جامعة أم القرى

كلية الطـــب

الماجستير في علم وظائف الأعضاء

and courses												
compulsory courses	16	8	24	11	29	6	60	18	24	10	41	16
Elective courses	8	4			1	1						
Thesis - Research Project	8	1	6	1	6	1	6	1			10	1
Total	32	13	30	12	36	8	66	19	24	10	51	17

We appreciate the suggestions of respected referee regarding Program Originality in comparison to Corresponding Programs..

Since this is the start of this program, we like to go step by step. Indeed we have ambition to bring our students to higher educational level, but we will be realistic for progressing. We plan to start MSc program in applicable areas using available techniques and methods.

We are grateful for the guidance of honorable referee regarding for enhancing originality in our program. The attached details (Appendix-8/9) will further satisfy our respected referee that we have been working for the past several years to organize a program suitable considering the facilities and environment. We wish to have innovative ideas and methodologies and to contribute in the World over literature for the advancement of medical knowledge and medical applications. Since, it is quite a start, and we are in the first step of development, we are quite careful, and hence start and emphasize more on common aspects-systemic concepts and medical conditions/ disorders. We hope, we will be able to upgrade our program to further cellular and molecular mechanisms for understanding the basic/ clinical/ systemic concepts. We, in fact do not like to jump to intricate molecular biology and biophysics, though we have introduced certain concepts in our courses for cellular, molecular and biophysical perspectives. We even have a future plan to extend our program to mathematical/ theoretical physiology as well since we have faculty members in our program who teach physiology as invited professors at cellular, molecular, biophysical and theoretical levels in abroad during summer vacations.

We have described the contents of courses in detail in the prospectus (Appendix-8/9) attached with form 102. All course contents relate to our needs and are hence, original in nature. The research methods and projects are in clinical, & molecular and cellular aspects, and program is similar to other programs in the sector.

The actual contents of all courses are given in the detailed prospectus (Appendix-8/9).

4. Learning and Teaching

4/1 Learning Outcomes and Graduate Specifications

4/1/1 Main tracks or specializations covered by the program:

(a) Major fields of Human Physiology

(b)

(c)

4/1/2 Curriculum Study Plan Table

Level	Course Code	Course Title	Required or Elective	Prerequisite Courses	Credit Hours
Level 1	1002601-02(BFH)	Physiology of Body fluids & Haemopoetic system	Required		1+1
	1002601-	Cardiovascular physiology	Required		3+1

	04(CVS)				
	1002601-03(RPH)	Respiratory physiology	Required		2+1
	1002601-03(GIT)	Gastrointestinal physiology	Required		2+1
	1002601-03(RPH)	Renal physiology	Required		2+1
Level 2	1002601-03(RPP)	Reproductive physiology	Required		2+1
	1002601-03(EPH)	Endocrine physiology	Required		2+1
	1002601-02(NMP)	Neuromuscular physiology	Required		1+1
	1002601-04(NPH)	Neurophysiology	Required		3+1
	1002601-02(SSP)	Special senses	Required		1+1
Level 3	1002601-02(CPH)	Contemporary physiology	Required		1+1
	1002601-02(BST)	Biostatistics	Required		2
	1002601-02(RMP)	Research methodology	Required		2
	1002601-01(ETH)	Ethics	Elective		1
	1002601-03(IEM)	Instructional & evaluation methods	Elective		3
	1002601-02(IPT)	Integrated physiology topics	Elective		2
Level 4	1002601-10(RPP)	Research Project	Required		10

Include additional levels or courses if needed

We agree to emphasize on outcomes and not merely learning objectives. Unfortunately the each component of course is described in the prospectus (Appendix-8/9) and not in the Form 102. We now have attached the missing Appendix-8/9 herewith.

This is owing to the reason that the respected referee could not receive the detailed contents describing the strength and objectives separately for each course. It was in fact essential for the respected referee to receive the detailed course contents for theory lectures and practicals to have idea about the actual level/ strength, applicability, learning domains, objectives and outcomes.

4/1/3 Field or Research Components of the Study Plan

4/1/3/1 Summary of Practical or Medical Clinical Fellowship Components Required by the Program (if any):

a) Brief Description of Field Experience:

Candidate is required to prepare & supervise practicals for undergraduates in addition to carrying out his/her own practical session as requirement for the degree (Not less than 2 hours weekly)

Students The MSc student will have to carry out his/her own practical sessions as according to the instructions and guidance of the supervisor, and help of technician.

b) Program Level (s) of Field Experience:

During the first three semesters

c) Contact Hours of Field Experience and Time Table (Day / Week / Semester)

2-4 hours per week during the first three semesters

- The oral examination (thesis only) will be carried out by the external examiner along with the student's supervisor
- There is summative as well as formative assessment for all other courses.
- The summative assessment includes written (MCQ), practical (OSPE) exam as well as an oral exam (thesis)
- There are end of course exams as well as final exam

Students will have a choice for selecting topic and the supervisor. Supervisor will be the member in oral as well as thesis examination. We like the supervisor be a part of examiners

We agree with the comments of respected referee that:
In future the research proposals by students will fulfill program objectives.

We appreciate the suggestions of the respected reviewer that the research project aligns very well with the program objectives. We will follow the precious guidance and viewpoint for the quality of projects and the way each individual lab meets the program objectives.

4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Master of Science (M.Sc.) in Human Physiology

Course Code: **1002601 (HPH)**

Date: 18-03-1440 .	**Institution**: ..Umm Alqura University.....
College: ..... Medicine.....	**Department**: .....Physiology.....

A. Course Identification and General Information

1. Course title and code: Master of science in Human Physiology
2. Credit hours: 51 (41+10)
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs)
4.Name of faculty member responsible for the course Prof. Amir Elmubarek Ali Bilal

5.Level/year at which this course is offered: Postgrad
6. Pre-requisites for this course (if any): MBBS or BSc from other health colleges
7. Co-requisites for this course (if any):
8. Location if not on main campus:

9. Mode of Instruction (mark all that apply):

a. Traditional classroom	√	percentage?	60%
b. Blended (traditional and online)	√	percentage?	20%
c. E-learning	√	percentage?	20%
d. Correspondence		percentage?	
f. Other		percentage?	

Comments: Students will be taught using traditional as well as innovative instructural methods such as e-learning & integrated educational methods considering previous & concurrent requirements

B Objectives

1. The main objective of this course

- Fulfilling the shortage of lecturer job in physiology in the Kingdom of Saudi Arabia

- Continuation for doctorate degree in physiology locally &/ or internationally

- Fulfilling the shortage of laboratory technicians for training undergraduate students in medical & health colleges

-Fulfilling the shortage of researchers in health colleges & research centers in KSA

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The program is composed of four semesters. In the first three semesters there are 16 credit

hours (12CH are for physiology topics & the remaining four are in research methodology, biostatistics, ethics & medical education

The department is planning to review the program each year for improving the curriculum

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The program is covered in four semesters, in the first three semesters there are 16 courses (12 of which cover physiology & the remaining four cover research methodology, biostatistics, ethics & medical education). The fourth semester is left for the research, thesis writing & presentation.

There are three elective courses. These are the integrated physiology topics, ethics and the instructional & evaluation methods

This is a revised copy after receiving the review comments. It is unfortunate that only the Form 102 was sent to the respected Reviewer, and the detailed Prospectus containing quantitative descriptions was not sent. Since the referee could receive simply a list of titles or generic statements with no details, he is absolutely right to suggest what he suggested.

We clarify that we attached the detailed systemic, medical, cellular, and molecular aspects (biophysical aspects as well where applicable) of physiology as essential contents in each course.

PLEASE SEE ATTACHED APPENDIX-8/9 (Sections 24-27) for details about each course in the MSc Program.

Unfortunately the reason is same as mentioned in above regarding the missing part for the reviewer relating to details that may explain the level of details for analysis. The contents in each course cover systemic, medical, cellular as well as molecular physiology beside biophysical aspects of physiology. Since, the respected referee could read only the general topics,he could not predict the levels of details and depths of the concepts only owing to the reason that he was not supplied with a prospectus or a booklet serving as Appendix-8/9.

It is quite unfortunate that the objective and aim of each topic in every course was given in the attached prospectus (Appendix-8/9) not sent to the reviewer, and hence, the reviewer could not assess the level of physiological knowledge, skills and educational training to assess whether the standard would be sufficient.

We hope the detailed information we attached herewith will be enough to assess the required level of the program. Furthermore, the attached information also provides details about the pre-requisites for entry to understand the level of students to be selected for this program.

Since the required information (detailed contents of courses) could not be sent to the respected referee, it was not possible to judge, know about the details and have evidence/ modernity for deciding whether this program is a traditional one with no innovations or a rare course in our environment where we are struggling to start MSc program with a hope to have a future PhD program in Physiology.

We appreciate the comments and suggestions of the respected referee for e-learning and integrated educational methods. We will follow the instructions of respected reviewer.

The respected referee could not receive the detailed course contents mentioning clinical, cellular and molecular physiology. Please see the attached Appendix-8/9.

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
Physiology of Body fluids & Haemopoetic system	2	30
Cardiovascular physiology	4	60
Respiratory physiology	3	45
Gastrointestinal physiology (GIT)	3	45
Renal physiology	3	45
Reproductive physiology	3	45
Endocrine physiology	3	45
Neuromuscular physiology	2	30
Neurophysiology	4	60
Special senses	**2**	30
Contemporary physiology	**2**	30
Biostatistics	2	30
Research methodology	2	30
Ethics	1	15
Instructional & evaluation methods	3	45
Integrated physiology topics	2	30
Self-paced learning	4	00
Research Project	15	10

Sufficient and appropriate evidence of description to appraise this element with respect to the titles was not clear since the detailed courses, objectives and outcomes given in the Appendix-8/9 (Prospectus) could not be sent to the respectable reviewer.

Most probably the detailed booklet attached with the Form 102 (Appendix-8/9) could not be received by the respected Referee.

The (Appendix-8/9) contains the detailed information about General objectives and specific objectives for each course/ course title, so that teaching will be consistent for each course.

Furthermore, Contemporary physiology has been specified, and the areas of study have been noted. Various topics of interest have been mentioned in the attached prospectus (Appendix-8/9) e.g. Membrane Biology, Aging, Neuroeducation, Apoptosis, Stem Cell Technology, Molecular Immunophysiology, Radiobiology, Molecular Biology, Reproductive Technology, Psychoneuroimmuology, Bioinformatics (Computational Physiology), Psychophysiology, Biotechnology, Nanobiotechnology etc etc.

Integrated physiology topics have also been specified in detail in the attached (Appendix-8/9).

Form 102 was submitted along with the detailed information (prospectus Appendix-8/9) for detailed contents and description of individual courses.

This is quite unfortunate that the respected referee could not receive the attached detailed information providing detailed course contents and objectives in Appendix-8/9.

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	450			330		780
	Actual						
Credit	Planned	30			11	10	51
	Actual						

A balance between theoretical and practical components will be established by organizing practical (experiment) sessions, visits/ tours, teaching sessions, self study, presentations/ conferences, research projects etc.

3. Individual study/learning hours expected for students per week. 4-6

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognizes full reliable knowledge on basis of human physiology .	-Interactive lectures -Practical sessions -Tutorials -Journal clubs	-Multiple choice questions (MCQ) -Organized structured practical examination (OSP) Final summative exam -Oral examination for the thesis
1.2	Reproduces & outlines human physiology topics from various sources such as scientific journals, websites using information technology	Seminars/tutorials. Panell discussions	-MCQs - Final summative exam

1.3	Writes scientific paper & presents it in scientific conferences	-Interactive lectures - Seminars/tutorials. -Panell discussions -Journal clubs	-MCQs - Final summative exam
2.0	**Cognitive Skills**		
2.1	Composes, presents & discusses different information (Oral & written)	-Interactive lectures - Seminars/tutorials. -Panell discussions -Journal clubs	-Multiple choice questions (MCQ) Final summative exam -Oral examination for the thesis
2.2	Applies scientific research methods in various fields	-Interactive lectures - Seminars/tutorials. -Panell discussions -Journal clubs	-Multiple choice questions (MCQ) Final summative exam -Oral examination for the thesis
2.3	Composes & operates scientific research under supervision & applies these to the thesis	-Interactive lectures -Practical sessions -Tutorials/seminars -Journal clubs	-Multiple choice questions (MCQ) Final summative exam -Oral examination for the thesis
3.0	**Interpersonal Skills & Responsibility**		
3.1	Reconstructs & conducts lectures in physiology using modern instructional methods & audiovisual aids	-Interactive lectures - Seminars/tutorials. -Panell discussions -Journal clubs	-MCQs - Final summative exam
3.2	Applies the basic principals in medical education	-Interactive lectures -Practical sessions -Tutorials/seminars -Journal clubs	-MCQs - Final summative exam
4.0	**Communication, Information Technology, Numerical**		
4.1	Develops his/her skills & imagination in designing proposing, & does research to address public health issues	-Interactive lectures -Practical sessions -Tutorials/seminars -Journal clubs	-Multiple choice questions (MCQ) Final summative exam -Oral examination for the thesis
4.2	Applies research on humans or laboratory animals & presents results in form of a thesis	-Interactive lectures -Practical sessions -Tutorials/seminars -Journal clubs	-Multiple choice questions (MCQ) Final summative exam -Oral examination for the thesis
5.0	**Psychomotor (if any)**		
5.1	Combines cognitive development & cognitive formation to be able to coordinate & arrange	-Interactive lectures -Practical sessions -Tutorials/seminars -Journal clubs	-Multiple choice questions (MCQ) Final summative exam -Oral examination for the thesis
5.2	Combine the personal components, relaxation, concentration, nerve control, calm, enthusiasm, & self confidence.	-Interactive lectures -Practical sessions -Tutorials/seminars -Journal clubs	-Multiple choice questions (MCQ) Final summative exam -Oral examination for the thesis

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Written theory exam & OSPE	Week 15 semester one	12.0 %

2	Written theory exam & OSPE	Week 15 semester two	14 %
3	Written theory exam & OSPE	Week 12 semester three	04.0 %
4	Written theory exam (Medical education courses & writing educational tasks)	Week 13 semester three	15.0 %
5	Comprehensive exam(Written theory exam & OSPE)	Week 15 semester three	30.0 %
6	Thesis Presentation & Examination	Week 15 semester four	25.0 %
7			
8			

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (includes the time of availability each week).
2.There is mentorship program in the faculty of medicine which is applied to all students
3.Each staff member has office hours(not less than four hours per week) written clearly on his door .
4.There is a list of information of all staff members in the department including their names, mobile numbers & e-mail addresses. This information will be found in the study guide.

E Learning Resources

We apologize that in hurry and shortage of time for submitting the application, our list of books and other reference sources was quite confusing. We agree with the respected Referee that the list provided by us was not up to date.

We updated the list of references in the attached APPENDIX-8/9 (SECTION-28).

The List of References related to respective courses is also given below:.

We have updated the references as suggested by the respected referee:

We are grateful to the respected reviewer for his comments for updating the given references. We have updated the references.

A. Books/ e-books

1.Textbook of Endocrine Physiology, eTextbook by William J Kovacs and Sergio R Ojeda, 6 edition (Due Jul 9, 2019).

