STUDY GUIDE
BLOCK-2
1st YEAR MBBS (2017-18)

Compiled by: *Department of Medical Education CMH Kharian Medical College (CKMC), Kharian Cantt.*

Learning Outcomes:

Knowledge:

• Acquire the basic science knowledge and terminology necessary to understand the normal structure and function of human body from biochemical to organ system level, as well as the concepts of diseases in the community, drug dynamics.
• Identify different anatomical planes and correlate the importance of these with clinical medicine.
• Explain the structure & development of MS.
• Explain the physiological anatomy, biochemistry affecting the functions of MS.
• Apply the knowledge of the basic sciences to understand pathophysiology of common fractures.
• Understand the constituents and functions of human blood
• Describe development of blood cell from stem cell.
• Describe the process of development of RBC, WBC and Platelets.
• Discuss the. Process of immunity.
• Describe the sequence of events involved in homeostasis
• Understand the physiology of conductive system of heart, cardiac cycle
• Explain different waves, segment and intervals of ECG and apply it to the interpretation of ECG
• Must understand the pathophysiology of edema, infarction, shock and thrombosis
• Demonstrate effective communication skill strategies while history taking and examining the patients with CVS problems.
• Describe the gross anatomy of mediastinum along with clear understanding of structures present in it.
• Correlate between histological structure of respiratory membrane and its role in diffusion of gases.
• Integrate the basic science knowledge with clinical sciences in order to describe the pathogenesis, clinical presentations of common respiratory disorders, e.g. COPD

Skill:

• Dissect limbs to demonstrate their gross Anatomy and relationship to each other.
• Identify histological features of parts of MS under microscope
• Perform the steps to determine the normal RBC count And ESR
• Identify the type of lymphoid tissue under microscope
• Demonstrate the differences between live attenuated vaccine and toxoids
• Perform, the steps to identify ABO and Rh typing

Attitude:

• Demonstrate the effective attitude towards the colleagues
• Demonstrate a professional attitude, team building spirit and good communication skills

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1. INTRODUCTION

1.1 BLOCK COMMITTEE

Chief Coordinator Block 1: Dr. Hammad Ahmed Butt — M.Phil.
HOD Pharmacology, CKMC

Coordinator: Dr. Noman Sadiq — Assistant Professor, Physiology
CKMC

Resource Persons

S No	Name	Designation	Deptt	Contact
1.	Dr. Ahmed Murtaz Khalid	Assistant Prof	Physiology	murtaz_khalid@hotmail.com
2.	Dr. Shaista Noor	Demonstrator	Biochemistry	drsnqureshi@gmail.com

For any information regarding block 1, contact in CKMC:
Faculty members:
Anatomy
Dr. Aneeqa Chughtai
Physiology
Dr. Noman Sadiq
Biochemistry
Dr. Sadaf Saleem Uppal
Surgery
Dr. Ahmed Raza
Medicine
Dr. Aamir Habib
Community Medicine
Dr. Iffat Naiyar
Behavioral Sciences
Dr. Asif Azeem Bajwa
Pharmacology
Dr. Hammad Ahmed Butt
Pathology
Dr. Nasira Shaheen
Radiology
Dr. Humaira Saleem
Gynae/ OB
Dr. Jasia Jabeen
Paediatric Medicine
Dr. Saeed Zaman
Department of Medical Education
Dr. Noman Sadiq

1.2 What is a study guide?

It is an aid to:

- ❖ Inform students how student learning program of the block has been organized.
- ❖ Help students organize and manage their studies throughout the module.
- ❖ Guide students on assessment methods, rules and regulations.

1.3The study guide:

- Informs about organization and management of the block.
- Defines the objectives which are expected to be achieved at the end of the block.
- Identifies the learning strategies such as lectures, small group teachings, clinical skills, demonstrations, tutorials and case based learning that will be implemented to achieve the block objectives.
- Provides a list of learning resources such as books, computer assisted learning programs, web-links and journals, for students to consult in order to maximize their learning.
- Highlights information on the contribution of continuous assessment and annual examinations on the student's overall performance.
- Includes information on the assessment methods.
- Focuses on information pertaining to examination policy, rules and regulations.

2. Curriculum framework:

Students will experience *integrated curriculum* of the block. The time table is adjusted so that related topics within subjects are scheduled at the same time, with similar topics being taught on the same day or week. In addition to subject based teaching, integrated teaching sessions are introduced in clinical basic science lectures and CBL sessions that brings together clinical and basic sciences. Students will be able to have better understanding of basic sciences when they repeatedly learn in relation to clinical examples.

2.1 Organizing system:

Medical college curriculum shall be organized in blocks of modules. The modules are named after body system for example a module of blood in a block. The key details are as follows:

1. There shall be three blocks in first year MBBS comprising modules.
2. The blocks shall be labeled as1, 2 and 3.
3. Each module in a block shall have a title. The name of the module shall represent the content taught and learned the majority of time in that module. Module shall be named after body systems.

4. The duration of three blocks shall vary between 8–11 weeks according to syllabus.

5. The syllabus shall be integrated horizontally around systems of the body.
6. There shall be vertical integration to the extent decided by the curriculum coordination committee.
7. Vertical integration shall be in case based learning sessions and in clinical lectures of basic sciences, scheduled in the structured training program.

3. Teaching and Learning methods (MIT):

Following modes of information transfer (MIT) shall be used

- Interactive Lectures
- Clinical lectures of basic sciences
- Case based Learning
- Tutorials
- Laboratory Work

3.1 Interactive lectures:

In large group, the lecturer introduces basic science concepts through common clinical conditions and explains the underlying phenomena through questions, pictures, videos of patients' interviews, exercises, etc. Students are actively involved in the learning process.

3.2 Self-study:

Students' assume responsibilities of their own learning through individual study, sharing and discussing with peers, seeking information from Learning Resource Center, teachers and resource persons within and outside the college. Students can utilize the time within the college scheduled hours of self- study.

3.3 Case based learning (CBL):

3.3.1 What is case based learning?

Case based learning is a form of small group learning that involves the use of learning activities commonly based on patient cases associated with real life situations. A case is used to stimulate learning and acquisition of knowledge, skills and attitudes. It is structured so that students develop the skills of clinical reasoning and critical thinking.

In CBL, the learning objectives for the case are explicitly stated at the beginning of the case, and the learners can focus their learning on attaining the specific outcomes. The students learning through CBL case is supported by other teaching modalities scheduled during the week (for example lectures, e-modules, videos, seminars, etc.).

All of these learning activities and resources have been designed and organized to allow students to approach their learning as "Discovery Learning" and to create a learning environment that brings together related content from the different domains of medical knowledge.

The Goal of CBL is for student to integrate knowledge and apply it to clinical situations from the start of their medical education.

3.3.2Self-Assessment and Reflection in CBL

When you are preparing for the case you should reflect and answer the following questions to help you focus your learning.

1. What resources should I use to understand the case?
2. Do I understand how the parts of the case are connected?
3. How has my previous learning experience shaped my approach to this case?
4. What do I know to solve the case and achieve the learning objectives?
5. How do I seek and use feedback from others?
6. How do I seek and use data from other sources?
    - External sources (e.g. text books/journal articles/lectures/role models)

It is also important for students to consider their emotional reaction to feedback and how they deal with this.

What steps should I take or resources should I use to respond to my areas in need of improvement?

You may consider various resources including:

- *Role models (tutor, other students who they find particular effective in their approach to learning)*
- *Literature:(journal articles/texts)*

3.3.3The CBL process

1. **Pre- Tutorial:** self-study by students

2. CBL session:

a. Introduction and group rules

- **Tutor Introductions:** Tutor introduce herself/himself
- **Student Introductions:** Tutor asks the students introduce themselves to the group.
- **Group Rules:** Every group needs to establish their own accepted rules for group behavior. These would likely include that only one person speaks at once; everyone listens attentively, comes to tutorial prepared and contributes to the discussion. Other ground rules might relate to checking internet, dictionary, notes or taking phone calls during the session.

b. Tutorial Discussions

- The group will determine any roles people will adopt during the session (scribe, time keeper, leader etc.).
- A student will volunteer to verbally read the first component of the case. The reading of the case provides the students an opportunity to formalize themselves with the pronunciation of unfamiliar terms, and provides auditory learning opportunities.
- Discussion might begin with learners identifying any terms or concepts they did not understand.
- The tutor will use active listening skills, and open-ended questions to promote discussion, and probing questions to prompt learners to explore topics more deeply. For Example, can a “normal” Lab value be abnormal? What do we expect it to be in this case? The teacher will not deliver the content. Tutor will only facilitate your learning.

c. Feedback:

Feedback is an interactive process between two or more people that allows the parties to share information with the intention of guiding future performance. Feedback helps an individual to keep their behavior “on target”, thus, it helps a person to better achieve their goals.

- **Feedback is specific rather than general.**

Provide specific information and examples. To make a general statement about another person’s work as a whole does not tell a person which part of his/her performance or actions need changing and which might serve as models.

- **Feedback is descriptive rather than judgmental.**

Respond with observations rather than assumptions. Avoiding judgmental language reduces the other’s need to respond defensively. *Share information – rather than give advice or tell learners what to do:*

- Offer suggestions
- Generate alternatives
- Share insight & experience

- **Feedback is both positive and negative.** A balanced description of a person's behavior or action takes both the strong and weak points into account.

- **Feedback takes into account the needs of both the receiver and the giver of feedback.** What you say to a person about his/her performance not only reflects his/her work or actions, but also how you feel about them at the moment.

