** • Dentinal tubules: • Peritubular dentin: • Intertubular dentin: • Predentin: • Incremental lines:			

	Dentinogenesis • Role of odontoblasts • Secretion of organic matrix and mineralization process • Differences in formation of primary vs. secondary dentin • Inductive interaction with ameloblasts during development **Innervation and Sensitivity** • Innervation of dentinal tubules • Theories of dentin sensitivity: **Clinical Correlations** • Dentin hypersensitivity: causes and management • Caries progression through dentin • Importance of dentin in restorative dentistry • Aging and dentin sclerosis			

• **List** the types of cementum (acellular and cellular). • **Identify** the composition of cementum . • **Describe** the structural differences between acellular and cellular cementum. • **Discuss** the relationship between cementum and the periodontal ligament (PDL), alveolar bone, and dentin. • **Distinguish** cementum from other hard tissues (enamel, dentin, bone) based on composition, function, and regenerative potential • **Evaluate** the role of cementum in periodontal health and disease (e.g., cemental resorption, hypercementosis). • **Discuss** the potential for cementum regeneration in periodontal therapies and tissue engineering.	**Introduction to Cementum** • Definition and basic function • Location: covers the anatomic root of the tooth • Role in the periodontium • Comparison with other dental hard tissues (enamel, dentin, bone) **Chemical Composition** • Inorganic content • Organic matrix • Water content Types of Cementum Cementogenesis Histological Features of cementum Functions of Cementum Clinical Correlations	2hrs	SGD +Interactive Lectures + PBL	MCQS

• **Define** dental pulp and describe its location within the tooth. • **List** the main components of the pulp (cells, fibers, ground substance, blood vessels, nerves). • **Identify** the different zones of the pulp (odontoblastic zone, cell-free zone, cell-rich zone, and central pulp). • **Describe** the functions of dental pulp: formative, nutritive, sensory, and defensive. • **Explain** the origin and development of dental pulp during tooth formation (from the dental papilla). • **Differentiate** between coronal pulp and radicular pulp in terms of structure and **Interpret** histological images of pulp tissue, identifying key structures and cell	**Introduction to Dental Pulp** • Definition and overview of dental pulp • Anatomical location: coronal pulp and radicular pulp • Relationship to dentin (dentin-pulp complex) **Embryologic Origin and Development** • Derivation from the dental papilla • Coordination of pulp and dentin development • Interaction with odontoblasts during tooth formation **Anatomy and Zones of the Pulp** • Pulp chamber, pulp horns, root canals, and apical foramen • Histological zones of the pulp **Components of Dental Pulp** • Cells: • Extracellular matrix	2hrs	SGD +Interactive Lectures + PBL	MCQS

types (e.g., odontoblasts, fibroblasts, immune cells). • **Relate** pulp structure to its role in dentin formation (dentin-pulp complex). • **Analyze** the pulp's response to caries, trauma, and restorative procedures (e.g., inflammation, reparative dentin formation). • **Evaluate** the clinical implications of pulp inflammation and necrosis in endodontic diagnosis and treatment. • **Discuss** emerging approaches in pulp regeneration, such as stem cell-based therapies and tissue engineering.	• Vascular supply • Nerve supply **Functions of Dental Pulp** **Age-Related Changes in the Pulp** **Clinical Correlations** • **Pulpitis**: reversible vs. irreversible • **Pulp necrosis** and its signs • **Endodontic considerations**: root canal therapy, apexogenesis/apexification • **Pulp testing and diagnosis** (vitality tests) • **Role in restorative dentistry**: importance of pulp protection			
• **Define** the periodontal ligament and describe its	**Introduction to the Periodontal Ligament**	2hrs	SGD +Interactive	MCQS

anatomical location between cementum and alveolar bone. • **List** the major components of the PDL (cells, fibers, ground substance, blood vessels, nerves). • **Identify** the principal fiber groups of the PDL (e.g., alveolar crest, horizontal, oblique, apical, interradicular fibers). • **Explain** the developmental origin of the PDL (from the dental follicle). • **Describe** the functions of the PDL: supportive, sensory, nutritive, formative, and remodeling. • **Differentiate** between the types of cells found in the PDL (fibroblasts, cementoblasts, osteoblasts, epithelial cell rests of Malassez, immune cells) • **Interpret** histological images	• Definition and location of the PDL • Relationship between cementum and alveolar bone • Importance in tooth support and attachment **Composition of the PDL** • Cells: • Fibers: • Ground substance: • Vascular supply and innervation **Functions of the PDL** **Development and Origin** • Derivation from the dental follicle • Timeline of PDL formation during tooth development **Structural Organization** **Clinical Correlations** • PDL response to mechanical forces • Changes in PDL during periodontal disease • Role of PDL in tooth mobility and abscess formation		Lectures + PBL	

of the PDL and identify major structures and fiber arrangements. • **Relate** the PDL's role in orthodontic tooth movement and trauma absorption. • **Analyze** the changes that occur in the PDL due to aging, occlusal trauma, or periodontal disease.	• Healing and regeneration of the PDL after injury or periodontal therapy **Age-Related Changes** • Reduction in cellularity and vascularity • Fibrosis and decreased regenerative capacity • Changes in fiber composition and arrangement			
• **Define** oral mucosa and describe its general functions in the oral cavity. • **Identify** the different types of oral mucosa: lining mucosa, masticatory mucosa, and specialized mucosa. • **List** the layers of the oral mucosa (epithelium, basement membrane, lamina propria). • **Explain** the histological features	**1. Introduction to Oral Mucosa** • Definition and general functions • Importance in oral health and protection **Types of Oral Mucosa** • Lining mucosa: • Masticatory mucosa: • Specialized mucosa: • Histological Structure of Oral Mucosa **Functions of the Oral Mucosa**		SGD +Interactive Lectures + PBL	MCQS

of each type of oral mucosa, including variations in epithelial thickness and keratinization. • **Describe** the functions of the oral mucosa related to protection, sensation, secretion, and repair. • **Discuss** the vascular supply and innervation of the oral mucosa. • **Differentiate** between keratinized and non-keratinized epithelium based on location and function	**Vascular Supply and Innervation** • Blood supply to oral mucosa • Types of nerve endings (free nerve endings, specialized receptors) • Importance of rich vascularization in healing **Clinical Correlations** • Common disorders affecting oral mucosa (e.g., aphthous ulcers, leukoplakia, oral candidiasis) • Effects of trauma and irritation on different mucosal types • Implications for local anesthesia and surgical procedures • Healing characteristics of oral mucosa compared to skin			
• **Define** salivary glands and describe their general function in the oral cavity. • **Identify** the major salivary glands (parotid, submandibular, sublingual) and their anatomical locations.	**Introduction to Salivary Glands** • Definition and role in oral health • Types of salivary glands: major and minor glands	2hrs	SGD +Interactive Lectures + PBL	MCQS

• **List** the types of saliva (serous, mucous, mixed) produced by different glands.
• **Describe** the microscopic structure of salivary glands.
• **Explain** the functions of saliva.
• **Discuss** the regulation of salivary secretion (neural control and stimuli).
	• Overview of saliva composition and functions
	
	Classification of Salivary Glands
	
	• **Major salivary glands:**
	  ○ Parotid gland: location, size, and secretion type (serous)
	  ○ Submandibular gland: location and mixed secretion (mostly serous)
	  ○ Sublingual gland: location and secretion type (mostly mucous)
	• **Minor salivary glands:**
	  ○ Locations (labial, buccal, palatine, lingual glands)
	  ○ Functions and secretion types
	
	Microanatomy of Salivary Glands
	
	• **Secretory units (acini):**
	  ○ Serous acini
	  ○ Mucous acini			

	○ Seromucous (mixed) acini • **Duct system:** ○ Intercalated ducts ○ Striated ducts ○ Excretory ducts • Histological features and staining characteristics Regulation of Salivary Secretion • Neural control: parasympathetic and sympathetic innervation • Reflex pathways and stimuli affecting secretion • Circadian rhythms and influence of systemic conditions **Clinical Correlations** • Disorders of salivary glands: ○ Xerostomia (dry mouth) causes and consequences ○ Sialolithiasis (salivary stones)			

	○ Infections: viral (mumps), bacterial ○ Tumors: benign and malignant lesions • Diagnostic techniques (sialography, biopsy) • Therapeutic approaches and management			
• **Define** the temporomandibular joint and describe its anatomical location. • **Identify** the main components of the TMJ: mandibular condyle, articular disc, articular eminence, glenoid fossa, joint capsule, ligaments, and muscles involved. • **Describe** the structure and function of the TMJ, including the role of the articular disc in joint movement. • **Explain** the types of movements permitted by the	**Introduction to the TMJ** • Definition and general overview • Importance of TMJ in oral function **Anatomy of the TMJ** • Bones involved: mandibular condyle and temporal bone (glenoid fossa and articular eminence) • Articular disc: structure, composition, and function • Joint capsule and synovial membrane • Ligaments supporting the TMJ:	2hrs	SGD +Interactive Lectures + PBL	MCQS

TMJ (hinge and gliding movements). • **Discuss** the blood supply and innervation of the TMJ. • **Interpret** clinical signs and symptoms of common TMJ disorders (e.g., clicking, pain, limited movement). • **Relate** the anatomy of the TMJ to its function in mastication and speech. • **Analyze** factors contributing to TMJ dysfunction and their impact on oral health	• Muscles of mastication associated with TMJ function **Physiology and Movement** • Types of TMJ movements: • Coordination of movements during chewing and speech • Role of articular disc in smooth joint function **Blood Supply and Innervation** • Arterial supply to TMJ • Nerve supply (auriculotemporal nerve and others) • Sensory and proprioceptive functions **TMJ Disorders and Clinical Correlations** • Common TMJ disorders: ○ Internal derangement (disc displacement) ○ Arthritis (osteoarthritis, rheumatoid arthritis) ○ Myofascial pain dysfunction syndrome **Developmental and Age-Related Changes** • TMJ development and growth			

	• Changes in TMJ structure and function with age			
• **Define** alveolar bone and describe its anatomical location and relationship to teeth. • **Identify** the different types of alveolar bone: alveolar bone proper (bundle bone), cortical bone, and trabecular bone. • **List** the cells involved in alveolar bone formation and resorption (osteoblasts, osteocytes, osteoclasts). • **Comprehension** • **Explain** the structure and composition of alveolar bone, including mineral content and matrix components. • **Describe** the process of bone remodeling and its significance in	**Introduction to Alveolar Bone** • Definition of alveolar bone • Role in the **periodontium**: supports and anchors teeth • Relationship with cementum and periodontal ligament (PDL) **Anatomy of Alveolar Bone** • Alveolar bone proper (bundle bone) • Supporting bone: • Alveolar process vs. basal bone **Composition of Alveolar Bone** • Inorganic matrix • Organic matrix • Cellular components: **Development and Remodeling** • Embryologic origin of alveolar bone • Bone formation (intramembranous ossification) • Continuous remodeling: coupling of bone	2hrs	SGD +Interactive Lectures + PBL	MCQS

maintaining alveolar bone health. • **Discuss** the functional role of alveolar bone in tooth support and adaptation to mechanical forces	formation and resorption • Response to mechanical forces and functional demands **Radiographic and Histological Features** • Appearance of lamina dura, crestal bone, and trabeculae on radiographs • Histological identification of osteons, Haversian systems, and bone-lining cells **Clinical Correlations** • Alveolar bone loss: • Orthodontic movement: • Bone grafting and regenerative procedures			
• **Define** gingiva and describe its anatomical position in the oral cavity. • **Identify** the different types and regions of gingiva: free (marginal), attached, and interdental gingiva.	**Introduction to Gingiva** • Definition and importance • Role as a component of the periodontium • Functions **Types and Regions of Gingiva**	2hrs	SGD +Interactive Lectures + PBL	MCQS

• **List** the layers and components of gingival tissue (epithelium, connective tissue, fibers, vasculature). • **Describe** the histological features of keratinized and non-keratinized gingival epithelium. • **Explain** the functions of gingiva in protecting underlying periodontal structures. • **Differentiate** between sulcular epithelium, junctional epithelium, and oral epithelium.	• Free (marginal) gingiva • Attached gingiva • Interdental gingiva (papilla) • Mucogingival junction **Histological Structure** • Epithelium layers • Connective tissue (lamina propria): • Functional Characteristics **Vascular Supply and Innervation** **Clinical Correlations** • Gingival health vs. disease • Gingival recession • Gingival enlargement (hyperplasia)			

Recommended Readings:

- Introduction to Oral Biology and Tooth Morphology, Scott & Symons
- Orban‟ s Oral Histology and Embryology, S, N.Bhaskar
- Oral Histology (Development, Structure and Function)
- Oral Development and Histology, James K.Avery)
- Ten Cate's Oral Histology: Development, Structure, and Function, Book by Antonio Nanci

Journals:

- Journal of Oral Diseases

- Archives of Oral Biology
- Journal of Dentistry
- Journal of Dental Research
- International Journal of Oral Science
- BMC Oral Health

ORB 702: Oral and Craniofacial Development

(1+1 Credit Hrs)

1. Competencies:

The M.Phil. Oral Biology curriculum is designed to develop students' core competencies as a Subject Expert, a Communicator, and a Research Scholar within the specialized domain of oral and craniofacial sciences.

Subject Expert: Upon completion, students will have a deep, evidence-based understanding of the embryological development of the oral cavity and associated structures. They will be able to apply this knowledge to analyze and interpret the cellular and molecular mechanisms underlying both normal development and congenital anomalies.

Communicator: Students will be proficient in communicating complex scientific concepts related to oral biology, both in written and oral forms, to a diverse range of audiences, including peers, educators, and the broader scientific community. This includes the ability to present research findings clearly and concisely.

Research Scholar: The program will equip students with the skills necessary to critically evaluate scientific literature, formulate research questions, and design and execute original research projects in the field of oral biology. They will be prepared to contribute meaningfully to scientific knowledge and innovation.

2. Objectives:

By the end of this course, students will have acquired a working knowledge of the embryological development of the oral and craniofacial systems. This include:

2.1. Cognitive Domain:

Fundamental Processes: Explain the basic embryological processes, including gastrulation, folding, and the role of neural crest cells, as they relate to the development of the face, jaws, palate, and teeth.

Critical Developmental Events: Analyze the series of critical events that create the morphologically and functionally intact craniofacial complex.

Genetic and Molecular Basis: Describe the genetic, molecular, and cellular mechanisms that regulate key developmental events in oral embryology.

Clinical Relevance: Detail specific congenital anomalies, such as cleft lip and palate, and the molecular and genetic concepts believed to be responsible for these conditions.

Problem-Solving: Apply knowledge of oral embryology to solve clinical problems and identify the morphologic features and pathogenetic factors of common craniofacial conditions.

2.2. Affective Domain:

Professional Conduct: Manage time effectively to submit assignments and research documents on time. Adhere to the principles of professional conduct in all written submissions, specifically by avoiding plagiarism.

Accountability: Demonstrate professional behavior by completing all course requirements and responding to faculty communications promptly. Attend all required course activities, such as laboratory sessions and workshops, punctually.

Ethical Behavior: Exhibit professional and ethical conduct during examinations by not seeking unfair advantages and reporting any unethical behavior observed among peers.

2.3. Research Domain:

Literature Analysis: Critically analyze and synthesize current research articles related to oral and craniofacial development to produce a comprehensive literature review.

Scientific Communication: Effectively present a critique of research findings in a professional setting, such as a poster presentation at a bi-annual research event. Neural Crest cells and molecular regulation of neural crest cell induction, specification, migration and differentiation, their role in craniofacial development. Pharyngeal arches, pouches, clefts, membrane and their derivatives. Development of cranial vault and base, Development of face, Development of palate, Development of tongue and clinical correlation, Development of Skull, Development of cranial sutures, Development of growth of jaw bones, Development of salivary glands and clinical correlation, tooth development, Development of craniofacial muscles, Signaling pathways involved in oral and craniofacial development.

S.no	TOPIC	Time
1.	Course introduction and general embryology	2 hrs
2.	Neural crest cells and head formation	2hrs
3.	Brachial apparatus	2hrs
4.	Craniofacial development	2hrs
5.	Facial and palatal development	2hrs
6.	Development of Skull	2hrs
7.	Mandible and maxilla	2 hrs
8.	Development of Tongue	2 hrs
9.	Oral Mucosa	2 hrs
10.	Craniofacial muscles	2 hrs
11.	Salivary Glands Development	2 hrs
12.	Temporomandibular joint	2 hrs
13.	Tooth Development	2 hrs

14.	Signalling pathways	2 hrs
15.	Associated anomalies	2 hrs

Table of Specifications:

Learning Objectives	Course Contents	MIT	Assessment
• Explain the fundamental processes of human development, including fertilization, cleavage, and gastrulation. • Analyze the formation and significance of the three primary germ layers. • Identify the origins and derivatives of the pharyngeal arches, pouches, and grooves. • Correlate early developmental disruptions with the potential for congenital anomalies affecting the oral and craniofacial region.	Introduction and General Embryology Introduction to Embryology: • Definition, scope, and importance in oral biology. • Historical milestones and modern molecular insights. • Terminology: Cephalic/caudal, dorsal/ventral, proximal/distal, etc. • Periods of prenatal development: Pre-embryonic (weeks 1–2), embryonic (weeks 3–8), fetal (week 9 to birth). Gametogenesis and Fertilization: • Spermatogenesis and oogenesis. • Structure of gametes. • Process of fertilization, capacitation, acrosome reaction, and prevention of polyspermy. • Formation of zygote and early cleavage. Cleavage, Blastocyst Formation, and Implantation: • Morula to blastocyst transition. • Trophoblast and inner cell mass.	SGD +Interactive Lectures + PBL	MCQS

	• Implantation process and decidual reaction. • Clinical relevance: Ectopic pregnancy, early pregnancy loss Gastrulation and Formation of Germ Layers: • Bilaminar to trilaminar disc. • Primitive streak, notochord, and germ layers (ectoderm, mesoderm, endoderm). • Fate mapping of germ layers Neurulation and Neural Crest Formation: • Neural plate, groove, tube formation. • Primary and secondary neurulation. • Origin and significance of neural crest cells (brief overview, expanded in later modules) Folding of the Embryo and Early Organogenesis: • Lateral and cranio-caudal folding. • Development of body cavities and intra-embryonic coelom. • Placenta and extra-embryonic membranes (amnion, yolk sac, chorion, allantois) Timeline of Early Human Development (Weeks 1–8): • Week-by-week milestones (Carnegie stages).		

	• Critical periods for teratogenesis. Molecular Mechanisms and Clinical Correlations: • Key signaling pathways (Wnt, BMP, FGF, SHH). • Teratogens and congenital anomalies (e.g., effects on oral development). • Induction, competence, and epithelial-mesenchymal interactions		
• Understand the origin, induction, and specification of neural crest cells from the dorsal neural tube. • Describe the epithelial-to-mesenchymal transition (EMT), migration pathways, and spatiotemporal patterning of cranial neural crest cells. • Explain the multipotent nature of cranial NCCs and their differentiation into diverse cell types relevant to the head and oral region. • Analyze the molecular mechanisms (e.g., signaling pathways like Wnt, BMP, FGF, SHH) regulating NCC migration, proliferation, and fate determination.	Neural Crest Cells and Head Formation Formation and Induction of Neural Crest Cells: • Origin at the border of neural and non-neural ectoderm during neurulation. • Induction by signals (BMP, Wnt, FGF) from adjacent tissues. • Regionalization: Cranial (cephalic) vs. trunk/vagal neural crest. Migration of Cranial Neural Crest Cells: • Streams from midbrain/hindbrain into pharyngeal (branchial) arches and frontonasal prominence. • Pathways: Dorsolateral migration into arches 1–4.	SGD +Interactive Lectures + PBL	MCQS

• Relate disruptions in NCC development to congenital craniofacial and oral anomalies (e.g., cleft lip/palate, Treacher Collins syndrome).
• Appreciate the evolutionary significance of neural crest in vertebrate head development and its implications for oral biology research
	• Hox gene expression patterns (Hox-negative in anterior cranial NCCs for facial identity).
	
	Role in Head and Craniofacial Formation:
	
	• Contribution to ectomesenchyme (neural crest-derived mesenchyme).
	
	• Formation of facial prominences (frontonasal, maxillary, mandibular).
	
	• Development of pharyngeal arches: Cartilage rods (e.g., Meckel's cartilage in arch 1), muscles, vessels, nerves.
	
	• Specific derivatives in the head:
	
	  ○ Bones and cartilage of the face, jaws, nasal capsule, and middle ear ossicles.
	
	  ○ Connective tissues, dermis, and adipose in ventral neck/face.
	
	  ○ Odontoblasts and dental papilla (teeth).
	
	  ○ Cranial ganglia, neurons, glia, and Schwann cells.
	
	• Interactions with ectoderm, endoderm, and mesoderm for patterning (e.g., oral epithelium signaling).
	
	Differentiation and Patterning:
	
	• Multipotency: Differentiation into osteoblasts,		

	chondroblasts, odontoblasts, melanocytes, neurons, etc. • Key signaling pathways: BMP for proliferation/apoptosis balance; FGF/SHH for anterior-posterior polarity; Wnt for EMT and survival. • Palatogenesis: NCCs in palatal shelves and fusion. Clinical and Pathological Relevance: • Neurocristopathies: Defects in migration/proliferation leading to syndromes (e.g., DiGeorge, Pierre Robin sequence). • Cleft lip/palate from failed fusion of prominences. • Implications for tooth development and oral regeneration.		