2.Cardiovascular Physiology, by David E. Mohrman and Louis Jane Heller,McGraw-Hill Education / Medical, USA; 9 edition (July 6, 2018).

3.Textbook of Medical Physiology, by D Venkatesh and HH Sudhakar, Wolters kluwe, India; 2 edition (2018).

4.Gastrointestinal Physiology, by Leonard R. Johnson, Elsevier, Netherlands; 9 edition (16 Nov 2018).

5.Human Physiology: An Integrated Approach, by Dee Unglaub Silverthorn, Pearson, UK; 8 edition (January 13, 2018).

6.Respiratory Physiology, by Michelle M. Cloutier, Elsevier, Netherlands; 2 edition (05 Oct 2018).

7.Renal Physiology, by Bruce M. Koeppen and Bruce A. Stanton,Elsevier, Netherlands; 6 edition, (24 Nov 2018).

8.Oxford Textbook of Clinical Neurophysiology, by Kerry R. Mills ,Oxford University Press, UK; 1 edition (January 24, 2017).

9.Biostatistics for the Biological and Health Sciences, by Marc M. Triola , Mario F. Triola and Jason Roy, Pearson, UK; 2 edition (January 11, 2017).

10.Essentials of Medical Physiology, by K Sembulingam and Prema Sembulingam, Jaypee Brothers Medical

Pub, India; 7 edition (June 2, 2016).

11.Bioethics: principles issues and cases by lewis vaughn, Oxford University Press, UK; 3 edition (July 15, 2016).

12.Textbook of Medical Physiology (Guyton Physiology), by John E. Hall Guyton and Hall, Saunders, USA; 13 edition (June 3, 2015).

13.Human Reproductive Biology, by Richard Jones and Kristin H Lopez , Academic Press, USA; 4 edition, (3rd December 2013).

14.Principles of Neural Science, by Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, Steven A. Siegelbaum, A. J. Hudspeth, McGraw-Hill Education / Medical, USA; 5th edition (October 26, 2012).

15.The student's guide to research ethics, by Paul Oliver, Open University Press. UK; 2 edition (2010).

16.Educational and psychological measurement and evaluation, by Kenneth D. Hopkins, Allyn and Bacon. Boston, USA; 8 edition (2010).

17.Physiology of the Special Senses, by Major Greenwood, Nabu Press, USA (2010).

B. List of Electronic Materials, Web Sites, Facebook, Twitter, etc.

A variety of website & internet sources in different areas of physiology/human physiology.
An example of these are:-

WWW.physoc.org/

WWW.Pubmed.com

C. Other learning material such as computer-based programs/CD, professional standards or regulations and software.
- Compact discs (CDs) illustrating physiology topics.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access, etc.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)
Class rooms to accommodate 25 males or 25 female students
Lecture halls for 50 male students or 50 female students

2. Technology resources (AV, data show, Smart Board, software, etc.)
Lecture halls are well equipped by smart boards, computers & advance audiovisual aids.
Wi-Fi internet access is expected to be available

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching Teaching staff performance will be evaluated by the students at the end of each semester through a feedback questionnaire carried out by university authorities
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department The department holds regular internal meetings to discuss the progress of the program & any difficulties .
3. Procedures for Teaching Development The staff of the department are encouraged to attend & participate in the workshops, training courses & conferences to achieve development in their performance & keep pace with scientific progress
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) - Random selection of students to recorrect their exam papers by an independent staff member - Conducting agreements to correct & assess the performance of the students by external examiners from other institutes
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. -The educational committee in the department will review the program every academic year & any detected defect will be reported to the college for action

Name of Course Instructor: Prof. Amir Elmubarek Ali Bilal

Signature: _  **_____ Date Completed: 1/12/2018**

Program Coordinator: Prof. Amir Elmubarek Ali Bilal

Signature: _____ Date Received: _____

APPENDIX-8/9

PROSPECTUS

M.Sc. IN HUMAN PHYSIOLOGY

LIST OF CONTENTS

Page No

1.INTRODUCTION TO M.Sc. PROGRAM IN HUMAN PHYSIOLOGY

This plan for MSc program in Human Physiology was recommended by the committee for the development of curriculum & programs of the Department of Physiology and approved by the departmental council and thereafter by the Board of the Faculty of Medicine, Umm Al-Qura University, Holly Makkah, Kingdom of Saudi Arabia.

One major aim of this program is to fulfill the requirement due to shortage of faculty staff in physiology departments of medical and health sciences faculties in KSA. For that to happen, we plan to develop an efficient program for producing qualified graduates who teach and train the undergraduate students with high quality professionalism, and conduct scientific research leading to significant applications and higher degree programs (PhD, and Postdoctoral Programs).

This program is perfectly compatible with the fullest consistency since we have the availability of important requirements (the qualified teachers, best researchers, intellectual mentors, efficient lab tutors/ teachers, interested students having zest to carry out the program, and teaching and research facilities) and appropriate environment created by the efforts of the University, College and Department. The Department, College, and University are fully agreed, and rather appreciate and highly recommend for the commencement of this program. Furthermore, this program is required to cope with the kingdom plan for the vast expansion of medical education institutes, hospitals and research centers across the country.

…… 2018

اسم البرنامج :
ماجستير علم وظائف الأعضاء البشري

فكرة البرنامج :
تم اقتراح البرنامج من قبل لجنة تطوير المناهج والبرامج بالقسم تم عرض ومناقشة المقترح على مجلس القسم الثاني عشر الذي انعقد في العاشرة والنصف من صباح السبت 1432/5/19هـ الموافق 2011/4/23م وبعد المناقشة المستفيضة أوصى بالموافقة علي المقترح وإحالته للجنة تطوير المناهج والبرامج بالقسم * لدراسته دراسة مستفيضة ومتعمقة ووافية وإجراء التعديلات اللازمة عليه ورفع التوصيات لمجلس القسم مرة أخرى .وقد نبعت الفكرة الأساسية لحاجة سوق العمل في المملكة العربية السعودية لكادر تدريسي وفني لسد النقص الكبير في هذا التخصص وذلك نسبة للزيادة الكبيرة في عدد كليات الطب والكليات الطبية والصحية الأخرى بالمملكة.
كما وأن البرنامج يهدف لتأهيل طلاب دراسات عليا يسهل تأهيلهم لنيل درجة الدكتوراه فيما بعد .
أهداف البرنامج وأهميته وعلاقته بتطوير القسم:
هذا البرنامج من البرامج التخصصية الهامة والتي يهدف القسم من خلاله الوصول لتحقيق أهداف الجامعة من تأهيل طلاب في الدراسات العليا وترقية البحث العلمي وخدمة المجتمع خاصة وأن بالقسم نخبة طيبة من أعضاء هيئة التدريس من أصحاب المؤهلات العلمية العالية وبنهاية هذا المقرر فإن البرنامج يهدف إلى تخريج طالب دراسات عليا يكون:-

- غني و واثق بالمعرفة العلمية لأساسيات علم وظائف الأعضاء.
- قادرا على الحصول على المعلومات في مختلف مواضيع علم وظائف الأعضاء من كل المصادر المختلفة كالمجلات العلمية والشبكة العنكبوتية والأوراق العلمية.
- عارفا بطرق البحث العلمي .
- قادرا على عمل مشروع بحث علمي .
- قادرا على كتابة الأوراق العلمية وتقديمها في الاجتماعات العلمية.
- قادرا على تقديم المحاضرات في علم وظائف الأعضاء مستخدما طرق التعليم المتقدمة.
- عارفا بأسس التعليم الطبي.
- قادرا على تقديم الدروس العملية لطلاب البكلاريوس.

الوضع الراهن بالقسم:
يقوم قسم علم وظائف الأعضاء بتدريس المادة لطلاب السنة الثانية والثالثة بكلية الطب وطلاب السنة التحضيرية لكل الكليات الطبية وطلاب السنة الثانية لكلية الصيدلة .كما يقوم القسم بالإشراف علي العديد من أبحاث الطلاب بكلية الطب وبعض الكليات الصحية .

إن قسم علم وظائف الأعضاء مهيأ لقبول طلاب الماجستير تدريسا وتدريبا وكذلك لإجراء البحوث العلمية كمتطلب للتخرج ونيل درجة الماجستير. ويبلغ عدد المتخصصين و المعنيين بتدريس مادة علم وظائف الأعضاء اربعة عشر عضوا (ثلاثة أساتذة، وثمانية أساتذة مشاركين وثلاثة أساتذة مساعدين) وهم :

الاسم	المرتبة العلمية	التخصص العام	التخصص الدقيق
أ.د. عامر المبارك علي بلال	أستاذ	علم وظائف الأعضاء	الجهاز الهضمي
أ. د . سيد تبريز علي	أستاذ	علم وظائف الأعضاء	الجهاز التوالدي
أ. د. ظهير حســين محمد أكبر	أستاذ	علم وظائف الأعضاء	العلوم العصبية
د. نبيه بن إبراهيم ركة	أستاذ مشارك	علم وظائف الأعضاء	الجهاز العصبي
د. عبد الحليم بن سالم صيرفي	أستاذ مشارك	علم وظائف الأعضاء	الجهاز القلبي الدوري
د. عادل بن عمر باحاذق	أستاذ مشارك	علم وظائف الأعضاء	جهاز الغدد الصم
د. عبد المنعم بن أحمد القاسم	أستاذ مشارك	علم وظائف الأعضاء	الجهاز القلبي الدوري
د. وهيب بن دخيل الله الحربي	أستاذ مشارك	علم وظائف الأعضاء	الجهاز التنفسي
د. أسامة بن عبد الرحمن شيخ عمر	أستاذ مشارك	علم وظائف الأعضاء	الجهاز الهضمي
د. بهاء الدين الخير العوض	أستاذ مشارك	علم وظائف الأعضاء	الجهاز الكلوي
د.سراج الدين صبري النطاح	أستاذ مشارك	علم وظائف الأعضاء	علم أعصاب العضل
د. نصرت عزيز	أستاذ مساعد	علم وظائف الأعضاء	الغدد الصم
د. سماح الحربي	أستاذ مساعد	علم وظائف الأعضاء	الجهاز الهضمي
د. رقية حسن	أستاذ مساعد	علم وظائف الأعضاء	علم الدم

هذا مع إمكانية الاستفادة من أعضاء هيئة التدريس بالأقسام الأخرى بكلية الطب كقسم طب المجتمع والرعاية الصحية للحجيج والأساتذة المختصون في التعليم الطبي من قسم التعليم الطبي بالكلية.

الفئة المستهدفة والمستفيدة من البرنامج:-

- حملة بكالوريوس الطب والجراحة
- حملة البكالوريوس من خريجي الكليات الصحية كطب المختبرات ، الصيدلة ، الأسنان ممن درسوا مقررات كافية في علم وظائف الأعضاء بشرط نجاحهم في الاختبار المؤهل للقبول والمقابلة الشفهية و تكون الأولوية لحملة بكالوريوس الطب والجراحة كمفاضلة في حالات تساوي النقاط للمتقدمين.

الإطار الزمني للبرنامج :

المدة الزمنية أربعة فصول دراسية تكون الثلاث فصول الأولي للمقررات الدراسية والفصل الرابع لإكمال مشروع التخرج .على أن تكون أقصى مدة للتخرج ثلاث سنوات وذلك وفقا للمادتين الثامنة والعشرون والتاسعة والعشرون من اللائحة الموحدة للدراسات العليا في الجامعات .

مجالات العمل :

تمنح درجة الماجستير في علم وظائف الأعضاء البشري بعد حصول الطالب على مجموع تراكمي لا يقل عن 2.5 وبعد انقضاء أربعة فصول دراسية على الأقل. ويمكن أن يعمل الخريج :-

- محاضرا أو باحثا في أي جامعة أو كلية صحية.

أو أن يواصل دراسته للحصول على درجة الدكتوراه في علم وظائف الأعضاء.

* قائمة أعضاء لجنة تطوير المناهج والبرامج بقسم علم وظائف الأعضاء:

الدكتور/ عبدالحليم بن سالم صيرفي	رئيسا
الأستاذ الدكتور/ عامر المبارك علي بلال	عضوا
الاستاذ الدكتور/ سيد تبرز علي	عضوا
الدكتور/ نبيه بن إبراهيم علي ركة	عضوا
الدكتور/ عادل بن عمر باحاذق	عضوا
الدكتور/ بهاء الدين الخير العوض	عضوا

* قائمة أعضاء الجنة المكلفة بمراجعة المقترح في قسم علم وظائف الأعضاء:

الدكتور/ وهيب بن دخيل الله الحربي	رئيسا
الأستاذ الدكتور/ ظهير حسين	عضوا
الاستاذ الدكتور/ سيد تبرز علي	عضوا

2.Title of the program:

MASTER OF SCIENCE IN HUMAN PHYSIOLOGY

3.Basic Idea:

The basic idea of initiating to develop a master program in Human Physiology was suggested and organized by the committee for the development of curriculum and programs in the department of physiology, and approved by the council of the department and then by the council of the Faculty of Medicine, Umm Al-Qura University – Holly Makkah, Saudi Arabia.

The roots and application of the mentioned idea were quite strong since the Department of Physiology is one of the major departments in the faculty of Medicine, and has a major role in teaching in several medical faculties, and conducting scientific research. Furthermore, the department has organized and contributed in a number of scientific meetings and symposia.

4.Mission of the program:

To develop an efficient program for producing qualified graduates who in future teach and train the students with high quality professionalism, and conduct scientific research leading to significant applications and higher degree programs (PhD, Postdoctoral etc).

5.Objectives & outcomes of the program

The graduated holders of the M.Sc. in human physiology are expected to :

- Fullfil the requirement of having physiology teachers in KSA.
- Pursue their post-graduate studies. i.e. graduates will be able to get enrolled easily in post graduate (Ph.D.) studies in local and foreign institutions.
- Fullfil the requirements of having technical staff in the undergraduate laboratories who can deliver practical sessions initially as a part of their training.

Candidates completing the MSc degree in Human Physiology are expected to:

1. Confidently have and express the knowledge of basic human physiology.

2. Be able to get more information about different physiology topics from various sources: books, general literature in biomedical sciences, periodicals, internet, information technology. etc. Students should also be able to present information using written and verbal language.
3. Apply the research methodologies in Physiology and related research areas.
4. Perform a scientific research under the guidance of a supervisor for small research project or dissertation (thesis).
5. Develop the skills and competency to conceptualize, design, write and communicate a thoughtful, persuasive research proposal preferably to address public health concern.
6. Perform research on human and /or experimental animals and be capable to present his/her results in a form of project/ thesis.
7. Be able to write scientific papers and present in scientific meetings.
8. Be able to lecture in physiology using the advanced instructional methods.
9. Apply the basic principles of medical education.
10. Participate in conducting practical and tutorial sessions for the undergraduate students of health faculties allocated by the by the department.
11. Fullfil the need of basic medical scientists in KSA.