- **Feedback is directed at behavior that the receiver can do something about.** When a person is reminded of some shortcoming over which he/she has no control, the major change is in terms of an increased frustration level.

- **Feedback is solicited rather than imposed.** Feedback is most useful when the receiver has formulated the kind of questions he/she most wants an answer to.

- **Feedback is directed primarily at the person's performance or behavior rather than at the person themselves.**
- **Avoid defensiveness**. Use less confrontational language; ask "what, when, where or how" rather than "why".

d. Assessment:

Tutor completes formal assessment for the student in the CBL tutorial at the end of tutorial process. The tutor meets with each student in person to encourage self-assessment, discuss the assessment, and provides additional feedback.

e. At the end of a Session

By the end of each session, the students need to clarify any outstanding questions.

3.3.4 Expectations from the learner in CBL

Case based learning is a student-centered process and it is the responsibility of individual student to participate fully, not only for his or her own learning, but also to aid the learning of others in the group. Although much time is spent alone in the library or at the computer, the full benefits of CBL cannot be realized in isolation.

3.3.5 Role of learner during CBL sessions:

During every CBL session, group chooses a group leader, a scribe and rest of the students become group members. One of the member acts as time keeper.

Role of group leader

- Keep the group on task.
- Ensure deadlines are met.
- Refine for the group the problem statement as the group learns more.
- Ensure that each member of the group understands his or her role and responsibilities.
- Help generate possible solutions.
- Help diffuse group conflict.
- Help ensure that rules are followed not by being dictatorial but by taking everyone along.

Role of scribe

- Summarize the group's discussions/ decisions in the various CBL steps.
- Write everything that is being said on the white board/flip chart.
- Organize information on the white board/flip chart.
- Summarize and clarify.

Role of group members

- Be an active participant in the process of learning.
- Share information.
- Assist in the maintenance of group dynamics.
- Identify gaps in self-knowledge.
- Search for information from various sources.
- Clarify & Summarize.
- Resolve conflicts.
- Reflect on group dynamics.
- Reflect on learning that is taking place individually and in group.
- Provide feedback.
- Assist in the establishment of rules for group dynamics.
- Follow established rules.
- Be regular and punctual.

3.3.6 Guide to professional behavior during CBL session

(Courtesy of McMaster University and CPSP DME)

Respect

- Listens, and indicates so with appropriate verbal or non-verbal behavior.
- Verbal and non-verbal behaviors are neither rude, arrogant nor patronizing.
- Allows others to express opinions and give information without "putting down" anyone.
- Participates in discussion of differences in moral values.
- Differentiates value of information from value of person.
- Acknowledges others' contributions.
- Apologizes when late or gives reason for being so.

Communication Skills

- Speaks directly to group members.
- Presents clearly.
- Uses words that others understand
- Uses open-ended questions appropriately.
- Identifies misunderstanding between self and others or among others.
- Attempts to resolve misunderstanding.
- Tests own assumptions about group members.
- Accepts and discusses emotional issues.
- Able to express own emotional state in appropriate situations.
- Non-verbal behavior indicates that statements have been understood.
- Recognizes and responds to group member's non-verbal communication.

Responsibility

- Punctual completes assigned tasks.
- Presents relevant information.
- Identifies irrelevant or excessive information.
- Takes initiative or otherwise helps to maintain group dynamics.
- Advances discussion by responding to or expanding on relevant issues.
- I own emotional or physical state when relevant to own functioning or group dynamics.
- Describes strengths and weaknesses of group members in a supportive manner.

Self-Awareness/ Self-Evaluation

- Acknowledges own difficulty in understanding
- Acknowledges own lack of appropriate knowledge
- Acknowledges own discomfort in discussing or dealing with a particular issue
- Identifies own strengths
- Identifies own weaknesses
- Identifies means of correcting deficiencies or weaknesses
- Responds to fair negative evaluative comment with reasonable proposals for behavioral change

3.3.7 Using learning resources

In CBL, one of the objectives is self-directed learning. Students search for literature, based on the individual learning goals developed as a result of self-assessment and reflection question provided earlier in the guide.

Bring books and previous notes and use them in tutorial, if necessary, to clarify concepts and terminology. It is helpful to have a good dictionary to check the meaning of terms. We often use words as if we knew what they meant; it may be helpful to challenge your colleagues to define key terms.

To obtain additional information, provided to you, you may be directed to a specific resource or asked how you might find a good resource (journal article, book, expert, etc.). It is important to avoid “guessing games” or wasting time tracking down an obscure reference. But, on the other hand, it is important to develop skill in finding good information.

You are encouraged to discuss matters of interests pertaining to specific case with your peers. Develop a specific list of references for each case considered. Part of the overall learning experience implicit in CBL is the development of skills that will facilitate access to learning resources throughout your future professional career.

4. Examinations:

No student will be allowed to sit in the annual examination if attendance is below 75% in theory and practical separately.

4.1 Assessment types

The assessment will be continuous. The purpose of continuous assessment is formative and summative.

- **Summative Assessment:** The marks of this type of assessment contribute in the final university result through internal assessment. It comprises:
  - CBL/tutorial assessment
  - Scheduled tests
  - Sub-stages
  - End of block exam

- Pre-annual exam
  Scheduled tests and sub-stages will be conducted intermittently throughout the block. Their schedule will be intimated through the time tables.
  The end of the block exam will be conducted after 8 weeks of instruction. It will comprise one theory paper and one practical exam for Anatomy, Physiology and Biochemistry. (Table of specifications (TOS) for exam has been provided)
- **Formative Assessment:** Tests may be quizzes, surprise tests/written assignments/self-reflection by students during the teaching time but their marks will not be added to internal evaluation marks. The purpose of formative assessment is to provide feedback to the students, for the purpose of improvement and to teachers to identify areas where students need further guidance.

4.2 Internal Assessment

(Will be submitted to the university before professional exam)

1. The weightage of internal assessment shall be 10 % in theory paper and 10 % in practical, in the annual professional examination (or 10 marks for a 100 marks in theory and practical each)

2. Scheduled tests, sub-stages, CBLs/tutorials, block examinations and pre-annual examinations, conducted by the college shall contribute towards internal assessment for professional examination.

4.3 Annual Professional Examination:

1. The professional examinations schedule will be provided by NUMS.

2. There will be two components of the final result

   (i) Examination-90 % (ii) Internal Assessment- 10 %

3. There will be one theory paper and one Practical exam for Anatomy, Physiology and Biochemistry each. For practical the class will be divided into batches. Each batch will have practical exam of one subject on the specified day, according to schedule.

4. Theory & Practical assessment shall be of 100 marks each in Anatomy, Physiology and Biochemistry, making a **total of 200 marks for each subject.**

5. The Annual Theory paper shall be of 90 marks. 10 marks of internal assessment of theory papers, conducted throughout the year will be added to it, to make annual theory assessment of 100 marks.

6. Similarly, the annual practical examination will be of 90 marks. 10 marks of internal evaluation of practical exams, conducted throughout the year will be added to it, to make annual practical assessment of 100 marks.

7. The pass score shall be 50 out of 100, in theory and practical separately.

4.4 Schedule of examinations:

a) Continuous assessments schedule

Schedule provided by each department in Time table.

b) Formative tests: Throughout the block

INTRODUCTION OF BLOCK 2

The total duration of the block is 10 weeks, with 08 weeks of instruction and 02 weeks of assessment.

Block 2 comprises 02 modules:

1. Thorax
2. Cardiovascular system

Structured Summary of Block

Code	Y1B2
Name of Block	BLOCK 2
Duration of Block	10 weeks
No of integrated modules in the block	02
Names of modules	1. Thorax 2. Cardiovascular system
Vertical integration	• CBL Sessions • Applied Clinical Physiology, Clinical Anatomy & Clinical Biochemistry Lectures • Community medicine lectures
Prerequisite for Block	As per admission Criteria

Summary of MIT (Mode of Information Transfer)			
Subject	**MIT**	**MIT # Per week**	**MIT # In 08 weeks**
Physiology	Large group interactive session(LGIS) Case base learning(CBL) Case base Tutorials Practical	05 ---- ---- ---- 01(3 Batches)	40 02 06 08
Biochemistry	LGIS CBL Small group Discussion SGD Tutorials Practical	05 --- --- ---- 01(3 Batches)	40 03 03 03 08
Anatomy • Histology • Embryology Gen Anatomy	LGIS CBL Dissection Practical	05 --- 03 01(3 Batches)	40 04 24 08
Horizontally Integrated Sessions	Block-I is horizontally integrated between Anatomy, Physiology and Biochemistry.		
Islamiyat	LGF	----	08

TABLE OF SPECIFICATION – EXAMINATION

Year: First

Block: One

SUBJECT: ANATOMY

A. TOS Theory examination: Total marks = 90

S. No	TOPICS	Section A (MCQ) 25 x MCQs of 1 mark each	Section B (PBQ) 2 X PBQ of 8 marks each	Section C (SAQ/SEQ) 7 X SAQ/SEQ of 7 mark each	Total Marks
1.	Embryology	05 (05 marks)	01 (08 marks)	01 (07 marks)	20
2	Histology	05 (05 marks)		02(07 marks)	19
3	General Anatomy	05 (05 marks)		01 (07 marks)	12
4	Gross Anatomy	10 (10 marks)	01 (08 marks)	03 (07 marks)	39
Total Marks		25	16	49	**90**