• Accurately describe the embryological origin of the oral and craniofacial structures, tracing their development from the pharyngeal arches. • Identify the specific developmental disturbances that lead to common congenital defects. • Apply their knowledge of embryology to clinical practice and research, forming a foundational link between the basic sciences and advanced dental and oral health sciences.	Brachial Apparatus • germ layers • Neural crest cells. Structure and Components: • The pharyngeal (or branchial) arches. • Pouches • Grooves (clefts) • Membranes. First Arch (Mandibular): • Maxilla • Mandible • Muscles of mastication (e.g., temporalis, masseter) • Cranial nerve V (trigeminal nerve). Second Arch (Hyoid): • Stapes • Parts of the hyoid bone • Muscles of facial expression • Cranial nerve VII (facial nerve). Third Arch: • Parts of the hyoid bone	SGD +Interactive Lectures + PBL	MCQS

	• Muscles like the stylopharyngeus • Cranial nerve IX (glossopharyngeal nerve). Fourth and Sixth Arches: • Laryngeal cartilages (thyroid, cricoid) • Muscles of the larynx and pharynx • Cranial nerve X Fate of Pouches and Grooves: • The auditory tube • The external auditory meatus • Palatine tonsils • Thymus gland Clinical Correlations and congenital anomalies: • Cleft lip and palate • Treacher Collins syndrome Pierre Robin sequence. • Other syndromes		

• Describe the formation, migration, and contributions of cranial neural crest cells to craniofacial structures. • Explain the development of pharyngeal (branchial) arches, their derivatives, and associated cranial nerves. • Understand the morphogenesis of facial prominences, their fusion, and the development of primary and secondary palate. • Analyze molecular signaling pathways (e.g., SHH, FGF, BMP, Wnt, retinoic acid) involved in patterning and growth of the craniofacial complex. • Identify critical periods of craniofacial development and the etiology of common congenital anomalies (e.g., cleft lip/palate, craniosynostoses, syndromic conditions like Treacher Collins or Apert syndrome). • Correlate embryological disruptions with clinical presentations in oral pathology, orthodontics, and maxillofacial surgery. • Discuss evolutionary aspects of craniofacial development and its	Craniofacial Development Recap of Cranial Neural Crest Contribution: • Migration streams into pharyngeal arches and facial regions. • Ectomesenchyme formation and multipotency for skeletal, connective, and neural tissues Development of Pharyngeal (Branchial) Arches: • Formation from weeks 4–5: Arches 1, 2, 3, 4, 6. • Components: Ectodermal clefts, endodermal pouches, mesenchymal core (neural crest + mesoderm), aortic arches. • Derivatives: Skeletal (e.g., Meckel's cartilage, Reichert's), muscular, vascular, glandular (e.g., thymus, parathyroid). • Cranial nerve associations. Facial Development: • Origin of facial prominences around stomodeum (weeks 5–7): Frontonasal, maxillary (from arch 1), mandibular (from arch 1). • Growth and fusion processes: Nasolacrimal groove, intermaxillary segment. • Formation of nose, lips, cheeks, and external ear.	SGD +Interactive Lectures + PBL	MCQS

implications for regenerative oral biology	Palate Development: • Primary palate (from frontonasal and maxillary prominences). • Secondary palate: Palatal shelf elevation, fusion, and ossification (weeks 7–9). • Role of TGF-ß, SHH in shelf growth and midline epithelial seam dissolution. Cranium and Skull Base Development: • Neurocranium (chondrocranium and desmocranium) vs. viscerocranium. • Endochondral vs. intramembranous ossification in craniofacial bones Molecular Regulation and Anomalies: • Hox-negative patterning in the face; Dlx, Msx, Pax genes. • Environmental factors (teratogens like alcohol, retinoids) and genetic mutations. • Common defects: Orofacial clefts, hemifacial microsomia, craniosynostosis		
• To understand the normal biological processes of craniofacial formation.	Facial and Palatal Development • Formation and breakdown of the oropharyngeal	SGD +Interactive	MCQS

• Application of that knowledge to the etiology, diagnosis, and potential prevention/treatment of developmental anomalies like cleft lip and palate.	membrane (buccopharyngeal membrane).
	• Development of the stomodeum (primitive mouth).
	
	Facial Process Formation:
	• Five facial prominences (primordia) that form the face:
	  ○ Frontonasal process (gives rise to the forehead, nose dorsum, and philtrum).
	  ○ Maxillary processes (midface, cheeks, lateral upper lip).
	  ○ Mandibular processes (lower jaw and lower lip).
	• Appearance and fate of the nasal placodes, medial nasal processes, and lateral nasal processes.
	
	Formation of the Primary Palate (Premaxilla):
	• The role of the medial nasal processes and maxillary processes.
	• The concept of merging (in facial development) versus fusion (in palatal development).
	
	Formation of the Secondary Palate:
	• Growth and elevation of the palatal shelves (palatal processes) from the maxillary processes.
		Lectures
		
		+ PBL	

	• Shelf elevation and its mechanical and intrinsic factors.
	• The fusion of the two palatal shelves with each other and with the nasal septum and primary palate.
	• Formation of the definitive palate.
	
	Derivatives of Pharyngeal (Branchial) Arches:
	• Focus on the first pharyngeal arch (mandibular arch) and its derivatives in the lower face.
	• The embryological basis of structures like the mandible, maxilla, and associated muscles and nerves.
	
	Molecular and cellular mechanism
	• Neural Crest Cells (NCCs):Primary source of mesenchymal tissue for the face and palate (skeletal, connective tissues).
	• Gene Regulation and Signaling Pathways:
	  ○ Master control genes and transcription factors (e.g., *Pax*, *Msx*, *Shox*, *Hox* genes)
	  ○ Key signaling pathways involved in cell proliferation, differentiation, and migration, such as FGF, BMP, Wnt, and Hedgehog signaling.		

	• Epithelial-Mesenchymal Interactions (EMI):
	  ○ The inductive and reciprocal signals between the ectoderm (epithelium) and the neural crest-derived mesenchyme.
	• Palatal Shelf Fusion Mechanisms:
	  ○ Detailed study of the events at the medial edge epithelium (MEE).
	• Extracellular Matrix (ECM) and Tissues:
	  ○ The role of specific ECM components (collagen, proteoglycans, fibronectin) and enzymes (MMPs) in tissue remodeling during growth and fusion.
	CLinical and research correlation
	• Craniofacial Anomalies:
	  ○ Pathogenesis and classification of Cleft Lip and Palate (CLP), Treacher Collins Syndrome, Pierre Robin Sequence, and Hemifacial Microsomia, and their known genetic/molecular basis.
	• Etiology of Defects:		

	○ The interplay of genetic factors (syndromic vs. non-syndromic CLP) and environmental factors (teratogens, maternal health, nutrition) in disrupting normal development. • Regenerative Biology: ○ Concepts of craniofacial tissue engineering and regenerative medicine.		

• To thoroughly explain and differentiate between the two major processes of bone formation in the skull.
• Elucidate Developmental Mechanisms.
• To relate the basic theoretical knowledge of craniofacial development and growth to its direct clinical implications in dentistry.
• To develop the ability to critically evaluate and discuss relevant scientific literature related to orofacial and skeletal biology
	Development of cranial vault and base
	
	• Neural Crest Cells (NCCs) and Mesoderm:
	  ○ Contribution to the Viscerocranium (facial skeleton) and parts of the Neurocranium (skull vault and base).
	  ○ Contribution of the paraxial mesoderm to the rest of the skull.
	• Types of Ossification:
	  ○ Intramembranous ossification
	  ○ Endochondral Ossification.
	• The Neurocranium (Braincase):
	  ○ Development of the Cranial Vault (Calvaria) and its flat bones.
	  ○ Development of the Cranial Base and the role of Synchondroses (cartilaginous joints) in growth.
	
	Growth and Remodeling Mechanisms:
	• Sutural Biology:
	  ○ Structure and function of Cranial
		SGD
		
		+Interactive
		
		Lectures
		
		+ PBL
			MCQS

	Sutures as growth centers for the vault. ○ Regulation of suture patency (remaining open) and the molecular signals that control fusion. • Growth Theories: ○ Classic theories of craniofacial growth (e.g., Sicher's, Scott's, Enlow's V-Principle and Craniofacial Growth Fields). ○ Mechanisms of growth at the condylar cartilage of the mandible and the synchondroses of the cranial base. • Bone Cell Biology: ○ Roles of Osteoblasts (formation), Osteoclasts (resorption), and Osteocytes (maintenance) in bone remodeling and achieving final skull morphology. Molecular Regulation and Pathophysiology: • Key Signaling Pathways and Genes: ○ In-depth study of growth factors and transcription factors (e.g., FGFR family, Runx2, MSX2, TWIST) that control cell		

	differentiation and bone formation. ○ The role of Wnt, BMP (Bone Morphogenetic Protein), and Hedgehog signaling in directing craniofacial patterning. • Developmental Anomalies: ○ Craniosynostosis: Premature fusion of cranial sutures (e.g., due to FGFR mutations) and the resulting dysmorphology. ○ Syndromes: Genetic disorders affecting the skull. • Translational Research: ○ The use of animal models (e.g., knockout mice) to study the functions of genes in skull development. ○ Principles of craniofacial tissue engineering and potential for bone regeneration.		

• Explain in detail the embryological origins of the maxilla and mandible • Differentiate and describe the processes of intramembranous and endochondral ossification • Identify the key growth sites • Describe the growth centers • Investigate the molecular mechanisms and signaling molecules • Correlate defects in the development and growth of the maxilla and mandible with clinical anomalies and syndromes	Mandible and Maxillary Formation Neural Crest Cell Contribution. Pharyngeal Arches: (Mandibular Arch) derivatives, including Meckel's cartilage. Ossification Processes: • Mandible Formation: Detailed process of intramembranous ossification endochondral ossification. • Maxilla Formation: Detailed process of intramembranous ossification from multiple centers (premaxilla and maxilla proper) and its relation to the nasal capsule. Alveolar Process Development: The intricate, coordinated development of the alveolar bone in relation to odontogenesis (tooth development). Signaling Pathways:Key molecular signals and epithelial-mesenchymal interactions that govern patterning and morphogenesis, such as BMPs, FGFs and Hox genes. Transcription Factors: Understanding the role of specific transcription factors. Matrix Biology: Advanced knowledge of the extracellular matrix (ECM) molecules that are fundamental to bone and cartilage formation, and	SGD +Interactive Lectures + PBL	MCQS

	their specific roles in the craniofacial region.		

• Describe the timing and sequence of the tongue's embryonic development • Correlate the embryonic origins with the adult tongue's innervation • Differentiate between the structural and functional properties of the four types of lingual papillae • Recognize and explain the developmental anomalies associated with tongue formation	Development of Tongue Embryological Origin and Stages: • Timeline: Beginning around the fourth week of intrauterine life (IUL). Pharyngeal Arch Contributions (Mucosa): Anterior Two-Thirds (Oral Part): Origin from the First Pharyngeal Arch. Formation and merger of two Lateral Lingual Swellings. The role of the central Tuberculum Impar (median lingual swelling) and its subsequent disappearance. The median sulcus as the line of fusion. Posterior One-Third (Pharyngeal Part): Origin from the Third and Fourth Pharyngeal Arches. Formation of the Copula (from the second and third arches) and the Hypobranchial Eminence (from the third and fourth arches). The third arch component overgrows the second arch. Posterior-most Part: Formation from the Fourth Pharyngeal Arch (epiglottal swelling). Musculature:Origin from Occipital Somites. Migration of myoblasts (muscle precursor cells) into the tongue region, bringing the Hypoglossal Nerve (CN XII) with them.	SGD +Interactive Lectures + PBL	MCQS

	Differentiation into Extrinsic and Intrinsic muscles.
	
	Foramen Cecum and Terminal Sulcus:
	
	The Terminal Sulcus (V-shaped groove) marking the fusion site of the anterior and posterior parts of the tongue.
	
	The Foramen Cecum at the apex of the sulcus, representing the origin point of the Thyroid Gland (and its clinical correlation, the Thyroglossal Duct/Cyst).
	
	Tissue Origin (Hybrid Nature):
	
	Connective Tissue and Vasculature: Derived from Cranial Neural Crest Cells (CNCC).
	
	Muscle: Derived from Occipital Somites (mesoderm).
	
	Development of Specialized Structures and Innervation
	
	• Lingual Papillae and Taste Buds:
	  ○ Filiform, Fungiform, Foliate, and Circumvallate.
	  ○ The origin and maturation of Taste Buds.
	
	Nerve Supply (Innervation):
	
	Special Sensory (Taste): CN VII (Chorda Tympani) for the anterior 2/3, CN IX (Glossopharyngeal) for the posterior 1/3, and CN X (Vagus, Superior Laryngeal) for the posterior-most area.		

	General Sensory (Touch/Pain): CN V (Mandibular branch, Lingual nerve) for the anterior 2/3, and CN IX for the posterior 1/3.
	
	Motor: CN XII (Hypoglossal) for all intrinsic and extrinsic muscles (except Palatoglossus).
	
	Cellular and Molecular Mechanism.
	
	• Cellular Components:
	  ○ Role of Cranial Neural Crest Cells (CNCC).
	  ○ Role of Myoblasts (from occipital somites) in forming the muscle cells.
	• Molecular Control (Myogenesis):
	  ○ Myogenic Regulatory Factors (MRFs): Such as Myf5, MyoD, MRF4, and Myogenin.
	  ○ Gene Interactions: The role of genes like *Pax3*, *Pax7*, and *Dlx*.
	  ○ Signaling Pathways: The involvement of Hedgehog, TGF-beta, WNT, and Notch.
	
	Clinical and Anatomical Correlations
	
	• Developmental Anomalies (Teratology):
	  ○ Ankyloglossia (tongue-tie, due to a short frenulum).		

	○ Macroglossia (abnormally large tongue). ○ Microglossia (abnormally small tongue). ○ Developmental causes of Cleft Tongue (Bifid/Cleft tip). • Functions: ○ Taste, speech, swallowing (deglutition), and food manipulation		

• Describe the structure, histological features, and regional variations of the oral mucosa. • Identify the types of oral mucosa and correlate them with their functions. • Explain the process of keratinization and epithelial renewal in the oral cavity. • Discuss the connective tissue, vascular, and neural components of the oral mucosa. • Recognize developmental origins, specialized structures, and clinical correlations related to oral mucosa. -	ORAL MUCOSA Definition and Overview Moist lining of the oral cavity that protects underlying tissues and provides sensation, secretion, and defense. Components: 1. Epithelium: Stratified squamous (keratinized or non-keratinized) 2. Lamina propria: Connective tissue support 3. Submucosa: Contains glands, vessels, and nerves (in movable regions) Classification and Regional Variations 1. Masticatory Mucosa: o *Location:* Gingiva, hard palate o *Epithelium:* Keratinized/parakeratinized o *Function:* Resists mastication stress 2. Lining Mucosa: o *Location:* Lips, cheeks, floor, soft palate, ventral tongue o *Epithelium:* Non-keratinized o *Function:* Flexible and cushioning 3. Specialized Mucosa: o *Location:* Dorsal tongue o *Features:* Papillae and taste buds	SGD +Interactive Lectures + PBL	MCQS

	o *Function:* Sensory (taste, touch) Histological Structure · Epithelium: Stratified squamous; keratinized (basale–spinosum–granulosum–corneum) or non-keratinized (basale–spinosum–superficiale). · Basement membrane: Laminin and collagen support layer. · Lamina propria: Papillary (loose CT) + reticular (dense CT) layers. · Submucosa: Present in movable areas; contains glands, fat, vessels. Functional & Molecular Aspects · Barrier: Protection from trauma and infection. · Sensory: Mechanoreceptors, nociceptors, taste buds. · Regeneration: Rapid turnover (5–14 days). · Molecular control: Growth factors (EGF, TGF-ß), cytokeratins, integrins, laminins. Vascular & Neural Supply · Arterial: Facial, lingual, maxillary branches. · Venous: Drains to internal jugular vein. · Lymphatic: Submental, submandibular, deep cervical nodes. · Innervation:		

	o Sensory – CN V o Taste – CN VII, IX o Autonomic – salivary glands Developmental & Clinical Correlations ·Development: From ectodermal proliferation and epithelial–mesenchymal interactions; taste buds by 7–8th week IUL. · Common Conditions: o Leukoplakia (hyperkeratosis) o Lichen planus (inflammation) o Candidiasis (fungal) o Aphthous ulcers (erosion) o Pigmentation disorders o Submucosal fibrosis (chronic irritation) Functions · Protection · Sensation (taste, pain, touch) · Secretion (minor salivary glands) · Microbial barrier · Repair and regeneration		
• Describe the embryological origin and development of craniofacial muscles.	CRANIOFACIAL MUSCLES Definition and Overview · Craniofacial muscles include the muscles of facial expression and	SGD +Interactive	MCQS

• Identify the main groups and functions of muscles involved in facial expression and mastication. • Correlate their anatomical arrangement with innervation and vascular supply. • Explain the structural and functional characteristics of these muscles. • Recognize developmental anomalies and clinical conditions affecting craniofacial muscles.	mastication, derived from pharyngeal arches and responsible for movements of the face, jaw, and scalp. · They control facial expression, speech, mastication, and contribute to swallowing and breathing. Embryological Origin ·Facial Expression Muscles: From second pharyngeal arch (hyoid arch) → innervated by Facial nerve (CN VII). · Muscles of Mastication: From first pharyngeal arch (mandibular arch) → innervated by Mandibular branch of Trigeminal nerve (CN V_3). · Other Muscles: o Tongue muscles → Occipital somites (CN XII) o Pharyngeal and laryngeal muscles → Third to sixth arches (CN IX, X, XI) Classification and Examples 1.Muscles of Facial Expression (CN VII): o *Orbicularis oris, orbicularis oculi, buccinator, frontalis, platysma, zygomaticus major/minor, nasalis.* o *Function:* Move skin of face for expression, speech, and eyelid/lip closure. 2. Muscles of Mastication (CN V_3): o *Masseter, temporalis, medial and lateral pterygoids.* o *Function:* Elevate, depress, protrude, and retract the mandible.	Lectures + PBL	

	3.Accessory Muscles Related to Facial Function: o *Suprahyoid and infrahyoid muscles* – assist in swallowing and jaw movement. o *Extraocular muscles* – control eye movement (CN III, IV, VI). Histology and Structure · Type: Skeletal (striated) muscle derived from mesoderm. · Arrangement: Bundles of muscle fibers surrounded by connective tissue (endomysium, perimysium, epimysium). ·Special Feature: Many facial muscles insert into skin rather than bone, allowing fine expression movements. Functional and Molecular Aspects · Functions: Facial expression, mastication, swallowing, speech, airway control. ·Molecular Regulation: o Myogenic regulatory factors (Myf5, MyoD, Myogenin) control differentiation. o Neural crest–mesoderm interactions guide patterning. · Neuromuscular Junction: Site of motor neuron–muscle fiber communication via acetylcholine. Vascular and Neural Supply ·Arterial: Branches of facial, maxillary, and superficial temporal arteries.		

	· Venous: Drains into facial and pterygoid venous plexuses. · Lymphatic: Submandibular and parotid lymph nodes. · Innervation: o CN VII – facial expression o CN V_3 – mastication o CN XII – tongue o CN IX, X, XI – pharyngeal and laryngeal muscles Developmental and Clinical Correlations · Development: Myoblasts from pharyngeal arch mesoderm migrate into facial region during 5th–8th week IUL. · Clinical Conditions: o Facial nerve palsy (Bell's palsy): Paralysis of facial muscles. o Trismus: Spasm of masticatory muscles. o Hemifacial microsomia: Underdevelopment of first/second arch derivatives. o Muscular dystrophies: Degeneration of muscle fibers. Functions · Facial expression (emotion and communication) · Mastication (chewing and jaw movement) · Speech articulation and swallowing · Eye and lip closure for protection		

	· Support of facial form and aesthetics		
• Describe the embryological origin and timing of salivary gland development. • Identify the major salivary glands and their ductal and acinar structures. • Correlate development with innervation, vascular supply, and function. • Recognize developmental anomalies affecting salivary glands.	Salivary Glands Development Innervation and Molecular Regulation Embryological Origin • All major salivary glands (parotid, submandibular, sublingual) and minor salivary glands originate from the oral ectoderm (ectodermal placodes in the primitive mouth/oral cavity). • Development involves epithelial-mesenchymal interactions: Ectodermal epithelium proliferates into underlying neural crest-derived mesenchyme (ectomesenchyme), which provides inductive signals. • Process: Thickening (pre-bud stage) → Initial bud → Elongated epithelial cord → Repeated branching morphogenesis → Canalization of ducts → Differentiation into acini (serous/mucous) and myoepithelial cells. • Parotid is unique in being purely serous and developing later; it becomes partially encapsulated by mesenchyme forming the facial nerve region. Timing of Formation (Human Embryonic Weeks)	SGD +Interactive Lectures + PBL	MCQS

	Salivary gland development occurs during the embryonic period (weeks 4–12), with variations among glands:
	• Parotid gland:
	  ○ Anlage appears at weeks 5–6 (earliest among major glands).
	  ○ Budding from parotid sulcus (posterior angle of stomodeum, near maxillary/mandibular processes).
	  ○ Branching and canalization by weeks 10–12; functional by fetal period (around month 6–7).
	• Submandibular gland:
	  ○ Anlage at weeks 6–7.
	  ○ Buds from submandibular sulcus (floor of mouth, linguo-gingival groove).
	  ○ Duct (Wharton's duct) canalizes by week 10; acini differentiate later.
	• Sublingual gland:
	  ○ Anlage at weeks 7–8 (latest major gland).
	  ○ Multiple buds from sublingual folds (floor of mouth, lateral to submandibular anlage).		