6.Targeted groups

1. **MBBS degree holders.**
2. Graduates in physiology, laboratory medicine, dentistry, physiotherapy, pharmacy, veterinary medicine/science, biology, psychology, biosciences, biomedical sciences, medical science, human biology, and other faculties with adequate physiology background can be admitted after passing a qualifying examination and / or prerequisite courses.
3. The graduates applying for admission having the degrees of BSc, BMSc, BS or other equivalent degrees.
4. Candidates already having a master degree in another subject with physiology background.

A Qualifying exam for those applying for MSc program will be managed according to the area/ specialty of the candidates.

7.Training area

Candidates will learn a variety of physiological techniques and will be guided properly to select their training area as according to their interest and background. Each student will keep performing his/ her own practical sessions alone for acquiring sense of learning to gain to lab skills with confidence. Each of the student will essentially require to take part as teaching assistant (TA) for teaching (lecture/ tutorial/ practical etc) and supervising the undergraduate students

8.Targeted fortnightly reading and presentation

One specific topic in physiology will be allocated to be studied in depth and presented by selected student/ students fortnightly. Copies of relevant recent articles will be provided to the students with two short written tasks each week that will serve as continuous assessment. Furthermore, journal club will be carried out every month regularly. This training for reading/ presenting articles and journal club will help students understand how to write research/ review articles, and raise various questions regarding methodologies, plan of work, investigations, and critical thinking / interpreting the investigations etc.

9.M.Sc. Information for Prospective Candidates

The course leading to master in human physiology is designed specifically for those who wish to gain expertise in the field of general human physiology.
The duration of the course is four semesters in a minimum of (24) months and a maximum of four years.

The courses will be in limited blocks and longitudinal blocks, with specific credit hours for each course. The research will start from semester three.

Candidates must gain **grade C** $^{+}$ to be awarded the degree of an M.Sc. in human physiology.

10.Instructional methods:

1. Seminars & tutorials.
2. Problem based learning.
3. Practicals.
4. Interactive Lectures.
5. Teaching training.
6. Journal clubs.

11.Resources available:

1. Physiology laboratory of good standard.
2. Library and internet service for journals.
3. Staff members: This will depend on the number of students enrolled in the program. However the available personnel resources of the department at the moment include:
   Three permanent professors, eight associate professors and five assistant professors.

   Well known visiting professors having specialty in various branches of physiology will also be invited to deliver lectures and provide additional guidance for our students.

12.Evaluation:

Assessment material will include periodic continous assessment and final written exam. At the end of the M.Sc course, a final comprehensive integrated exam will be held. It includes written, oral, and OSPE that measures the overall gain and access of the M.Sc programme. It will provide assurance that the passed candidates (At least 60%) are able to face and handle their most common deficiencies in physiological concepts/ applications and are able to make up nicely in future.
The dissertation will be evaluated by an external examiner (see below).

13.Summative Evaluation and Grading

Final grades are based on grades earned for each of the periodical exams, the lab exams and final theory exam.

Letter grades are based on the following final numeric grades:

A^{+} = 95 - 100
A = 90- less than 95
B^{+} = 85- less than 90
B = 80- less than 85
C^{+} = 75- less than 80
C = 70- less than 75
D^{+} = 65- less than 70
D = 60- less than 65
F = 59 and below

Depending on the credit hours system and the grade point average (GPA) the students in each course could score:

A :	4	points
B+ :	3.5	points
B :	3	points
C+ :	2.5	points
C :	2	points
F :	0	points

The minimum score accepted in each course will be C^+:2.5 points. The courses will be evaluated twice: end of course exam (50% of the total), and final exam including an external examiner (50%).

The dissertation will represent (25%) of the total requirement, and will be evaluated by an external examiner with a minimum score of (B: 3) to be accepted.

Final weightage of each part of the evaluation will be:

1. 30% for the end of courses exam.
2. 30% for the courses final exam.
3. 15% for educational courses and paper writing assignment.
4. 25% for the project/ dissertation.

14. Conducting a course:

The course will be organized and controlled by the Department of Physiology , in the faculty of medicine. The chairman of the curriculum and program development committee (Professor of Physiology) will be responsible for academic aspects of the course. The members of the curriculum and program development committee in the department will act as a management group for the course, members of which give advice concerning the course contents and how to conduct that course.

15. Course work:

The M.Sc. in human physiology will be awarded by the faculty of medicine only to those who demonstrate regular detailed study throughout the course and who reach a high standard of knowledge, research, understanding and practical expertise. A commitment to regular study at home is required. This will help the students to attain good command of what they would study.

16.M.Sc. course structure:

There are sixteen modules, twelve of them are purely physiology courses. The remaining four are on research methodology, biostatistics, ethics and medical education. "Study Aims" to guide candidates' work during each week of study will be given. Relevant articles will be provided. Readings will be focused each week on that subject.

17.Assessment:

The examination at the end of the course will be held for all students, even those who have done exceptionally well on the continuous assessment. Passing the examinations will be essentially required for obtaining MSc degree. Furthermore, the examinations will be held in the Faculty of Medicine consisting of a multiple choice question-single best answer (MCQ- SBA) and Objective Structured Practical Examination (OSPE). An oral exam is to be conducted for discussion of the research project/ thesis dissertation.

The examiners will be the academic staff and external examiners for reviewing theory and practical parts. The external examiners will also be responsible for evaluating the research project/ thesis dissertation.

18.Fees for the course:

The fees for the course will be according to the university rules and regulation.

19.Application for the course:

Applicants to be considered for admission please complete the enclosed application form and forward it to: The department of Physiology, Faculty of Medicine, Umm Al-Qura University, P. O. Box 7951,Holly Makkah, KSA, Tel: +966 12 5270000, Ext. 4365; or 4361.

20. The structure (Map) of the program Semester-1:

(Physiology courses)

Course	Practical	Theory	Total CH	Duration (weeks)
Physiology of Body fluids & Haemopoietic system	1	1	2	
Cardiovascular physiology	1	3	4	
Respiratory physiology	1	2	3	
Gastrointestinal physiology	1	2	3	
Renal physiology	1	2	3	
Total			15	

Total credit hours: 15

21. The structure (Map) of the program Semester-2:

(Physiology courses)

Course	Practical	Theory	Total CH	Duration (weeks)
Reproductive physiology	1	2	3	
Endocrine physiology	1	2	3	
Neuromuscular physiology	1	1	2	
Neurophysiology	1	3	4	
Special senses	1	1	2	
Total			**14**	

Total credit hours: 14

22. The structure (Map) of the program Semester-3:

(Core courses)

Course	Practical	Theory	Total CH	Duration(weeks)
Contemporary physiology	1	1	2	
Biostatistics			2	Long.
Research methodology			2	Long.
Ethics			1	Long.
Instructional & evaluation methods			3	Long.

Integrated physiology topics		1	2	
Total			**12**	

Total credit hours: 12

23. The structure (Map) of the program Semester-4:

(Research)

Course	Practical	Theory	Total CH	Duration(weeks)
Project			10	Long.
Total			10	

Total credit hours: 10

Total: 41 Credit Units in addition to the research project.

24.Detailed Physiology courses

Semester (1):

24.1. Physiology of body fluids and haemopoietic system:

Course	Practical	Theory	Total CH
Physiology of Body fluids & Haemopoetic system	1	1	2

24.1.1.Objectives & Outcomes:

a) .Objectives

Student should understand that the body may be viewed as a system of fluid compartments separated by membranes, and to recognize the mechanisms which determine the volume and composition of various compartments.

At the end of this course the students will be able to describe the structure, formation and functions of different blood cells in order to understand the causation and pathophysiology of common hematological disorders such as anaemia. In addition, the student will be able to understand the classification of blood groups and recognize their roles in blood transfusion during this course, the student will recognize the mechanism of homeostasis and blood coagulation so as to understand the pathophysiology of diseases arising from excessive bleeding or intravascular clotting. Throughout the course, the student will acquire preliminary skills in using laboratory techniques commonly encountered in clinical hematology.

At the completion of this course, students are expected to :

Define the major body fluid compartments:

Total body water	(TBW)	Intestinal fluid	(ISF)
Intracellular fluid	(ICF)	Blood plasma	(PV)
Extracellular fluid	(ECF)	(Plasma volume)	

Identify the ”barriers“ which divide the total body water into these various compartments.

State size of each compartment as a percentage of body weight and in absolute magnitude (liters) for a 70 kg man:

TBW = 60%, ECF = 20%, ICF = 40%, PV = 4%, ISF = 16%

Define lean body mass; explain the effect of increased obesity on the percentage of total body weight which is water.

Give the approximate normal concentration in ECF of: Na^+, K^+, Ca^{++},HCO_3^-, and Cl^-, and know that the predominant anions in the ICF are organic/inorganic phosphate (most), and proteins (2^{nd} most).

Know the relation of total mass of an ion present in a compartment, volumes of the compartment, and concentration of the ion in the compartment; i.e., given any two of these values for a particular ion and compartment, the third can be calculated.

Define haematocrit and know approximate normal value; apply relation of red cell volume, plasma volume, blood volume, haematocrit, and calculate all four volumes, given data for any two.
Define and understand the dilution principle for measurement of compartments;
Identify volumes measured by: Cr^{51} red cells, Evans blue, radioactive Na^+ inulin, ^3H_2O, and other molecules/ions whose distribution in the body is otherwise known.
Given data, calculate size of body compartments on basis of dilution principle.
Describe assumptions involved in use of dilution principle.
Define total exchangeable mass of sodium and potassium.
Identify major locations of exchangeable sodium and potassium.
Define osmotic pressure. State the determinants of osmotic pressure.
Define osmole , know significance of dissociating vs. nondissociating solutes.
Know relationship of osmotic pressure to osmolarity.
State the relative quantitative contribution to the total osmolarity of crystalloid vs. colloid (protein) constituents of interstitial, intracellular fluid, plasma.
Know that normal body fluid osmolarity is about 300 mOsm/L.
Distinguish between penetrating and non-penetrating solutes in establishing effective osmotic pressure differences.
Define isotonic, hypotonic, hypertonic, isosmotic, hypo-smotic, hyperosmotic. State that each term applies to any given solution.
Define the "balance concept", as applied to electrolytes and water.
Know what are the types of acidosis and alkalosis?
Describe acidosis ans its medical implications
Describe the medical conditions/ disorders caused by alkalosis
Identify the causes and symptoms of edema
Evaluate factors involved in edema
Describe quantitatively the sources of water for the body and the routes of loss.
Define the obligatory loss of water and state the routes by which this occurs.
Describe the role of the kidney in bringing about water balance.
Describe the source and routes of loss of sodium, potassium, chloride, bicarbonate, and hydrogen ion.
Know the approximate composition (Na^+, K^+, HCO_3^-, Cl^-,) in fluids which the body may lose under certain situations: e.g., sweat, diarrhea, vomiting.
Describe qualitative changes and calculate quantitative changes in the composition and size of the various body fluid compartments under a variety of clinical conditions. The following are examples or situations to which the student can apply these principles:

a) Intravenous administration of glucose and water.
b) Intravenous administration of isotonic, hypertonic, or hypotonic solutions.
c) Sweating.
d) Severe water restriction and dehydration.
e) Severe sodium depletion.
f) Diarrhea, vomiting.

Explain the importance of protein channels in the movement of solutes
State three major functions of blood.
Recognize the two major constituents of blood and indicate in percent the contribution of each constituent to the total blood volume.
Describe the composition of plasma.
Recognize the difference between plasma and serum.
Identify plasma proteins, types, concentration and sites of production.
State the major functions of plasma proteins.
Recognize the consequences of hypoproteinemia.
Describe the structure of red blood corpuscle (RBC).
Identify typical values of dimensions, cellular volume, and haemoglobin content and blood concentration of RBCs.
State two major functions of RBCs.
Identify prenatal and postnatal sites of red blood cells production.
State the main stimulus to red blood cell production.
Identify erythropoietin, its major origin, site of action and functional significance.
Recognize the significance of Vit B_{12}, intrinsic factor and folic acid in the formation of RBC.
Recognize the significance of protein, iron, copper and cobalt in the formation of haemoglobin.
State the average life span of red blood cells and describe the process of red blood cell destruction.
Define anemia and polycythemia.
State the three major classes of anemia and their causes.
Identify the effect of anemia on viscosity of blood and oxygen tensions in blood and tissues.

Estimate hemoglobin concentration, RBC concentration and haematocrit in a human : blood using cyanomethaemoglobin method, hemocytometer and Microhaematocrite tube and centrifuge respectively.
Understand the methods of body fluid sampling (radial artery puncture, venipuncture, lumbar puncture, thoracocentesis, amniocentesis, paracentesis etc).
Identify body fluid testing (blood analysis, CSF analysis, pleural fluid analysis, peritoneal fluid analysis, pericardial fluid analysis, amniotic fluid analysis, urinalysis, sweat chloride, synovial fluid analysis, semen analysis, fetal fibronectin (ffn), etc) for HIV, drug abuse, genetic and other conditions/diseases.
Identify the volume and osmolality of intra/extracellular fluids in abnormal conditions
Know about the clinical abnormalities of fluid volume regulation.
Understand hyponatremia, and hypernatremia conditions.
Identify body fluid-related diseases and disorders.
Understand the causes and symptoms of acidosis, alkalosis.
Know about blood cell lineages
Understand hematopoiesis and hematopoiesis models
Understand haematopoietic stimulants /erythropoiesis-stimulating agents
Have idea of gene expression and cellular differentiation for hematopoiesis
Have the concept of gene expression and cellular differentiation
Know about leukemia, myeloma and other cancerous growth and platelet disorders, eosinophilic disorders
Have physiological concept of the cellular and molecular mechanisms in Immunological disorders-autoimmune diseases, immune deficiency, hypersensitivities, transplant rejection etc.
Know about hemophilia, blood cancers, stem cells transplantation
Have awareness about body-fluid transmission, common symptoms, cellular and molecular mechanisms, and management of diseases spread through blood and body fluids.

b).Outcomes:
Students carrying out this course may:
Serve in teaching courses in hospital/ university and/ or other institutions related to hematology and blood/ body fluid diseases.
Serve in blood bank programs.
Work for an organization/ society/ association struggling for the control of blood/ body fluid diseases.
Join blood transfusion services
Join a job in emergency services related to blood/ body fluid life saving programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for blood/ body fluid disorders
Serve in nutrition study programs involving care about the body-fluid transmission, blood/ body fluid disorders.
Have an employment related to toxicological studies for body-fluid transmission, blood/ body fluid disorders.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to blood/ body fluid disorders.
Embark in supplying biochemicals, instruments and other items related to blood/ body fluid disorders to biomedical/ biological/ health related institutions.
Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to blood/ body fluid disorders.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate blood/ body fluid diseases.
Do a job/ study in national survey/ statistical records for blood / blood fluid disorders.
Join a hematological study in basic, clinical or research programs.
Carry out work in hematology lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.
Get involved in further research programs leading to either PhD or clinical / applied medical specializations
Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

24.1.2. Contents:

Lecture No. 1

Body Fluids Compartments, The intercellular and extracellular fluid compartments.
Measurements of fluid volumes in compartments: The indicator-dilution principle.
Methods of body fluid sampling (radial artery puncture, venipuncture, lumbar puncture, thoracocentesis, amniocentesis, paracentesis etc)
Body fluid testing (blood analysis, CSF analysis, pleural fluid analysis, peritoneal fluid analysis pericardial fluid analysis, amniotic fluid analysis, urinalysis, sweat chloride, synovial fluid analysis, semen analysis,fetal fibronectin (ffn), etc) for HIV, drug abuse, genetic and other conditions/diseases

Lecture No. 2

Movements of material through circulation and across compartment barriers
Ionic composition of body fluid compartments
Total exchangeable mass of sodium and potassium
Major location of exchangeable sodium and potassium.