B. TOS Practical examination: Total marks = 90

Viva Voce		Practical				
Examiner 1	Examiner 2	OSPE				Manuals (Gross embryology & histology)
		Un-observed stations		Observed stations		
		Gross anatomy, embryology & X – rays	Histology	Long slide	Surface marking	
25 marks	25 marks	20 marks	10 marks	05 marks	02 marks	03 marks
50		**40**				
90						

C. Theory paper pattern:

Total marks: 90

Time allowed: 03 hours

- Section A: 25 min
- Section B & C: 2 hrs. 35 min

Question number	Instrument of examination	Topic	Marks
Section-A			
Q. 1 to Q. 25	MCQ X 25	Embryology	5
		Histology	5
		General Anatomy	5
		Gross Anatomy (thorax)	10
		TOTAL (Section A)	**25**
Section-B			
Q.1	PBQ	Embryology	8
Q. 2	PBQ	Thorax	8
Section-C			
Q.4	SEQ/SAQ	Embryology	7
Q. 5	SEQ/SAQ	Histology	7
Q. 6	SEQ/SAQ	Histology	7
Q. 7	SEQ/SAQ	General Anatomy	7
Q. 8,9&10	SEQ/SAQ X 3	Thorax	21
		TOTAL (Section B and C)	**65**
		GRAND TOTAL (Section A, B & C)	**90**

SUBJECT: PHYSIOLOGY

A. TOS Theory examination: Total marks = 90

S. No	Topic	No of MCQ 1 mark each	PBQ 08 marks each	SAQ/SEQ 7 X SAQ/SEQ of 7 marks each
1.	Heart, cardiac muscle, the heart as a pump, conductive system of the heart, cardiac action potentials	5 (5 marks)	1 (08 marks)	1 (7 marks)
2	Cardiac cycle, ECG, Arrhythmias	5 (5marks)		1 (7 marks)
3	Hemodynamics of cardiovascular system, microcirculation and lymphatic drainage	5 (5 marks)		1 (7 marks)
4	Local blood flow, regulation of arterial pressure, cardiac output, venous return	5 (5 marks)	1 (08 marks)	2 (14 marks)
5	Heart sounds, Shock, cardiac dysfunction	5 (5 marks)		2 (14 marks)
Total.		25 (25 marks)	2 (16 marks)	7 (65 marks)
Grand total		**90**		

B. TOS Practical examination: Total marks = 90

Viva (theory)		Practical				
Examiner 1	Examiner 2	OSPE				
		Observed	Unobserved	Viva + Performance	Procedure	Copy
25	25	10	10	12	5	3
Grand Total = 90						

3. SUBJECT: BIOCHEMISTRY

A. TOS Theory examination: Total marks = 90

S. No	**Topic**	**Section A** No of MCQ: 25 01 mark each (Time allowed :25 min)	**Section B** Q1,2, - PBQ Q 3,4,5,6,7,8,9,10- SEQs& SAQs (07 marks each) (Time allowed 2 hours:35 min)
1.	Chemistry of carbohydrates	07	02
2	Chemistry of Lipids	06	1.5
3	Enzymes	06	02
4	Body Fluids Minerals & Trace Elements	06	1.5
Total.		**25 (marks)**	**65**
Grand total		**90(marks)**	

*Section A will be taken back from the students after 25 min.

Table of Specifications for End of Block Exam: Practical

Viva (Theory)		**Practical**				**Total**
Internal Examiner	External Examiner	OSPE (20)		Table Viva + Performance	Copy	
		Observed 2 stations	Unobserved 10 stations			
25	25	10	10	15	5	**90**

BLOCK SYLLABUS

(Subject wise)

ANATOMY

Summary:

Code	*Y1M2*
Name	***Anatomy***
Duration	*10 weeks*
Broad Themes of Module **(Theme: a subject that is being integrated a majority of time of module)**	1.Thorax 2.Cardiovascular system
Subject Themes	**Gross anatomy** Thorax **Embryology** Embryonic period, Fetal period Placenta and fetal membranes Twining CVS **Histology** Circulatory System Immune system **General Anatomy** Lymphatic system Circulatory system
Prerequisite Module	Y1M1

Mode of Information Transfer

MIT
Lectures
Dissection
Tutorials (PTT)
CBL
Practicals
Class tests

Anatomy

MBBS - Y1M2

PROPOSED LEARNING OBJECTIVES AND SUGGESTED MITs (mode of Information transfer)

GENERAL ANATOMY			
S.NO.	**TOPICS**	**LEARNING OBJECTIVES**	**MIT**
	Circulatory System	Discuss the general structural plan of blood vessels. Classify blood vessels on anatomical and functional basis Explain each type of blood vessel and give examples Discuss general plan of systemic, pulmonary and coronary circulatory system. Discuss general plan of portal system with brief accounts of arterial and venous portal systems giving examples. Differentiate between anatomic end arteries and functional end arteries giving examples Define anastomosis; describe various types of anastomosis with examples and their clinical significance. Describe blood supply of arteries and veins. Explain the importance of collateral circulation	LGIS (Large group interactive session)
	Lymphatic System	Discuss general plan of the lymphatic circulatory system of the body. Explain the mechanism of formation and flow of lymph. Enumerate the factors responsible for flow of lymph. Discuss the structural plan of lymphatic vessels. Describe the structural plan of lymph nodes and their role in lymphatic system Enumerate the capsulated lymphoid organs	LGIS

		Correlate the role of lymphatic system with spread of cancer and infection. Correlate the role of lymphatic system with development of edema.	
HISTOLOGY			
	Circulatory System	**KNOWLEDGE:** Discuss the general histological plan of blood vessels. Describe and compare the histological structure of: Elastic artery Muscular artery Arteriole Different types of Capillaries Venule Medium sized vein Large vein Describe histological changes in intima in atherosclerosis or arteriosclerosis **SKILLS:** Identify elastic artery, muscular artery and large vein under light microscope and enlist at least two identification points for each. Draw labelled diagram of elastic artery, muscular artery and large vein with the help of eosin and hematoxylin pencils on the histology notebook	LGIS Lab
	Immune System	**KNOWLEDGE:** Enumerate the cells of immune system. Describe the structure of primary and secondary lymph nodule. Describe the histological features of: Lymph node Thymus Spleen Tonsils Compare the histological structure of thymus, lymph node, spleen and tonsils. **SKILLS:** Identify slides of lymph node, thymus, spleen and palatine tonsils under light microscope and enlist at least two identification points for each.	LGIS Lab

		Draw labelled diagram of lymph node, thymus, spleen and palatine tonsils with the help of eosin and hematoxylin pencils on the histology notebook	
EMBRYOLOGY			
KNOWLEDGE			
	Embryonic period (3^{rd} to 8^{th} week)	Define neurulation Describe process of formation of neural plate, neural tube and neural crest cells. Enlist derivatives of: Surface ectoderm Neurectoderm Neural crest Intraembryonic mesoderm (paraxial, intermediate, lateral plate) Endoderm Describe somitogenesis and early differentiation of somites. Describe the development of intraembryonic coelom Describe the folding of the embryo in the longitudinal plane and correlate it with its consequences Describe the folding of the embryo in the horizontal plane and correlate it with its consequences Describe relocation of connecting stalk to the anterior abdominal wall and its differentiation into umbilical cord. Describe the process of formation of blood and blood vessels and differentiate between angiogenesis and vasculogenesis Explain the embryological basis of the neural tube defects like anencephaly and spina bifida Define hemangioma and explain its embryological basis	LGIS
	Fetal period (third month to birth)	Define fetal period Enumerate various methods to estimate fetal age Describe factors affecting fetal growth	LGIS

		Enlist the external body landmarks from third month to birth Define intrauterine growth retardation	
	Placenta and fetal membranes	Enlist types of chorion and give fate of each. Enlist types of decidua and give fate of each. Enumerate the fetal and maternal components of placenta. Differentiate between stem, anchoring and terminal villi Enumerate the layers forming placental barrier Describe placental circulation (maternal and fetal) Enumerate functions of the placenta Enlist the features of maternal and fetal surfaces of placenta. Enumerate placental changes by the end of pregnancy List fetal membranes and their functions Describe production, circulation and significance of the amniotic fluid. Describe the development of umbilical cord Define preeclampsia and correlate it with trophoblastic differentiation Describe the embryological basis of amniotic bands, umbilical cord defects, erythroblastosis fetalis and hydrops fetalis Define poly and oligohydramnios. Enumerate their embryological causes and adverse effects	LGIS
	Twining	Name two basic types of twins. Describe the mechanism behind occurrence of dizygotic & monozygotic twins. Discuss the possible arrangements of fetal membranes in case of monozygotic twins. Discuss fetus papyraceus, twin transfusion syndrome and conjoined	LGIS

		twins on basis of knowledge of embryology	
	CVS-I (Heart)	Explain the formation of heart tube. Describe the mechanism of cardiac looping Enlist the parts of heart tube and their definitive derivatives Explain the embryological basis of dextrocardia Describe histogenesis of heart Describe contribution of bulbs cordis and sinus venosus to the development of heart Explain different methods of septal formation Describe division of atrioventricular canal Explain the embryological steps involved in formation of interatrial septum Correlate the internal differentiation of right atrium with internal structure of right atrium of definitive heart Describe the formation of left atrium and pulmonary veins Explain the division of conotruncus Describe the formation of interventricular septum and identify sources of its different parts Describe the development of valves of heart Describe the development of conducting system of heart Explain the embryological basis of the following heart defects: Various forms of atrial septal defects Ventricular septal defects Fallot's tetralogy Transposition of great vessels Persistent truncus arteriosus Pulmonary stenosis Aortic stenosis Tricuspid atresia Hypertrophic right and left heart syndromes	LGIS