	○ Ducts (Bartholin's and Rivinus) form by weeks 9–10. • Minor salivary glands: ○ Appear later, from weeks 8–12, as buds from oral epithelium in lips, cheeks, palate, etc. · Innervation: o Parasympathetic: CN IX (parotid), CN VII (submandibular and sublingual) → stimulates saliva secretion. o Sympathetic: Superior cervical ganglion → modulates protein content. · Molecular Signals: o FGF, EGF, BMP, Wnt, Shh → regulate branching, proliferation, and differentiation. o Neural crest–mesenchyme interaction critical for patterning. Developmental and Clinical Correlations · Developmental anomalies: o Aplasia or hypoplasia → absent/reduced salivary glands. o Ectopic salivary tissue → accessory glands in unusual sites. o Branching defects → cystic malformations. · Clinical Relevance: Understanding development helps explain congenital conditions and guides surgical interventions. Functions		

	· Lubrication of oral cavity and food. · Initiation of digestion (enzymes like amylase). · Antimicrobial defense (IgA, lysozyme). · Oral tissue protection and wound healing. ·Saliva homeostasis for taste, speech, and mastication.		
• Describe the embryonic origin and timeline of TMJ development. • Identify the formation of the mandibular condyle, articular disc, and joint capsule. • Correlate embryonic development with adult TMJ structure and function. • Recognize developmental anomalies of the TMJ.	TEMPOROMANDIBULAR JOINT Embryological Origin and Timeline · Mesenchyme: Derived from first pharyngeal (mandibular) arch. · Condylar cartilage: Forms as secondary cartilage on mandibular mesenchyme. · Articular disc & joint capsule: Form from mesenchymal condensation between condyle and temporal bone. Timeline: · 6th week IUL: Mesenchymal blastema appears between condyle and temporal bone. · 8th–9th week IUL: Condylar cartilage forms; joint cavity begins via cavitation. · 10th–12th week IUL: Upper and lower joint compartments develop; articular disc becomes distinct. · 12th–20th week IUL: Fibrocartilage differentiation on condyle and fossa; joint maturation continues.	SGD +Interactive Lectures + PBL	MCQS

	· Postnatal: Condylar cartilage contributes to mandibular growth and remodeling. Histological Development · Condyle: Secondary cartilage develops and ossifies intramembranously. · Articular disc: Fibroblastic mesenchyme separates upper and lower compartments. · Capsule & synovial membrane: Fibrous tissue surrounds joint cavity and forms functional capsule. Muscle and Neural Associations · Muscles of mastication: Derived from first pharyngeal arch mesoderm; attach to condyle. · Innervation: Mandibular nerve (CN V_3) grows with developing muscles and joint capsule. Developmental and Clinical Correlations · Anomalies: o Condylar hypoplasia → small mandible, micrognathia o TMJ ankylosis → fusion of joint components o Dysplasia of disc or condyle · Significance: Explains jaw growth, occlusion patterns, and congenital TMJ disorders. Functions After Development · Jaw rotation and translation (mastication, speech) · Load-bearing and shock absorption (via articular disc		

	-		
• Describe the embryonic origin and timeline of tooth development. • Identify the stages of odontogenesis and their histological features. • Correlate embryonic structures with adult tooth anatomy. • Recognize developmental anomalies affecting teeth.	TOOTH DEVELOPMENT Embryological Origin · Epithelium: Oral ectoderm forms dental lamina. · Connective tissue / dentin-pulp complex: Derived from cranial neural crest mesenchyme (ectomesenchyme). · Timeline: o 6th week IUL: Initiation stage – dental lamina forms in each jaw. o Bud stage (8th week): Epithelial buds invade ectomesenchyme. o Cap stage (9th–10th week): Formation of enamel organ, dental papilla, dental follicle. o Bell stage (11th–12th week): Histodifferentiation – ameloblasts, odontoblasts differentiate; shape of future tooth crown defined. o Late bell stage / Apposition: Deposition of enamel and dentin begins. o Root formation: Hertwig's epithelial root sheath guides root morphogenesis; begins after crown formation. Stages of Tooth Development 1. Initiation Stage: Thickening of oral epithelium → dental lamina. 2. Bud Stage: Rounded epithelial proliferation into mesenchyme; mesenchymal condensation forms tooth germ. 3. Cap Stage: Formation of enamel organ (epithelium), dental	SGD +Interactive Lectures + PBL	MCQS

	papilla (mesenchyme → dentin/pulp), dental follicle (cementum, PDL, alveolar bone). 4. Bell Stage: Differentiation of ameloblasts (enamel) and odontoblasts (dentin); crown shape determined. 5. Apposition & Maturation: Enamel and dentin deposited; mineralization occurs. 6. Root Formation: Hertwig's epithelial root sheath guides root length and shape. Histological and Molecular Aspects · Cell types: o Ameloblasts: Enamel formation (from epithelium) o Odontoblasts: Dentin formation (from ectomesenchyme) o Cementoblasts / PDL / alveolar bone cells: From dental follicle · Molecular control: o Signaling pathways: BMP, FGF, WNT, SHH o Transcription factors: MSX1, PAX9, DLX2 Clinical and Developmental Correlations · Anomalies: o Hypodontia / Oligodontia (missing teeth) o Supernumerary teeth (extra teeth) o Amelogenesis imperfecta (enamel defect)		

	o Dentinogenesis imperfecta (dentin defect) o Delayed eruption or malformation · Significance: Understanding embryology explains tooth morphology, eruption patterns, and congenital dental disorders. Functions After Development · Mastication · Speech articulation · Aesthetic and facial support · Protection of oral cavity and oral tissues		
• Describe the key signalling pathways involved in craniofacial and oral embryogenesis. • Identify the role of each pathway in tissue patterning, growth, and differentiation. • Correlate signalling disruptions with developmental anomalies. -	SIGNALLING PATHWAYS Overview · Signalling pathways are molecular communication systems that regulate cell proliferation, migration, differentiation, and apoptosis during embryogenesis. · Critical in craniofacial structures: cranial neural crest cells, pharyngeal arches, teeth, muscles, TMJ, and salivary glands. Key Signalling Pathways 1. BMP (Bone Morphogenetic Protein) o Role: Induces bone and cartilage formation, regulates tooth development and cranial neural crest differentiation.	SGD +Interactive Lectures + PBL	MCQS

	o Clinical relevance: BMP defects → craniosynostosis, tooth anomalies. 2. FGF (Fibroblast Growth Factor) o Role: Controls cell proliferation, migration, limb and craniofacial morphogenesis. o Clinical relevance: FGF mutations → craniofacial dysplasia (e.g., Apert syndrome). 3. SHH (Sonic Hedgehog) o Role: Determines midline patterning, tooth cusp formation, tongue and palate development. o Clinical relevance: SHH defects → holoprosencephaly, cleft lip/palate. 4. WNT o Role: Regulates cranial neural crest cell fate, tooth morphogenesis, and jaw patterning. o Clinical relevance: WNT mutations → tooth agenesis, craniofacial malformations. 5. Notch o Role: Mediates cell fate decisions, boundary formation, and differentiation. o Clinical relevance: Defects → cleft palate, craniofacial defects. 6. TGF-β (Transforming Growth Factor-beta) o Role: Controls epithelial-mesenchymal interactions, palate and tooth development.		

	o Clinical relevance: TGF-β mutations → cleft palate, enamel defects. Integration in Development · These pathways often interact to coordinate: o Migration and differentiation of cranial neural crest cells o Growth of branchial arch derivatives o Patterning of teeth, tongue, TMJ, and salivary glands · Disruption can lead to congenital anomalies and craniofacial malformations. Clinical Correlations · Holoprosencephaly (SHH defect) · Craniosynostosis (FGF/BMP defects) · Cleft lip and palate (TGF-β, SHH, WNT) · Tooth agenesis or supernumerary teeth (WNT, BMP) Functions · Guide cell proliferation, differentiation, and tissue patterning during craniofacial development. · Ensure proper formation of oral structures, muscles, bones, and glands. · Maintain coordination between epithelium and mesenchyme.		

• Identify congenital anomalies affecting structures of the head and neck. • Correlate embryological origin and molecular pathways with specific anomalies. • Understand clinical implications and presentations of developmental defects. • .Recognize how disruptions in neural crest cells, branchial arches, craniofacial structures, and signalling pathways lead to malformations.	ASSOCIATED ANOMALIES . Neural Crest and Head Formation · Disruption of neural crest migration → craniofacial dysmorphism, Treacher Collins syndrome, DiGeorge syndrome. 2. Branchial Apparatus Anomalies · First arch: Mandibular hypoplasia, hemifacial microsomia. · Second, third, fourth arches: Branchial cysts, sinuses, fistulas. 3. Craniofacial Development Defects · Craniosynostosis: Premature suture closure (FGFR mutations). · Midface hypoplasia, clefting, hypertelorism, facial asymmetry. 4. Facial and Palatal Anomalies · Cleft lip and/or palate (1st arch or palatal shelves fusion failure). · High-arched palate, bifid uvula. 5. Skull, Maxilla, and Mandible · Micrognathia, macrognathia, cranial base malformations. · Plagiocephaly, cranial asymmetries. 6. Tongue · Ankyloglossia (short lingual frenulum), macroglossia, microglossia, bifid tongue. 7. Oral Mucosa	SGD +Interactive Lectures + PBL	MCQS

	· Submucosal fibrosis, pigmentation disorders, congenital oral lesions. 8. Craniofacial Muscles · Hypoplasia/aplasia of branchial arch muscles. · Facial palsy due to developmental CN VII defects. 9. Salivary Glands · Agenesis, hypoplasia, accessory ducts, cysts. 10. Temporomandibular Joint · Congenital ankylosis, dysplasia of condyle, disc malformation. 11. Tooth Development · Hypodontia, anodontia, supernumerary teeth, enamel hypoplasia, abnormal shape or size. 12. Signalling Pathways Related Anomalies · SHH disruption → holoprosencephaly, midline defects. · WNT/BMP/TGF-β → cleft lip/palate, tooth agenesis, craniosynostosis. · FGF → craniosynostosis, facial dysmorphism. · Notch → boundary formation defects, tooth and palate anomalies. 13. Clinical Correlations · Many anomalies present with functional deficits: feeding difficulties, speech impairment,		

	airway obstruction, aesthetic concerns. · Early diagnosis often involves imaging, genetic analysis, and multidisciplinary management.		

Recommended Readings:

Recommended Readings:

- Orban" s Oral Histology and Embryology, S, N.Bhaskar
- Oral Histology (Development, Structure and Function)
- Oral Development and Histology, James K.Avery)
- Introduction to Oral Biology and Tooth Morphology, Scott & Symons
- Oral Embryology, Sperber
- Longmans" Medical embryology by T.W Sadler
- Illustrated Dental Embryology, Histology, and Anatomy Mary Bath-Balogh, Margaret J. Fehrenbach
- Medical Embryology by Jan Langman (10th Edition)
- The Developing Human by Keith L. Moore (8th Edition)
- High-yield Neuroanatomy by James D Fix

Journals:

- Critical Reviews In Oral Biology and Medicine
- Archives of Oral Biology
- Journal of Oral Biology and Craniofacial Research
- International Journal of Oral Biology

BMS 740: Research Techniques Basic instrumentations (Optional)

(1+1 Cr Hrs)

Course objectives

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

1. Prepare stock and working solutions to be used in standard post-graduate laboratory.
2. Comprehend the basic principles of spectroscopy and analyze samples with different concentrations

3. Describe theory of Chromatography and analyze HPLC spectra
4. Discuss theory of ELISA assay
5. Explain the principles of DNA and RNA extraction
6. Classify different types of electrophoresis and their applications
7. Design experiment using standard biological starting material for DNA-based assay
8. Describe principles of histological staining techniques like H&E and analyze the slides under microscope
9. Classify different types of blotting and design a western blotting experiment
10. Explain DNA sequencing and interpret an Sanger sequencing's electropherogram

Course Contents:

1. Types of Solutions
    a. Understanding and preparation of different types of solutions in a lab
2. Spectrophotometry
    a. Basic Principles of spectrometry
    b. Types of spectroscopy
    c. UV-vis spectroscopy and instrumentation
3. Chromatography
    a. Theory of chromatography
    b. Applications
    c. HPLC instrumentation and analysis
4. ELISA
    a. Principle
    b. Application
    c. Types and instrumentation
5. DNA extraction
    a. Principle and different methods
6. RNA extraction
    a. Methods and theory
7. Horizontal gel electrophoresis
    a. Basic principle of the technique
    b. Sample preparation, running the gel and interpretation of results
8. Polymerase Chain Reaction
    a. Theory
    b. Pre-reaction considerations
    c. Performing the reaction
    d. Quantitative PCR
9. Histological analysis
    a. Theory
    b. Slide preparation
    c. Microscopy
    d. Immunohistochemistry principles and practice
10. Vertical Gel Electrophoresis
    a. Polyacrylamide gel electrophoresis
    b. Principles
    c. Gels and sample preparation
    d. Gel staining and data interpretation
11. Blotting techniques
    a. Different types of blotting
    b. Western blotting
12. Nucleotide sequencing

a. Principle
b. Sample preparation and interpretation of data

Recommended Readings:

1. Fundamentals of Analytical Chemistry
2. Molecular Cloning: A Laboratory Manual
3. Theory and practice of histological techniques

ORB 703: Head, Neck, and Oral anatomy

(1+1 Credit Hrs)

1.Course Objectives:

Upon successful completion of this course, student will be able to

- Develop a thorough understanding of the anatomical structures and landmarks of head and neck and orofacial region.
- Origin, development, organization, and structure of various cells and tissues of the human body.
- Identify the tissues that form the human face and neck and describe their function in the developmental process.

- Describe the timely steps in the development of the human face and conclude the possible causes of facial and palatine defects.
- Explain what takes place during the various stages of tooth development, eruption, and shedding including possible causes for defects and their clinical effects.
- Apply aspects of tooth anatomy and development.
- Present a thorough understanding of a histological process

2.Course Contents:

Lecture	Topics	Subtopics
1 & 2	Maxilla & Mandible	· Anatomy: Detailed bony structure, processes, articulations, foramina, and associated spaces. · Neurovascular Supply: Arterial, venous, nerve, and lymphatic drainage. · Pathologies: Fractures, cysts, tumors, infections, developmental anomalies, TMJ disorders, and surgical implications.
3 & 4	Scalp & Face	· Scalp: Layered structure, muscular anatomy, neurovascular supply, and clinical lesions. · Face: Facial bones, muscles of expression and mastication, neurovascular supply, trauma, tumors, infections, and nerve pathologies.
5	Temporomandibular Joint (TMJ)	· Anatomy: Articular disc, capsule, ligaments, and muscles. · Function: Mandibular movements and biomechanics. · Pathologies: Disc displacements, arthritis, ankylosis, bruxism, and muscular disorders.
6	Muscles of Mastication	· Anatomy: Origin, insertion, nerve supply, and actions of masseter, temporalis, medial and lateral pterygoids. · Innervation & Vascular Supply: CN V3 (mandibular nerve), maxillary artery branches. · Function & Clinical Relevance: Role in chewing and TMJ movement, myofascial pain, trismus, bruxism.

7	Muscles of Facial Expression	· Overview: Grouped by region (scalp, orbit, nose, mouth, neck). · Innervation: Facial nerve (CN VII) and its clinical implications. · Functions: Facial movements, speech, eye closure. · Clinical: Facial palsy, esthetic and surgical considerations.
	Mid Term	_
8 & 9	Salivary Glands	· Types & Functions: Major (parotid, submandibular, sublingual) vs minor glands; saliva composition. · Anatomy & Histology: Acinar and ductal systems. · Innervation & Vascular Supply: Parasympathetic/sympathetic control; relevant arteries and veins. · Clinical Relevance: Infections, stones, tumors.
10	Vascular Supply of Head & Neck	· Arterial: Maxillary, facial, lingual arteries and their branches. · Venous: Pterygoid venous plexus, facial, lingual, retromandibular veins. · Clinical: Anastomoses, danger areas, surgical considerations. · Tissues & Nodes: Waldeyer's ring, superficial and deep lymph nodes. · Pathways: Facial and oral regions to cervical lymphatics.

	Lymphatic Drainage of Head & Neck	· Clinical: Lymphadenopathy, cancer metastasis, systemic disease indicators.
11	Nerve Supply of Head & Neck	· Cranial Nerves: Functional overview with focus on CN V, VII, IX, X, XI, XII. · Distribution: Sensory/motor innervation to face, tongue, oral cavity, pharynx, larynx. · Autonomic Innervation: Sympathetic and parasympathetic supply to glands and vessels. · Clinical Relevance: Neuralgia, palsies, anesthetic applications in dental procedures.
12	Oral Mucosa	· Types of oral mucosa based on location, structure, and function, distinguishing between lining, masticatory, and specialized mucosa. · Histological features of the oral mucosa, including epithelial types, connective tissue components, and site-specific variations. · Structure and function of oral mucosa with clinical conditions, including developmental anomalies, inflammatory and systemic diseases, and oral manifestations of malignancy.

13	Tongue, Hard & Soft Palate	· Gross anatomy, histological features, and types of papillae of the tongue, its oral and pharyngeal parts. · Intrinsic and extrinsic muscles of the tongue and their roles in speech, taste, mastication, and swallowing. · Common clinical conditions affecting the tongue, including inflammatory, traumatic, and neoplastic lesions, and relate them to underlying anatomical structures. · Anatomy of hard and soft palate
14	Physiologic Tooth Movement	· Types and stages of physiologic tooth movement, including pre-eruptive, eruptive, and post-eruptive phases. · Biological mechanisms and cellular components involved in tooth eruption and movement, focusing on the role of the periodontal ligament and alveolar bone. · Principles of physiologic tooth movementwith clinical applications such as orthodontic tooth movement.
15	Eruption and Shedding of Teeth	· Phases of tooth eruption. · Biological basis and patterns of primary tooth shedding, including the role of odontoclasts and succedaneous teeth. · Identify common clinical anomaliesrelated to eruption and shedding and their developmental implications.

3.Table of Specifications:

Learning Objective	Course Content	MIT	Assessment
Discuss the anatomical features of Maxilla and its relation with teeth and bones and muscles of face. Explain the neurovascular and lymphatic supply of the maxilla, including its arterial and venous systems, nerve innervation, and lymphatic drainage. Identify and explain common pathological conditions of the maxilla and developmental anomalies.	Maxilla · Gross Anatomy o Bony structure (body and sinus), processes (frontal, zygomatic, palatine and alveolar), articulations with other bones, foramina and canals, associated fossa and spaces. · Neurovascular Supply o Arterial supply (maxillary artery and its branches) and collateral circulation. o Venous Drainage o Nerve Supply (maxillary nerve and autonomic innervation) o Lymphatic Drainage • Pathological aspects o Trauma o Infections o Cysts o Tumors o Developmental Anomalies	SGD + SDL +Interactive Lectures + PBL	MCQS

Describe the anatomical structure and key features of the mandible. Identify its neurovascular and lymphatic supply. Recognize common mandibular pathologies and surgical considerations.	Mandible · Gross Anatomy o Body, Ramus, Alveolar process, Foramina and canals, Condylar and coronoid processes, Articulations. · Neurovascular Supply o Arterial supply (inferior alveolar, mental, mylohyoid artery, facial and submental) o Venous Drainage o Nerve supply (inferior alveolar, mental, incisive, lingual, mylohyoid and facial nerve) · Lymphatic Drainage · Pathological aspects o Fractures o Infections o Cysts o Tumors o Implant consideration o Joint disorders o Orthognathic surgeries	SGD + SDL +Interactive Lectures + PBL	

Discuss the anatomical features of scalp and its relation with bones and muscles of face with focus on functional, pathological and clinical consideration and explore their relevance in research and surgical planning.	SCALP • Layers of scalp • Muscles of scalp • Neurovascular supply including arteries, veins, nerves and lymphatics. • Clinical Correlation (laceration, hematomas, infections, benign and malignant lesions)	SGD + SDL +Interactive Lectures + PBL	MCQS
Identify the bones, muscles, and neurovascular structures of the face. Recognize clinical conditions affecting facial structures, including trauma, infections, tumors, and neurological or congenital anomalies.	Face • Bones of the face (maxilla, mandible, zygoma, nasal, lacrimal, vomer, orbital cavity. • Muscles (facial expression, mastication) • Neurovascular supply (arterial, venous, nerve and lymphatics. • Clinical consideration (soft tissue and bony trauma, infections, cysts and tumors, neurological conditions like facial nerve palsy and trigeminal neuralgia, congenital anomalies.	SGD + SDL +Interactive Lectures + PBL	MCQS

Describe the anatomy, histology, and functional biomechanics of the temporomandibular joint. Identify common TMJ disorders and their clinical implications.	Temporomandibular Joint • Gross Anatomy • Bones, Articular disc, Joint capsule, ligaments, muscles of mastication and neurovascular supply. · Histology • Articular surfaces, disc, synovial membrane, joint capsule and ligaments. · Movements • Opening, closing, protrusion, retrusion and excursion, centric relation and centric occlusion. • Biomechanics (condyle-disc-fossa relationship, role of synovial fluid, influence of occlusion and neuromuscular control) · Pathologies/Disorders and Clinical Aspects • Disc displacements, inflammatory conditions, degenerative joint diseases, ankylosis, and dislocation. • Muscular disorders (pain, spasm, trismus, bruxism and clenching)	SGD + SDL +Interactive Lectures + PBL	MCQS

Describe the anatomical features (origin, insertion, action, and innervation) of the primary muscles of mastication. Explain the functional role of masticatory muscles in mandibular movements and their coordination with the temporomandibular joint. Identify common clinical conditions related to masticatory muscles and interpret their significance in diagnosis and treatment.	Muscles of mastication · Introduction o Overview and classification of muscles of mastication o Functional roles in mastication and speech · Anatomy of Muscles Ø Origin, insertion, nerve supply, and action of: • Masseter • Temporalis • Medial pterygoid • Lateral pterygoid · Innervation o Mandibular division of the trigeminal nerve (CN V3) o Pathways and clinical correlations · Vascular Supply o Arterial and venous supply o Maxillary artery branches · Functional Dynamics • Role in mandibular movements: elevation, depression, protrusion, retrusion, lateral excursion · Clinical Considerations	SGD + SDL +Interactive Lectures + PBL	MCQS

	o Myofascial pain o Spasm, trismus, and bruxism o Effects of nerve injury o Implications in temporomandibular joint disorders · Research & Imaging		

Describe anatomical features, position and function of facial muscles. Relationship with other structures like fascia and vessels.	Muscles of Facial Expression · Overview o Classification and general characteristics o Embryological origin (second pharyngeal arch) · Anatomy Ø Location-based grouping: • Scalp • Orbit • Nose • Mouth • Neck · Innervation o Facial nerve (CN VII): course, branches, and clinical relevance · Functional Roles o Expression, speech articulation, eye closure, and oral competence · Clinical Relevance • Facial nerve palsy (e.g., Bell's palsy) • Asymmetry and muscle dysfunction • Implications in reconstructive surgery and esthetics	SGD + SDL +Interactive Lectures + PBL	MCQS

Describe the anatomy, histology, and neurovascular supply of the major salivary glands. Recognize common clinical conditions associated with salivary glands and their diagnostic approaches.	Salivary Glands · Introduction • Types of salivary glands: major vs minor • Functions and composition of saliva · Anatomy of Major Glands • Parotid gland: location, duct (Stensen's), relations • Submandibular gland: location, duct (Wharton's), relations • Sublingual gland: position, ducts, relations · Histology • Acinar types: serous, mucous, and mixed • Ductal system: intercalated, striated, and excretory ducts · Neurovascular Supply • Arterial and venous supply • Parasympathetic and sympathetic innervation · Clinical Relevance • Sialadenitis, sialolithiasis • Tumors (pleomorphic adenoma, mucoepidermoid carcinoma) • Imaging and biopsy considerations	SGD + SDL +Interactive Lectures + PBL	MCQS

Explain the arterial supply of the oral cavity, with emphasis on branches of the external carotid artery, including the maxillary, lingual, and facial arteries, and their relevant subdivisions. Describe the venous drainage pathways of the oral cavity, including key venous structures such as the pterygoid venous plexus, facial, lingual, and retromandibular veins, and their clinical significance. Analyze the anastomotic networks within the oral cavity, highlighting the collateral circulation and its relevance in surgical procedures and pathological conditions.	Vascular Supply of Oral Cavity · Arterial Supply Ø Branches of External Carotid Artery: o Maxillary Artery: Detailed study of its three parts and branches supplying the oral cavity, including Inferior alveolar artery, buccal artery and posterior superior alveolar artery. o Infraorbital artery o Greater palatine artery o Lesser palatine artery o Lingual Artery: Detailed course and branches o Facial Artery: Branches contributing to oral cavity supply (e.g., superior and inferior labial arteries to lips, angular artery). o Ascending Pharyngeal Artery: Contributions to soft palate. o Anastomotic Networks: Extensive collateral circulation within the oral cavity, emphasizing connections between major arterial systems. · Venous Drainage o Pterygoid Venous Plexus: Location, tributaries (e.g., inferior alveolar vein, deep facial vein, posterior superior alveolar vein), and connections to	SGD + SDL +Interactive Lectures + PBL	MCQS

	cavernous sinus (clinical significance: "danger triangle"). o Facial Vein: Tributaries from lips, cheeks, and its drainage into the internal jugular vein. o Lingual Veins: Dorsal lingual, deep lingual, sublingual veins, and their drainage. o Retromandibular Vein: Its role in draining superficial temporal and maxillary veins. o Internal Jugular Vein: The primary drainage pathway for most oral cavity veins.		