Lecture No. 3

Regulation of fluid exchange between compartments:
Force determining fluid movements, e.g. hydrostatic and osmotic pressures.
Osmotic phenomena. Determinants of osmotic pressure. The significance of dissociating vs. non-dissociating solutes and penetrating and non-penetrating solutes.
Volume and osmolality of intra/extracellular fluids in abnormal conditions

Lecture No. 4

Challenges of salt and water homeostasis
Intracellular and extracellular edema, causes and symptoms of edema
Regulation of ECV, volume receptors, regulation of ECF composition, roles of hypothalamus and the kidney. Clinical correlations, normal and abnormal intake and losses of water & electrolytes, Clinical abnormalities of fluid volume regulation, hyponatremia, hypernatremia, Body fluid-related diseases and disorders, Causes and symptoms of acidosis, alkalosis,

Lecture No. 5

Overview of functions of blood.
Role of blood in homeostasis.
Composition of blood.
Composition and functions of plasma:
Components - relationship to E.C.F.
Plasma proteins - origin and function.
hypoproteinaemia - causes and consequences.

Lecture No. 6

Blood cell lineages
The erythrocyte:
Structure, composition, functions.
Regulation of production, hemopoieses or hematopoiesis. haematopoietic stem cells (HSCs) and hemopoiesis, hematopoiesis models, haematopoietic stimulants /erythropoiesis-stimulating agents, gene expression and cellular differentiation, factors influencing quality and quantity. Destruction. Anemia, polycythemia.

Lecture No. 7

The leukocyte and reticule-endothelial systems:
Types of white cells. Structure, chemical and functional characteristics.
Sites of production and destruction.
Properties of neutrophils, monocytes and macrophages. leukemia, myeloma and other cancerous growth, and platelet disorders, eosinophilic disorders
Elementary immunology:
Humoral and cellular immunity. Development.
The reticulo-endothelial system.
Immunity, innate and acquired, passive and active.
Cellular and molecular mechanisms in Immunological disorders-autoimmune diseases, immune deficiency, hypersensitivities, transplant rejection etc.
Clinical correlates.

Lectures No.8

Blood groups and blood transfusion: Blood types, and its inheritance. Blood typing. Rh group. Blood transfusion.
Transfusion reactions, hemolytic disease of the newborn.
Tissue and organ transplantation. Elementary treatment, problems and solutions.
Homeostasis and blood coagulation.
Evenets in homeostasis, Mechanism of blood coagulation and lysis of clots.
Prevention of clotting. Excessive bleeding in man.
Thrombo-embolic conditions in man.
Anticoagulant therapy.
Blood coagulation tests. hemophilia, blood cancers, stem cells transplantation
Body-fluid transmission, common symptoms, cellular and molecular mechanisms, and management of diseases spread through blood and body fluids.

24.1.3. Practicals:

Experiment 1 (Body fluid / Hematology)

To identify the hematocrit percentage from the human blood sample and use it for the calculation of intra-vascular volume

Experiment 2 (BF / Hematology)

To determine bleeding time, clotting time and blood group from your own blood sample

Experiment 3 (BF / Hematology)

To determine blood group from your own blood sample

Experiment 4 (BF / Hematology)

To observe(i) Lewis triple response and (ii) reactive hyperemia in human blood vessels of the skin

24.2. Cardiovascular physiology

Course	Practical	Theory	Total CH
Cardiovascular physiology	1	3	4

24.2.1. Objectives & Outcomes:

a).Objectives:

This course deals with the heart and the circulation system. At the end of this course, the student will be able to explain how the heart works as a pump and the role of the chambers, valves and the muscle. Special emphasis will be placed n heart sounds, E.C.G. and introduction to abnormal cardiac function. In the second part of this course, the student will be introduced to the physics of haemodynamics and the regulation of circulation. This will enable the student to understand the responses of cardiovascular system to stress, e.g. hemorrhage and exercise, and to develop an awareness of the disordered physiology underlying some major cardiovascular problems such as heart failure and cardiac ischaemia. In addition, during this course, the students will acquire basic preliminary skills in using laboratory and bedside techniques commonly encountered in clinical cardiology, e.g. recording an E.C.G., measuring blood pressure and pulse.

At the completion of this course, students are expected to be able to:

Describe the components of the cardiovascular system and identify the function of each component.
Describe the morphology of the heart and understand the role of valves in the heart.
Describe congenital heart defects and their causes
Describe signs , symptoms and causes of congenital heart defects
Distinguish between the three types of cardiac muscle cells (pacemaker, conducting, contracting) which generate the force of systole.
Distinguish between myocarditis and endocarditis and their effects on the heart
Distinguish between the effects of myocardial ischemia and infarction on the heart.
Describe the symptoms, diagnosis, causes, and treatment of ischemic heart disease.
Identify the functional role of intercalated disks and the all or none principal as it applies to the heart.
Describe what are cardiac arrhythmias
Describe the nervous supply of the heart and state the functional significance of it.
Identify the cardiac receptors and state their functional significance.
Describe the blood supply of the heart.
Describe the conductive system of the heart.
Describe the transmission of cardiac impulse through the heart.
Identify the pacemaker concept of the heart and the normal locus of the pacemaker.
Recognize the possibility of and identify the mechanism of abnormal pacemakers within the heart.
Describe the form, ionic bases and functional significance of a pacemaker potential.
Describe the form and ionic bases of an action potential recorded from a single myocardial muscle cell.
Draw a well-labeled diagram showing the temporal relationship between electrical and mechanical activity in a ventricular muscle cell.
Explain why the heart cannot be tetanized.
State Starling's law of the heart.
State the parameters of the Starling's curve which correspond to the initial length and tension in the length tension diagram of skeletal muscle.
Correlate the length tension relationship in Starling's law with ventricular volume and pressure changes.
State and explain the mechanisms of the effects of vagal and cardiac sympathetic nerves on heart rate and force of contraction.

Indicate a neurotransmitter with:
- positive chronotropic action.
- negative chronotropic action.
- positive inotropic action.

State the effects of temperature on the sinoatrial rate.
Explain what an E.C.G. is.
Describe the methods of recording an E.C.G.
Draw a diagram of the E.C.G. and indicate with which events the waves correspond.
Recognize typical E.C.G. values for P-R, QRS, QT and S-T intervals.
Understand the factors, which determine normal configuration of E.C.G. waves.
List the information (at least 7) that might be derived from an E.C.G. record.
Record an E.C.G.
Calculate heart rate, P-R intervals, QRS duration, Q-T interval and S-T interval from the record E.C.G.
Measure amplitudes of E.C.G. waves in different lead systems.
Determine the axis of the heart from the recorded E.C.G.
Describe ECG changes and electrical events in the sounds heart makes.
Explain electrocardiograms and their correlation with systole
Use the E.C.G. in order to identify common cardiac abnormalities (conduction defects, arrhythmia's and Ischemic heart disease).
Describe the cardiac cycle and its three phases
Define systole and diastole and give their approximate duration at rest.
State which phase of the cardiac cycle is affected in the case of sinus tachycardia and in what way.
Describe the pressure and volume changes in the atria, ventricles, pulmonary artery and aorta during the six phases of the cardiac cycle.
Describe cardiac output and its function in the cardiovascular system
Identify end-diastolic, end-systolic and stroke volumes, their typical values at rest and recognize the variabilities of these values.
Recognize the aortic and left ventricular pressure curves during the cardiac-cycle.
Identify systolic and diastolic pressures, their typical values and dicrotic notch and its cause.
Identify the functional significance of atrial contraction and the origin of a, c, and v pressure waves of the atria and great veins (jugular veins).
Recognize the genesis and characters of the first and the second heart sound.
Record some aspects of the cardiac cycle, namely arterial pulse wave, venous pulse wave, E.C.G. and heart sounds, noting the correct time relationships between E.C.G. waves, J.V.P. waves, heart sounds and pulse wave.
Define cardiac output and give the basic formula that indicates its primary determinants.
Identify the principle in Fick and indicator dilution methods for quantitation of cardiac output.
State normal values for cardiac output and index and their variance with age, body posture and metabolic rate.
Recognize intrinsic mechanisms of autoregulation of the heart to altered venous return and autonomic innervation as basic means by which cardiac function is regulated.
State and explain the effects of sympathetic and parasympathetic stimulation on the cardiac output.
Use Starling's law of the heart to explain the relationship between venous return and cardiac output.
State factors, which affect venous return.
Recognize the normal role of peripheral resistance in determining venous return and cardiac output when arterial pressure remains about normal and the consequences of failure to maintain arterial pressure.
State and explain the effects of circulating catecholamines on cardiac output.
State and explain the effects of hypoxia, hypercapnia and acidosis on cardiac output.
Identify ventricular function curves, their significance and factors producing hypo effective or hyper effective hearts.
Identify the effects of variations of extracellular concentrations of potassium, sodium and calcium ions on cardiac function.
Perform an experiment with an isolated mammalian heart preparation to demonstrate the effects of acetylcholine, noradrenaline, excess potassium and calcium ions on heart rate and force of contraction.
Define flow and state its relationship to pressure and resistance.
Recognize the techniques used to measure blood flow.
Identify the characteristics of laminar versus turbulent flow.
List the factors likely to promote turbulence and be able to use these factors to explain Korotkow sounds in blood pressure measurements, audiable sounds over an aneurysm, haemic murmur in long standing and severe anemia and turbulent flow at the root of the aorta and pulmonary artery.
Recall the genesis and characters of the first and second heart sounds.
Understand the mechanism underlying the physiological split of the second heart sounds.
State the differences between heart sounds and heart murmurs.
Predict the timing of murmur in common valvular diseases of the heart.
Identify resistance, its means of determination, and the peripheral resistance unit and typical values of total peripheral and total pulmonary resistance at rest.
Identify the relationship of vascular resistance to vessel diameter, vessel length and blood viscosity.
State the factors, which affect blood viscosity.
Recognize the relationship between vessel diameter and flow.

Define systolic blood pressure, diastolic blood pressure, mean circulatory pressure and recognize their normal values.
Identify appropriate methods and standard units used for blood pressure measurements.
Describe the cardiovascular pulse
Describe how blood pressure is measured and the ranges of blood pressure readings
Describe the role of the cardiovascular center in regulating blood pressure
Explain the role of baroreceptors and cardiovascular centers (ANS) in blood pressure control
Describe chemical substances to control blood pressure
Explain the long-term renal regulation of blood pressure
Select the appropriate method for checking circulation
Identify the relationship of mean pressure to gravity, blood volume, and cardiac output and peripheral resistance.
Contrast the pressure volume relationship of arterial and venous system and their functional significance. Identify the effect of varied sympathetic tone on these relationships.
Identify the Law of Laplace and its physiological significance with respect to heart and circulation.
Recognize the general structural design and functions of the systemic and pulmonary circulation.
Identify component functions of the aorta and elastic arteries, muscular arteries, arterioles, capillaries, venules and veins.
Recognize the relative percentage distribution of blood volume in various segments of the cardiovascular system.
Define velocity of blood flow and state its relationship to the total cross sectional area of the vascular system.
Recognize the form of the curves relating total cross-sectional area, and mean velocity to the progression of cardiovascular segments in systemic circulation.
Define pulse pressure and state its typical value at rest.
Identify the progression of mean and pulse pressure through the systemic circulation and their relationship to vascular resistance.
Identify systolic, diastolic and mean pressure for the aorta, mean capillary and venacaval pressures and the locus of highest resistance among cardiovascular system.
Identify normal arterial pulse contour and the diacrotic notch.
Recognize the influencing factors and the resultant consequences of variations of stroke volume and arterial compliance on the pulse pressure.
Recognize the resultant effects of arteriosclerosis, aortic regurgitation and patent ductus arteriosus on systolic, diastolic and pulse pressure.
Identify radial pulse, the rate, rhythm and volume.
Recognize the relationship between pulse volume and pulse pressure.
Define tachycardia and bradycardia giving examples in each case.
Recognize the collapsible nature of veins and its effects on peripheral venous resistance and pressure.
Identify the consequences of elevated right atrial pressure and elevated abdominal pressures on peripheral venous pressure.
Recognize the potential reservoir function of veins and its influence on the circulatory filling pressure.
Define control venous pressure, its typical value and potential range.
Identify the effects of varying blood volume, respiration, heart failure and increased intra-abdominal pressure on central venous pressure.
Recall the factors affecting venous return.
Identify the three major types of blood flow controls.
Contrast the blood flow to different tissues and organs under resting or basal conditions.
Recognize the local control of blood flow in proportion to tissue metabolism.
Identify metarterioles, preferential channels, true capillaries and precapillary sphincters.
Contrast the significant segments and characteristics of the systemic microcirculation involved in the regulation of blood flow.
Define autoregulation and state 3 organs in which autoregulation is a prominent feature.
Identify the relationship between flow and pressure in an organ showing autoregulation and another organ not showing autoregulation.
Recognize and explain the myogenic and metabolic theories of autoregulation.
List seven vasodilatation metabolites.
Recognize the significance of humoral regulation of blood flow.
State the origin and resultant circulatory effects of noradrenaline, adrenaline, angiotensin II, vasopressin and kinins.
Describe the autonomic innervation of blood vessels.
Recognize the sympathetic vasodilator fibers and sympathetic vasoconstriction fibers. Their origin, comparison on tissue and organ distribution and the type of transmitter involved in each case.
Locate and identify the vasomotor and cardioinhibitory neurons. Their role in vasomotor tone and cardiac performance.
State and explain the significance of increased and decreased activity of vasomotor neurons on arterioles and blood pressure, veins and venous return, heart rate, stroke volume, cardiac output and adrenal medulla.
Identify sympathetic vasodilator system, pattern of circulatory and respiratory responses and its component structures, resultant effects and functional significance.
Identify vaso-vagal syncope and its probable causes.
Recall definitions of SBP, DBP, and mean pressure and pulse pressure.
Recognize their normal ranges and their relationship to age.
Identify an appropriate method for measurement of blood pressure in humans and explain the mechanism involved.
Recognize the comparative constancy of arterial blood pressure versus cardiac output and peripheral resistance.