		Ectopia cordis	
	CVS-II (Arterial system)	Define aortic arches Explain the development and fate of aortic arches Enumerate the developmental sources of aorta Justify the relationship of recurrent laryngeal nerves on the basis of your knowledge of embryology Enumerate the segmental branches of dorsal aortae & give their fate Explain the fate of vitelline & umbilical arteries Explain the development of arteries of the limbs Enumerate & explain the congenital anomalies of arterial system which include: Patent Ductus Arteriosus Coarctation of aorta Double aortic arch Right aortic arch Abnormal origin of the Right Subclavian Artery An interrupted aortic arch	LGIS
	CVS-III (Venous system)	Explain the fate of vitelline, umbilical and cardinal veins Explain the development of inferior vena cava Explain the development of superior vena cava Correlate following anomalies of venae cavae with their development Double Inferior Vena Cava Absence of Inferior Vena Cava Left Superior Vena Cava Double Superior Vena Cava Explain the development of lymphatic system	LGIS

	CVS-IV (Fetal circulation)	Describe fetal circulation Describe following fetal circulatory changes at birth: Closure of the umbilical vein and ductus venosus Closure of the ductus arteriosus Closure of the oval foramen	LGIS
SKILLS			
	Embryology	Identify the structures related to general development and development of cardiovascular system on given models and diagrams	SGD (Small group discussion)
GROSS ANATOMY			
THORAX			
KNOWLEDGE:			
	Thoracic wall (Bones and soft parts)	Enumerate the bones contributing in thoracic cage Describe the bony framework of the thoracic cage with topographic placement of each bone Identify structures forming the thoracic inlet and outlet/costal margin Discuss sternum, with reference to its parts and attachments Define sternal angle and discuss its importance in clinical practice Classify ribs into true and false Determine side of ribs Discuss parts of a typical rib Differentiate between typical and atypical ribs Identify typical thoracic vertebra, describe its different parts and identification points Compare a typical and atypical thoracic vertebra Describe the joints of thorax with reference to their types and movements Discuss and differentiate between the pump handle and bucket handle movements and their effect on diameters of chest cavity	SGD and dissection

		Discuss the role of the accessory respiratory muscles during inspiration and expiration Enlist the contents of a typical intercostal space including muscles, nerves and vessels Describe the attachments, actions and nerve supply of thoracic muscles Discuss the arterial supply and venous drainage of the thoracic wall. Discuss the course and distribution of a thoracic spinal nerve Identify and justify the most suitable site for an invasive procedure in an intercostal space Analyze the clinical scenario related to blunt chest trauma and its complications with anatomical reasoning	
	Diaphragm	Describe the parts, attachments and nerve supply of diaphragm Enlist the apertures in diaphragm with their levels and structures passing through each Discuss the role of diaphragm and scalene muscles in increasing the vertical diameter of thoracic cavity Analyze the clinical scenario related to diaphragmatic hernia and phrenic nerve lesions with anatomical reasoning Correlate the tip of shoulder pain with irritation of diaphragm	SGD and dissection
	Pleura	Enumerate and discuss various parts of pleura and identify their locations Describe the pleural reflections and recesses Describe the innervation of the visceral and parietal layers of the pleura Discuss the clinical significance of reflections and recesses of pleura and pleural cavity Define pleural effusion, pneumothorax, empyema and hemothorax	SGD and dissection

		Enlist the anatomical structures encountered in chest tube insertion	
	Lungs	Identify the side of lungs Enlist borders and surfaces of lungs Discuss the topographic arrangement of structures in hilum of each lung Discuss the blood supply, nerve supply , lymphatic drainage and relations of various surfaces of both lungs Define bronchopulmonary segments. Enlist them in each lung. Discuss their significance. Discuss with anatomical reasoning, the clinical presentation of bronchogenic carcinoma and lung trauma	SGD and dissection
	Mediastinum (General outline)	Define mediastinum Describe how the mediastinum is further divided Enlist the structures lying at the level of transverse thoracic plane Outline the boundaries of each division of mediastinum Enumerate contents of each division of mediastinum	SGD and dissection
	Anterior mediastinum	Outline the boundaries of anterior mediastinum Enumerate the contents of anterior mediastinum Describe the shape, relations and blood supply of thymus	SGD and dissection
	Superior mediastinum	Outline the boundaries of superior mediastinum and describe its general topography Enumerate the contents of superior mediastinum Identify carina at the site of bifurcation of trachea into main principal bronchi Describe immediate relations, blood and nerve supply of thoracic part of trachea	SGD and dissection

		Justify the right bronchus being the most probable site of foreign body impaction in respiratory tract Describe the orientation, relations and branches of arch of aorta Describe the formation, relations and tributaries of superior vena cava and brachiocephalic veins Determine the site of ligamentum arteriosum and its relation to left recurrent laryngeal nerve Describe the origin, course, relations and distribution of both phrenic nerves Analyze the clinical scenarios related to compression of trachea and damage/irritation of phrenic nerve based upon your knowledge of Anatomy	
	Posterior mediastinum	Outline the boundaries of posterior mediastinum and describe its general topography Enumerate the contents of posterior mediastinum Describe the relations and branches of descending aorta Describe the course, relations and constrictions of thoracic part of esophagus Discuss the reason behind esophageal varices in case of portal hypertension Describe the thoracic duct with reference to its formation, course, tributaries, termination and area of drainage Analyze the clinical scenarios related to chylothorax with the help of your knowledge of Anatomy Describe the course, relations and distribution of both vagus nerves in thorax Discuss the azygos system of veins with reference to formation, course, relations, tributaries and area of drainage of both azygos and hemiazygos veins Discuss the role of azygos vein in case of caval obstruction	SGD and dissection

		Identify the lymph nodes in the posterior mediastinum Define splanchnic nerves and identify the location of thoracic sympathetic chain	
	Pericardium	Enumerate various layers of pericardium Describe the gross features of fibrous pericardium Describe the gross features of serous pericardium (both parietal and visceral layers) Describe the reflections of parietal and visceral pericardium resulting in formation of transverse and oblique sinuses Identify the locations of pericardial sinuses Describe the surgical significance of the Transverse Pericardial Sinus Discuss the innervation of various layers of the pericardium Define pericarditis and pericardial effusion Identify the best location for and enlist the anatomical structures encountered in pericardiocentesis	SGD and dissection
	Heart	Describe anatomical position, borders, surfaces, apex and base of heart Describe external features of the heart Describe internal structure of various chambers of heart Compare the functional anatomy of right and left ventricles Describe structure of various valves of heart Enumerate the structures comprising the cardiac skeleton and describe its significance Describe the arterial supply of heart Explain the basis of right or left dominance of heart Describe the venous drainage of heart Describe nerve supply of heart Define angina pectoris, myocardial infarction and cardiac tamponade	SGD and dissection

		Describe variations of coronary arteries in context of myocardial infarction Justify the chest pain, left upper limb pain, jaw pain and epigastric discomfort as presenting complaint of ischemic heart disease with anatomical reasoning	
SKILLS:			
	Gross Anatomy of Thorax	Identify muscles, bones, ligaments, nerves, vessels, organs and their parts located in thorax: on a cadaver after performing dissection on prossected specimens on provided models	SGD and dissection
	Surface marking	Identify the important bony landmarks of thorax and mark them on a subject. Mark the borders of lungs, pleural reflections, borders and apex of heart, valves of heart, thoracic duct, esophagus, trachea, main vessels and nerves of thorax on the given subject	SGD and Skills lab
	Imaging of head and neck	Identify the bones of thorax, aortic knuckle, borders of heart, lungs, trachea, hilar shadows, diaphragm and its recesses on chest radiographs	SGD and skills lab

PHYSIOLOGY

Summary:

Code	*Y1M2*
Name	***Physiology***
Duration	*10 weeks*
Broad Themes of Module **(Theme: a subject that is being integrated a majority of time of module)**	1.Thorax 2.Cardiovascular system
Subject Themes	Cardiovascular Physiology
Prerequisite Module	*Y1M1*

Mode of Information Transfer:

MIT
Lectures
Tutorials (PTT)
CBL
Practicals
Class tests

Physiology learning outcomes and Modes of information transfer:

Physiologic anatomy of heart and cardiac action potential (LGIS)	Appreciate the physiological arrangement of right and left hearts along with the parallel arrangement of systemic circulation. Know the physiologic anatomy of cardiac muscles, its functional syncytium and intercalated disc and difference between cardiac, skeletal and smooth muscles. Know the phases of action potential in cardiac muscle and autorrhythmic cells/ conducting system of the heart along with comparison of action potential in different tissues of the heart. Associate movement of ions across the cell membrane with different phases of action potential. Comprehend importance and relationship between refectory period and mechanical periods. Know the mechanism of generation and propagation of cardiac impulse in conductive system of heart. Appreciate characteristics of spread of cardiac impulse through conductive system, atrial and ventricular myocardium and its association with the function of heart.