Describe the anatomical organization and classification of lymphoid tissues in the head and neck. Identify and trace the lymphatic drainage pathways of the face and oral cavity, detailing the role of superficial, regional, and deep cervical lymph nodes, as well as terminal drainage into the jugular trunks and thoracic duct. Interpret clinical implications of lymphatic anatomy, such as the spread of infections and malignancies, recognizing signs of lymphadenopathy, lymphadenitis, and oral manifestations of systemic lymphatic disorders.	Lymphatic Drainage of Head & Neck: · Lymphoid Tissue Anatomy • Classification and components (Waldeyer's ring) • Tonsils: palatine, lingual, pharyngeal, tubal · Lymph Nodes • Superficial nodes of head and face (e.g., occipital, preauricular, parotid, facial) • Regional oral lymph nodes (submental, submandibular) • Deep cervical lymph nodes (superior and inferior) • Terminal drainage (jugular trunks, thoracic duct) · Lymphatic Drainage Pathways • Specific regions of the face and oral cavity • Interconnections and flow toward systemic circulation · Clinical Correlations • Lymphadenopathy and lymphadenitis • Spread of infections (e.g., odontogenic) • Metastasis in head and neck cancers • Oral signs of systemic lymphatic diseases	SGD + SDL +Interactive Lectures + PBL	MCQS

Describe the functional classification and major branches ofcranial nerves relevant to the head and neck. Explain the sensory, motor, and autonomic innervation of facial structures, oral cavity, and associated glands. Identify common clinical conditions related to cranial nerve dysfunction and their implications in dental and surgical practice.	Nerve Supply of Head & Neck: · Cranial Nerves Overview o Functional classification (motor, sensory, mixed) o Key cranial nerves relevant to head and neck: V (Trigeminal), VII (Facial), IX (Glossopharyngeal), X (Vagus), XI (Accessory), XII (Hypoglossal) · Trigeminal Nerve (CN V): o Divisions: Ophthalmic (V1), Maxillary (V2), Mandibular (V3) o Sensory and motor distribution · Facial Nerve (CN VII): • Motor branches to muscles of facial expression • Chorda tympani (taste and salivary glands) · Other Cranial Nerves o Glossopharyngeal and vagus: pharyngeal and laryngeal innervation o Hypoglossal: motor to tongue muscles o Accessory nerve: motor to sternocleidomastoid and trapezius · Autonomic Nerve Supply: • Sympathetic and parasympathetic pathways	SGD + SDL +Interactive Lectures + PBL	MCQS

	• Innervation of salivary glands, lacrimal glands, and blood vessels · Clinical Relevance o Neuralgia (e.g., trigeminal neuralgia) o Nerve injuries (facial paralysis, hypoglossal palsy) o Anesthesia and nerve blocks in dentistry		

Identify and describe the classification, structure, and histological features of the different types of oral mucosa. Explain the functional roles of oral mucosa in protection, sensation, and permeability. Recognize and correlate common clinical conditions and systemic manifestations associated with oral mucosal changes.	Oral Mucosa: · Anatomy and Histology · Classification of Oral Mucosa • Lining mucosa (non-keratinized; buccal, labial, alveolar mucosa, soft palate, floor of mouth) • Masticatory mucosa (keratinized/parakeratinized; gingiva, hard palate) • Specialized mucosa (dorsal tongue; papillae) · Histology • Epithelium: types (keratinized, non-keratinized), cellular layers, specialized cells • Lamina propria: connective tissue types, fibers, vasculature, innervation • Submucosa: presence, components, functional relevance • Site-specific histology and clinical appearance · Functions of Oral Mucosa o Protective barrier o Sensory functions o Absorption and permeability o High epithelial cell turnover and regeneration · Clinical Considerations	SGD + SDL +Interactive Lectures + PBL	MCQS

	o Developmental Anomalies: Ankyloglossia, fissured/geographic tongue o Inflammatory & Infectious Lesions o Autoimmune & Mucocutaneous Diseases o Potentially Malignant & Malignant Lesions o Systemic Conditions: Oral signs of nutritional deficiencies, hematologic, GI, and skin diseases · Junctional complexes		

Describe the anatomical divisions, papillae types, and muscular structure of the tongue, including their respective roles in shape and positional control. Explain the functional significance of the tongue in taste perception, articulation, mastication, and swallowing. Identify common clinical conditions affecting the tongue and correlate their manifestations with underlying anatomical and functional features.	Tongue · Anatomy and Histology of the Tongue o Gross Anatomy: Divisions (oral and pharyngeal parts), sulcus terminalis, foramen cecum, median sulcus. · Papillae: o Filiform Papillae o Fungiform Papillae o Circumvallate Papillae o Foliate Papillae · Muscles of the Tongue: o Intrinsic Muscles: (Superior longitudinal, inferior longitudinal, transverse, vertical) – responsible for changing tongue shape. o Extrinsic Muscles: (Genioglossus, Hyoglossus, Styloglossus, Palatoglossus) – responsible for changing tongue position. · Function o Taste Perception o Speech (Articulation o Mastication and Swallowing (Deglutition) · Clinical Consideration o Glossitis	SGD + SDL +Interactive Lectures + PBL	MCQS

	o Geographic Tongue o Hairy Tongue. o Traumatic Lesions o Neoplasms · Hard & Soft Palate Anatomy		

Differentiate and describe the various types of physiologic tooth movement. Explain the complex cellular and molecular events that drive bone remodeling within the alveolar bone and periodontal ligament during tooth movement. Understand the Role of the Periodontal Ligament (PDL). Explain the various theories and factors contributing to tooth eruption. Detail the mechanisms by which teeth maintain their position throughout life. Correlate the understanding of physiologic tooth movement with its implications in various dental disciplines.	Physiologic Tooth Movement · Types of Physiologic Tooth Movement Ø Pre-Eruptive Tooth Movement: o Bodily Movement o Eccentric Growth: o Associated bone remodeling Ø Eruptive Tooth Movement (Active Eruption): o Definition Ø Mechanisms/Theories of Eruption: o Root Formation Theory o Bone Remodeling Theory o Periodontal Ligament (PDL) Traction Theory o Vascular Pressure Theory · Post-Eruptive Tooth Movement. o Movements to Accommodate Jaw Growth o Compensation for Occlusal Wear o Compensation for Proximal Wear (Mesial Drift)	SGD + SDL +Interactive Lectures + PBL	MCQS

	Ø Factors include: o Anterior component of force during mastication. o Contraction of transseptal fibers of the PDL. o Soft tissue pressure from cheeks and lips. · Biological Basis of Tooth Movement o Periodontal Ligament (PDL) o Alveolar Bone: Ø Pressure-Tension Theory: · Clinical Implications o Orthodontics: Understanding physiologic tooth movement is fundamental to orthodontic tooth movement		

• Describe the phases of tooth eruption and the factors influencing its timing and progression. • Explain the cellular and molecular mechanisms involved in the shedding of primary teeth and the role of permanent successors. • Identify clinical anomalies related to eruption and shedding and discuss their developmental significance.	Eruption and Shedding of Teeth · Tooth Eruption o Phases of Tooth Movement. • Pre-eruptive Phase. • Eruptive (Prefunctional) Phase. • Intraosseous Stage. • Extraosseous Stage. • Post-eruptive (Functional) Phase. • Compensation for jaw growth. • Compensation for occlusal wear. • Compensation for proximal wear (mesial drift). o Role of the Dental Follicle. o Gubernacular Cord and Canal. o Cellular and Molecular. Regulation of Eruption. o Key Signaling Molecules. o Factors influencing variations in eruption timing. · Shedding of Primary Teeth (Exfoliation) o Definition and mechanisms of Root Resorption. • Role of the Succedaneous Permanent Tooth. • Influence of Masticatory Forces.	SGD +SDL +Interactive Lectures + PBL	MCQS

	o Pattern of Shedding: • Role of dental follicle of the permanent tooth in signaling resorption. · Clinical Implications o Developmental Anomalies of Eruption: Impaction, delayed eruption, premature eruption, ankylosis, submerged teeth, eruption cysts/hematomas. o Anomalies of Shedding: Premature shedding, prolonged retention of primary teeth, abnormal resorption patterns.		

4.Recommended Readings:

- Orban" s Oral Histology and Embryology, S, N.Bhaskar
- Oral Histology (Development, Structure and Function)
- Oral Development and Histology, James K.Avery)
- Oral Anatomy, Histology and Embryology by Barry Berkovitz G. Holland, Bernard Moxham published by Mosby, 2009
- High-yield Neuroanatomy by James D Fix
  Journals:
- Critical Reviews In Oral Biology and Medicine
- Archives of Oral Biology
- Journal of Oral Biology and Craniofacial Research 4. International Journal of Oral Biology

ORB 705: Oral Histology & Pathology

(2+1 Credit Hrs)

Oral histopathology is a key discipline of Anatomical Pathology. This course provides a sound understanding of histology and pathology as medical science disciplines. The role of diagnostic laboratories in the diagnosis of various disease states and in patient care and management will be covered. This course facilitates students to develop understanding of the microscopic structure, organization and function of human cells and tissues in health and disease, and develop expertise in the techniques used for their microscopic study. It will also provide an introduction for the further systematic study of histopathology and cytopathology disciplines. This course focuses on developing theoretical knowledge and practical skills required for histopathological techniques and cytological interpretation and diagnosis in a variety of specimens.

1.Objectives:

Upon successful completion of this course, student will be able to;
Recognize and define the regulatory and safety procedures for specimen reception, identification and handling in anatomical pathology.
Discuss and explain the principles and perform: fixation, microtomy and various staining techniques for histopathological specimens. This includes the selection and application of immunohistochemical methods.
Relate the knowledge of the principles and procedures involved in the collection, processing, cytopreparation, screening, interpretation and reporting of common cytology specimens. This includes the use of ancillary testing, to different cytoathological diagnosis.
Relate basic knowledge to the aetiology, pathogenesis, pathology, histology and cytology to Interpret and describe the morphological features found in cytology specimens

2.Course Contents:

Week	Topic	Subtopics
1	Introduction to Histology & Pathology	8. Scope and importance 9. Methods of tissue preparation and microscopy 10. Types of epithelium in the oral cavity 11. Terminology and basic disease concepts Methods of diagnosis: biopsy, staining, histopathology 12.
2	Introduction to Histological Techniques	Importance of tissue processing Overview of histopathology workflow Types of specimens and grossing
3	Tissue processing	Introduction to tissue processing Main stages of tissue processing Automation in tissue processing Artifacts in tissue processing Alternative Tissue Processing Techniques Safety and Quality Control
4	Fixation	Definition and purpose Mechanism of action Factor affecting fixation Methods of fixation Types of fixatives

5	Microtomy	Introduction to microtomy Types of microtomes Parts of a Microtome Microtome Knives and Blades
6	Staining	Introduction to staining Basic (routine) staining Special stains Cytological stains Staining artifacts Mounting and Coverslipping Storage and quality control
7	Cytpreparation	Introduction to Cytopreparation Collection and Fixation of Cytological Specimens Cytological Smear Preparation Techniques Staining of Cytological Specimens Mounting and Slide Labeling Microscopic Evaluation Quality Control in Cytopreparation Safety and Waste Disposal
8	Screening, Interpretation, and Reporting of Common Cytology Specimens	Introduction to Cytological Screening Types of Cytology Specimens

		Screening techniques Interpretation of Cytological Features Reporting formats and guidelines Quality control and Assurance
9	Midterm Exam	Written + Practical (spotting/model ID)
10	Benign Conditions of Oral Tissues	Developmental/Hereditary Lesions Reactive/Inflammatory Lesions Benign Neoplasms Cysts Pigmented lesions
11 & 12	Premalignant Disorders	Leukoplakia (homogenous & non-homogenous) Erythroplakia Oral Submucous Fibrosis Oral Lichen Planus (controversial PMD) Actinic cheilitis Dysplastic changes – histological grading (mild, moderate, severe)
13	Malignant Lesions of the Oral Cavity	Squamous cell carcinoma Verrucous Carcinoma Salivary Gland Malignancies Sarcomas and Others
14	Biopsy	Incisional Excisional Brush biopsy

15 & 16	Differential Diagnosis of Common Oral Lesions	Ulcers White/red lesions Pigmented lesions Swellings Radiolucent/radiopaque jaw lesions

Table of Specifications:

Learning objectives	Course content	Time	MIT	assessment

• Define oral histology and oral pathology.
• Explain the relevance of oral histology and pathology in dental practice
• Discuss the role of oral pathology in diagnosing and managing oral diseases.
• Appreciate the integration of clinical, radiographic, and microscopic findings in patient care
• Understand the principles and steps in tissue preparation for microscopic examination.
• Describe the use of various types of microscopies in oral histology and pathology.
• Identify common staining techniques and their diagnostic applications.
• Demonstrate basic handling of histological slides and microscopes.
  • Classify and describe the different types of epithelia lining the oral cavity.
	• **Definition and Introduction**
	  • Oral histology: study of microscopic structure of oral tissues.
	  • Oral pathology: study of disease processes affecting oral tissues.
	• **Introduction to Histological Techniques**
	  • Importance in diagnosis and research.
	• **Tissue Fixation**
	  • Purpose, types of fixatives (formalin, alcohol, glutaraldehyde).
	• **Tissue Processing**
	  • Dehydration, clearing, embedding.
	• **Sectioning and Mounting**
	  • Use of microtome
	  • Slide preparation and cover slipping.
	• **Staining Techniques**
	  • Hematoxylin and eosin (H&E)
		2hrs	SGD+
			Interactive
			Lectures+ PBL
				MCQS

• Understand the structural differences between keratinized and non-keratinized epithelium **Describe** the sequential steps involved in preparing tissue for microscopic examination.
 	
• **Identify** common reagents and materials used at each processing step.
• **Demonstrate** knowledge of embedding and sectioning techniques.
• **Recognize** errors or artifacts in tissue processing and their impact on diagnosis.
• **Understand** safety protocols and proper handling of biological specimens and chemicals.
	• Special stains (PAS, Masson's trichrome, Van Gieson
	
	Introduction to Oral Epithelium
	
	• Definition and general features.
	
	Types of Oral Epithelium
	
	• **Keratinized (Orth keratinized and Para keratinized)**
	  ○ Found in gingiva, hard palate.
	• **Non-keratinized**
	  ○ Found in buccal mucosa, labial mucosa, floor of mouth, soft palate.
	• **Specialized epithelium**
	  ○ Dorsum of tongue (taste buds, papillae).
	
	• **Histological Layers**
	
	• Basal, prickle (spinous), granular, and keratin layer
	• Differences in keratinized vs. non-keratinized epithelium.
	
	• **Function of Oral Epithelium**
	
	• Barrier protection, sensation, secretion.
	• **Microscopic Identification**			

	• Slide observation and identification in lab sessions			
• Understand the purpose of fixation in preserving biological tissues. • Identify common fixatives (e.g., formaldehyde, glutaraldehyde) and their mechanisms of action. • Differentiate between physical and chemical methods of fixation. ▫ Describe the steps involved in tissue processing for microscopic examination. • Analyze how improper fixation can affect histological results	**Introduction to Tissue Processing** • Definition and objectives of tissue processing. • Importance in oral histology and pathology. • Overview of steps: fixation, dehydration, clearing, infiltration, embedding, sectioning, staining, mounting. • **Fixation** • Purpose: preserve tissue morphology and prevent decomposition. • Factors affecting fixation: pH, osmolarity, temperature, volume. **Dehydration:** • Purpose: remove water from tissue before embedding. • Dehydrating agents: graded ethanol series (70%, 90%, 100%). • Alternative agents: acetone. • Duration and technique for optimal dehydration. **Clearing:** • Purpose: remove alcohol and make tissue transparent before wax infiltration. • Common clearing agents:	**2hrs**	**SGD+ Interactive** **Lecture+ PBL**	**MCQS**

	○ Xylene (most common) ○ Chloroform **Infiltration:** • Purpose: impregnate tissue with embedding medium (e.g., paraffin). • Factors affecting infiltration: time, temperature, tissue size. **Embedding:** • Purpose: support tissue to allow thin sectioning. • Embedding media: ○ Paraffin wax (routine histology) ○ Resin (for ground sections or undecalcified bone) • Molds and orientation techniques (important for diagnostic accuracy). • Labeling and storage of blocks. **Sectioning:** • Use of microtome (rotary, sliding, sledge types). • Optimal section thickness (3–5 µm for routine histology). • Techniques for obtaining wrinkle-free, intact sections. • Section floating (water bath), lifting, and mounting on slides. • Common sectioning errors/artifacts. **Staining**			

	• Purpose of staining: enhance contrast to identify tissue components. • Routine stains: Hematoxylin and Eosin (H&E). • Introduction to special stains: PAS, Masson's Trichrome, etc. **Mounting** • Purpose: preserve stained tissue and cover with a protective layer. • Use of mounting media (e.g., DPX). • Cover slipping and labeling. • Storage of prepared slides.			
• **Define** microtomy and explain its role in histopathology and diagnostics. • **Identify** and describe different types of microtomes and their applications. • **Explain** the principles of tissue sectioning, including thickness, ribboning, and blade angle.	**Introduction to Microtomy** • Definition and importance • Historical background • Role in tissue diagnostics and research **2. Microtome Types and Mechanisms** • **Rotary microtome** (most common for paraffin-embedded tissue) • Sliding microtome • Sledge microtome • Ultramicrotome (for EM) • Cryostat (for frozen sections) • Vibratome (for unfixed tissues)	**2hrs**	**SGD+ Interactive** **Lectures+ PBL**	**MCQS**

	3. Tissue Embedding and Block Preparation • Orientation of tissue for optimal sectioning • Embedding media (paraffin wax, resin) • Trimming blocks for sectioning **4. Blades and Knife Technology** • Types of blades: steel, tungsten carbide, glass, diamond • Disposable vs. reusable blades • Blade angle and positioning • Blade maintenance and sharpening techniques (if applicable) **5. Sectioning Techniques** • Standard section thicknesses (3–5 µm for H&E) • Creating ribbons • Adjusting microtome settings (clearance angle, feed rate) • Floatation and mounting of sections on slides **6. Common Sectioning Artifacts** • Chatter or “venetian blinds” • Compression • Wrinkles and folds • Knife lines or scores • Poor ribboning • Causes and corrective actions			

	7. Cryotomy (Frozen Sectioning) • Use of cryostat microtome • Embedding with OCT compound • Sectioning technique at low temperatures • Rapid intraoperative diagnosis			
• Define the purpose and importance of staining in histology and pathology. • Explain the chemistry of staining, including dye-tissue interactions. • Classify different types of stains (routine, special, histochemical, immunohistochemical). • Perform routine H&E staining with proper technique. • Understand the principles behind special stains (e.g., PAS, Masson's trichrome, Ziehl-Nelsen	**Introduction to histological staining** • Purpose and goals of staining • Overview of tissue processing to staining • Importance in diagnosis and research **Principles of Staining** • Tissue components and chemical properties • Acidic vs. basic dyes • Affinity and specificity • Mordants and their role • Direct vs. indirect staining	**2hrs**	**SGD+Interactive Lectures** **+ PBL**	MCQS

• Explain the function and use of cytopreparatory instruments and equipment	**Introduction to Cytopreparation** • Definition and scope • Importance in cytology and diagnostic pathology • Role of cytopreparators and cytotechnologist **Overview of Cytological Specimens** • Types: Gynecological (GYN), Non-Gynecological (NON-GYN), Fine Needle Aspiration (FNA) • Differences in cellularity and handling • Indications for cytological analysis **Specimen Collection Techniques**	**2hrs**	**SGD+ Interactive** **Lectures** **+ PBL**	**MCQS**
• Identify and describe benign conditions affecting the oral cavity. • Differentiate benign from malignant oral lesions. • Understand etiopathogenesis, clinical features, diagnostic approaches, and treatment options for benign oral conditions.	**Introduction to Oral Soft Tissue Lesions** • Definition and classification of oral lesions • Differentiation: Benign vs Premalignant vs Malignant • Diagnostic approach to oral soft tissue lesions **Developmental Anomalies** • Fordyce's granules • Leukoedema • Lingual thyroid nodule • Fissured tongue • Median rhomboid glossitis	**2hrs**	**SGD+ Interactive** **Lectures+ PBL**	**MCQS**

	• Geographic tongue (benign migratory glossitis) • Ankyloglossia **Benign Mucosal Lesions** • Mucocele and ranula • Irritation fibroma • Epulis types (e.g., fibrous, granulomatous) • Pyogenic granuloma • Peripheral giant cell granuloma • Papilloma (squamous papilloma) • Verruca vulgaris • Condyloma acuminatum **Benign Pigmented Lesions** • Physiological pigmentation • Melanotic macule • Oral melanocytic nevus • Smoker's melanosis • Amalgam tattoo **Benign Salivary Gland Disorders** • Sialolithiasis • Sialadenitis (acute and chronic) • Sialadenitis • Benign salivary gland tumors (overview) • Mucous retention cyst **Benign Bone and Periodontal Lesions** • Tori and exostoses • Cement-osseous dysplasia • Fibrous dysplasia • Ossifying fibroma • Central giant cell granuloma			