Contrast the general characteristics of rapidly acting control mechanisms versus the long term control mechanism for the regulation of arterial blood pressure.
Describe the physiological anatomy of baroreceptors, two principle areas of their location and their afferent nerves.
State the response of baroreceptors to pressure, their effect on cardioinhibitory and vasomotor neurons and their resultant influence on the cardiovascular system.
Recognize the "buffer" function of the baroreceptors control system.
Identify the functions of baroreceptors in cardiovascular adjustments to gravitational forces, the adaptive properties of baroreceptors and their consequences.
Identify the carotid sinus syndrome.
Describe the physiological anatomy of chemoreceptors, two principle areas of their location and their afferent nerves.
State the effects of oxygen, carbon dioxide and hydrogen and the resultant effects of their stimulation.
Describe two major locations of volume receptors and their afferent nerves.
Recognize the role of atrial receptors in the regulation of arterial blood pressure.
Identify the effects of stimulation of volume receptors on peripheral resistance, renal arterioles, heart rate and antidiuretic hormone secretion.
Identify the effects of elevated carbon dioxide and ischaemia on the cardioinhibitory and vasomotor neurons, the C.N.S. Ischemic response, the Cushing reaction and the limitations of extreme ischaemia on these mechanisms.
Identify respiratory pressure waves in arterial pressure recording and their mechanistic origin. Identify "Mayer waves" or "Traube-Itering waves" and potential mechanism for their existence.
Recognize noradrenaline-adrenaline, renin-angiotensin and ADH mechanisms for the rapid control of arterial pressure.
Identify the significant characteristics of each of these control mechanisms.
Identify the long-term pressure control mechanisms and the relative importance of these mechanisms as controllers of arterial pressure.
Recognize the sequences and significant characteristics of intermediate steps involved in the renal body fluid feedback control system for the regulation of arterial blood pressure.
Contrast the roles of renal resistance versus total peripheral resistance as determinants of the long-term level of arterial pressure.
Recognize the secondary association of increased total peripheral resistance with high blood pressure.
Identify the roles of the rennin angiotensin system and of aldosterone in the long term regulation of arterial blood pressure.
Acquire the skill of measuring blood pressure in humans using mercury sphygmomanometer.
Describe the structural features and functional properties of a typical capillary bed and the capillary wall.
Identify the functional roles and significant properties of the capillary endothelium.
Distinguish between capillary filtration and diffusion processes.
Identify the four primary pressures influencing transcapillary fluid movements, their typical magnitudes and their contributing forces.
Identify net filtration and reabsorption pressures, their typical magnitudes and their contributing causes.
Identify the magnitude of interstitial fluid flow and its influencing factors.
Define edema.
Identify the conditions of altered capillary pressure, capillary permeability, plasma protein concentration, lymphatic function and renal function resulting in edema. Recognize potential causes of these conditions.
Identify the functional significance of lymphatic system. Describe the physiological anatomy of the lymphatic drainage system.
Describe the origin and composition of lymph.
Describe lymphatic circulation, dynamics and the structure of lymphatic vessels
Identify the location, structure, and role of lymphatic capillaries in maintaining the pressure of the interstitial fluid
Identify the magnitude of lymph flow, determinant factors for lymph flow and the mechanism of actions of lymphatic pumps.
Describe the types of lymph vessels and lymph trunks and their roles
Explain the structure of the lymphatic system and its role in the immune system and blood circulation
Describe the location of B cells and T cells in lymph nodes and the path of lymph circulation
Identify the control mechanisms of interstitial fluid protein concentration and interstitial fluid pressure and their significance.
Describe the origin, distribution and drainage of the coronary vessel.
Identify normal variations in coronary flow and the consequences of ventricular systole and diastole on the regional distribution and phasic nature of coronary flow.
Identify the role of O2 demand and local metabolism in the regulation of coronary flow.
Identify the factors influencing O_2 consumption and the significance of local autoregulation of coronary blood flow.
Identify the direct and indirect effects of autonomic nerves on coronary flow.
Distinguish the cardiac distribution and alpha and beta-receptors.
Identify angina pectoris and myocardial infarction and their common causes.
Define shock.
Distinguish between hypovolaemic, cardiogenic and low resistance shock.
State the common causes of hypovolaemic.
State the effect of hemorrhage on blood volume and venous return.
State the immediate changes in heart rate and cardiac contractility in haemorrhagic shock.
State the mechanisms responsible for the changes and the ultimate compensatory physiological benefit.

List the vascular beds in which vasoconstrictor tone is increased and the vascular beds that are spared in the general vasoconstriction in the early stages of hemorrhage shock.
Explain the mechanisms accounting for this and the physiological advantages.
Describe the mechanisms resulting in veinoconstriction in haemorrhagic shock.
State the physiological advantages of this.
List the physiological disadvantages of increased vasoconstriction tone in haemorrhagic shock.
Use this knowledge in physiology to explain the following features of haemorrhagic shock:

a) dry mouth, b) cold skin, c) increased respiration
d) poor alimentary secretions, digestion and absorption
e) oliguria or anuria.

State and explain the changes in capillary blood pressure in haemorrhagic shock.
State the advantages and disadvantages resulting from these changes.
State the roles of adrenaline (secreted by adrenal medulla) angiotensin II, aldosterone, ADH in the attempt by the body to restore blood pressure to normal in haemorrhagic shock.
Describe the mechanism by which the body restores R.B.C. after haemorrhagic shock.
Identify the irreversible stage of haemorrhagic shock and its underlying causes.
State the physiological bases of the following procedures in the management of haemorrhagic shock:

a) Transfusion of blood or plasma expanders. State the advantage of each.
b) Raising the blood of the bed.
c) Oxygen therapy.
d) Correction of metabolic acidosis.

Understands cardiac reserve, its normal adaptive and pathological range of values and the consequences of its variance.
Understand the meaning of a failing heart.
Identify the associated changes in cardiac output and venous return curves with heart failure
Define backward failure and forward failure.
State and explain the consequences of backward failure of the right ventricle, backward failure of the left-ventricle and forward failure.
Use this knowledge in physiology to explain the following features of heart failure:

a) Dysponea b) Ankle or sacral edema
c) Hepatomegaly d) Increased J.V.P.
e) Weakness and exercise intolerance

Understand the resting skeletal muscle flow.
Understand the influence of intermittent and sustained muscle contraction on muscle blood flow and the mechanistic roles of local regulation and autonomic innervation in the control of blood flow through skeletal muscles.
State and explain the changes in heart rate and peripheral resistance just before or just after the beginning of exercise.
Identify the essential roles of the autonomic nervous system in providing circulatory adjustments required by exercising muscle.
State and explain the changes in peripheral resistance, cardiac output, systolic blood pressure, diastolic blood pressure and pulse pressure during exercise.
Explain the increase in oxygen consumption by skeletal muscles during exercise under the following headings:

a) Arterial O_2 delivery to skeletal muscles.
b) Affinity of haemoglobin to O_2.
c) Transport of O_2 between capillary blood and skeletal muscle cells.
d) Muscle tissue O_2 tension.

Examine the relationship between angiogenesis and disease
Describe the cause of varicose veins
Describe the main factor associated with syncope
State the factors involved in hypertension
Distinguish between hypertension and hypotension
Describe the effects of aging on the heart
Describe the development of the heart, arteries and veins,
Describe heart failure and its treatments

b).Outcomes:

Students carrying out this course may:

Serve in teaching courses in hospital/ university and/ or other institutions related to cardiovascular diseases
Work for an organization/ society/ association struggling for the control of heart and cardiovascular diseases.
Join a job in emergency services related cardiac/ cardiovascular programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for cardiovascular disorders
Serve in nutrition study programs involving care about the body-fluid transmission, heart and cardiovascular diseases.
Have an employment related to toxicological studies for heart and cardiovascular diseases.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to heart and cardiovascular diseases
Embark in supplying biochemicals, instruments and other items related to heart and cardiovascular diseases

for biomedical/ biological/ health related institutions.
Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to heart and cardiovascular diseases.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate cardiovascular diseases.
Do a job/ study in national survey/ statistical records for cardiovascular diseases.
Join a cardiovascular study in basic, clinical or research programs.
Carry out work in cardiovascular lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.
Get involved in further research programs leading to either PhD or clinical / applied medical specializations
Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

24.2.3.Contents:

Lecture No. 1

Introduction to circulatory system, Critical role of the circulation in homeostasis.
Structural and functional components of the circulation.
The heart as pump. Excitatory, conducting, contractile and rhythmic properties.

Lecture No. 2

Functional anatomy of the heart:
Myocardium, pacemaker and conducting tissues. Valves, innervation and
cardiac receptors. Coronary vasculature.

Lecture No. 3

Functional properties of pacemaker and conducting tissue:
Electrical and conducting properties, ionic fluxes.

Lecture No. 4

Control of pacemaker activity and relation to heart rate.
Correlation with pump function of heart.

Lecture No. 5

Functional properties of myocardium and valves.
Mechanical and electrical characteristics of myocardium and their regulation.
Ionic and electrical events in myocardium. Correlation with pump action. Length-tension relations and correlation with ventricular volume and pressure changes. Frank-Starling law

Lecture No. 6

Endocarditis & myocarditis-classification, symptoms, diagnosis, outcomes, Cardiac arrhythmia-conduction systems,
arrhythmias,fibrillation and treatment

Lecture No. 7

Congenital heart defects, Signs , symptoms and causes of heart defects, role of genetics, fetal environment, hypoplasia in congenital heart diseases.

Lecture No. 8

The electrocardiogram
Characteristics of normal ECG.
Relationship of ECG to atrial and ventricular activity.
Principle components-voltage, time.
Methods of recording, ECG leads.

Lecture No. 9

The electrocardiogram: (continued)
Principle of vectorial analysis.
Mean electrical axis of the ventricle.
Cardiac arrhythmia's, ECG and other manifestations.

Lecture No. 10

The cardiac cycle-pulse, cardiac cycle and systolic and diastolic blood pressure, Mechanical and functional characteristics of atria, ventricles and valves in cardiac cycle. Pulse, cardiac cycle and systolic and diastolic blood pressure), Pressure, volume and ECG changes and interrelations. Changes in valve action. Heart sounds, Abnormal heart sounds, phonocardiogram.
Pressure changes in aorta and pulmonary artery.

Lecture No. 11

Cardiac output, heart rate, stroke volume, mean arterial pressure and Frank-Starling law of the heart, Definition, Primary determinants, measurement. Intrinsic and extrinsic regulation. Ventricular function curves, work output of heart. Control of output under physiological conditions, The Fick principle applied to cardiac output and blood flow to

other organs, Fick principle applied to cardiac output and blood flow to other organs. Effects of debility, exercise, ions on heart.

Lecture No. 12

Haemodynamics :
Characteristics of the pulmonary and systemic circuits.
Flow-pressure-resistance relations. Poiseuille law.
Vessel geometry and relationship to dynamics of flow.
Bernoulli principle and application.
La Place law applied to heart and circulation.
Streamline and turbulent flow. Reynolds number.

Lecture No. 13

Haemodynamics: (continued)
Role of gravity/posture on vascular pressure.
Application of Poiseuille law and Bernoulli principle to circulation.
Hemodynamic basis of normal and abnormal heart sounds, Kortokov sounds, coarctation, aneurysms.

Lecture No. 14

The systemic circulation: Overview, pressures - velocity profile and flow distribution in systemic circuit. Functional anatomy of great vessels, arteries, arterioles, veins. Relationship to function.

Lecture No. 15

The veins and their functions: Vascular dispensability of veins.
Reservoir function.
Venous return. Respiratory and muscle pumps, gravity. Effects of posture.
Role in blood pressure regulation. Importance of central venous pressure.

Lecture No. 16

Circulatory diseases and disorders, Angiogenesis and disease, Angiogenesis and cancer, Angiogenesis and cardiovascular disease, Varicose veins-causes and treatment.

Lecture No. 17

Control of blood flow:
Local controls by tissues themselves. Autoregulation.
Nervous control. Roles of autonomic nervous system. Reflex regulation.
Humoral regulation. Vasoconstrictor and vasodilator agents.

Lecture No. 18

Regulation of arterial blood pressure-measurement, role of the cardiovascular center,short-term neural control, baroreceptor reflexes/ function, and short-term chemical control (chemical Vasoconstriction/ vasodilation), long-term renal (rennin-angiotensin-aldostrone) regulation, Relationship to cardiac output and peripheral resistance.
Regulation by baroreceptors and chemoreceptors, volume receptor reflexes.
Integration of cardiovascular, nervous, endocrine, renal, hormonal and haemopoetic factors. Hypotension, Syncope-vasovagal (situational) syncope and other types, Hypertension-primary and Secondary types.

Lecture No. 19

Capillary dynamics:
Functional anatomy of microvasculature. Functional correlates. Fluid exchange between blood and interstitial fluid. Starling-Landis principle.
Application to mechanism of edema formation.

Lecture No. 20

Lymphatic system and interstitial fluid: Functional anatomy of lymphatic system. Lymphatic vessel structure (layers and valves), distribution of lymphatic vessels (lymph node distribution, flow through lymph vessels), lymph transport (transport through lymph capilaries, vessels, nodes and endings), lymphatic capillaries (structure, function, fluid pressure regulation and edema prevention), and lymph trunks and ducts, Lymph formation and circulation. Eema and pulmonary fluid formation.

Lecture No. 21

Coronary circulation: Anatomic consideration.
Pressure gradients and flow in the coronary vessels.
Control of coronary flow.
Angina pectoris and myocardial infarction- symptoms, diagnosis, causes and treatment

Lecture No. 22

Cardiovascular responses to hemorrhage: Effect of hemorrhage.
Immediate compensatory reactions, late compensatory reactions.

Irreversible shock.
Physiological bases of management of haemorrhagic shock.

Lecture No. 23

Aging and the heart, Development of the heart and vasculogenesis, causes, symptoms, pathophysiology, diagnosis and
treatment of heart failure, Backward failure and forward failure.

Lecture No. 24

Circulatory responses during exercise: Muscle blood flow.
Systemic circulatory changes.
Changes in oxygen consumption by skeletal muscles during exercise.

24.2.4. Practicals:

Experiment 5 (CVS)
To examine the heart and peripheral pulses of a human subject by inspection, palpation and auscultation
Experiment 6 (CVS)
To observe the effect of body position, physical exercise and valsalva maneuver upon cardiovascular parameters
Experiment 7 (CVS)
To record arterial blood pressure in human subject by using mercury sphygmomanometer
Experiment 8 (CVS)
To record electrocardiogram using unipolar and bipolar leads
Experiment 9 (CVS)
To observe and calculate the jugular venous pulse pressure (JVP) of a human subject
Experiment 10 (CVS)
To observe the influence of respiration, carotid sinus massage and eyeball pressure on heart rate
Experiment 11 (CVS)
Test to measure the cardio-vascular fitness of a human subject
Experiment 12 (CVS)
To understand and perform the steps of basic life support in emergency care medicine

24.3. Respiratory physiology

Course	Practical	Theory	Total CH
Respiratory physiology	1	2	3

24.3.1. Objectives:

The course covers the general functions of the respiratory system but concentrates mainly on the role of the system as a gas exchange organ.
This involves a consideration of the principles of the mechanics of breathing, ventilation, gas transfer, gas transport in blood, and the regulation of ventilation. The acute changes and the compensatory response of the respiratory system to high altitude, given the location of Abha at 3000 meters above sea level, will be considered. Students will be expected to relate above principles to the diagnosis, presentation, and pathophysiology

By the end of this course, students are expected to:

Identify the major functions of the respiratory system.
List the main reasons for breathing
Identify that breathing controls blood chemistry
Describe the role of chemoreceptors in the regulation of breathing
Determine the effect of proprioception (the sense of the relative position of the body and effort being employed in movement) on breathing
Identify the essential gas laws as applied to gas transport and diffusion of gases across membranes.
Describe the functional anatomy of airways and lungs.
Describe the respiratory anatomy of the pharynx
Identify the symptoms of respiratory acidosis and alkalosis
Identify the basic mechanisms of ventilation - inspiration and expiration, role of thoracic cage in ventilation.
Differentiate among the types of pulmonary ventilation: minute, alveolar, dead space
Describe the relationship of pressure changes to lung volume.
Describe the important (elastic and non-elastic) properties of thoracic cage, application of above to disorders of chest injuries, rib fractures, chest deformities etc.