Cardiac cycle (LGIS)	To understand various cardiac events in relation to each other To understand and interpret cardiac cycle diagram Comprehend preload and afterload, its influence on stroke volume. The Frank-Starling's mechanism and role of autonomic regulation of heart rate and pumping action. Know about the myocardial bioenergetics.
ECG (LGIS, SGD/ tutorial, Practical)	Comprehend genesis of ECG, the way it is recorded and its relationship with the electrical axis of heart. Understand significance of waves, segments and intervals of ECG recording. Learn the concept of a vector and principles of the measurement of ECG vector. Appreciate relationship between vector and lead, type and locations of leads and principles for vector analysis. Know general principles of analysis of ECG.
Arrhythmias (LGIS, SGD/ tutorial, Practical)	Understand the basis of common cardiac arrhythmias, process that produce them and their clinical significance. Evolve the concept of sinus arrhythmia and its clinical significance. Appreciate principal changes in ECG during myocardial ischemia and infarction. Comprehend changes in ECG and cardiac function during common abnormalities in ionic composition of body fluids. Understand the pathophysiology of ectopic focus and its clinical significance. Know how and when to carry out cardiac massage and its significance. Appreciate the events of cardiac cycle and prospective changes in ECG, heart sounds, pressures and volumes during different phases thereof.
Hemodynamics of circulation (LGIS)	Know the organization of circulatory systems i.e. Greater (Systemic) and Lesser (Pulmonary) circulations along with accessory circulatory system (Lymphatic). The physiologic anatomy of different types of blood vessels and their importance. To know the relationship between flow, resistance and conductance. Have the concept of blood flow, its types and significance of turbulent and laminar flow, the concept of pressure gradient, resistance to blood flow and its significance. Understand the Physiology of vascular compliance? Changes in compliance of blood vessels with age and

	comparison between the compliance of arteries versus veins. Appreciate the origin of arterial pressure pulse and its propagation to the peripheral arteries. Know the factors damping the arterial pulse and abnormalities of arterial pulse. Know about the jugular venous pulse, its significance and differentiation from arterial pulse.
Control of Local Blood Flow (LGIS)	To know about acute and chronic control of local blood flow To about theories of metabolic control of blood flow To know about active and reactive hyperemia To know the effects of blood flow control on total peripheral resistance
Capillary dynamics (LGIS)	Understand the principles of capillary dynamics, structure of Interstitium, Starling's forces for fluid exchange across the capillary membrane and factors affecting thereof. Ha ve the concept of starling's equilibrium, and how of the interstitial space is kept dry? Know the mechanism of formation of interstitial fluid, its composition and factors creating starling's disequilibrium leading to the development of edema. Appreciate Types of edema, its pathophysiology and safety factors preventing edema formation.
Cardiac output (LGIS)	Understand the determinants of cardiac output and factors affecting cardiac output. Appreciate the mechanics of low and high cardiac outputs along with their effects on heart. Comprehend the factors affecting stroke volume, heart rate and total peripheral resistance. Understand Fick's principle for the measurement of cardiac output.
Venous return (LGIS)	Recognize the role of veins in blood flow, their functions and factors regulating venous return and significance of venous reservoirs. Appreciate the equality of cardiac output and venous return. To understand factors affecting venous return

Arterial blood pressure (LGIS, SGD/ tutorial, Practical)	Comprehend the determinants of arterial pressure, factors affecting and mechanisms regulating blood pressure on short and long term basis. Understand mean arterial pressure and its significance. Comprehend the individual and integrative role of baro receptors, chemoreceptor, volume receptors, arterial natriuretic factors and Renin-angiotensin – aldosterone system in regulation of arterial pressure. Understand the characteristics of regional circulations (skeletal muscles, pulmonary, coronary & cerebral) and factors regulating thereof.
Cardiac failure (LGIS)	Define cardiac failure, its pathophysiology and clinical manifestations To know different types of cardiac failure Physiology of treatment of cardiac failure
Heart sounds (LGIS, SGD/ tutorial, Practical)	To know about origin of heart sounds To know about murmurs To know about clinical importance of various heat sounds
Circulatory shock (LGIS)	Define shock, its types, stages of development and differences between compensated and uncompensated shock. Understand the pathophysiology of compensated and uncompensated shock. Comprehend the short term and long term compensatory mechanisms in circulatory shock. Know the pathophysiology of irreversible shock. Comprehend the general principles for the treatment of shock.
Effect of exercise on CVS (LGIS, SGD/ tutorial, Practical)	Know the types and severity of exercise in different sports. Have the concept of general adaptive changes in muscles in response to increased and decreased physical activity. Know about the fuels available in body during rest and exercise. Comprehend cardiovascular and pulmonary changes (including oxygen consumption) during different grades of exercise.

BIOCHEMISTRY

Summary:

Code	*Y1M2*
Name	***Biochemistry***
Duration	*10 weeks*
Broad Themes of Module (Theme: a subject that is being integrated a majority of time of module)	1.Thorax 2.Cardiovascular system
Subject Themes	Chemistry of carbohydrates Chemistry of Lipids Enzymes Body Fluids Minerals & Trace Elements
Prerequisite Module	*Y1M1*

Mode of Information Transfer:

MIT
Lectures
Tutorials (PTT)
CBL
Practicals
Class tests

Biochemistry learning outcomes and modes of information transfer (MIT):

Carbohydrate Chemistry (LGIS, SGD/tutorial, Practical)	Upon successful completion of this course, students will be able to: Define and classify carbohydrates with the understanding of biochemical nature, significance of important member of each group. Explain structure of carbohydrates, isomerism and properties of monosaccharide. Enlist different dietary sources and understand common disorders related to chemistry of CHO. Describe important homo and hetero Polysaccharides, their important examples and biochemical role, Understand the biomedical importance of carbohydrates and their derivatives in health and disease conditions
Lipid Chemistry (LGIS, SGD/tutorial, Practical)	By the time the students finish the course, they will be able to: Define and classify lipids on different basis along with appropriate examples. Difference between oil, fat, waxes and vegetable ghee as well as the process of hydrogenation and iodination, saponification, acid number Polansky's number and other physical attributes. Describe saturated, unsaturated, poly unsaturated, essential, non-essential, Trans and cis type of fatty acids and their significance in health and disease. Distinguish structure of Glycerol and sphingophospholids as well as other different complex lipids and appreciate their biochemical significance. Describe Eicosanoids, their functions in health and disease and the inhibitory action of NSAIDS and steroids on them. Recognize the sterol structure and different important steroids especially the cholesterol, its functions and significance with regards to IHD. Summarize classification of lipoproteins, chemical composition, functions and disorders Understand the rancidity, its types and lipid per oxidation and its clinical implications

Enzymes (LGIS, SGD/tutorial, Practical)	At the end of the course, students are expected to be able to: Define different terms e.g, Coenzymes, co-factors, holozymes, prosthetic group, ribozymes, zymogens isozymes etc. Classify enzymes and describe mechanism of enzyme actions. Explain different properties of enzymes and factors affecting enzymes activity. Illustrate enzyme kinetics in relation to Michaelis-Menten Equation and Lineweaver- Burke plot. Describe enzyme regulations, activation, inhibition and biomedical importance of synthetic inhibitors. Understand role of enzymes in clinical diagnosis and therapeutics.
Body Fluids (LGIS, SGD/tutorial)	By the time the students finish the course, they will be able to: Define pH, buffers and briefly explain their mechanism of action. Explain Henderson- Hasselbach Equation and develop problem-solving skills based on this equation. Describe Types of particles, solutions and colligative properties Understand the phenomenon of osmosis and osmotic pressure and its implications regarding clinical situations. Explain Surface tension, viscosity & their importance related to body fluids.
Minerals and Trace elements (LGIS, SGD/tutorial, Practical)	By the end of the course, the students will be able to: Classify minerals (macro minerals e.g Na, K, Ca, Cl, PO_4 and micro minerals e.g Fe, Zn, Mg, Se, I, Cu, Cr, Cd, Mn). Describe absorption/resorption and body regulation of minerals, nutritional sources, RDAs, toxicity and deficiency states of minerals. Enlist the trace elements and briefly explain their biochemical significance.

Case Base Learning Scenarios

ANATOMY

CBL Case-1

Forty years old Azmat Ali presented in the accident and emergency department with history of road traffic accident. He was driving the car when he hit a Pole. On examination, pulse 100/min BP 110/70 mm of hg SPO2 95%. Chest examination revealed marked diminished air entry on right middle and lower zone of Chest. Resident surgeon noticed paradoxical movements of the chest-ray chest were taken which shows that multiple ribs are broken bilaterally at multiple sites. Bilateral chest intubation and endotracheal intubation was planned.

Learning objectives:

Demonstrate the morphological features of thoracic cage on skeleton.
Differentiate typical and atypical ribs and thoracic vertebrae.
Describe the framework of the thorax, including the sternum and its parts.
Identify potential causes of blunt chest trauma.
Identify complications of blunt chest trauma.
Learn the bilateral chest intubation and endotracheal intubation
Identify possible treatments and initial management for blunt chest trauma.

Learning Resources:

Clinical Anatomy by Snells
Clinically Oriented Anatomy by Keith. L. Moore

CBL Case-2

A middle aged female presented with multiple fractured ribs and right side haemothorax after a road accident. A chest tube was put in to drain the hemothorax. She was comfortable, no respiratory distress and maintaining the oxygen saturation without oxygen supplementation. There is decrease air entry at base and check X-ray revealed markedly elevated diaphragm on Rt. Side. C.T Chest-suspicion of traumatic diaphragmatic hernia with herniation of liver in thorax. Surgeon planned lateral thoracotomy through 7th I.C.space. Before opening he placed laparoscope through chest tube site and confirmed the diagnosis. Liver and a part of colon were in thorax. After opening both structures could be reduced easily. Rent in diaphragm repaired with 1/0 Prolene suture. Post-operative – uneventful recovery.