	• Odontogenic cysts (non-neoplastic) **Benign Odontogenic Tumors (Overview)** • Ameloblastoma (benign but locally aggressive) • Adenomatoid odontogenic tumor • Odontoma **White Lesions of the Oral Mucosa (Benign Types)** • Frictional keratosis • Linea alba • Cheek biting (morsicatio buccarum) • Nicotinic stomatitis • Hairy tongue **Benign Ulcerative and Vesiculobullous Lesions** • Recurrent aphthous ulcers • Traumatic ulcers • Thermal/chemical burns **Systemic Conditions with Benign Oral Manifestations** • Diabetes-related oral changes • Hormonal changes • Nutritional deficiencies (e.g., angular cheilitis, glossitis) • Anemias			
• Define and classify potentially malignant disorders (PMDs) of the oral cavity.	**Etiology and Risk Factors**	**2hrs**	**SGD+I nteractive** **Lectures+ PBL**	**MCQS**

• Understand the risk factors associated with malignant transformation. • Describe clinical and histopathological features of various OPMDs. • Identify diagnostic and management strategies for OPMDs	**Classification of Oral Potentially Malignant Disorders (WHO Classification 2020)** • Oral leukoplakia • Oral erythroplakia • Oral submucous fibrosis (OSMF) • Oral lichen planus (OLP) • Actinic cheilitis • Proliferative verrucous leukoplakia (PVL) • Oral lichenoid lesions **Oral Leukoplakia** • Definition (by exclusion) • Clinical types: • Risk of malignant transformation • Histopathology: dysplasia grading • Management **Oral Erythroplakia** • Clinical appearance and sites • High-risk lesion (highest rate of malignant transformation) • Histopathological features • Management strategy **Oral Submucous Fibrosis (OSMF)** • Etiology: areca nut, nutritional factors • Pathogenesis and fibrosis mechanism • Clinical features: burning, restricted mouth opening • Staging and classification • Histological grading • Risk of malignant transformation			

	• Management
	
	Oral Lichen Planus (OLP)
	
	• Immunologically mediated condition
	• Clinical types: reticular, erosive, plaque-like, bullous, atrophic
	• Risk of transformation (controversial)
	• Histopathological features: saw-tooth rete pegs, basal cell degeneration
	• Management:
	  ○ Corticosteroids (topical/systemic)
	  ○ Immunomodulators
	  ○ Regular follow-up
	
	Proliferative Verrucous Leukoplakia (PVL)
	
	• Persistent, multifocal, progressive leukoplakia
	• High rate of recurrence and malignant transformation
	• Clinical and histological progression
	
	Actinic Cheilitis
	
	• Sun-induced premalignant lesion of the lip (typically lower lip)
	• Clinical signs: dryness, scaling, ulceration
	• Risk factors: fair skin, chronic sun exposure
	• Prevention and treatment
	
	Histopathology of Epithelial Dysplasia			

	• Grading (mild, moderate, severe)
	• Key histological features:
	  ○ Cellular atypia
	  ○ Loss of polarity
	  ○ Increased mitotic activity
	• Carcinoma in situ			

• Define and classify malignant lesions of the oral cavity.
• Recognize early clinical signs and symptoms of oral malignancies.
• Understand the etiopathogenesis and risk factors.
• Describe histopathological features and grading systems.
• Explain staging (TNM classification) and treatment modalities.
• Emphasize the importance of
	Introduction to Oral Cancer
	• Definition of oral cancer
	• Epidemiology:
	  ○ Global incidence and mortality
	  ○ High-risk regions
	• Oral cancer vs oropharyngeal cancer
	
	Etiology and Risk Factors
	• Tobacco (smoked and smokeless)
	• Areca nut and betel quid
	• Alcohol
	• Human Papillomavirus (HPV) – especially HPV-16
	• Sun exposure (for lip cancer)
	• Chronic trauma/irritation
		2hrs	**SGD+ Interactive**
			
			Lectures+ PBL
				MCQS

prevention and early diagnosis	• Immunosuppression **Classification of Oral Malignancies** **.Epithelial Malignancies** • **Squamous Cell Carcinoma (SCC)** – Most common (over 90%) • Verrucous carcinoma • Basal cell carcinoma (lip) • Spindle cell carcinoma **Salivary Gland Malignancies** • Mucoepidermoid carcinoma • Adenoid cystic carcinoma • Polymorphous adenocarcinoma • Acinic cell carcinoma **Lymphoproliferative Malignancies** • Non-Hodgkin's lymphoma • Plasmacytoma • Leukemia (oral manifestations) **Sarcomas** • Kaposi's sarcoma (HIV-associated) • Osteosarcoma • Rhabdomyosarcoma **Melanoma** **Metastatic Tumors to the Oral Cavity**			

	Oral Squamous Cell Carcinoma (OSCC) • Sites • Clinical features • Types • Histopathology • Staging and grading • Diagnostic methods • Management • Prognosis and survival • Complication and reoccurrence • Prevention and early detection			
• Understand the principles and indications for various types of biopsies • Demonstrate knowledge of biopsy techniques. • Know how to handle and process biopsy samples. • Interpret biopsy results in clinical context. • Identify complications and management post-biopsy.	**Introduction to Biopsy** • Definition and importance of biopsy in diagnosis. • Historical evolution of biopsy techniques. • General indications and contraindications. • Risks, benefits, and ethical considerations. **Types of biopsies** • **Needle Biopsies:** • Fine Needle Aspiration (FNA) • Core Needle Biopsy • Vacuum-Assisted Biopsy **Surgical Biopsies:** • Incisional • Excisional **Endoscopic Biopsy**	**2hrs**	**SGD+ Interactive** **Lectures** **+ PBL**	**MCQS**

	Punch Biopsy (Dermatology)
	
	Brush Biopsy
	
	Curettage **Biopsy**
	
	Pre-Biopsy Assessment
	
	• Patient history and examination.
	• Coagulation profile & contraindications.
	• Imaging support (ultrasound, CT, MRI-guided biopsies).
	• Antiseptic and anesthetic procedures.
	• Biopsy site preparation and marking.
	
	Post-Biopsy Care and Complications
	
	• Observation and monitoring.
	• Management of common complications:
	  ○ Bleeding
	  ○ Infection
	  ○ Pneumothorax (lung biopsy)
	  ○ Pain and hematoma
	• Patient education and follow-up instructions.			

• Differential Diagnosis of Common Oral Lesions	**Classification of Oral Lesions (by Clinical Appearance)** • **White Lesions** • **Red Lesions** • **Ulcerative Lesions** • **Pigmented Lesions**	**2 hrs**	**SGD +Interactive** **Lectures** **+ PBL**	**MCQS**

	• **Vesiculobullous Lesions** • **Nodular/Mass Lesions** • **Radiolucent/Radiopaque Lesions (Intraosseous)** **White Lesions** Non-scrapable or scrapable white patches/plaques **Scrapable White Lesions** • Oral Candidiasis (Pseudomembranous) • Moscato buckram (chronic cheek biting) • Chemical burns (aspirin, clove oil, etc.) **Non-Scrapable White Lesions** • Leukoplakia (premalignant) • Lichen planus (reticular type) • Chronic hyperplastic candidiasis • Oral hairy leukoplakia (seen in HIV) • Frictional keratosis • White sponge nevus (genetic) **Red Lesions (Erythrolein / Erythematous)** Erythematous areas, often with or without ulceration • **Erythrolein** (high risk of malignancy) • **Atrophic candidiasis** (e.g., denture stomatitis) • **Lichen planus** (atrophic/erosive type) • **Discoid lupus erythematosus**			

	• Desquamative gingivitis • Thermal burns **Ulcerative Lesions** Breaks in mucosal continuity **Acute Ulcers** • **Traumatic ulcer** • **Aphthous ulcers (minor, major, herpetiform)** • Primary herpetic gingivostomatitis • Herpes simplex virus (HSV-1) **Chronic Ulcers** • Oral squamous cell carcinoma • Tuberculous ulcer • Syphilitic ulcer • Fungal infections (histoplasmosis) • Chronic traumatic ulcers **Pigmented Lesions** **Physiologic / Benign Pigmentation** • Racial (ethnic) pigmentation • Smoker's melanosis • Amalgam tattoo • Melanotic macule **Pathological / Malignant Pigmentation** • Oral melanocytic nevus • Malignant melanoma • Drug-induced pigmentation (e.g., minocycline)			

	• Addison's disease (diffuse pigmentation) **Vesiculobullous Lesions** Blisters or vesicles that rupture and ulcerate **Infectious** • **Herpes simplex virus** • **Varicella-zoster virus** (chickenpox, shingles) • Hand-foot-and-mouth disease (Coxsackievirus) • Herpangina **Autoimmune** • **Pemphigus vulgaris** • **Mucous membrane pemphigoid** • **Bullous pemphigoid** • **Erythema multiforme** • Stevens-Johnson syndrome **Nodular/Mass Lesions** Localized swellings or growths **Reactive/Benign** • **Fibroma (traumatic fibroma)** • Pyogenic granuloma • Peripheral giant cell granuloma • Mucocele / Ranula • Lipoma • Hemangioma • Lymphangioma			

	Neoplastic / Malignant • **Squamous cell carcinoma** • **Salivary gland tumors** (e.g., pleomorphic adenoma, mucoepidermoid carcinoma) • Lymphoma • Metastatic tumors **Radiographic (Intraosseous) Oral Lesions** May present as jaw swelling or discovered on imaging **Radiolucent Lesions** • Periapical (radicular) cyst • Dentigerous cyst • Ameloblastoma • Odontogenic keratocyte (OKC) • Traumatic bone cyst **Radiopaque Lesions** • Condensing osteitis • Odontoma • Cementoblastoma • Osteoma **Mixed Lesions** • Calcifying epithelial odontogenic tumor (Pindborg tumor) • Adenomatoid odontogenic tumor (AOT)			

Recommended Readings:

Bancroft JD, Gamble M. Theory and practice of histological techniques. London: Churchill Livingstone, 6th ed, 2008.

Journals:

Journal of Histotechnology
American Journal of Pathology

Journal of Histochemistry and Cytochemistry

Journal of Pathology

Biotechnic and Histochemistryzz

ORB 707: Oral Physiology & Saliva

(2+1 Credit Hrs)

Oral cavity itself is a system consisting of the teeth, the tongue, the oral and the perioral, muscular, soft tissue and glandular components which work harmoniously to cater various functions. The major functions include Mastication, Speech, and Taste Sensation and Production & Regulation of saliva. This course helps you in unveiling the mysteries of these fascinating processes.

Course Objectives:

Upon successful completion of this course, student will be able to:

- Understand the basic physiological functions of orofacial systems.
- Relate physiological principles to clinical dentistry and understand the signs, symptoms, pathology, and treatment of dental disease based upon a thorough knowledge of oral physiology.
- Have appropriate knowledge of oral physiology required for a thorough understanding of dental anesthesia, oral medicine, oral pathology, oral surgery, and pharmacology & therapeutics.
- Explain the role of flora in the oral environment.
- Explore human immunological response to inflammation and immunity.

Course Contents:

Week	Topic	Subtopics
1	Introduction to Saliva	• Definition and overview • Daily secretion volume and flow rates • Historical significance and modern relevance • Role of saliva in oral and systemic health • Composition of saliva
2	Salivary Glands Anatomy & Histology	▫ Major salivary glands: Parotid, Submandibular, Sublingual ▫ Minor salivary glands (location and function)

3	Physiology of saliva	▫ Mechanism: Two-stage model (primary secretion + modification) ▫ Electrolyte transport mechanisms ▫ Role of myoepithelial cells ▫ Types of saliva: serous, mucous, mixed

4	**Regulation of Salivary Secretion**	• Autonomic nervous system control:
		  ○ Parasympathetic: Watery secretion
		  ○ Sympathetic: Protein-rich secretion
		• Neural pathways and reflexes (gustatory, masticatory)
		• Conditioned vs unconditioned reflexes
		• Influence of circadian rhythm, taste, smell, mastication
		• Hormonal influence

5	Oral microbial flora	Composition of oral microbiota Oral Habitats and Site-Specific Flora Biofilm Formation and Dental Plaque Oral microbiota in health Factors affecting oral microbiota
6	Saliva in Special Conditions	▫ Age-related changes in salivary flow ▫ Changes in pregnancy, menopause ▫ Impact of systemic diseases: Diabetes, HIV/AIDS, cancer ▫ Effects of drugs (anticholinergics, antidepressants, antihistamines)
7	Introduction to Sensory Physiology	▫ Definition: ▫ Classification of senses: ▫ Basic components of a sensory system:

8	**Sensory Receptors**	• Classification of receptors:
		  ○ Based on stimulus type
		  ○ Based on location

		• Properties of receptors:
		  ○ Specificity
		  ○ Threshold
		  ○ Adaptation (rapid vs slow)

9	Midterm Exam	Written + Practical (spotting/model ID)
10	Somatosensory System	▫ **Pathways**: ▫ Dermatome distribution ▫ Sensory homunculus ▫ Sensory integration in the somatosensory cortex
11 & 12	• Pain and temperature sensation	**Pain and Temperature Sensation** • Nociceptors and pain pathways • Types of pain • Gate control theory of pain • Referred pain and its physiological basis • Modulation of pain • Thermoreceptors and temperature regulation
13& 14	Special senses overview(1)	• Vision • hearing
15 & 16	Special senses overview(2)	• Olfaction • taste
17	Physiology of mastication	Introduction Muscles of mastication Neural control Phases of mastication Role of saliva in mastication
18	Physiology of speech	▫ Definition of speech ▫ Importance of speech in communication ▫ Difference between **speech**, **language**, and **voice**

		▫ Overview of the speech production process • Respiratory system • Phonatory system • Articulatory system • Neural control of speech • Disorders of speech

Table of Specifications:

Learning objective	Course content	Time	MIT	Assessment
1.Define saliva and explain its origin in the human body. Describe the composition of saliva, including its organic and inorganic components. Identify the major and minor salivary glands and compare their secretions. Explain the physiological functions of saliva in digestion, oral health, and immunity. Discuss the neural regulation of salivary secretion. Recognize clinical conditions associated	. Introduction to Saliva Definition of saliva Average daily production Physical properties Classification: serous, mucous, and mixed saliva **Composition of Saliva** **a.** Inorganic components **b.** Organic components Functions of saliva	2 hour	Lec+ SGD + SDL + Practical	MCQS

with abnormal salivary flow, such as xerostomia and sialorrhea.				
2. Identify the major and minor salivary glands and describe their anatomical locations. Differentiate between the parotid, submandibular, and sublingual glands based on structure and duct systems. Trace the pathway of salivary secretion through the associated ductal systems. Describe the neurovascular supply and innervation of the major salivary glands	Introduction to Salivary Glands Classification Role in oral physiology and digestion Gross Anatomy of Major Salivary Glands Anatomy of minor salivary gland Ductal system anatomy Histological Structure of Salivary Glands Innervation and blood supply	2 hour	Lec+ SGD + SDL + Practical	MCQS
3.Describe the volume, composition, and physical characteristics of saliva. Explain the two-stage model of saliva formation, including acinar and ductal modifications.	Mechanism of Saliva Secretion A. Two-Stage Model of Secretion B. Duct System	2 hours	Lec+ SGD + SDL + Practical	MCQS

Differentiate between the types of salivary secretions from the major glands. Discuss the neural regulation of salivary secretion, including parasympathetic and sympathetic control. Identify the stimuli that initiate and modulate salivary secretion.				
4. Define oral microbial flora and describe its role in oral and systemic health. Identify the major microbial species commonly found in the oral cavity. Explain the ecological niches in the mouth and how they influence microbial composition. Differentiate between resident (commensal) and	**Introduction to Oral Microbiota** Definition of oral flora / oral microbiome Oral cavity as a complex microbial habitat **Ecological Niches in the Oral Cavity** **Types of Oral Microorganisms** a. Bacteria b. Fungi c. Viruses	2 hour	Lec+ SGD + SDL+ Practical	MCQS

transient (pathogenic) flora. Discuss the dynamic interactions between oral microbes and host defenses. Describe factors that influence the composition of oral flora (age, diet, hygiene, antibiotics). Relate changes in oral flora to diseases like caries, periodontitis, and systemic infections. Explain the concept of microbial biofilms and dental plaque formation.	d. Protozoa **Colonization and Succession** **Biofilms and Dental Plaque** **Role of Oral Flora in Health** **Factors Affecting Oral Microbial Composition** **Oral Microflora and Disease** a) Dental Caries b) Periodontal Disease c) Oral Candidiasis d) Systemic Infections			
5. Identify physiological and pathological conditions that alter salivary flow and composition. Explain the impact of systemic diseases (e.g., diabetes,	**Saliva in Physiological Conditions** a. Age-Related Changes b. Pregnancy C. Exercise	2 hour	Lec+ SGD + SDL + Practical	MCQS

autoimmune diseases) on saliva. Describe the changes in saliva during psychological stress and dehydration. Discuss the effects of aging, medications, and therapies on salivary glands	**a. Saliva in Pathological Conditions** Xerostomia (Dry Mouth) Sialorrhea (Hypersalivation) Diabetes Mellitus Sjögren's Syndrome Cystic fibrosis b. **Saliva in Psychological and Environmental Conditions:** Stress and Anxiety Dehydration Sleep **c. Saliva and Therapeutic Interventions** Medications Affecting Saliva Radiation Therapy Chemotherapy			
6. Define sensory physiology and its role in the nervous system. Classify the different types of sensory receptors based on	**Overview of Sensory Physiology** **Sensory Modalities**	2 hour	Lec+ SGD + SDL +	MCQS

stimulus type and location. Describe the basic pathway of sensory signal transmission (from receptor to cortex). Explain key concepts: transduction, adaptation, threshold, and receptive fields. Differentiate between somatic and special senses.	**Types of sensory experiences:** General (Somatic) senses Special sense **Sensory Receptors** a. Based on Stimulus Type b. Based on Location **Neural Pathways of Sensory Transmission** First-order neurons Second-order neurons: Third-order neurons		Practical	
7. Describe the structure, function, and mechanisms of sensory receptors in the human body. Understand how sensory systems transduce stimuli into electrical signals that the brain can interpret, covering all major receptor types, pathways, and their	**Introduction to Sensory Systems** ▫ Overview of sensory systems. • Sensory transduction • Sensory thresholds **Mechanoreceptors** • Types of mechanoreceptors: Tactile, proprioceptors, and baroreceptors.	2 hour	Lec+ SGD + SDL + Practical	MCQS

physiological and clinical relevance	• Detailed structure and function of Pacinian corpuscles, Merkel discs, Meissner's corpuscles, and others. • **Thermoreceptors** ▫ Function and types of thermoreceptors (cold vs. warm receptors). ▫ Role of thermoreception in thermoregulation and homeostasis **Photoreceptors** • Structure of the eye and the role of photoreceptors (rods and cones). • Mechanisms of phototransduction and light adaptation **Nociceptors and Pain Perception** • Types of nociceptors: Mechanical, thermal, and chemical. • Pain pathway 13. • pain modulation, and referred pain.			

	Chemoreception (Taste and Smell) ▫ Chemoreceptors for smell (olfactory receptors) and taste (gustatory receptors). ▫▫ Mechanism of olfaction and gustation. **Disorders of Sensory Receptors** Vision disorders (e.g., myopia, glaucoma, macular degeneration). Hearing disorders (e.g., sensorineural hearing loss, tinnitus). Pain disorders (e.g., fibromyalgia, neuropathy). Smell and taste disorders (e.g., anosmia, ageusia).			
8.Understand the Structure of the Somatosensory System Classify Somatosensory Receptors Analyze Sensory Pathways	**Introduction to the Somatosensory System:** Overview of Sensory Systems Definition and general function of sensory systems. The role of the somatosensory system in	2 hour	Lec+ SGD + SDL + Practical	MCQS

Understand how the somatosensory cortex processes sensory information Understand how dysfunctions of the somatosensory system lead to disorders (e.g., neuropathy, phantom limb pain).	perception, motor coordination, and interaction with the environment. **Components of the Somatosensory System** Sensory receptors: specialized structures that detect stimuli Receptive fields: the area each receptor can cover. Pathways: afferent neurons carrying sensory signals from receptors to the CNS. **Somatosensory Pathways** **3.1 Afferent Neurons and Sensory Pathways** First-order neurons: Receptors to the spinal cord or brainstem. Second-order neurons: From spinal cord/brainstem to thalamus.		Lec+ SGD + SDL + Practical	

	Third-order neurons: From thalamus to somatosensory cortex. **Pathways for Different Sensory Modalities** Dorsal Column-Medial Lemniscal Pathway: Carries fine touch, vibration, and proprioceptive information. Spinothalamic Pathway: Carries pain and temperature sensations. **Processing of Sensory Information** The role of the thalamus as a sensory relay station			

Recommended Readings:

Guyton, A.C. textbook of Medical Physiology, Saunders.

Bradley, R.M. Essentials of Oral Physiology, Mosby, Toronto, 1995.

Junge, D. Oral Sensorimotor Function, Medico Dental Media International, John S. Swift Company, St. Louis, 1998.

Lavelle, C.L.B. Applied Oral Physiology, 2nd edition, Wright, Toronto, 1988.

Marsh and Martin's oral microbiology and immunology

Journals:

Archives of oral biology

BMS 754: Biomaterials (Optional)

(1+1 Credit Hrs)

Course Objectives:

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

1. Understand and appreciate the principles of biomaterials
2. Review physical and chemical structural and mechanical properties of different materials used in biomaterial industry
3. Apply knowledge of different materials used in biomaterial industry and its medical application

Course Contents:

The course contents will include: Structure of solids (Atomic bonding, crystal structure, Imperfections in crystalline structures, Long chain molecular compounds, super cooled and network solids, composite material structure), Metallic implant material (Stainless steel, Co-Based alloys, Ti and Ti- Based alloys, Dental metals, Corrosion of metallic implants), Ceramic implant materials (Structure-Property relationship of ceramics, Aluminium oxides, Zirconium oxides, Calcium phosphates, Glass ceramics, Carbons, Deterioration of ceramics), Polymeric implant materials, Polymerization and properties (Effect of structural modification and temperature on properties, Polymeric implant materials, High strength thermoplastics, Deterioration of polymers), Composites as biomaterials (Structure, Mechanics of composites, Applications of composite biomaterials, Biocompatibility of composite biomaterials).

Books Recommended:

1. Biomaterials: An Introduction, by Joan Park & R.S. Lakes, Springer: Latest Ed.
2. Biocompatibility of Dental Materials by GottfrideSchmalz&DortheArenholt: Latest Ed.
3. Dental Materials in Vivo; aging and related phenomena by George Eliades: Latest Ed.