Describe the general function of airways.
Describe the physiological anatomy of the nose and paranasal sinuses
Describe the physiological anatomy of the larynx
Describe the structure and functions of the trachea
Illustrate the anatomical structure and describe the functions of the bronchi and their subdivisions
Describe the structure, principal function, and location of the lungs
Distinguish between the right and left lungs based on their lobes, fissures, and lobules
Describe the alveoli of lungs
Distinguish between pulmonary and systemic circulation of blood
Explain surfactant and its role in alveolar fluid surface tension
Describe the factors involved in lung compliance
Describe airway resistance and how it affects pulmonary ventilation
Describe the airway caliber changes, airway resistance and effect of changes on ventilation, e.g. bronchial asthma.
Describe the elastic and non-elastic properties of the lungs and relationship to pulmonary function in health and disease, e.g. emphysema, fibrosis.
Identify the functional importance of surfactant in surface tension changes, describe the changes in lung expansion that occurs at birth, and the pathophysiology of hyaline membrane disease.
Apply the above mentioned principles to the concept of compliance in health and pulmonary disorders.
Recognize the principles of spirometry.
Perform measurement and identify normal values of lung volumes and capacities.
Prescribe the functional importance of lung volumes and capacities.
Differentiate among tidal volume, inspiratory reserve volume, expiratory reserve volume, and vital capacity of lungs
Discuss the non-respiratory air movements of the respiratory system
Explain from Dalton's law of partial pressure the sum of partial pressures in alveoli
Describe the way in which Henry's law relates to gas exchange in the respiratory system
Explain changes in lung volumes in health and disease - e.g. effect of exercise, airway obstruction, emphysema etc.
Describe respiratory adjustments during exercise and at high altitude.
Explain the concept of dead space - both anatomical and physiological.
Describe Alveolar space and ventilation.
Identify gas tension in air, alveoli, blood and tissues, and changes with altered ventilation, e.g. hypoventilation, hyperventilation etc.
Identify the effect of physiological dead space and uneven ventilation on blood gases.
Understand the functional anatomy of the pulmonary vascular bed.
Describe pressure changes along the pulmonary vasculature, importance and relationship to function.
Identify the effect of posture on distribution of blood, relationship to disease, e.g. pulmonary TB.
Identify the effect of gravity on alveoli and blood distribution in the lungs.
Identify the effect of gravity on air distribution in inspiration.
Describe ventilation-perfusion relations for whole lung and regions of the lungs - base was opposed to the apex.
Describe the concept of physiological shunt.
Revise physiological dead space;
Understands application of these factors to uneven ventilation-perfusion in the lungs and effect on blood gases.
Revise main factors governing directional movement of O_2.
Modes of O_2 transport in blood.
Importance of hemoglobin as a carrier.
Principles and functional significance of the O_2-Hb dissociation curve and factors affecting it - pCO_2, H^+. Application of curve to O_2 uptake at the lungs and delivery to tissues.
Structural changes in Hb molecule - HbS, HbF, myoglobin etc. and effects on O_2 transport.
Appreciate concepts of O_2 transport, e.g. hypoventilation, hyperventilation etc.
Effect of altered ventilation on O_2 transport, e.g. hypoventilation, hyperventilation etc.
Identify the main factors governing movement of CO_2.
Identify the modes of transport in blood.
Identify the role of RBC, the CO_2 dissociation curve and its difference from the CO_2 dissociation curve - the chloride shift, and the Haldane effect.
Identify the effect of altered ventilation on CO_2 Transport, e.g. hypoventilation, hyperventilation etc.
Describe the general organization for the control of ventilation.
Identify the chemical and neural factors which govern ventilation.
Describe the role of pCO2 and pO_2; interaction between hypercapnia, hypoxia and hypocapnia.
Identify the peripheral and central chemoreceptors ,their location and functional differences.
Describe the central regulation - organization of respiratory center, influences of both peripheral (pulmonary and extra pulmonary) afferents and central modulation.
Identify the effect of drugs on ventilation e.g. analgesics, anesthetic agents, muscle relaxants
Identify alterations in ventilation, causes and consequences of:
Hypoxia - various types, causes and management.
Hypoventilation - causes, effect on pulmonary function.

Hypocapnia - causes, effect on pulmonary function.
Asphyxia - causes, effect on blood gases etc.

Describe abnormal patterns of ventilation, e.g. Kussmaul's breathing, Cheyne-Stokes breathing etc. - causes etc.
Identify the effect of altitude on pO_2, pCO_2 acute changes in pulmonary function, major compensatory mechanism of acclimatization. i.e. Physiology of altitude -
Apply the principles of pulmonary function covered during the course, to following abnormal conditions:

Severe pneumothorax.
Chest injuries, e.g. fracture of ribs etc.
Bronchial asthma.
Airway obstruction.
Destructive lung disease, e.g. emphysema.
Restrictive lung disease, e.g. pulmonary fibrosis.

Identify the physiological changes in respiration during deep sea diving and other hyperbaric conditions.
Describe the physiological anatomy of voice producing structures in the respiratory system
Explain the neural mechanism of the respiratory center in respiration control
Describe the mechanism of the neural cortex in respiration control
Describe the triggers that cause asthma (reversible blockage of bronchi) attacks, respiratory distress syndrome (RDS) and cystic fibrosis (CF)
Differentiate between hypoxia and hypoxemia

b).Outcomes:

Students carrying out this course may:

Serve in teaching courses in hospital/ university and/ or other institutions related to respiratory diseases
Work for an organization/ society/ association struggling for the control of pulmonary diseases.
Join a job in emergency services related to pulmonary disease programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for respiratory disorders
Serve in nutrition study programs involving care about the pulmonary disorders.
Have an employment related to toxicological studies for pulmonary disorders.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to pulmonary disorders.
Embark in supplying biochemicals, instruments and other items related to pulmonary disorders to biomedical/ biological/ health related institutions.
Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to respiratory disorders.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate pulmonary diseases.
Do a job/ study in national survey/ statistical records for pulmonary disorders.
Join a respiratory physiology study in basic, clinical or research programs.
Carry out work in pulmonology lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.
Get involved in further research programs leading to either PhD or clinical / applied medical specializations
Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

24.3.2. Contents:

Lecture No. 1

Introduction: General functions of the respiratory system
Functional anatomy of airways and lungs, Physiology of alveoli, Physiological anatomy and functions of nose and paranasal sinuses, Structures and basic mechanisms used in voice production

Lecture No. 2

Structure and principal function of the lungs, lobes, fissures, and lobules of lungs,
systemic circulation and related disorders, Ventilation, gas transport, tissue respiration.
Pressure changes during pulmonary ventilation, Mechanisms of inhalation and exhalation, Normal and altered breathing patterns

Lecture No. 3

Biophysics of ventilation-1:
Pressure-volume relations of lungs and chest
Elastic and non-elastic properties of lungs and thorax

Lecture No. 4

Mechanics of breathing, breathing controls blood chemistry, Factors affecting pulmonary ventilation: surface tension of alveolar fluid, compliance of the lungs and airway resistance, Compliance and elastic recoil of the lung symptoms of respiratory acidosis and alkalosis,

Lecture No. 5
Biophysics of ventilation-2
Air flow, Poiseuille law , Laminar and turbulent flow
Diffusion
Fick's diffusion law.

Lecture No. 6
Surface tension. Role of surfactant. Lung volumes and capacities: Principles, instrumentation in spirometry.
Nonrespiratory air movements

Lecture No. 7
Measurement, values in health and disease. Specific references to tidal volume,
reserve volumes etc. Ventilation: General functions of airway, Anatomical and physiological dead space.

Lecture No. 8
Alveolar space and ventilation.
Dead space and uneven ventilation.

Lecture No. 9
Blood flow to lungs: Pulmonary circulation
Functional anatomy of pulmonary vascular bed. Total pulmonary flow.
Topographical distribution. Starling principal applied to lung vascular bed.

Lecture No. 10
Effects of various maneuvers on flow distribution. Physiological shunt,
immobilization, pulmonary edema.

Lecture No. 11
Ventilation-perfusion relations:
Whole lung, regional ventilation-perfusion ratio.

Lecture No. 12
Effect of altered airation on blood gases. Dalton's law of partial pressure, Henry's law

Lecture No. 13
Gas tension in air, alveoli, blood and tissue:
Symbols and essential gas laws.

Lecture No. 14
Gas tension in air, dead space, and arterial and venous blood tissues. Changes in
alveolar and arterial gas tension in ventilation.

Lecture No. 15
Oxygen transport:
Directional movement. Modes of carriage. Oxygen-hemoglobin dissociation
curve and factors affecting it.

Lecture No. 16
Dissociation curves for myoglobin, fetal hemoglobin, in anemia and polycythemia. Functional significance. Types of hemoglobin and clinical significance.

Lecture No. 17
Carbon dioxide transport:
Directional movement. Modes of carriage. Carbon dioxide dissociation curve.

Lecture No. 18
Chloride shift. Haldane effects. Buffer function of hemoglobin, proteins, and
bicarbonate. Henderson-Hasselbalch equation. Role of lungs in acid-base
regulation.

Lecture No. 19
Control of ventilation: 1
Overview and organization of ventilation control. Respiratory centers in medulla, pons and cerebral cortex, Neural mechanisms and regulation of respiration, Chemoreceptor regulation of breathing, Negative feedback,

Lecture No. 20
Control of ventilation: 2
Central controller sensors, effectors and their response. Hearing-Breuer reflex.

Lecture No. 21
Control of ventilation: 3
Ventilatory responses.
Humoral and chemical influences. Proprioceptor regulation of breathing

Lecture No. 22
Altered ventilation, causes and consequences:
Hypoxia, hypercapnia, hypocapnia, asphyxia.

Lecture No. 23
Oxygen therapy, Cheyne-stokes breathing. Drowning.

Lecture No. 24
Respiratory responses to Environmental changes : 1

Acute and chronic exposure to low oxygen tension.

Lecture No. 25

Major means of acclimatization.

Lecture No. 26

Respiratory responses to Environmental changes : 2
Effect of increased barometric pressure.

Lecture No. 27

Nitrogen narcosis, decompression ,sickness, air embolism, oxygen toxicity.
Hyperbaric oxygen therapy. Respiratory adjustments during exercise

Lecture No. 28

Physiological respiratory changes in space. Respiratory adjustments at high altitude

Lecture No. 29

Physiological respiratory changes during diving.

Lecture No. 30

Respiratory diseases-causes, diagnosis and treatment of asthma, respiratory distress syndrome (ARDS) and Cystic fibrosis (CF), Hypoxia vs. Hypoxemia

24.3.3. Practicals:

Experiment 13 (Resp)
To examine the respiratory system of a human subject by inspection, palpation and auscultation.
Experiment 14 (Resp)
To record normal and rapid breathing rate by using power lab.
Experiment 15 (Resp)
To perform the breath holding test
Experiment 16 (Resp)
To measure various lung volumes and capacities in human subjects by using datospir spirometer.
Experiment 17 (Resp)
To measure vital capacity and FEV_1 from human subject using Detospir spirometer
Experiment 18 (Resp)
To observe the effect of yawning on normal respiratory cycle

24.4. Gastrointestinal physiology

Course	Practical	Theory	Total CH
Gastrointestinal physiology (GIT)	1	2	3

24.4.1.Objectives:

By the end of this course, the student should learn sufficient basic gastrointestinal physiology. Through lectures, Practicals and tutorials, the student should be able to describe the functions and regulation of the gastrointestinal tract, and understand the pathophysiology and mechanisms of certain gastrointestinal problems e.g. peptic ulcer.
At the completion of this chapter, students should be able to:

Describe the overall role of the gastrointestinal system with respect to the absorption of nutrients and excretion of waste products.
State the four general processes associated with gastrointestinal function.
State the approximate volumes of fluids entering and leaving the normal gastrointestinal tract daily.
Define the cephalic, gastric and intestinal phases of GI tract regulation.
Name and locate the myenteric and submucus plexus.
Describe the relation between the autonomic nervous system, the enteric nervous system and the effectors organs of the GI tract.
Define the terms “long reflex” and “short reflex” with respect to the GI tract.
Describe the location of the endocrine cells secreting Gastrin, secretin, and cholecystokinin (CCK).
Describe the similarities in structure (identifies related hormones - does not memorize amino acid sequences) between Gastrin, secretin, and CCK, and between these and other hormones.
Recognize the existence of multiple forms of various GI hormones.
Describe the tropic actions of GI hormones.
Identify the following regulatory peptides, describe their structure, site of secretion ,and physiological action: gastric