Learning objectives:

Identify major anatomical landmarks of the diaphragm including its muscular portion, central tendon, right and left crus, esophageal hiatus, aortic hiatus, and caval foramen.

Learning Resources:

Clinical Anatomy by Snells
Clinically Oriented Anatomy by Keith. L. Moore

CBL Case-3

A 10-year-old boy had a coughing fit while chewing on a pen top and subsequently realized that the inside of the pen top was missing. He was sent home from the local emergency department after a normal chest radiograph. Two days later he started to wheeze and cough. A chest radiograph was again normal, but he had wheeze that was louder on the right side of the chest and a fever. He was given intravenous antibiotics but he did not improve and the following day was transferred to the regional pediatric center for assessment. With rigid bronchoscopy under general anesthesia the pen top was removed from his right main bronchus.

Learning objectives:

Identify the thoracic part of the trachea and bronchi describe its blood supply and innervation.

Identify and describe the location of the lungs in the thoracic cavity.

Identify the relations of the pulmonary artery, pulmonary veins, and the bronchi at the hilum of each lung.

Define a bronchopulmonary segment and discuss its general organization.

Name the bronchopulmonary segments and give their approximate location in reference to the lobes of the lungs.

Learning Resources:

Clinical Anatomy by Snells

Clinically Oriented Anatomy by Keith. L. Moore

CBL Case-4

Consultative support to a patient was asked who had become unstable during his postoperative phase of surgery. The patient was currently recovering from a modified radical neck procedure for squamous cell carcinoma of the tongue. The patient presented with tachycardia and hypotension with decreasing urinary output and poor skin turgor. He was intermittently combative and semi-conscious. On physical exam, surgeon noticed the neck was edematous, and a palpable mass roughly 8 cm in diameter was felt. After connecting the bulb suction to the wall suction apparatus approximately 600 ml of milky white fluid was immediately aspirated from the wound with a subsequent diminution in the size of the mass. He was diagnosed a case of chylothorax . The plan for management includes contacting the thoracic surgery team and replacing the patient's lost fluid volume.

Learning objectives:

What is chylothorax? How would you explain the milky white fluid following this kind of operation? Which lymphatic channel/duct would be involved?

Given the location of the surgical procedure - How would a definitive diagnosis be made?

What is the course of the thoracic duct? What structures drain into the thoracic duct?

Define the boundaries of the posterior mediastinum, what lymph nodes can be found

in the posterior mediastinum?
Describe the major contents of the posterior mediastinum and their relationships

Learning Resources:
Clinical Anatomy by Snells
Clinically Oriented Anatomy by Keith. L. Moore

CBL Case-5
A previously healthy 50-year-old woman presented with a low-grade fever, a generalized headache, and chest pain of 2 to 3 weeks' duration. She described intermittent sharp chest pain over the precordium that intensified when she lay down and shortness of breath after minimal exertion. On physical examination, she appeared weak and ill. Her temperature was 36.7°C (98.0°F), and her pulse was 110 beats per minute, regular, and had normal volume and character. Her blood pressure was 115/70 mm Hg, which decreased to 90/70 mm Hg on inspiration; her respiratory rate was 22 breaths per minute. Dullness to percussion, scattered inspiratory crackles, and diminished air entry were evident over both lung bases. A CT scan of the chest showed bilateral pleural effusions. An abdominal CT scan was normal. The patient was admitted to the coronary care unit and underwent diagnostic pleural aspiration and pericardiocentesis. The diagnostic procedure was a pericardial biopsy. The patient had cardiac tamponade, caused by tuberculosis.

Learning objectives:
To learn the anatomy of the intercostal space and its contents.
To learn the anatomy of the pleura its reflections and pleural spaces.
To learn the anatomy of the pericardium its reflections and pericardial spaces.
For what other reasons (besides sampling pleural fluid) might a thoracocentesis be performed? what is the procedure of pericardiocentesis and pericardial biopsy
Learning Resources:
Clinical Anatomy by Snells
Clinically Oriented Anatomy by Keith. L. Moore

CBL Case-6
Mr. Ahmed, a middle aged businessman after a heavy meal at a well-known restaurant, walked briskly to join his fellows. He fell short of breath and developed chest pain radiating to inner aspect of his left arm. The pain reduced on stopping.
He was taken to Casualty Department. On arrival, his pulse rate was 95/minute, blood pressure was 80/50 mmHg and he had pallor on face and cold sweat. The heart sounds were normal on auscultation. His chest X-ray (PA view) showed cardiomegaly. He informed the doctor that he was taking medication for hypertension.
He was admitted to CCU and given supportive therapy. His Electrocardiogram showed ST-elevation in all leads. Troponin-I (cardiac marker) was raised in blood. His coronary angiography next morning showed narrowing of 3 coronary arteries

Learning objectives:

What are the possible causes of pain in this case? Why do you think this is cardiac pain? Chest pain with radiation to the neck or arm is a 'characteristic' symptom of acute myocardial infarction (AMI) in many patients; explain why the pain can be felt in these distant regions.

Describe the blood supply to the heart, listing the major arteries and branches. What arteries of the heart are most commonly occluded?

Why do occlusions rapidly lead to infarct in the heart? Which artery supplies the papillary muscles?

What does the left anterior descending (LAD or anterior interventricular) coronary artery supply?

What branches come off the LAD? What arteries of the heart are most commonly occluded? Why do occlusions rapidly lead to infarct in the heart?

What is myocardial infarction? Which mechanisms cause an acute myocardial infarction (AMI) considering changes in coronary artery?

What is coronary angiography ?

Learning Resources:

Clinical Anatomy by Snells

Clinically Oriented Anatomy by Keith. L. Moore

CBL 7

During a routine physical exam for participation in interscholastic sports, the physician noted that Bilal, a twelve-year-old boy, had a long continuous heart murmur at the second intercostal space near the left sternal border. A systolic thrill was also noted in the same region. When questioned, the patient's mother recalled that Bilal had periods of cyanosis and breathlessness as an infant, but that his previous pediatrician said that the murmur and the symptoms were nothing to be concerned about. Bilal also mentioned that he tires easily during physical activity. Chest films and Doppler ultrasound were ordered. The radiographs indicated slight left ventricular hypertrophy, and ultrasound revealed a patent ductus arteriosus. Bilal was scheduled for surgery to ligate the ductus arteriosus. The surgery resulted in successful ligation of the ductus arteriosus; however, Bilal experienced hoarseness when speaking following the procedure. Laryngoscopy revealed paralysis of the left vocal fold.

Learning objectives:

What is the ductus arteriosus, and where is it located?

What is the prenatal function of the ductus arteriosus, and what usually happens to it after birth?

What are the eventual consequences if the ductus arteriosus is not closed?

What likely caused paralysis of the left vocal fold?

Why would Doppler ultrasound be used to diagnose a patent ductus arteriosus?
Identify and trace all the branches of the arch of the aorta in the region and the relationship of the vagus and phrenic nerves to them.
Identify the anatomy of the four chambers
Compare and contrast the anatomical characteristics right and left sides of the heart.

Learning Resources:

Clinical Anatomy by Snells
Clinically Oriented Anatomy by Keith. L. Moore

CBLS BIOCHEMISTRY

Topic: CHO chemistry (Anticoagulation)

A 62-year-old female presented to clinic with pain, swelling and redness to her right lower leg. She stated that she was experiencing right calf pain worse with walking. She noted that she returned home from a vacation to Europe last week which included a 15-hour flight. The patient's vital signs were stable and she was afebrile. The patient had a past medical history including hypertension and type 2 diabetes both of which were controlled with oral medications.

On examination, physician noticed that patient's right leg to be slightly erythematous and her calf is tender to touch. She had trace pedal edema in the affected leg and limps slightly when walking. Her right calf was greater in size compared to her left. Given this patient's medical history as well as her recent sedentary activity on her long flight, physician suspected her to have DVT and ordered a venous ultrasound of her right leg. Ultrasound results reveal a deep venous thrombus in her popliteal vein. Based on this patient's ultrasound results, doctor prescribed her five days of subcutaneous injectable heparin as well as coumarin. She was instructed her to return to the clinic in five days to recheck her INR. She was issued strict instructions to return should she develop chest pain or shortness of breath.