Journals:

1. Materials
2. Biomaterials
3. Acta biomaterialia
4. Materials Science and Engineering: Part A, B, C

BMS 755: Tissue Engineering (Optional)

(1+1 Credit Hrs)

Course Objectives:

Students will be able to:

1. Understand and appreciate the principles of tissue engineering
2. Understand about regenerative materials, and scaffolds.

Course Contents:

Structure-Property relationships of Biological materials (Proteins, Polysaccharides, Structure-Property relationship of tissues), Tissue response to implants (Normal wound healing process, Body response to implants, Blood compatibility, Carcinogenicity), Soft Tissue replacement (Sutures, Skin implants, Maxillofacial implants), Hard tissue replacement (Wires, Pins, Screws, Fracture plates, Intra medullary devices, Acceleration of bone healing, Dental restorations and implants, Interface problems in orthopaedic and dental implants), Tissue engineering materials and regeneration (Substrate scaffold materials, Sterilization of scaffolds, Regeneration stimulated electrically, Cellular aspects, viability, stem cells, Bone regeneration).

Books Recommended:

1. Applied Dental Materials by John F. McCabe & W.J. Walls: Latest Ed.
2. Dental materials and their selection, by William J.O' Brien: Latest Ed.
3. Introduction to Dental Materials, by Richard Van Noort: Latest Ed.
4. Restorative Dental Materials, by R.G. Craig: Latest Ed.

Journals:

1. Dental Materials
2. Materials
3. Materials Science and Engineering: Part A, B, C

Annexure 1
MPhil Student Progress review Form

Annual MPhil Student Review Form

(To be submitted to Dean IBMS at the end of every review)

Section A: General Student Information

This section is to be completed by the Student

Session:.....

Student name: .....

Registration number: .....

Start date:.....

Year/Semester of study:.....

Supervisor names

Supervisor 1: .....

Supervisor 2: .....

Department: .....

Thesis title: .....

.....

Section B: Student self-assessment

This section is to be completed by the student.

1. Please provide a brief description of the written work you have submitted for the progress review as directed by your supervisor (e.g. presentation, draft chapter of thesis, literature review.

.....

.....

.....

2. Please provide a paragraph, giving an assessment of your progress in relation to your research and general development in the most recent session.

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.....

3. Please provide an update of training and development activity you have undertaken in the most recent session for the purposes of your research and for your professional development, referring to any training needs identified at the beginning of the year.

.....

.....

4. Have you and/or your supervisors identified any issues which are affecting your progress? (e.g. skills gaps, facilities/equipment available, etc). If yes, please give details of the issues identified and how these will be resolved.

.....

.....

5. Please describe your supervisory arrangements. (You may wish to refer to frequency of contact, timing and content of feedback on your work etc.)

.....

.....

6. Please provide a summary of the objectives you and your supervisory team have agreed for the coming session? (e.g. fieldwork, written work, publication, thesis submission, conference attendance, project management training etc. Please give details of nature, volume and deadlines as appropriate)

.....

.....

7. Are there any training or development opportunities not currently provided that you would find useful? If so, please specify.

.....

.....

8. If you wish to make any other comments about your experience as a research student within the Graduate School, you may do so here – or separately, and confidentially, to the Graduate School Office.

.....

.....

.....

Signature of student …… Date ……

Section C: Supervisor's report

This section is to be completed by the principal supervisor and any co-supervisors who have a significant and regular contact with the student. The student should also sign this section to indicate that he/she has received and read a copy of the Supervisor's report.

1. Are you in regular contact with the student? Please give approximate frequency, nature (e.g. email, face to face, telephone) and extent of your contact with the student.

Supervisor 1:

.....

.....

Supervisor 2:

.....

.....

2. What training or development activity have you recommended to facilitate the student's progress in the most recent session? (e.g. presentation or attendance at internal or external seminars, colloquia, conferences, fieldwork trips, submission of written work, project management training, academic writing etc.).

.....

.....

3. Have you identified any issues affecting the student's progress in the past session? If yes, please specify how these have been managed and give an assessment of the outcome.

.....

.....

6. Please rank the student's progress by ticking one of the following:

Excellent ❑ Very Good ❑ Good ❑ Adequate ❑ Unsatisfactory ❑

Please use the space below to provide more detail of your assessment. ***If you assess the student's progress to be unsatisfactory, a reason must be given*** (for final year students please include an assessment of the student's ability to submit according to their submission schedule)

.....

.....

Supervisors Statement

We the supervisors of the above-named student confirm that the above assessment of the student's progress follows a review with the student of their performance over the past year.

Supervisor 1

Signed: .....

Date: .....

Supervisor 2

Signed: .....

Date: .....

Student statement

Please do not sign this section until the supervisor's section has been completed, signed and dated

I confirm that I have met with my supervisors to discuss the content of this Review Report ❑

I confirm that I have received and read my Supervisors' assessment of my progress and their recommendations as provided in Section C of this form. ❑

I confirm that the details concerning my personal, degree and submission date information as provided in Section A of this form is accurate and up to date. ❑

Signed: .....

Name: .....

Date: .....

Section D: Review panel recommendation (To be done with Review 3 only)

This section is to be completed by the members of Graduate studies committee and relevant subject experts following the GSC meeting (File of the student will be submitted to the ASRB for approval of thesis defense)

Date of Review.....

Please provide details of the format of the review meeting and the membership of the review panel below:

.....

.....

Please attach the formal note of the review panel meeting including relevant feedback to the student and supervisor.

Formal note attached ❑

Please tick the appropriate box, supplying additional information where required

We recommend that the student be permitted to register for the submission of thesis ❑

(no further action required)

We recommend that the student be permitted for the submission of thesis ❑

subject to the following conditions (minor action required)

Provide details and attach documentation as appropriate

.....

.....

We DO NOT recommend that the student be permitted proceed durther unless the ❑

following substantial action is taken

Provide details and attach full documentation as appropriate

.....

.....

We recommend that the student be excluded from further study ❑

(Please attach all relevant documentation to support this recommendation)

Dean IBMS

Signed: .....

Name: .....

Date: .....

Review Panel Member 1

Signed: .....

Name: .....

Date: .....

Review Panel Member 2

Signed: .....

Name: .....

Date: .....

Review Panel Member 3

Signed: .....

Name: .....

Date: .....

Review Panel Member 4

Signed: .....

Name: .....

Date: .....

Review Panel Member 5

Signed: .....

Name: .....

Date:

Annexure II
Thesis writing guidelines

Thesis Guidelines Handbook

For

MPhil
/PhD Program

Institute of Basic Medical Sciences
Khyber Medical University
Peshawar

Guidelines for Thesis Writing

I. A thesis should comprise of the following components

i. Title pages 1&2
ii. Dedication (optional)
iii. Certificate
iv. Declaration
v. Acknowledgements (One page only)
vi. Abstract
vii. Table of contents
viii. List of tables (if there)
ix. List of figures (if there)
x. List of abbreviations
xi. Chapter 1: Introduction
xii. Chapter 2: Materials and Methods
xiii. Chapter 3: Results
xiv. Chapter 4: Discussion
xv. Conclusion (One page only)
xvi. References (Harvard style/Vancouver)
xvii. Appendices (Optional)

II. General guidelines for thesis writing and binding

i. Page size should be A4, with 1inch margins on the top, bottom and right side while 1.5 inches on left side.
ii. All the pages from abstract to dedication should be numbered as in lower case Roman numerals (i,ii,iii…).
iii. All pages starting from introduction to the end of the thesis should be numbered in Arabic numeral (1,2,3…).
iv. Page numbers should appear on the center bottom of the page.
v. Chapter number and respective chapter title should be written on the page header in the center for example 1-Introduction.
vi. Time New Roman or Calibri script should be used for writing thesis.
vii. All the headings should be written in bold face.
viii. Major headings should appear centered all in capitals (16pt).
ix. First order headings should be left aligned (14pt).
x. Second order headings should be left aligned (12pt).
xi. Third order headings should be left aligned and italicized (12pt)
xii. Font size should be 12pt in main body text and 10pt for table & figure legends.
xiii. Line spacing should be 1.5 and 6pt (before and after) between the paragraphs.
xiv. Thesis should be printed on one side of a good quality paper at least 70g and bound in soft (strip binding) to be sent for external review.
xv. All prints should be taken on portrait format and use of landscape format should be avoided but if used should not be numbered though the number shall be counted.
xvi. At the time of submission for review the thesis must be final in all aspects except the hard binding and incorporation of any amendments as required by the examiner(s).
xvii. Final hard bound copy should be in black in case of MPhil and Maroon in case of PhD with golden writing. The contents in covering front board should be the same as presented in the covering page of thesis in soft binding.
xviii. The spine of the thesis should carry name of the scholar, name of the degree and year.

xix. The title of the thesis should be exactly the same in all aspects as approved and notified by the AS&RB.

xx. The final copy of thesis (after viva examination) should be duly signed by all the concerned.

Thesis Title (Font 20, Regular)

Student Name (*14, Italics)*

Registration Number (14 regular)

MPhil/PhD Thesis

Histopathology (18, Regular)

Institute of Basic Medical Sciences
Khyber Medical University
Peshawar (16, Regular)

Month Year (14, Regular)

Thesis Title (Font 20, Regular)

A thesis submitted in the partial fulfillment of the requirement for the degree of (14, Regular)

Master/Doctor of Philosophy

in

Histopathology (16 Regular)

Student Name (14, Italics)

Registration Number (14 regular)

Institute of Basic Medical Sciences

Khyber Medical University

Peshawar (16, Regular)

Month Year (14, Regular)

CERTIFICATE

This thesis by **xxxxxxx** is accepted in its present form, by the Department of Histopathology, Institute of Basic Medical Sciences, Khyber Medical University Peshawar, as satisfying thesis requirements for award of degree of Master of Philosophy in Histopathology.

Supervisor: _____

(Dr. xxxx)

Co-Supervisor: _____

(Dr. xxx)

External Examiner: _____

(Dr……...)

Director: _____

(Prof. Dr. xxx)

Date: _____

DEDICATION (Optional)

This is dedicated to my parents who always guided, supported and helped me to complete my M Phil program. This success is achieved because of my parents' prayers. Without their support I would have unable to achieve anything. I thank Allah Almighty for blessing me with such kind and loving parents.

DECLARATION

I hereby declare that the work accomplished in this thesis is my own research effort carried out in Gastroenterology and Pathology Departments of Hayatabad Medical Complex Peshawar and Institute of Basic Medical Sciences, Khyber Medical University Peshawar. The thesis has been written and composed by me.

The work in this thesis has neither been previously submitted for examination leading to the award of a degree nor does it contains any material from the published resources that can be considered as the violation of the international copyright law.

I also declare that I am aware of the terms 'copyright' and 'plagiarism'. I will be solely responsible for the consequences of violation to these rules (if any) found in the thesis. The thesis has been checked for plagiarism by turnitin software.

Name: xxxxx

Signature: _____

Date: May 12, 2014

ABSTRACT

ACKNOWLEDGMENT

Thanks to Allah, Almighty for all his blessing on me throughout my life and who enable me to complete my thesis because of His blessing I am able to achieve this goal. I sincerely pay my humble and heartedly thanks to my most affectionate parents who supported and encouraged me throughout my life time in completing my education. My success is fruit of their devoted prayers.

I am deeply obliged to my supervisor Dr xxxxxx who guided me during my research and thesis. His keen interest and valuable suggestions made this work to end. Thanks to my co supervisor Dr xxxxx Histopathologist at Hayatabad medical complex Peshawar who gave his expert opinion regarding gastric biopsy and to all laboratory staff at Hayatabad medical complex Peshawar.

I would like to thanks to senior registrars Dr xxxx and Dr xxx gastroenterologist at Hayatabad Medical complex, Peshawar who help in providing gastric biopsies of concern cases and also to the trainee medical officers Dr xx, Dr xx, Dr xx and Dr xx who helped me in providing gastric biopsies and endoscopic findings.

I am also thankful to xxxx who is master in statistics and gold medalist she gave her precious time to calculate statistical analysis regarding thesis.

xxxxx

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

α Alpha (12, regular)

β Beta

1 INTRODUCTION (Centered, 16 Bold)

1.1 Dyspepsia (left aligned, 14 bold)

In this chapter, clearly state what the purpose of the study is and explain the study's significance. The significance is addressed by discussing how the study adds to the theoretical body of knowledge in the field and the study's practical significance for communication professionals in the field being examined.

Ph.D. students also must explain how their research makes an original contribution to the body of knowledge in their discipline. They also should address the significance of the study for mass communication education.

Before writing introduction in the thesis, the student should study relevant literature retrieved from published papers. Only pertinent references are cited but not extensively reviewed in this section. Rationale of the study should be mentioned at the end of introduction. Without a clearly defined purpose and strong theoretical grounding, the thesis or dissertation is fundamentally flawed from the outset. Main body text (Justified, 12pt)

The purpose of the study should suggest some theoretical framework to be explained further in this chapter. The literature review thus describes and analyzes previous research on the topic. Background to the study, including a statement of the problem (can be personal) your context and situate yourself in this context, Preliminary Review of the literature (search strategy, narrative summary and critical appraisal) including relevant educational theory. Highlight the gap in the literature that your study addresses. Brief outline of your literature review, your rationale for the study – and outline of relevance to your context finally Specific and achievable research question(s) or in some cases a hypothesis. This chapter, however, should not merely string together what other researchers have found. Rather, the scholar should discuss and analyze the body of knowledge with the ultimate goal of determining what is known and is not known about the topic. This determination leads to your research questions and/or hypotheses. In some cases, of course, you may determine that replicating previous research is needed. It should be a collective review and critique in the candidate's own words of various viewpoints supported by relevant data, and should not be copied from published work. The review should be properly referenced. References should preferably be of the last 15 years, including some published in the recent past. However, older references can be cited provided they are relevant and historical.

A special effort should be made to collect and review all work done in Pakistan on the chosen topic. This should include work published in recognized journals and in publications of various societies and medical colleges. Data collected by others, whether published or unpublished, must be acknowledged whenever included[1].

Main body text (Justified, 12pt)

1.1.1 Types of dyspepsia (Left aligned, 12 bold)

2.MATERIAL AND METHODS (Centered, 16 Bold)

(On new page)

2.1 Study design (Left aligned, 14 bold)

2.1 Study design (Left aligned, 14 bold)

This is an elaboration of your methodology in your synopses which was approved by the AS&RB of KMU. Any additional information which the scholar needs to share with the assessor / evaluator can be added in the methodology section. Past tense should be used here since the research will reflect the project is undertaken in the past.

In this section, the following sequence of headings may be used; Study Design, Study Population/Settings, Sampling Technique, Sample Size, Study Duration: From date to date, Inclusion Criteria, Exclusion Criteria, Data Collection Procedure, Data Analysis Procedure.

Hypothesis: A hypothesis is a statement showing expected relation b/w 2 variables. Hypothesis must be mentioned clearly and must reflect the objectives of the study. An alternate hypothesis should be clearly written in the following study designs: All interventional studies, Cohort, Case control, Comparative cross sectional

Objectives: Objectives are statements of mentions. They inform the reader clearly what the researcher has done in his/her work. The must identify the variables involved in research. Objective should be sufficiently specific, measurable, achievable, relevant and time bound (SMART). The objective should be exactly the same as written in the research proposal & approved by the advanced studies & research board of KMU and should be written in past tense.

Operational Definitions: Should be present in every research thesis/report. Operational definitions reflect the reader or the assessor about how the research measured individual variables, where they were measured, how they were measured. Essentially an operational definition completes once a tool of detection with possible time frame is added to conventional definition.

In case of qualitative or medical education you may provide an overview of study design including theoretical basis for your researcher decisions and the chosen research approach

Description of setting and educational context and how you have identified your participants, Sampling strategy, sample size, selection and recruitment, Data source and data collection procedures, Data management and analysis procedures, Strategies for ensuring quality and rigor. Discuss any important ethical issues and how they will be managed.

3 RESULTS (Centered, 16 Bold)

(On new page)

3.1 Age and sex wise distribution of patients (Left aligned, 14 Bold)

3.1 Age and sex wise distribution of patients (Left aligned, 14 Bold)

This chapter addresses the results from your data analysis only. This chapter does not include discussing other research literature or the implications of your findings.

Usually you begin by outlining any descriptive or exploratory/confirmatory analyses (e.g., reliability tests, factor analysis) that were conducted. You next address the results of the tests of hypotheses. You then discuss any ex post facto analysis. Tables and/or figures should be used to illustrate and summarize all numeric information.

For qualitative and historical research, this chapter usually is organized by the themes or categories uncovered in your research. If you have conducted focus groups or interviews, it is often appropriate to provide a brief descriptive (e.g., demographic) profile of the participants first. Direct quotation and paraphrasing of data from focus groups, interviews, or historical artifacts then are used to support the generalizations made. In some cases, this analysis also includes information from field notes or other interpretative data (e.g., life history information).

4 DISCUSSION (Centered, 16 Bold)

(On new page)

The purpose of this chapter is not just to reiterate what you found but rather to discuss what your findings mean in relation to the theoretical body of knowledge on the topic and your profession. Typically, students skimp on this chapter even though it may be the most important one because it answers the "So what?" question.

Begin by discussing your findings in relation to the theoretical framework introduced in the literature review. In some cases, you may need to introduce new literature (particularly with qualitative research).

This chapter also should address what your findings mean for communication professionals in the field being examined. In other words, what are the study's practical implications?

Doctoral students also should discuss the pedagogical implications of the study. What does the study suggest for mass communication education?

This chapter next outlines the limitations of the study. Areas for future research then are proposed.

5 CONCLUSIONS (Centered, 16 Bold)

(On new page)

This is the last section of the text in which conclusions or inferences drawn on the basis of the results of study are described. The conclusions should be linked with the objectives of the study. Recommendations for further research may be included when appropriate It is important to be careful that the conclusions should not go beyond data and should be based on the study results and population**.**

REFERENCES (Centered, 16 Bold)

(On new page)

Should be written in Vancouver OR Harvard style as any other style is NOT recommended in KMU. Refer to a variety of guidelines available on the internet to learn about how to write references in Vancouver style. It is generally recommended that reference managers like END NOTE should be used during thesis writing to manage references comfortably.

Floyd, R.A., 1990. The role of 8-hydroxyguanine in carcinogenesis. Carcinogenesis, 11(9), pp.1447-1450.

Henderson, B.E. and Feigelson, H.S., 2000. Hormonal carcinogenesis. Carcinogenesis, 21(3), pp.427-433.

Tai, M.H., Chang, C.C., Olson, L.K. and Trosko, J.E., 2005. Oct4 expression in adult human stem cells: evidence in support of the stem cell theory of carcinogenesis. Carcinogenesis, 26(2), pp.495-502.

Croce, R., Van Grondelle, R., Van Amerongen, H. and Van Stokkum, I. eds., 2018. Light Harvesting in Photosynthesis. CRC Press.

Annexes

The follow annexes must follow after chapter 8 in the specific order before sending the thesis for binding. However, additional annexes can be added where necessary. The following annexes MUST be included in the thesis in specific order as below;

Annexure I: Copy of approved proposal along with data collection tool from AS&RB KMU.

Annexure II: KMU-AS&RB approval certificate

Annexure III: Ethical clearance certificate from KMU-Ethics board or any other relevant board of any other institute.

Annexure IV: Anti plagiarism certificate issued by Quality Enhancement Cell of KMU.

Annexure V: Any other document relevant to the research project.

Annexure III
Supervision and Co-Supervision forms

INSTITUTE OF BASIC MEDICAL SCIENCES PESHAWAR

SUPERVISION CONTRACT

This is an agreement between:

Name of Supervisee: _____S/O, D/O_____

Department/Institute_____

AND

Name of Supervisor: _____

Department/Institute_____

Duration of supervision session: _____TO_____

The purpose of supervision is to: ☐ meet requirements for training supervision and ☐ (any other) _____

3 Purpose, Goals and Objectives of Supervision:

a. To fulfill requirements for training supervision

b. To promote development of supervisee's professional identity and competence

c. To (Other) (*As agreed upon by supervisor and supervisee)*

_____

_____

- **Context and Content of Supervision:**

1. The content will focus on the acquisition of knowledge, conceptualization, and skills within the defined scope of practice.

2. The context will ensure understanding of ethics, codes, rules, regulations, standards, guidelines (including consent, confidentiality/ privacy), and all relevant legislation.

3. **A supervisory record form/Students Progress report** will be used to document impressions of each supervisory session. Feedback will be provided at the close of each session.

- **Rights and Responsibilities of Supervisor**

a. Supervisor Rights	b. Supervisor Responsibilities
1. To bring concerns/issues about Supervisee's work. 2. To question Supervisee about his/her work and workload. 3. To give Supervisee constructive feedback on his/her work performance. 4. To observe Supervisee's practice and to initiate supportive / corrective action as required.	1. To uphold ethical guidelines and professional standards. 2. To make sure supervision sessions happen as agreed and to keep a record of the meeting. 3. To create a supervision file containing supervision records and other documents relating to development and training. 4. To ensure that Supervisee is clear about his/her role and responsibilities. 5. To monitor Supervisee's performance. 6. To set standards and assess the Supervisee against these. 7. To deal with problems as they impact on the Supervisee's performance. 8. To support supervisee on the agreed personal development plan

- **Rights and Responsibilities of Supervisee**

a. Supervisee Rights	b. Supervisee Responsibilities
1. To uninterrupted time in a private venue of supervisor's attention, ideas and guidance. 2. To set part of the agenda and challenge ideas and guidance in a constructive way. 3. To receive feedback and ask questions. 5. To have his/her development/training needs met.	1. To uphold ethical guidelines and professional standards; 2. To be prepared to discuss patient cases/research findings with the aid of written case notes and / or video / audio tapes; 3. To validate diagnoses, interventions, approaches and techniques used; 4. To be open to change and use alternate methods of practice if required; 5. To consult supervisor or designated contact person in cases of emergency; 6. Implement supervisor directives in subsequent sessions; and 7. Maintain a commitment to on-going research by being regular and on time for each appointment.

- **Procedural considerations:**

a. Supervisee's written cases notes (plus research plans) and synopsis/thesis write-up may be reviewed in each session;
b. Issues relating to supervisee's professional development will be discussed

c. Sessions will be used to discuss issues of conflict and failure of either party to abide by the guidelines outlined in this contract. If concerns of either party are not resolved in supervision, then head of the institute will be consulted; and
d. In event of an emergency, supervisee to contact supervisor. If not available, then contact head of institute**.**

- ## Finances/ Insurance

What is the source of funding for your research:

_____

_____

_____

This contract is subject to revision at any time, upon the request of either the supervisee or the supervisor. A formal review, however, will be conducted every six months and revisions to the contract will be made only with consent of the supervisee and approval of supervisor.

We agree, to the best of our ability, to uphold the guidelines specified in this supervision contract and to manage the supervisory relationship and supervisory process according to the research & ethical principles of the Khyber Medical University.

_____ _____

Supervisor **Supervisee**

This contract is in effect from **DATE** _____

Date of revision or termination: **DATE** _____

Institute of Basic Medical Sciences
Khyber Medical University
Consent form for Co-Supervision (PhD/ MPhil)

Undertaking

I am willing to guide Mr/Ms/Mrs/Dr ……in _____(degree) as his/her co-supervisor in his/her research work leading to PhD/MPhil degree at Institute of Basic Medical Sciences, Khyber Medical University. I will guide him/her for the entire duration of his/her research work on

_____

_____

_____ and will supervise him/her work throughout the research process where and whenever required.

Name of the primary Supervisor: .....Signature.....

Designation: ..... Area of speciality: .....

Contribution: .....

....

1. Name of the co-supervisor-I.....Signature…….....

Designation: .....Area of speciality: .....

Contribution: .....

....

.....

2.Name of the co-supervisor-II.....Signature.....

Designation: ....Area of speciality: .....

Contribution: .....

....

....

3.Name of the co-supervisor-III.....Signature.....

Designation: ....Area of speciality: .....

Contribution: .....

....

Date: .....

Annexure IV
Third Party Proof Reader Policy

Policy on the Use of Third Party Proof-readers

Students are responsible for their written work: be it an assignment, report, article, thesis, dissertation or any other form of academic writing.

All MPhil/PhD students of IBMS are taught academic writing, Microsoft Office and SPSS during their course work. In addition, a number of workshops are organized regularly throughout the year. Thus as part of academic writing one of the most important skills for a student to develop is proof reading their work. Although this is highly encouraged however, in some instances it may be considered acceptable for students to seek help in proof-reading their work. This help may be by friends or family members or even professional proof-readers. A Proof-reader is any person, other than the author of the text or the supervisor/course leader/tutor (i.e. a third party) who carries out proof-reading.

As a default the guidance to avail any such services as stated below shall apply to all academic assessed work of a word limit of 7000 and above at the final stage and not interim stage of writing.

However, if the supervisor or institute decide that the purpose of the assessment is to determine students' abilities then the rubric for assessment should state clearly that no proof-reading assistance is permitted.

Students wishing to engage the services of a proofreader must do so with the approval of their supervisor and obtain written verification from the member of faculty[1].

The use of third party proof-readers is not permitted for work where the word limit is fewer than 7,000 words.

A proof-reader may[2]

- May work on a printed or electronic version of the thesis or dissertation but suggested amendments must be indicated by comment tools, rather than tracked changes[3]
- Identify typographical, spelling and punctuation errors;
- Identify formatting and layout errors and inconsistencies (e.g. page numbers, font size, line spacing, headers and footers);
- Identify grammatical and syntactical errors and anomalies or ambiguities in phrasing;
- Identify minor formatting errors in referencing (for consistency and order);
- Identify errors in the labeling of diagrams, charts or figures;
- Identify lexical repetition or omissions.

A proof-reader may not

- Add to content in any way;
- Check or correct facts, data calculations, formulae or equations;
- Rewrite content where meaning is ambiguous;
- Alter argument or logic where faulty;
- Re-arrange or re-order paragraphs to enhance structure or argument;

- Implement or significantly alter a referencing system;
- Re-label diagrams, charts or figures;
- Reduce content so as to comply with a specified word limit;
- Translate any part of the work.

Authorial responsibility

Students have overall authorial responsibility for their work and should choose whether they wish to accept the proof-reader's advice. A third party proof-reader should mark up the student's work with suggested changes which the student may then choose to accept or reject. The thesis/dissertation candidate must keep a copy of the draft that contains the third party's comments.

Failure to adhere to these guidelines could constitute a breach of academic integrity and contravene KMU and HEC plagiarism policy. It is therefore the student's responsibility to provide the proof-reader with a copy of this policy statement.

Thesis proofing/editing services if used should be duly acknowledged in all academic writing including thesis/dissertations. The text to be integrated into the declaration is, as below[4]:

"I have used a proof-reader, paid or unpaid, to support the submission of this assignment" YES/NO

The University expects all proof-readers to comply with its policy in this area. By ticking 'yes', you confirm that the proof-reader was made aware of and has complied with the IBMS's proof-reading policy"

The use of a third party, does not absolve the supervisor(s) from the normal advisory duties connected with the intellectual content and text of the thesis or dissertation. In this context the intention of this policy is not to stop or restrict good supervisory practice. So as faculty are bound by professional codes of conduct and their primary role is to support students in producing strong academic content they may do this through actively annotating drafts and highlighting/correcting errors that would be prohibited in other contexts[4].

Students and supervisors should ensure that both parties are clear regarding to what level proof-reading will be undertaken and with what frequency.

IBMS is unable to comment on or verify the experience or qualifications of any proofreader. The institute will not take responsibility for the quality of work of any particular proofreader.

References

1. Francis L, Placzeck S, Clough G. Policy on Proofreading Students ' Written Work. 2015.

2. Oxford U of. Policy on the Use of Third Party Proof-readers, Education Committee. [cited 2018 Mar 24]; Available from: https://www.admin.ox.ac.uk/edc/policiesandguidance/policyonproofreaders/

3. Dean of Graduate Studies. Third Party Editing and Proofreading of Theses and

Dissertations Guidelines - The University of Auckland [Internet]. 2018 [cited 2018 Mar 24]. Available from: https://www.auckland.ac.nz/en/about/the-university/how-university-works/policy-and-administration/teaching-and-learning/postgraduate-research/undertaking-your-research/third-party-editing.html

4. Hasler L. Proofreading Policy [Internet]. [cited 2018 Mar 24]. Available from: https://warwick.ac.uk/services/aro/dar/quality/categories/examinations/policies/v_proofreading/

Circular

It has been brought to our attention that a number of individuals/groups are offering **'Thesis Writing Services'** on social and conventional media. These adverts are directed towards post graduate students.

This is to reiterate a zero tolerant policy by IBMS, KMU in accordance to HEC plagiarism policy guidelines, in that:

1. All academic writing by students is their **SOLE** responsibility and is expected to be student's original work
2. IBMS has a clear cut policy on the use of Thesis proof reading services.
3. Thesis proofing/editing services if used should be duly acknowledged in all academic writing including thesis/dissertations. The text to be integrated into the declaration is, as below:
   "I have used a proof-reader, paid or unpaid, to support the submission of this assignment" YES/NO
4. The University expects all proof-readers to comply with its policy in this area. By ticking 'yes', you confirm that the proof-reader was made aware of and has complied with the IBMS's proof-reading policy"
5. It is the sole responsibility of the student to ensure data presented is their original work and thus any plagiarism is the **SOLE** responsibility of the student and cannot be blamed on commercial thesis writing services.
6. Lack of computer literacy cannot be used as an excuse for using these commercial writers.
7. The use of a third party, does not absolve the supervisor(s) from the normal advisory duties connected with the intellectual content and text of the thesis or dissertation

KMU reserves the right to take disciplinary action against students involved in such malpractices according to HEC plagiarism policy guidelines.

It is therefore stated that students remain vigilant and not fall prey to such offers.

Annexure V
IBC Form

Institutional Biosafety Committee

BIOSAFETY REGISTRATION FORM
(KMU/IBC/Registration_v1)

Please follow all instructions. Use additional paper when necessary. Complete and signed forms should be submitted to KMU Biosafety Officer (BSO)

For official use only:	
IBC application no:	
Ethical approval no:	
Approval date:	
Expiration date:	
Signature and stamp:	

1. Applicant (Principal Investigator/ Student/ Supervisor)		
(1) Name, Degree(s)	(2) Job Role	(3) If student then degree program (eg. M. Phil/ PhD)
(4) Department	(5) Phone:	
(6) Interoffice Address:	(7) e-mail address	

b. LIST ***ALL OTHER PERSONNEL*** DIRECTLY INVOLVED IN THIS PROJECT

NAME	PROJECT POSITION(S)	EMAIL ADDRESS	PHONE	
(1)				
(2)				
(3)				
(4)				
(5)				
(6)				

2. RESEARCH PROJECT		
a. Applying for (check only one)		
New protocol registration ☐	Exemption ☐	
b. FUNDING SOURCE (check only one)		

Departmental funds ☐	External funds ☐	Funding to be applied ☐

c. PROJECT TITLE

d. RESEARCH INVOLVES (check all that apply)

In vitro work ☐	Whole animals ☐	Human subjects ☐

e. SPECIFIC AIMS/OBJECTIVES OF THE RESEARCH PROJECT:

f. SUMMARY OF THE PROJECT: (in lay terms and not exceeding 250 words)

g. **EXPERIMENTAL PROCEDURES** (Briefly describe in lay terms the methodologies employed in the proposed research relevant to biosafety)

h. MICROORGANISMS USED (VIRUSES, BACTERIA, etc.)

Strain	Characteristic (e.g. pathogenic)	Procedure (e.g. culture)	Treatment	Procedure location	Hazard to humans (yes/no)

i. EXPERIMENTAL ANIMALS					
Animal strain	Characteristic (transgene, immunodeficient)	Procedure (eg. IV, oral)	Drug/ chemical/ exposure	Procedure location	Hazard to human (yes/no)
j. HUMAN PARTICIPANTS USED (Briefly describe if participants in your research are healthy, sick, young or old, immunocompetent or immunodeficient)					
Participant group (eg. experimental, control)	Characteristic (eg. immunodeficient)	Procedure (eg. IV, oral)	Drug/ chemical/ exposure	Procedure location	Hazard to participant (yes/no)
k. TYPES OF HUMAN TISSUE USED (Briefly describe if archived samples are used eg. Paraffin embedded tissues)					
Sample type	Characteristic (eg. Potentially hazardous)	Procedure (eg. DNA extraction)	Further treatment (eg. PCR amplification)	Procedure location	Hazard to human (yes/no)
l. TYPES OF RADIATION EXPOSURE: (Briefly describe if research project involves radiation exposure eg. X-ray, radio-isotopes)					
m. TYPES OF RECOMBINANT MATERIAL USED (Briefly describe the origin of recombinant insert or transgene, and vector. Also describe if these can be of potential hazard to the researcher or environment)					
4. SAFETY AND PROTECTION					
a. Standard operating procedures (SOP) written and approved by the PI/Supervisor?		Yes ☐		No ☐	
b. Which buildings/laboratories will be used in your research? (Research projects with a particular biosafety requirement must be conducted in building/laboratory with required biosafety level)					
Laboratory			**Biosafety level available**		
5. SHIPPING AND TRANSPORT: (Briefly describe if the biohazardous material will be transported to a local, national or international laboratory. Describe what measures will be undertaken to ensure safe transport)					

6. TRAINING: (Briefly describe if the researchers working on this project have received appropriate biosafety training. If no, a training with biosafety office must be arranged before start of the project)			
Name of researcher	**Biosafety level required**	**Training received:**	
		Yes ☐	No ☐
		Yes ☐	No ☐
		Yes ☐	No ☐
		Yes ☐	No ☐

6. OCCUPATIONAL HEALTH REQUIREMENTS:			
i. Have you ensured safe disposal of solid sharp waste generated in this project?	Yes ☐	No ☐	NA ☐
ii. Have you ensured safe disposal of non-sharp solid waste generated in this project?	Yes ☐	No ☐	NA ☐
iii. Have you ensured safe disposal of liquid waste generated in this project?	Yes ☐	No ☐	NA ☐

7. WASTE DISPOSAL:			
i. Are there any special groups of workers at risk of infection or disease from the use of the biohazard(s)/ hazardous drug(s) (e.g. pregnant, immuno-compromised, allergic, etc.)? If yes, describe below:	Yes ☐	No ☐	NA ☐
ii. Are any special immunizations necessary for personnel involved in the research (e.g. Hepatitis B, Tetanus/Tdap, etc.)? If yes, describe below:	Yes ☐	No ☐	NA ☐
Is there a need to monitor the health of personnel involved (e.g. testing)? If yes, describe below:	Yes ☐	No ☐	NA ☐

6. ASSURANCE:	
a. PRINCIPAL INVESTIGATOR/ STUDENT/SUPERVISOR	INTIALS
I certify the information provided in the KMU IBC registration form is complete and accurate and understand my responsibilities as noted in it.	
No changes will be made without advance approval form the KMU Institutional Biosafety committee.	
I acknowledge my responsibility for the safe conduct of this research in accordance with KMU IBC guidelines	
Involving Recombinant DNA Molecules. I will inform all associated personnel of the nature and risks of this work, as well as necessary precautions and safe practices.	
I also agree to comply with the requirements for the shipment and transfer of recombinant DNA materials.	

I further acknowledge my responsibility to ensure compliance with the following:	
(1) Work surfaces will be appropriately decontaminated at least daily and immediately after working with biohazardous materials.	
(2) All personnel involved will wash thoroughly with soap and water. Clothing will be changed as needed.	
(3) All contaminated materials will be discarded appropriately according to KMU IBC guidelines (e.g. as Biohazard waste, as Hazardous drug waste, as Chemotherapeutic waste).	
(4) BSO (KMU IBC) will be immediately notified of all spill or incidents occurred at biosafety level 2 and up laboratories.	
(5) In the event of an incident where there is a risk of infection or other consequences to incident, affected personnel will be counselled to seek appropriated medical attention.	
SIGNATURE:	**Date:**
b. CO- INVESTIGATOR	
I certify that I have reviewed this Biosafety Registration form and that the information provided in it is complete and accurate.	
SIGNATURE OF CO- INVESTIGATOR	**Date:**
SIGNATURE OF CO- INVESTIGATOR	**Date:**
SIGNATURE OF CO- INVESTIGATOR	**Date:**
SIGNATURE OF CO- INVESTIGATOR	**Date:**
c. ENDORSEMENT OF HEAD OF INSTITUTION (not needed for KMU students/supervisors/PIs who have received ASRB approval)	
In addition to endorsing the PI's certification, if the experiments are supported primarily by department or university funds, I certify that I have reviewed the protocol and it is judged to be of scientific merit.	
SIGNATURE AND STAMP OF THE HEAD OF INSTITUTION	**Date:**

Annexure VI

Grant application

APPLICATION FORM FOR RESEARCH GRANT (PHD/MASTERS/UNDERGRADUATE STUDENTS)

Serial No (for office use): _____Date of submission: _____

Name of the institute: _____

Date of Registration with institute: _____session: _____

Program/Specialty: _____

Name: _____ Fathers name: _____

Contact No: _____Email_____

Name & Designation of Supervisor: _____

Type of Participants: Humans ____Animals_____ Others specify: _____

Title of the project: _____

_____

_____

Expected Number of Research Articles to be published after completion of Project: _____

Please tick the following checklist before submission:

Budget Attached:	Yes / No
Availed any Grant already for this Research Project:	Yes / No
Applied for grant to any other Funding Agency:	Yes / No
KMU-AS&RB Approval obtained (NA for undergraduates):	Yes / No

Candidate Signature:

Supervisor Signature and Stamp:

For office (KMU ORIC-MC) use only

Date Received: _____ Date of discussion in KMU-ORIC-MC: _____

Remarks: _____

_____

Amount Requested in Budget: _____ Amount Approved by ORIC MC: _____

Director ORIC KMU: _____ Chairman KMU ORIC-MC: _____

Annexure VII
Research Integrity

Appendix A; Policy 2016-01-ORIC

Undertaking of Integrity

I _____ s/o | d/o _____, resident of

_____ National Id Card No. _____

hereby solemnly undertake that I have been thoroughly briefed about and have understood all the rules and bylaws of Khyber Medical University regarding Academic, Intellectual, and Research Integrity and will abide by them without any exceptions.

I fully acknowledge the fact that in case I am found guilty of breach of any of these valued principles, I will be subject to disciplinary action including, but not limited to, termination of my services / studies and blacklisting for any future employment / admission in any constituent or affiliated institution of Khyber Medical University.

Signed: _____

Date: _____

Appendix B; Policy 2016-01-ORIC

Research Scholar's Undertaking

I _____s/o | d/o _____ resident of _____ National Id Card No. _____, a scholar at: _____, for the degree of: _____ am submitting to the Advanced Studies and Research Board the research proposal titled:

_____

_____

I hereby solemnly undertake that I will carry out my research in strict compliance with the policies of Khyber Medical University Khyber Medical University, in full commitment to the principles of Intellectual and Research Integrity and Ethics.

I solemnly affirm that I will absolutely avoid plagiarism, fabrication, and falsification and that I will not only avoid any use of mercenary authorship and ghostwriting, but will also report such practices to the institution immediately on any knowledge of these.

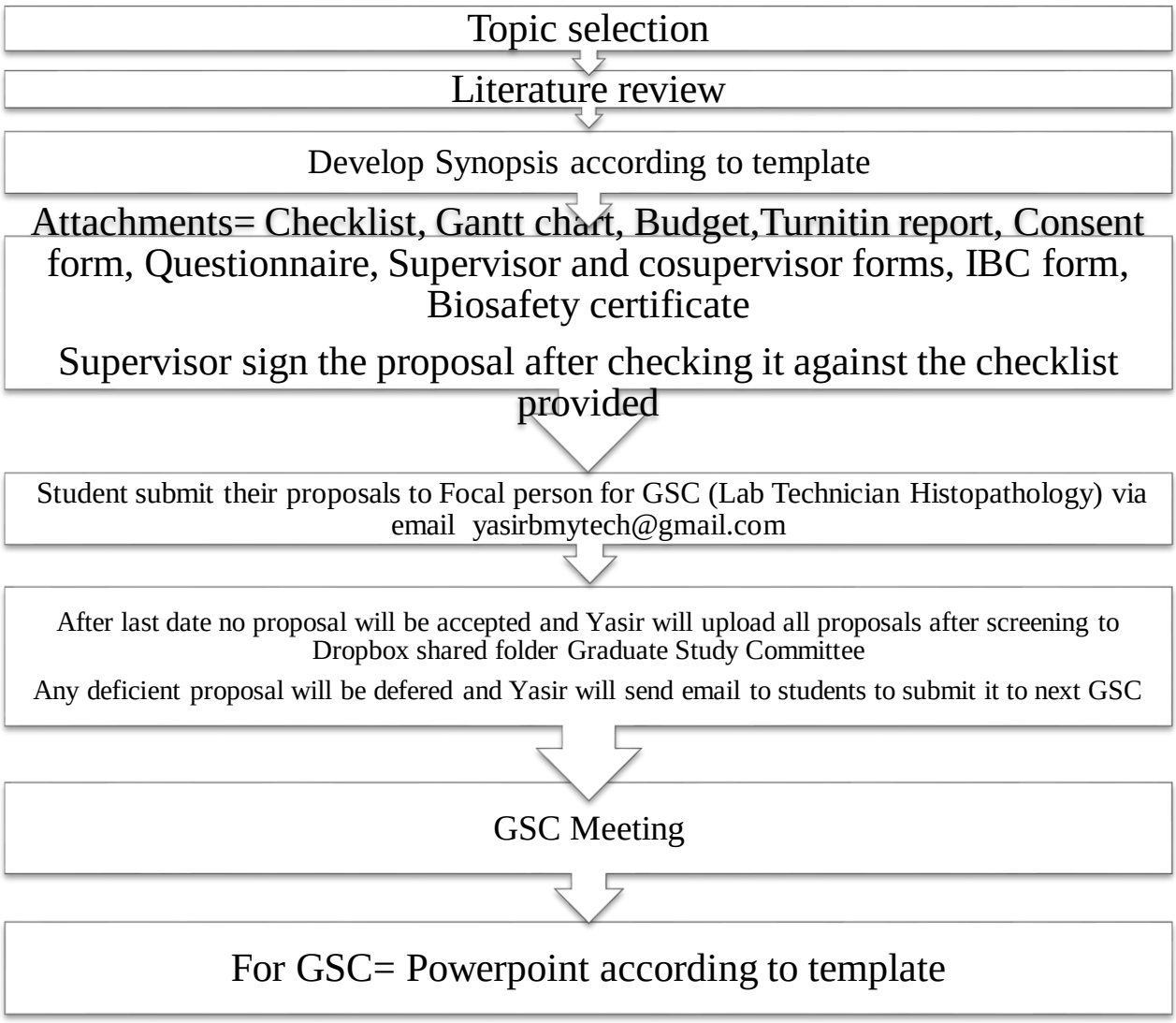
I acknowledge that the penalty for any breach of these practices is immediate termination of studies, expulsion from the institution, and blacklisting for any future admission in any constituent of affiliated institution of Khyber Medical University.