LEARNING OBJECTIVES:

1. Chemistry and functions of GAGs
2. Heparin and its role in body
3. Proteoglycans chemistry and functions

REFERENCE BOOKS:

1. Harper's text book of Biochemistry.
2. Davidson's Practice of Medicine.
3. Lippincott's textbook of Biochemistry

Topic: Enzymes (Diagnosis of biliary obstruction)

A 40 years old female presented with jaundice and pain in epigastrium for three days. She also complained of nausea, vomiting, itching on skin, anorexia, pale color stools and dark color urine. On examination her skin and sclerae were yellow. There was no history of fever or weight loss over last few months. Ultrasonography abdomen showed gall stones and no mass in the bile duct was seen. Other lab investigations are as under

LAB INVESTIGATIONS:

Test Name	Result	Normal Values
Serum bilirubin Total	40µmol/L	2-17 µmol/L
Conjugated	22 µmol/L	0-4 µmol/L

Unconjugated	18 µmol/L	0-13 µmol/L
Serum ALT	46 U/L	Upto 40 U/L
AST	49 U/L	Upto 40 U/L
ALP	620 U/L	132-365 U/L
GGT	130 U/L	Upto 30 U/L

Enzymes are mostly intracellular species or they are secreted into specific cavities e.g, digestive enzymes. Normal cellular turnover causes some release into the plasma and that constitute the basis for normal levels of plasma enzymes. If a certain enzyme in increased more than normal in plasma, it means cellular rupture in the tissue in which this particular enzyme or its specific isoform was abundant. Isoforms or isozymes of one enzyme mean a single change in primary structure of protein which does not affect the activity or stability of enzyme much but give different bands on electrophoresis. Increase in plasma ALT means hepatocellular damage

LEARNING OBJECTIVES:

1. Classification of enzymes
2. Factors affecting enzyme activity
3. Mechanism of enzyme action

Topic: **Enzyme**

A 65 years old chronic alcoholic reported to surgical OPD CMH Rwp with complains of **weight loss, anorexia & abdominal pain radiating to the back**. Physical examination showed a palpably enlarged gall bladder. Lab investigation showed:

Lab Investigation:

Computed tomogharapgy showed a **mass in the head of pancreas**. The patient was diagnosed as a case of **obstructive jaundice due to the pancreatic adenocarcinoma.**

	Patient Value
Serum conjugated bilirubin level	Increased
Urine bilirubin	Present
Urine urobilinogen	Absent
Fecal urobilinogen	Absent
Serum ALP	Highly Increased
Serum ALT	Marginally Increased
Serum AST	Marginally Increased

Many diseases that cause tissue damage result in an increased release of **intracellular enzymes into the plasma**. The level of specific enzyme activity in the plasma frequently correlates with the **extent of tissue damage**. Alkaline phosphatase

(ALP) is elevated in certain bone **and liver diseases.** ALP is useful for the diagnosis of **rickets, hyperparathyroidism, carcinoma of bone, and obstructive jaundice.**

LEARNING OBJECTIVES:

Mechanism of action of enzymes
Factors affecting enzyme activity
Role of enzymes in clinical diagnosi

Topic: Body Fluids

A 45-year-old male previously known to have duodenal ulcer presents with complaints of persistent vomiting for past 36 hrs. He has no history of abdominal pain. He complains of being dizzy when he stands up.
On examination his pulse is 95 beats/min, blood pressure is 90/50mmHg with sunken eyes and dry oral cavity.

LAB INVESTIGATIONS:

Test Name	Result	Normal Values
Plasma Na+	130mEq/L	135 – 145mEq/L
pH	8	7.35 -7.45
Urea	50mg/dl	10-40mg/dl
Cl-	80mEq/L	90-106mEq/L

LEARNING OBJECTIVES:

1. Body fluid compartments.
2. Regulation of water balance
3. Weak acids and bases
4. Henderson Hassel Balch equation

CBL Session

A middle aged man was brought to emergency department with a history of persistent vomiting and profuse watery diarrhea for the last 10 hours. Pt had a rapid feeble pulse, sunken eyes and coated tongue. His blood pressure was 80/40 mm of Hg. He was diagnosed as a case of acute gastroenteritis.

Related lab investigations:

	Result	**Normal value**
Serum Na +	130 meq/L	135-145 meq/L
" K +	2.8 meq/L	3.5-5 meq/L
" Urea	50 mg/dl	upto 40 mg/dl
" Creatinine	1.2 meq/L	0.6-1.2 mg/dl
" Cl -	76 meq/L	96-106 meq/L

Learning Objectives:

Movement of materials across cell membranes
Simple diffusion

Carrier mediated diffusion and active transport
Osmosis and surface tension

Topic: <u>Minerals (Copper Storage Disease. WD disease)</u>

An 8-years boy was brought to PAEDS OPD in the hospital. He was presenting mild **cognitivedeterioration and clumsiness** and common **parkinsonian** features. Parents informed that the child had delayed slurred speech. It was also informed by the parents that on opening arms child present **wing-beating tremors**. On details family history parents informed that three years girls died two years earlier because of same symptoms. Physician observed **Kayser–Fleischer rings (KF rings) using** slit lamp and **skin turgor&Spasticity** was poor. Persistent elevatedlevels of serum alanine aminotransferase (ALT), and aspartate aminotransferase (AST) levels were observed. The attending pediatrician suspected Wilson Disease. Liver nodular growths were observed in abdominal USG. To confirm diagnosis Liver FNAC was performed which showed very high level of copper accumulation. High level of copper was also observed in 24-hour urine exam. Furthermore, reduced Serum ceruloplasmin levels was observed. In order to confirm the Wilson disease whole blood samples was sent to molecular laboratory for genetic analysis in ATP7B gene.

S.No	Tests	Patients	Refence
1	ALT	134U/L	Upto 42 U/L
2.	Urine Cu	65mmol/L	>1mmol/l
3.	Serum Cu	75mmol	11-24mmol/L
4.	Serum ceruloplasmin	8 mg/L	15-20mg/L
5.	USG abdomin	Nodular liver	Negative

<u>Learning Objectives</u>:

Copper metabolism in Human and its absorption
Functions of Copper
Dietary sources of Copper
Copper containing Enzymes

<u>Topic: Iron Deficiency Anemia:</u>

A multiparous female presented in medical OPD with the complaints of generalized weakness, occasional dizziness, easy fatigability and shortness of breath. She belonged to a low socio-economic status. Her past medical history reveals postpartum hemorrhage.

On examination she was pale, her pulse was 90 beats/min, blood pressure was 100/70mmHg.

LAB INVESTIGATIONS:

Test Name	Result	Normal Values
Hb	8.5g/dl	12-14g/dl
MCV	70fl	80-100fl
MCH	20pg	27- 31pg
MCHC	28g/dl	32- 36g/dl
S.Fe	34µg/dl	50- 170µg/dl
TIBC	400µg/dl	250- 370µg/dl
S. Ferritin	10µg/L	15- 150µg/L
Peripheral Blood Smear	Hypochromia Microcytosis	

LEARNING OBJECTIVES:

1. Classify minerals
2. Sources, Absorption and Transport of Iron
3 Disorders of iron metabolism

PHYSIOLOGY

PBL 1

A 55 years old male was brought to cardiac emergency department with the history of severe left sided chest pain. His ECG showed ST segment elevation and significant Q waves in leads I, aVL and V6. These findings suggested that he sustained acute infarction of the left side of left ventricle. QRS complex was positive in lead aVF and predominantly negative in lead I. The treating doctor showed ECG to final year medical students and told that there was right axis deviation in the ECG as well.

Learning objectives

To know about basics of cardiac impulse generation and propagation
To understand ECG leads and normal ECG
To understand and interpret vector analysis
To know Physiological basis of ST segment shift (current of injury)
To understand ECG changes in acute myocardial infarction
To understand physiology of treatment of acute myocardial infarction

Resources:

Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood.
Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
Electronic modes

PBL 2

A 65 years old man suddenly woke up while sleeping during night due to severe breathlessness. On arrival to emergency, his blood pressure was 105/70 mm Hg and pulse rate 110 per minute. Auscultation of lungs revealed fine crepitations. Further investigations revealed a low cardiac output of 4 l/min and right atrial pressure of 10 mm Hg. After few days he developed pitting oedema of legs and sacral region. The patient was diagnosed as a case of heart failure.

Learning objectives:

To understand pathophysiology of heart failure

To know about types and stages of heart failure
To understand starling forces acting on capillary
To understand pathophysiology of pulmonary and systemic oedema
To understand role of kidney in heart failure
To understand physiology of treatment of heart failure

Resources:

Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood.
Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
Electronic modes

PBL 3

A 75 years old man comes into emergency department and faints. Five minutes later, he is alert. An electrocardiogram was recorded immediately. It showed 75 P waves of normal morphology per minute whereas QRS complexes were recorded at the rate of 35 per minute. Close observation of ECG revealed that QRS complexes were wide with high voltage and there was no relation between P waves and the QRS complexes.

Learning objectives:

1. To know the normal anatomy and physiology of heart.
2. To know about the generation and conduction of cardiac impulse.
3. To understand the physiological basis of normal electrocardiogram.
4. To know about vectorial analysis
5. To know about sinus arrhythmias.
6. To learn the pathophysiology of heart blocks.
7. To know the physiological basis of escape beats/rhythm.
8. To understand about ectopic beats/rhythm.
9. To learn the mechanisms of tachyarrhythmias.
10. To know about paroxysmal tachyarrhythmias

Resources:

Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood.
Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
Electronic mode

PBL 4

A 73 years old man comes to emergency department complaining of chest pain, dyspnea on exertion and syncope. The patient has poorly managed hypercholesterolemia and 10 years history of hypertension.

Vital signs

Temperature 37 degree C
Pulse 85/min

RR 18/min
BP 100/75mmHg

Physical examination

Palpation of carotid upstroke reveals a pulse that is both decreased and late, relative to the apical impulse that is laterally displaced
A systolic murmur is present, loudest over the aorta, and peaking at mid-systole
Lungs are clear and there are no rales

Investigations

ECG: left axis deviation. No abnormalities in ST segment
Chest X-ray: Enlarged left ventricle and calcification of aortic valve
Doppler ultrasonography: A greatly increased velocity of flow during the systolic portion of the cardiac cycle. The left atrium and left ventricular chambers are enlarged. Left ventricular hypertrophy is present.
Cardiac enzymes: CK-MB, troponin-I and myoglobin levels are within normal ranges

Diagnosis: Aortic valve stenosis

Learning objectives:

To develop a working knowledge of:

1. Physiological anatomy of the heart
2. Cardiac cycle
3. Heart sounds and their relationship to events of cardiac cycle
4. Cardiac output & venous return
5. Concept of ventricular ejection and diastolic filling
6. Concept of pre-load and after-load
7. Cardiac work & pumping effectiveness of heart
8. Cardiomegaly and ventricular hypertrophy
9. Clinical examination of the cardiovascular system (CVS)
10. Types of murmurs
11. Pulmonary complications of cardiovascular disease
12. Differential diagnoses of dyspnea on exertion
13. Electrocardiogram (ECG)
14. Biochemical indicators of myocardial damage

Resources:

Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood.
Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
Electronic modes

PBL 5

A 68-year-old woman presents to the emergency center with shortness of breath, light-headedness, and chest pain described as being like “an elephant sitting on her chest.” She is diagnosed with a myocardial infarction. She is given oxygen and an aspirin to chew and is not felt to be a candidate for thrombolytic therapy. Her heart rate is 40 beats per minute (bpm). Although there are P waves, they seem to be dissociated from the QRS complexes on the electrocardiograph (ECG). The patient is diagnosed with complete heart block, probably as a result of her myocardial infarction. The patient is taken to the intensive care unit for stabilization, and plans are made for pacemaker insertion.