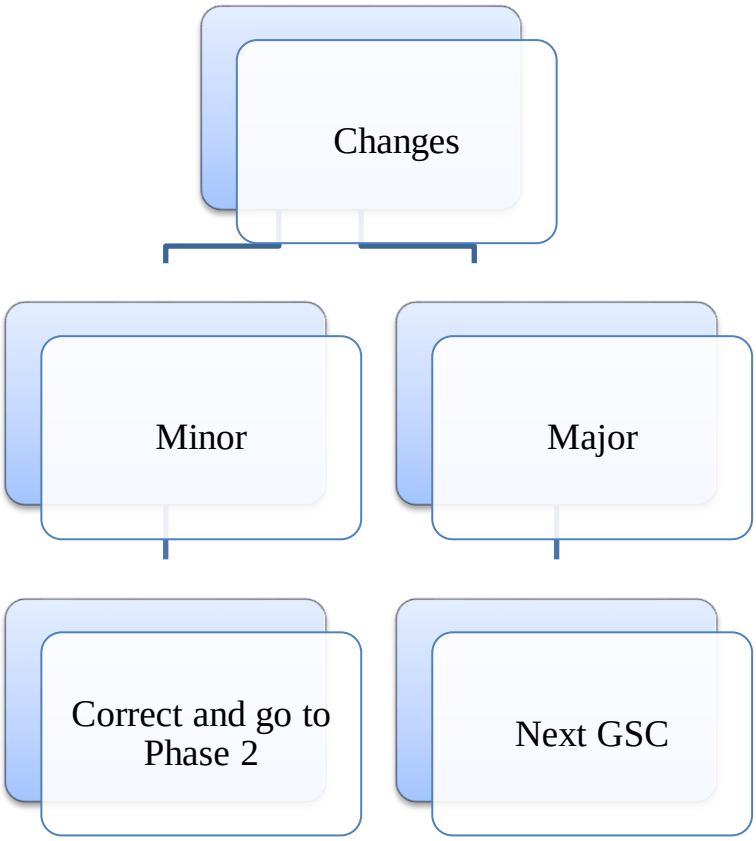
I also acknowledge that even after I have been awarded my degree, if any such allegation is proved beyond reasonable doubt, my degree will be cancelled and I will be blacklisted for any future employment or studies in any of the constituent or affiliated institutions of Khyber Medical University

Signed: _____

Annexure VIII
Phase wise flow of MPhil

PHASE 1: End of Semester 2/beginning of Semester

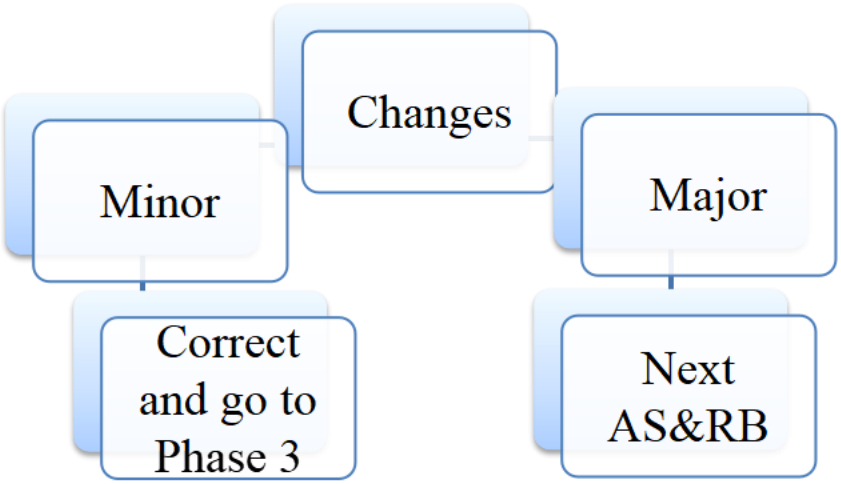



Changes
Minor
Major
Correct and go to Phase 2
Next GSC

Submit to AS&RB

Forms and number of copies from ORIC

AS&RB

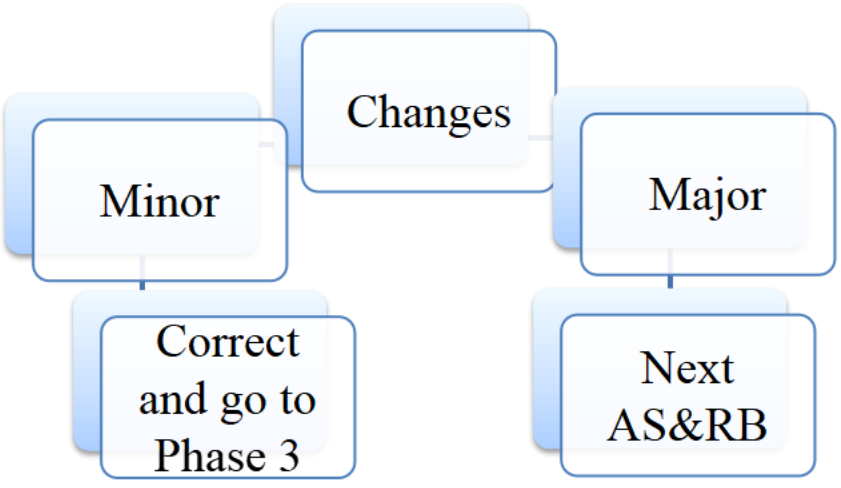


PHASE 2: End of Semester 2/beginning of Semester 3

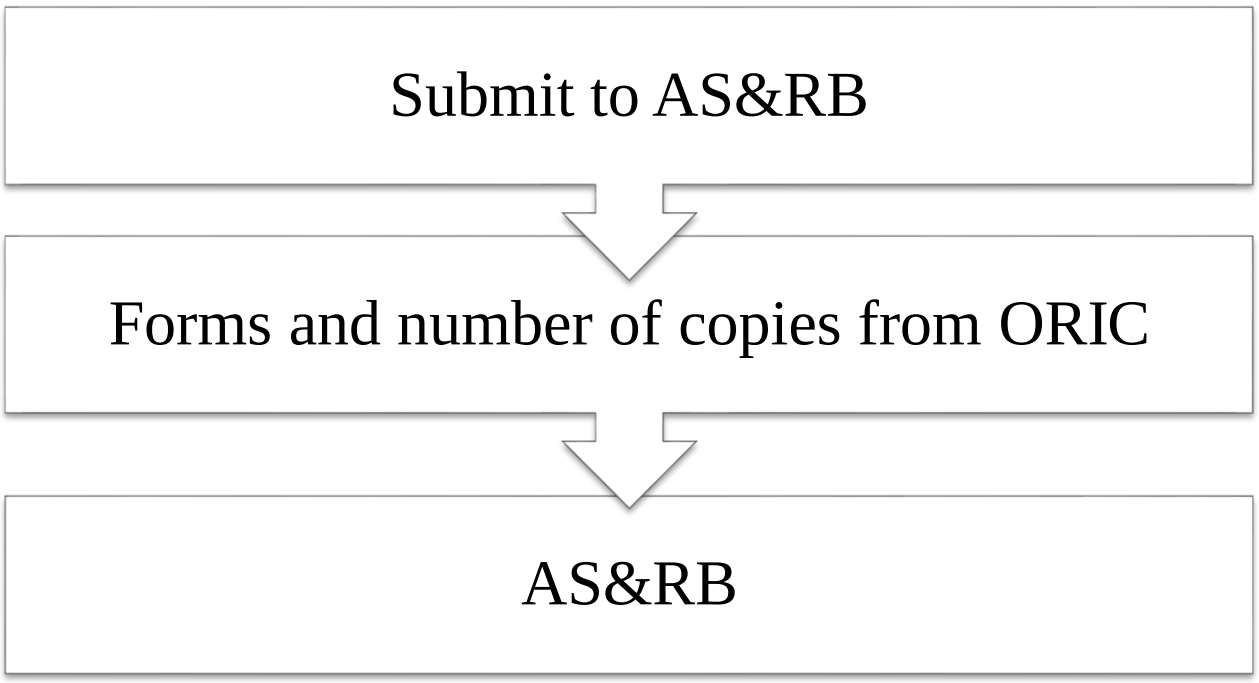
Submit to AS&RB

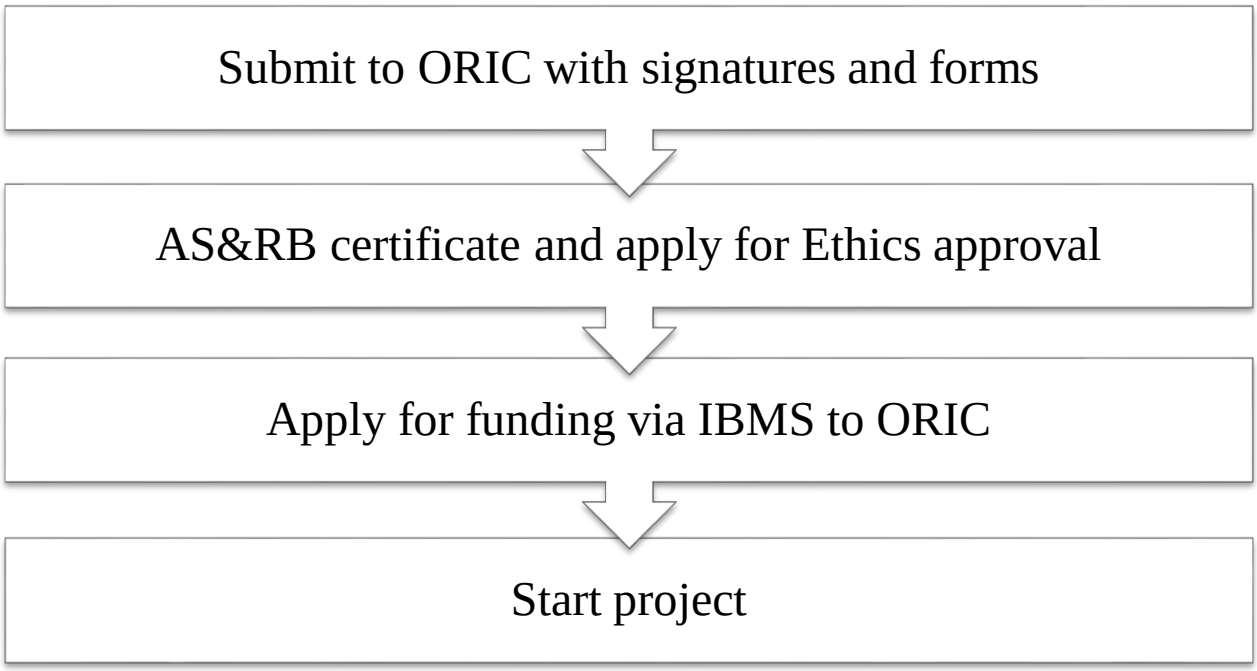
Forms and number of copies from ORIC

AS&RB

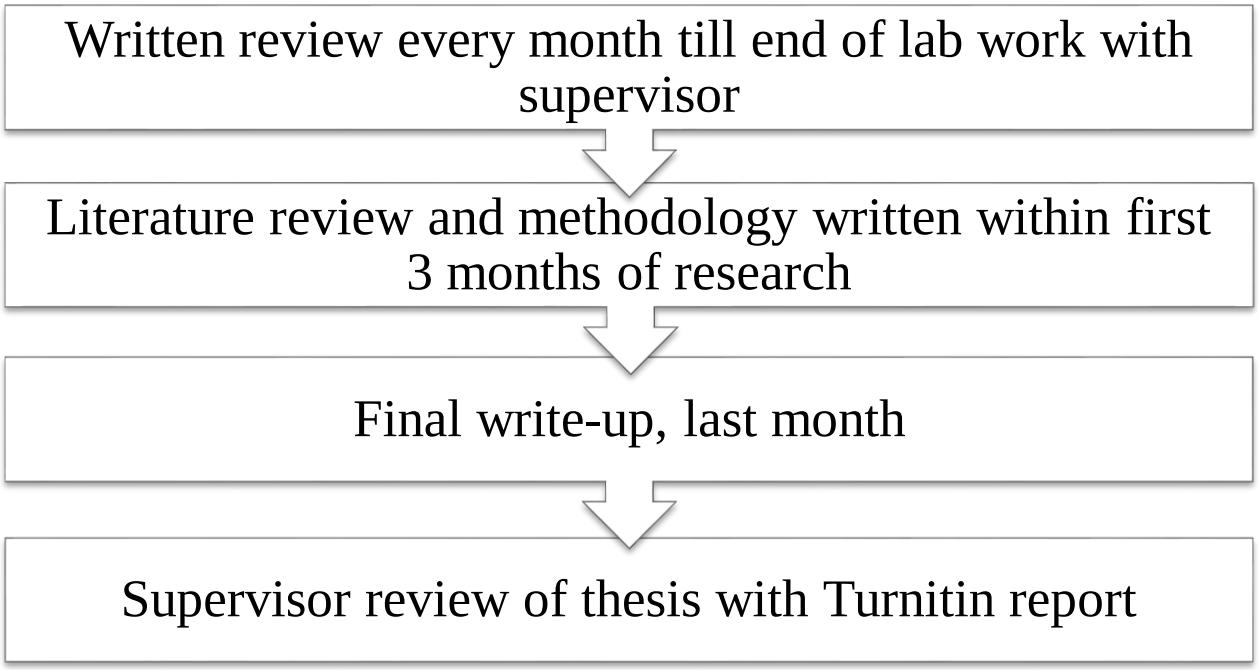


PHASE 3: Semester 3

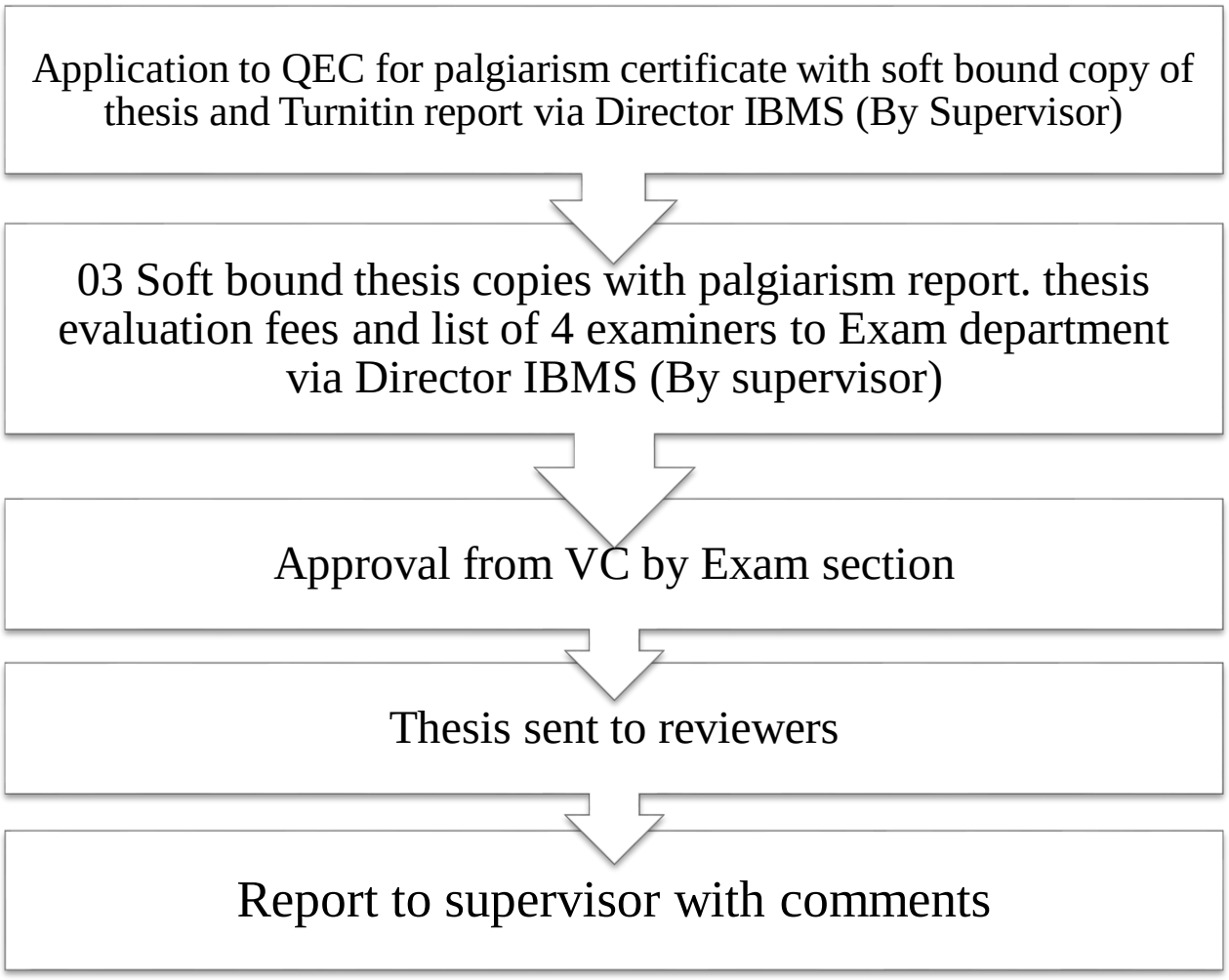


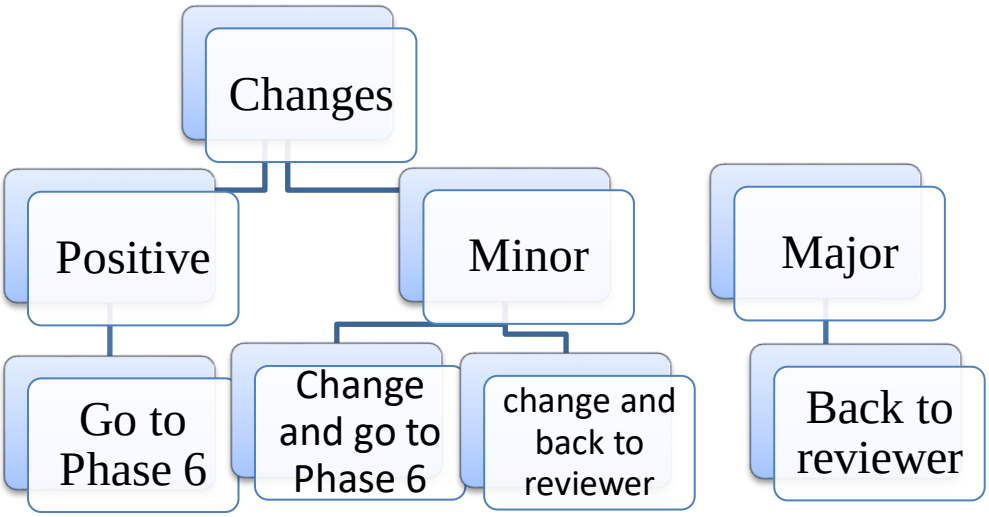


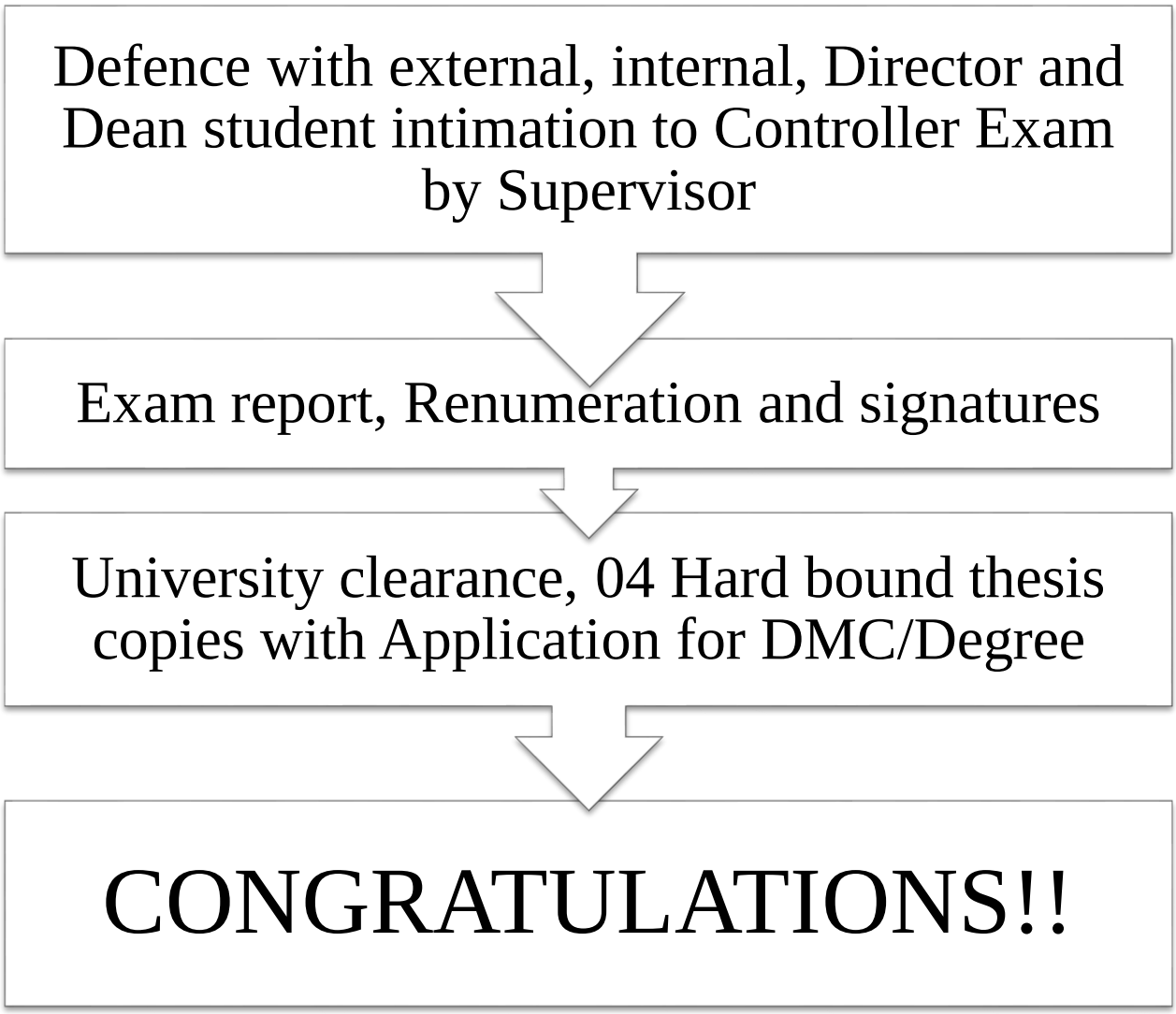
Phase 4: Semester 3 and 4



Phase 5: Semester 4 end




Changes
Positive
Minor
Major
Go to Phase 6
Change and go to Phase 6
change and back to reviewer
Back to reviewer


Defence with external, internal, Director and Dean student intimation to Controller Exam by Supervisor
Exam report, Renumeration and signatures
University clearance, 04 Hard bound thesis copies with Application for DMC/Degree
CONGRATULATIONS!!

Details of faculty members

	Names	PG degree	University	Year	Total teaching experience
1	Dr. Umar Nasir	BDS, FCPS in Oral and Maxillofacial Surgery	College of Physicians and Surgeons	2012	14 years
2	Dr. Saeed Ur Rahman	PhD (Dental Science), Postdoc (Oral Biology)	Seoul National University, South Korea (PhD), The State University of New York at Buffalo, USA (Postdoc)	2015 (PhD), 2018 (Postdoc)	10 years
3	Dr. Muhammad Shahzad	BDS, PhD Human Nutrition	University of Glassgow	2015	10 years
4	Dr. Bushra Khan	BDS, MPhil Oral Biology	Riphah University	2022	4 years
5	Dr. Wahaj Anees	BDS, Masters in Forensic Odontology	University of Dundee	2022	5 years
6	Dr. Samar Kamran	BDS, MPhil Oral Biology	Gandhara University	2020	3 years
7	Dr.Aleena Farman	Bachelors in Dental Surgery MPhil in progress	Khyber Medical University	2023	May 2025 till date
8	Dr. Intikhab Alam	Bachelors in Dental Surgery (FCPS-II) OMFS	Khyber Medical University	2017	May 2025 till date
9	Dr. Sara Israr	Bachelors in Dental Surgery MPhil in progress	Riphah University	2021	February 2025 till date