Learning objectives:

To understand concept of circus movements.
To define current of injury and know the significance of J point.
To gain insight into concept of re-entrant signals in heart muscle.
To elaborate factors resulting in cardiac impulse delay at AV node.
To list factors responsible for cardiac conduction blocks.
To classify various types of heart blocks.
To develop detailed knowledge of various types of AV nodal blocks.

Resources:

Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood.
Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
Electronic modes

PBL 6

A 57-year-old man presents to the emergency center with complaints of chest pain with radiation to the left arm and jaw. He reports feeling anxious, diaphoretic, and shortness of breath. His past history is significant for type II diabetes mellitus and hyperlipidemia. On examination, the patient appears to be in moderate distress and anxious. His electrocardiograph (ECG) shows evidence of acute myocardial injury in the inferior leads. The emergency room physician suspects that the left anterior descending artery is involved.

Learning objectives:

To understand regulation of coronary circulation.
To develop an understanding of various neuronal receptors on coronary vasculature.
To gain insight into concepts of coronary steal syndrome and systolic stretch.
To identify ECG changes in myocardial infarction.
To apply concepts of vectorial analyses to abnormal ECG findings.

Resources:

Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.

Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood.
Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
Electronic modes

PBL 7

A 60 years old lady presented in medical OPD with complaints of bilateral swelling lower limbs for the last about three months. She also gives history of epistaxis. Physical examination revealed pitting oedema over the legs. Laboratory investigations showed prolonged clotting time and decreased plasma proteins. Ultrasound abdomen revealed cirrhosis of the liver.

Learning objectives:

To know the various causes of bilateral swelling of lower limbs.
To know the relation of decreased plasma proteins with swelling of legs.
What is the cause of epistaxis in this problem?
To know the causes of pitting edema.
To know about the causes of non-pitting edema.
To know about forces acting upon capillary membrane.
To know about Starling's equilibrium.
To know about edema safety factors.
To know about lymphatic system.

Resources:

Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood.
Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
Electronic modes

PBL 8

A 55 years old man presented in medical OPD of Military Hospital with dyspoea, pallor swelling of legs for the past one month. On physical examination, he had pitting edema of legs and sacral region, and raised JVP. His chest radiograph showed marked enlargement of heart while ECG revealed Q wave in leads 1, V3 and V4. Doppler Echocardiography revealed ejection fraction of 30%. Physician diagnosed that the patient was suffering from congestive cardiac failure due to past myocardial infarction.

Learning objectives:

To know pathophysiology of edema and its types.
To comprehend the mechanism of development of edema.
To know safety factors to prevent the development of edema.
To understand concept of preload, after load, ejection fraction and peripheral resistance.
To know changes in ECG presenting in the old myocardial infarction.
To understand changes in cardiovascular system in response to myocardial infarction that lead to changes in Starling's forces and development of edema.
To learn the mechanism of development of cardiomegaly and cardiac dilatation and changes leading to reduction in ejection fraction.
To understand pathophysiology of raised JVP in this patient.

Resources:

Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood.
Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
Electronic modes

PBL 9

A 58 years old business man with obesity, having BMI of 31, with sedentary lifestyle and a known case of essential hypertension is on irregular treatment. He had previous history of chest pain on/off which was relieved by taking rest and placing some tablet under tongue. He was brought to emergency department with a history of severe, crushing precordial chest pain, radiating to left arm for last one hour, associated with history of profuse sweating and two episodes of vomiting. On examination he had blood pressure of 145/80mmHg, pulse rate 62 beats/min regular, respiratory rate 28 breaths/min. ECG showed significant ST segment elevation. Serum cardiac enzymes CPK and Trop-T were markedly raised.

On the basis of history, clinical examination and investigations, he was diagnosed as a case of **acute myocardial infarction**. He was shifted to coronary care unit and managed with thrombolytic therapy, high saturation oxygen inhalation, and opioid analgesics. Few hours later he again developed chest pain and became unconscious, repeat ECG was done and bizarre electrocardiogram was noted down without any regular cardiac rhythm and diagnosis of ventricular fibrillation was made, immediate CPR was started and electrical current applied to chest wall via AED (automatic

electrical defibrillator), but patient could not revive despite of all possible and timely measures.

Learning objectives:

To be able to develop knowledge to answer following queries:
What is blood pressure?
What are the determinants of blood pressure?
What is mean arterial pressure and how will you calculate it?
What is essential hypertension? How will long term un-controlled hypertension affect heart functioning?
Discuss the nervous regulation of blood pressure?
What is angina pectoris? Why taking rest relieved chest pain in this patient?
What is acute myocardial infarction? Discuss the pathophysiologic events leading to myocardial infarction.
Besides ventricular fibrillation what could be the other possible causes of death in this patient?
What is ventricular fibrillation?
Explain the causes of ventricular fibrillation?

Resources:

Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
Human Physiology: From Cells to Systems, 8th Edition by Lauralee Sherwood.
Ganong's Review of Medical Physiology, 24th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
Electronic modes

List of Practical Work

ANATOMY

HISTOLOGY PRACTICALS

List of Practical Histology (Anatomy):

1. Cardiac muscle
2. The Circulatory System-I
3. The Circulatory System-II
4. The Circulatory System-III

PHYSIOLOGY

1. Examination of the chest related to CVS
2. Examination of arterial pulse.
3. ECG recording & interpretation.
4. Measurement of arterial B.P
5. Effect of exercise & posture on BP
6. Examination of the apex beat
7. Auscultation of normal heart sounds.
8. JVP / Tripple response
9. Any other practical relevant to that Module

BIOCHEMISTRY

1. Experiments on carbohydrates
2. Benedict's test
3. Molisch test
4. Iodine test
5. Fehling's test
6. Seliwanoff's test
7. Experiment on lipids (rancidity of fats)
8. Microscopic study of cholesterol
9. Crystals
10. Color tests for cholesterol (Salkowskis test)
11. Liebermann Burchard test

LEARNING RESOURCES

1. ANATOMY

- **BOOKS:**

Gross Anatomy:

1- Snell's Clinical anatomy by regions': Richard S. Snell (9th Edition)
2- Last's Anatomy: Regional and applied by R.J. Last (12th Edition)
3- Clinically oriented anatomy by Keith L. Moore (7th Edition)
4- Gray's Anatomy: The anatomical Basis of Clinical Practice by Susan Standring (41st Edition)
5- Atlas of Human Anatomy by Frank H. Netter
6- Cunningham's Manual of Practical Anatomy: Volume 1 Upper and Lower limb
7- Gray's Anatomy for Students: Text book by Adam W. M Mitchell and Richard Drake

Histology

1- Junqueira's Basic Histology Text and Atlas by Lulz Carlos,Uchoa Junqueira (14th Edition)
2- Medical Histology by Laiq Hussain Siddiqui

Embryology

1- Langman's medical Embryology by Thomas W. Sadler (13th Edition)

General Anatomy

1- General Anatomy by Laiq Hussain Siddiqui

- **ELECTRONIC MODES**

2. PHYSIOLOGY

1. Guyton and Hall Textbook of Medical Physiology, 13th Edition by John E. Hall.
2. Human Physiology: From Cells to Systems, 9th Edition by Lauralee Sherwood.
3. Ganong's Review of Medical Physiology, 25th Edition (LANGE Basic Science) by Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen Brooks.
4. Practical physiology by CL Ghai
5. Electronic modes

3. BIOCHEMISTRY

1. Lippincott's illustrated reviews, 7th edition
2. Harper's illustrated Biochemistry, 30th edition
3. M.N Chatterjea Textbook of Biochemistry , 8th edition

4. M.D Vasudevan, Sreekumari, M.D.S;Kannan, M.D. Vaidyanathan D.M Textbook of Biochemistry for medical students, 2016
5. Practical Biochemistry Manual (Prof Maj Gen AK Naveed, Dr Shakir Khan)
6. Electronic modes

Exam time table – week 09 **Theory Paper 9:00 a.m- 12:00p.m**	
Monday	**Anatomy**
Tuesday	----------
Wednesday	**Physiology**
Thursday	----------
Friday	**Biochemistry**

Exam time table – week 10 **PRACTICAL EXAM SCHEDULE**				
DAY/DATE	**TIME**	**ANATOMY**	**PHYSIOLOGY**	**BIOCHEMISTRY**
Monday	8:00 a.m-2:00p.m	BATCH A	BATCH B	BATCH C
Tuesday	8:00 a.m-2:00p.m	BATCH B	BATCH C	BATCH A
Wednesday	8:00 a.m-2:00p.m	BATCH C	BATCH A	BATCH B