inhibitory peptide (GIP), motilin, Gastrin-releasing peptide (GRP), somatostatin, substance P and vasoactive intestinal peptide (VIP).
State the major components present in salivary secretions.
State the substrates and digestion products of salivary amylase (ptyalin).
Describe the contribution of salivary amylase to the digestion of carbohydrates in the stomach.
Describe the function of salivary mucus.
State the types of stimuli that increase salivary secretion.
State the effects of parasympathetic and sympathetic stimulation on salivary secretion.
Describe the mechanisms by which the rate of secretion alters the composition of the saliva entering the mouth.
Describe the contribution of the acinar and duct cells to the final composition of the saliva.
State the pressure in the esophagus at rest and their variation during respiration.
Describe the function of the upper esophageal sphincter (UES) and lower esophageal sphincter (LES).
State the stimulus that initiates the swallowing sequence.
Describe the pressure changes that occur in the esophagus as a bolus of food moves from the pharynx to the stomach.
State when the UES and LES are normally closed and open during the course of a swallow.
Describe primary and secondary peristalsis.
State the mechanisms that normally prevents reflux from stomach to esophagus.
State the immediate cause of heartburn.
State the functions of the stomach.
Describe the contents of the parietal (Oxyntic) cell secretions.
Describe the contents of chief cell secretion.
State the steps in HCL secretion by parietal cells.
Describe the alkaline tide accompanying HCl secretion.
Describe the role of HCl in gastric digestion.
State the effects of ingested protein on gastric acidity.
Describe the function of gastric mucus.
State the mechanism of activating pepsinogen.
Describe the digestion products of pepsin activity.
Describe the relation between the stomach, intrinsic factor and pernicious anemia.
Describe the causes and prognosis of peritonitis
Given a meal of a particular composition, describe the approximate physical state and chemical composition of the chyme emptied by the stomach into the duodenum.
Describe the type of molecules that are absorbed into the blood across the wall of the gastric mucosa.
State the effect of vagal stimulation of HCl secretion.
State the effect of Gastrin on HCl secretion.
State the effects of histamine on HCl secretion.
State the effects of somatostatin on HCl secretion.
Describe the stimuli and possible pathways giving rise to the cephalic, gastric and intestinal phases of HCl secretion.
State the effect of luminal peptides on HCl secretion.
Describe the stimuli that increase and inhibit Gastrin release.
Define the term Enterogastrone.
State the effects of acid, fat and solutions of high osmolarity in the duodenum on gastric secretion.
State the stimuli, which increase pepsinogen secretion.
Define receptive relaxation of the stomach and states mechanism.
Define Basic Electrical Rhythm (BER) {also termed the Pacesetter Potential (PSP), and Electrical Control Activity (ECA)}.
Describe the interaction between BER and the neural and hormonal stimuli that produces changes in the force of smooth muscle contractions.
Describe the origin and progression of peristaltic waves across the body and antrum of the stomach.
Describe the effects of peristalsis on the mixing and propulsion of stomach contents.
Compare the peristaltic activity of an empty and full stomach.
State the duodenal stimuli that alter the rate of gastric emptying.
Predict effects of meal content (osmolarity, fat content, etc.) and volume on the rate of gastric emptying.
State the afferent stimuli to the vomiting center in the medulla oblongata that trigger retching and vomiting.
State the mechanics of retching and vomiting.
Describe the causes, diagnosis, pathophysiology and treatment of gastric and duodenal ulcers.
Analyze lactose intolerance and tolerance
List the major contents of pancreatic secretions.
Describe the mechanisms by which chyme is neutralized in the duodenum.
Describe the mechanism by which pancreatic Zymogen are activated in the small intestine.
State the stimuli that release secretin.
State the stimuli that release CCK.
State the effects of secretin and CCK on pancreatic secretion.
State the effects of the autonomic nerves to the pancreatic secretion.
Describe the mechanisms by which the rate of secretion alters the composition of pancreatic juice.
Understand the role of ATP, Na-H exchange, carbonic anhydrous and Cl-HCO_3 exchange in the production of

pancreatic juice.
Describe the relation between steatorrhoea and pancreatic function.
State the composition of bile as secreted by the liver.
Describe the changes in the composition of bile that occur while bile resides in the gallbladder.
Describe the effects of CCK on the contraction of the gallbladder and the sphincter of Oddi.
State the effects of CCK and secretin of the composition of bile entering the small intestine.
Describe the amphipathic structure of bile acids.
State the effect of conjugation of bile acids with taurine or glycine.
Describe and compares the physical state of an emulsion and a micelle solution.
State the conditions necessary for emulsification of fat in the duodenum.
Define enterohepatic circulation.
State the mechanism of reabsorption of conjugated and unconjugated bile acids.
State normal turnover rate of bile acid pool.
State the maximum rate of replacement of bile acids by liver when loss is excessive.
Describe mechanism of formation of cholesterol gallstones.
State the function of the small intestine.
Describe the sequence of cell division, maturation and desquamation of enterocytes.
Describe the composition and sources of intestinal secretion.
State four sources of digestive enzymes that contribute to the digestion of organic nutrients prior to their absorption.
Describe the role of the microvilli, the unstirred layer, and tight junctions in determining the rate at which a given nutrient is absorbed.
Describe the functions of the colon.
Describe the motility of the colon; segmentation contractions, peristaltic waves, gastro-ileal reflex and the mass action contraction.
State the mechanism of colonic absorption of salt and water.
State the mechanism of colonic potassium and bicarbonate secretion.
State the effect of aldosterone on sodium and potassium transport across the colonic epithelium.
Define "dietary fiber".
Describe the role of colonic bacterial metabolism in gas formation (flatus).
State the forms of the major ingested carbohydrates.
State the forms of the carbohydrates entering the duodenum from the stomach.
Describe the role of pancreas in carbohydrate digestion.
Identify and describes the role of the brush-border enzymes involved in carbohydrate digestion.
Describe the pathways by which glucose, galactose and fructose cross the apical and basolateral membranes of enterocytes.
State the defect causing lactose intolerance.
Describe the state of the proteins entering the duodenum from the stomach.
Describe the role of the pancreas in protein digestion.
Identify and describes the role of the brush-border enzymes involved in protein digestion.
Describe the mechanism by which amino acids, di- and tripeptides are absorbed.
Describe the state of ingested lipids.
Describe the role of the pancreas in lipid digestion.
Describe the products of fat digestion by pancreatic lipase.
Describe the role of co-lipase.
Describe the role of micelles in lipid absorption.
Describe the role of the endoplasmic reticulum in processing lipids absorbed across the apical membranes of enterocytes.
Describe the composition and formation of chylomicrons.
Describe the release of chylomicrons across the basolateral membrane of enterocytes.
Describe the role of the lacteal in fat absorption.
Define steatorrhoea.
Describe the absorption of fat-soluble vitamins.
Describe the absorption of water-soluble vitamins.
Describe the role of intrinsic factor in absorption of vitamin B12.
Describe the changes in osmolarity that occur in chyme as it passes from the stomach to the duodenum and gives the explanation for these changes.
Describe the pathways by which sodium ions are absorbed in the small intestine.
Describe the relation between sodium absorption and water absorption.
Describe the physiology of osmotic diarrhea.
Describe the absorption of iron.
Describe the absorption of calcium.
Describe the pattern of intestinal motility seen during the absorptive phase (segmentation).
Describe the pattern of intestinal motility seen during the post-absorptive phase between meals (the migrating motility complex, MMC).
Describe the effects of parasympathetic and sympathetic nervous activity on small intestinal motility.
Describe the effects of distention on small intestinal motility.
Define the gastroileal reflex.

State effects of increased pressure in the ileum and Caecum on the ileocoecal sphincter.

b).Outcomes:

Students carrying out this course may:

Serve in teaching courses in hospital/ university and/ or other institutions related to gastrointestinal tract (GIT) diseases
Work for an organization/ society/ association struggling for gastrointestinal tract (GIT) diseases.
Join a job in emergency services related to gastrointestinal tract (GIT) diseases programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for gastrointestinal tract (GIT) diseases
Serve in nutrition study programs involving care about gastrointestinal disorders.
Have an employment related to toxicological studies for gastrointestinal disorders.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to gastrointestinal
Embark in supplying biochemicals, instruments and other items related to gastrointestinal disorders to biomedical/ biological/ health related institutions.
Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to gastrointestinal disorders.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate gastrointestinal diseases.
Do a job/ study in national survey/ statistical records for gastrointestinal disorders.
Join a gastrointestinal study in basic, clinical or research programs.
Carry out work in gastrointestinal lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.
Get involved in further research programs leading to either PhD or clinical / applied medical specializations
Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

24.4.2. Detailed Contents:

Lecture No. 1
Functional organization of the GIT.
The intestinal wall and its innervation.

Lecture No. 2
Nervous control of the GIT.
Intrinsic innervation of the GIT.
Extrinsic innervation of the GIT.
Introduction to peristalsis.

Lecture No. 3
GIT blood flow with special emphasis on splanchnic circulation.

Lecture No. 4
GIT hormones

Lecture No. 5
Salivary secretion:
Salivary glands
Characteristics of saliva

Lecture No. 6
Functions of saliva
Regulation of salivary secretion.

Lecture No. 7
Physiology of Swallowing

Lecture No. 8
Function of the esophagus:
The upper and lower esophageal sphincter.
Disorders of swallowing and LES e.g. Dysphagia, Achalasia, Incompetence and Diffuse esophageal spasm.

Lecture No. 9
Motor functions of the stomach and intestine:
The stomach-functional anatomy, storage function, mixing function, emptying.
Peritonitis-causes, symptoms and complications and treatment

Lecture No. 10

Properties of visceral smooth muscle.
The small intestine-movements, regulation of motility, functions of ileocoecal, Lactose intolerance-causes, effects on
nutrition, assessment and treatment
valve.

Lecture No. 11
The large intestine-motor functions.

Lecture No. 12
Principles of GIT secretion.

Lecture No. 13
The gastrointestinal glands-anatomical types, basic mechanism of secretion.
Importance of mucus in the GIT.

Lecture No. 14
Gastric secretion: its characteristics.
Mechanism of secretion and significance of hydrochloride acid.
Pepsinogen, gastric mucus, and gastrin.

Lecture No. 15
Regulation of gastric secretion.
Other functions of stomach.
Causes, symptoms, diagnosis and pathophysiology of peptic ulceration and its management. Indications and Consequences of Vagotomy, gastrectomy

Lecture No. 16
The exocrine pancreatic secretion versus endocrine pancreatic secretion:
Pancreatic juice-characteristics, formation of hydroelectrolytes.

Lecture No. 17
Pancreatic enzymes and their activation.
Regulation of secretion.

Lecture No. 18
Pancreatic failure.

Lecture No. 19
The liver-physiological histology, and functions.
Synthesis and release of bile.

Lecture No. 20
Bile secretion and gall bladder functions. Gall bladder storage of bile and emptying.
Bile salts and bile salt pool.. Gall stones.

Lecture No. 21
The small intestine, secretion(Succus Intericus) and motility

Lecture No. 22
Consequences of Resection of small intestine.

Lecture No. 23
The large intestine: secretion and motility.
Absorption in the large intestine.
Colonic (intestinal) bacterial flora.

Lecture No. 24
Digestion of carbohydrates :
Dietary carbohydrates digestion.

Lecture No. 25
Digestion of fat :
Dietary fat digestion: in the mouth, in the stomach, and in the small intestine.
Emulsification, digestion by small intestinal lipase, and micelle formation.

Lecture No. 26
Protein-digestion by pepsin, in the stomach.
Protein digestion in the small intestine.

Lecture No. 27
Absorption of nutrients: Water and electrolyte absorption. Absorption from the stomach.

Lecture No. 28
Small intestinal absorption-anatomical factors. Absorption of carbohydrates, fat and amino acids.
Metabolic diseases, Phenylketonuria (PKU), galactosemia and glycogen storage disease,

Lecture No. 29
Composition of stool .

Lecture No. 30
Physiology of daefication.

24.4.3. Practicals:

Experiment 19 (GIT)
Examination of abdominal viscera in human subject by inspection, palpation, percussion and auscultation.
Experiment 20 (GIT)
To study the effect of Salivary amylase upon carbohydrate digestion
Experiment 21 (GIT)
To observe enzymatic digestion of protein and enzyme activity by altering temperature and pH
Experiment 22 (GIT)
To study the properties of lipid and lipase activity.
Experiment 23 (GIT)
To perform liver function tests (LFTs) in a human subject.
Experiment 24 (GIT)
To estimate serum/plasma cholesterol level in human blood sample.

24.5. Renal physiology

Course	Practical	Theory	Total CH
Renal physiology	1	2	3

24.5.1. Objectives:

By the end of this course, the student should learn sufficient basic renal physiology.

Student should be able to recognize the importance of renal function in homeostasis through regulation of water and electrolyte balance and acid-base balance; and appreciate the kidney as endocrine organ secreting important regulatory hormones.
At the completion of this lecture, students are expected to be able to:

Describe the gross anatomical structure of the kidneys.
Describe the different components of the Nephron.
Describe the blood supply to the Nephron.
Define the three basic renal processes: Filtration, absorption and secretion.
Know the composition of the ultrafilterate.
State the three layers separating the glomerular capillary lumen and Bowman's space.
Describe glomerular sieving in terms of size and charge selectivity.
Relate the sieving curve to filtration of plasma proteins.
Define GFR, state the relationship between GFR and its determinants in a formula; give normal values.
Define the balance of forces across the capillary bed.
Predict how changes in arterial pressure and glomerular arteriolar resistance will affect glomerular capillary pressure.
Define the term clearance.
Understand why the clearance of creatinine approximates GFR
Identify normal values of plasma creatinine and GFR.
Identify the limitations of Creatinine as a measure of GFR.
Identify the relation between steady state, PCT and GFR.
Estimate the change in GFR from a known PCT.
Given data, calculate rate of net absorption for a filtered substance.
Describe the basic mechanism of Na, Cl, and water absorption by the renal tubules; state their driving forces.
Identify the approximate percentages of Na and water absorbed in each Nephron segment.
Identify the urinary Na concentration in extracellular volume depletion.
Describe the nature and locations of receptors in Na-regulating reflexes.
List the main factors that regulate Na excretion.
Identify the effects of sympathetic activation in Na regulation.
Identify the relation between Na balance and GFR and list the inputs controlling GFR when extracellular volume changes.
Describe the basic mechanism of action of diuretics.
State the source of rennin, the components of the rennin - angiotensin system, and their biochemical interrelationships, and function.
State the three main factors controlling rennin secretion.
State the origin of aldosterone and its renal actions.

List the factors controlling aldosterone secretion.
Distinguish between primary and secondary hyperaldosteronism.
Describe the effects of chronic administration of aldosterone on salt balance.
State the origin of Atrial Natriuretic Factor (ANF), its stimulus for secretion, and its renal effects.
Describe the role of the thirst mechanism and the control of thirst.
Describe the principles of countercurrent multiplication for urine concentration.
Describe the origin of ADH and the two major reflex controls of its secretion.
Describe the effect of ADH on renal tubules.
State the effect of inappropriate plasma levels of ADH on plasma osmolarity and plasma Na concentration.
Define diabetes insipidus.
State the normal distribution of body potassium.
Describe the effect of each nephron segment on K handling.
Describe the effect of a high and low K diet on tubular K handling.
Describe the relation between K secretion and fluid delivery to the collecting tubules.
Identify the effect of most diuretics on K secretion.
Describe the factors that control the rate of K excretion in the homeostatic regulation of K balance.
Describe the effect of aldosterone on K secretion.
Compare K secretion in persons with primary versus secondary hyperaldosteronism.
Describe the renal tubular handling of glucose.
State the tubular location and the basic transport system for the absorption of glucose and other organic nutrients.
Describe the concept of the tubular transport maximum.
Describe the mechanism of osmotic diuresis.
Identify the relation between plasma glucose concentration and urinary glucose excretion.
Describe the renal handling of Urea.
Describe the renal handling of calcium and phosphate.
Describe the composition of normal urine.
Describe the physiological phenomenon of micturition.
State the sources and sites of hydrogen and bicarbonate gain and loss.
Define "metabolic" and "respiratory" acidosis and alkalosis: state common causes of each.
Write the Henderson-Hasselbalch equation for the CO_2-bicarbonate buffer system.
Given values, distinguish between metabolic and respiratory acidosis.
Identify the three renal processes that determine bicarbonate excretion.
Describe the effect of bicarbonate absorption on urinary pH.
Describe the mechanism of bicarbonate absorption.
State the role of carbonic anhydrase.
Describe the effect of pCO_2 on bicarbonate absorption.
State the effect of respiratory compensation on arterial pH in metabolic acidosis.
Describe how tubular H ion secretion can lead to the excretion of H ions, i.e. to the addition of new bicarbonate to the blood.
State the major luminar non-bicarbonate buffers and its normal rate of excretion.
Describe the luminar non-bicarbonate buffers in diabetic ketoacidosis.
Describe why the urinary excretion of ammonium contributes to the addition of new bicarbonate to blood.
Define net acid excretion.
Describe the direct effect of aldosterone on H^+ secretion.
List the changes in the excretion of net acid, titratable acid, ammonium, and bicarbonate in metabolic and respiratory acidosis.
Name possible causes for the generation of a metabolic alkalosis.
Describe the effects of volume contraction and Cl^- depletion, aldosterone in the capacity of the kidneys to correct an alkalosis.
Describe the principle of haemodialysis in the management of renal failure.
Distinguish between acute kidney injury and chronic kidney disease
Explain nephroptosis or floating kidney
Distinguish between autosomal dominant and autosomal recessive polycystic kidney disease (PKD).

b).Outcomes:
Students carrying out this course may:
Serve in teaching courses in hospital/ university and/ or other institutions related to renal diseases
Work for an organization/ society/ association struggling for the control of nephrourological diseases.
Join a job in emergency services related to renal disease programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for renal disorders
Serve in nutrition study programs involving care about the renal disorders.
Have an employment related to toxicological studies for renal disorders.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to renal disorders.
Embark in supplying biochemicals, instruments and other items related to renal disorders to biomedical/ biological/ health related institutions.

Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to renal disorders.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate renal diseases.
Do a job/ study in national survey/ statistical records for renal disorders.
Join a renal study in basic, clinical or research programs.
Carry out work in renal lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.
Get involved in further research programs leading to either PhD or clinical / applied medical specializations
Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

24.5.2. Contents:

Lecture No. 1
Functional anatomy of the kidney:
The nephron. Structure and functional features.

Lecture No. 2
Organization and special features of renal vasculature. Anatomical and functional heterogeneity.

Lecture No. 3
Basic elements of renal function:
Evidence for glomerular ultrafiltration, tubular reabsorption, and tubular secretion. Stop-flow.

Lecture No. 4
Renal Haemodynamics:
Glomerular filtration. Magnitude, measurement, regulation.

Lecture No. 5
Renal blood flow. Fick's principle and clearance techniques.

Lecture No. 6
Renal autoregulation.

Lecture No. 7
Tubular reabsorption:
Overview, overall and segmental reabsorption. Passive and active reabsorption, exhibiting Tm. Renal titration curves.

Lecture No. 8
Glomerulotubular balance.
Mechanism of glucosuria.

Lecture No. 9
Tubular secretion:
Overview. Active and passive secretion. Active secretion exhibiting Tm.
PAH titration curves. The Fick principle and clearance applied to PAH.

Lecture No. 10
Regulation of renal blood flow. Filtration fraction and its significance.

Lecture No. 11
Renal handling of specific solutes and factors affecting them:
Renal handling of sodium and potassium.

Lecture No. 12
Renal handling of calcium, phosphate, chloride .

Lecture No. 13
Renal handling of urea, creatinine, uric acid.

Lecture No. 14
Production of concentrated and dilute urine:
Overview of concentration of fluid in discrete nephron segments.

Lecture No. 15
The countercurrent multiplier and exchange systems.
Mechanisms of urine concentration and dilution.

Lecture No. 16
Regulation of extracellular fluid volume and composition.
Regulation of ECV, volume receptors, sodium, kidney.
Regulation of ECF composition.

Lecture No. 17
Roles of hypothalamus and the kidney in the regulation of extracellular fluid volume

and composition.
. Clinical correlations.

Lecture No. 18
Normal and abnormal intake and losses of water.

Lecture No. 19
Endocrine functions of the kidney. (Erythropoietin, renin, 1,25 DHC and renal prostaglandins).

Lecture No. 20
Normal & abnormal composition of urine.

Lecture No. 21
Physiology of Micturition.

Lecture No. 22
Regulation of pH.
The Henderson-Hasselbalch equation and its use.

Lecture No. 23
Magnitude of problem. Intracellular and extracellular buffers.

Lecture No. 24
The role of the kidneys in pH regulation.

Lecture No. 25
Renal handling of bicarbonate, role in acid-base balance.

Lecture No. 26
Renal production and excretion of hydrogen ion and ammonia.

Lecture No. 27
Altered acid-base states. Basic changes and compensations.

Lecture No. 28
Renal conditions and diseases-1:
Metabolic and respiratory acidosis and alkalosis.
Potassium balance and effect on acid-base state, Renal tubular acidosis. Nephroptosis (floating kidney)-causes, symptoms, diagnosis and pathophysiology

Lecture No. 29
Renal conditions and diseases-2:
Polycystic kidney disease (PKD)-characterization, genetics and complications.

Lecture No. 30
Renal conditions and diseases-3:
Renal disease and failure-diagnosis, uremia,categories, Pathophysiology of renal failure.

24.5.3. Practicals:

Experiment 25 (Renal)
To perform physical examination of a given sample of urine.

Experiment 26 (Renal)
To perform chemical examination of a given sample of urine.

Experiment 27 (Renal)
To perform microscopic examination of a given sample of a normal human urine.

Experiment 28 (Renal)
To assess renal functions in human by estimating serum urea levels using spectrophotometer-1.

Experiment 29 (Renal)
To determine urinary creatinine level in a human subject.

Experiment 30 (Renal)
To determine the molarity of the acid in the acidified urine sample by titration method.

25. Detailed Physiology courses- Semester (2):

25.1. Endocrine physiology

Course	Practical	Theory	Total CH
Endocrine physiology	1	2	3

25.1.1. Objectives:

This course aims to provide students with basic information of endocrine control of body functions. It highlights slow regulatory mechanisms, which adjusts the functions of body systems according to changing internal and external environmental conditions. Endocrine mechanisms, which control metabolism, growth, and homeostatic functions, are covered.

At the completion of this lecture, the student is expected to be able to:
List the major physiological functions of the endocrine system such as:
- Regulation of the volume and composition of body fluids.
- Regulation of growth and development.
- Regulation of the reproductive process.

Describe the physiological response to emotional trauma.
Understand the basic features of the operation of the endocrine system.
List the various factors that stimulate hormone secretion.
Describe the role of trophic hormones.
Define a target cell.
Define a hormone receptor and describe the cellular locations of the receptors for the various hormones.
Describe signal transduction and hormone-receptor interaction.
Distinguish between bound and free forms of hormones in the blood and understand their physiological significance.
List the ways in which hormones influence cell activity.
Explain a paracrine action of a hormone.
Explain an autocrine action of a hormone.
Explain the permissive action of hormones.
Identify the chemical nature of the hormones produced by the body.
List those hormones that are amino acid derivatives.
List those hormones that are lipids.
List those hormones that are peptides or proteins.
List those hormones that are fatty acid derivatives.
Understand the concept of neuroendocrine transducer and identify the various types of neuroendocrine transducers.
Describe the characteristics of endocrine neurons in the hypothalamus; distinguish between magnocellular and parvicellular neurons' and define a hypothalamic nucleus.
Describe the following areas and recognize the importance of each in Neuroendocrine communication:
- i) Median eminence.
- ii) Hypothalamic-pituitary portal system.
- iii) Anterior lobe of the pituitary.
- iv) Posterior lobe of the pituitary.
- v) Suprachiasmatic nucleus.

Identify sites of synthesis, transport and release of hormones from endocrine neurons, and the cellular changes that lead to release.
Describe the phenomenon of pulsatile hormones secretion and recognize its neural basis.
Understand how endocrine neurons relay information to the pituitary and recognize the difference between the anterior and posterior pituitary in this regard.
Identify the hormones discharged from endocrine neurons and the major functions of each.
Identify the hormones secreted by the pituitary (anterior and posterior lobes) and the major functions of each.
Identify input signals, which regulate the activity of endocrine neurons.
- a) Neural inputs: signals from other neurons via neurotransmitters.
  - (i) Identify important neurotransmitters and neuropeptides in Neuroendocrine communication.
  - (ii) Recognize how dopamine serves both as a neurotransmitter and a hormone.
- b) Hormonal: signals from endocrine glands via hormone feedback loops:
  - i) Long-loop feedback.
  - ii) Short-loop feedback.
  - iii) Ultra-short loop feedback.
  - iv) Positive feedback.
  - v) Negative feedback.

Recognize the different sites that target-gland hormone feedback in Neuroendocrine regulation and the general nature of the feedback effects at these sites.
Identify the chemical nature of growth hormone.
Describe the effect of growth hormone on growth and the role of IGF-I.
Describe the diabetogenic and insulin-like actions of growth hormone.
Describe the mechanism regulating the secretion of growth hormone.
Describe how the pattern of growth hormone secretion changes throughout the life spans of the individual.
List the factors that can stimulate growth hormone secretion.

Understands the growth hormone as a species specific.
List the clinical syndrome of growth hormone dysfunction.
Identify their possible causes and clinical presentation in children and adults.
Identify the chemical nature and cells of origin of TSH, ACTH, FSH, LH, MSH and prolactin.
Describe the action of TSH on the thyroid gland.
Describe the control of TSH and the role of TRH.
Describe the control of ACTH and the role of CRH.
Identify the role of ACTH in stressful conditions - such as trauma and hypoglycemia.
Contrast the action of FSH and LH in men and women.
State the effects of Estradiol, testosterone and gonadal protein hormones on FSH and LH secretion.
State the actions of prolactin on mammary glands and production of milk.
State the effect of the following on secretion of prolactin:

a) Dopamine from hypothalamus
b) Pregnancy
c) Estrogens
d) Suckling

List the clinical syndromes of prolactin dysfunction. Identify their possible causes and common clinical features.
State two hormones secreted by the posterior pituitary gland. Identify their chemical nature.

Identify target organ and mechanism of action of ADH.
State and explain the action of ADH on:

a)Water absorption
b)Urine osmolarity
c)Peripheral vascular resistance

State and explain the effects of the followings on ADH secretion.

a)Plasma osmolarity
b)Plasma volume
c)Blood pressure

Define diabetes insipidus - causes and presentation.
Identify the chemical nature of oxytocin.
State and explain the actions of oxytocin on mammary glands, uterus and parturition.
State and explain the main factor, which control oxytocin secretion.
Describe the functional anatomy of the thyroid gland.
Identify the hormones secreted by the thyroid gland.
Identify the thyroid gland utilization of iodine and the fate of ingested iodides.
Recognize the importance of adequate dietary iodine and the effect of iodine deficiency.
Identify thyroglobulin and its functional role.
Describe the synthesis, storage and release of T_3 and T_4.
Identify the characteristics of T_3 and T_4 release from thyroglobulin and their transport to tissues.
Recognize the effect of thyroid hormones on:

a) Oxygen consumption and BMR
b) Growth and development
c) Fat, protein and carbohydrate metabolism
d) Water and salt metabolism
e) Blood cholesterol level
f) Nervous system
g) Cardiovascular system
h) Response to cold
i) Skin and hair

Identify the regulatory mechanisms controlling thyroid hormone secretion:

a) Identify TSH, its chemical nature, action and control.
b) Recognize the negative feedback - action of TSH and TRH.
c) Identify neurogenic influences.
Describe the basic clinical features of excess thyroid hormone (thyrotoxicosis).

Describe the basic clinical features of inadequate secretion of thyroid hormones (myxoedema and cretinism).
Perform an experiment to measure basal metabolic rate (BMR), understand factors that affect BMR and how BMR is altered in thyroid diseases.
Describe the functional anatomy of the adrenal gland.
Characterize the major types of endocrine secretions of the adrenal gland and describe their basic chemistry. Identify synthesis in steroidogenic tissues (adrenals, gonads, placenta).
Describe the transport and metabolism of adrenal hormones.
Glucocorticoids:

a) Describe the action of Glucocorticoids on:
i)Carbohydrate, fat and protein metabolism.
ii)Cardiovascular and gastrointestinal systems.

iii)Bone and calcium.
iv) Water and electrolyte metabolism.
v)Blood.
vi)Central nervous system.
vii)Inflammation and immune responses.

b) Recognize the control of cortisol secretion:
i)The effect of ACTH, action and control.
ii)Role of CRF.
iii)Effects of stress and circadian rhythm.

c) Describe the effects of excess cortisol secretion (Cushing's Syndrome).
d) Describe the effects of insufficient cortisol secretion (Addison's disease).

Mineralocorticoids:

a) Describe the action of Mineralocorticoids on water electrolyte balance.
b) Describe the control of Mineralocorticoids via-Rennin angiotensin system.
c) Describe the effect of hemorrhage, salt and water loss and postural changes on aldosterone secretion.
d) Describe the effects of excess Mineralocorticoids secretions (Conn's syndrome).

Adrenal androgens:

a) Describe the actions and controls of adrenal androgens.
b) Describe adrenogenital syndrome.

Identify synthesis, storage and release of catecholamines.
Describe the control of catecholamine release by the sympathetic nervous system.
Describe the integral actions of sympatho adrenal and endocrine system in:
a)Hemorrhage
b)Physical and emotional stress
c)Hypoglycemia
d)Changes in posture
Describe the major actions of catecholamines.
Identify therapeutic usage and endocrine implications of catecholamines.
Describe the basic features resulting from hypo- and hypersecrtion of catecholamines.
Recognize the importance of Ca^{++} in body fluids, bone and excitable tissue.
Describe the factors controlling Ca^{++} homeostasis.
Identify parathormone, cells of origin, action on bone, kidney and intestine.
Identify Vitamin D; effects on liver and kidney to produce 1,25-dihydroxycholicalciferol;
effects on intestinal calcium absorption.
Identify calcitonin; cells of origin, actions on bone, control and secretion.
Describe the effects of Glucocorticoids, thyroxin, growth hormones and sex steroids on calcium metabolism.
Describe the effects of hyper- and hypo-parathyroidism.
Describe the clinical syndromes arising from dysfunction of Vit. D.
Identify estimates of energy expenditure in adults.
Identify energy equivalents of foodstuffs.
Describe the metabolic interrelationships among carbohydrate, protein and fat.
Describe the functional anatomy of the pancreas.
Identify Islet of Langerhan's , types of cells and the hormone they secrete.
Describe the structure, synthesis and secretion of insulin.
Identify the effects of the followings on insulin secretion:
i)Blood glucose
ii)Amino acid intake
iii)Autonomic nervous system
iv)GIT hormones
v)Somatostatin
vi)Ketoacids
vii)Oral hypoglycemic agents
Describe the actions of insulin on:
a)Glucose uptake and metabolism by skeletal muscle cells.
b)Glucose uptake and metabolism by adipose tissue.
c)Fatty acid uptake and triglycerides synthesis by adipose tissue.
d)Metabolism of glucose by the liver.
e)Glucose production by the liver.
f)Protein metabolism.
g)electrolytes.
h)Diabetes mellitus.
Describe the chemical nature of glucagon.
Describe the effects of the followings on glucagon secretion:
a)Hyperglycemia
b)Protein intake.

c)Somatostatin
d)Sympathetic and parasympathetic nervous system.
e)G. I. Hormones

State the action of glucagon on:
a)Blood glucose - gluconeogenesis and glycogenolysis
b)FFA mobilization

Identify insulin-glucagon ratio and metabolism during:
i) Fasting.
ii)Exercise
iii)The newborn period
iv)Carbohydrate intake
v) Protein intake
vi)Fat intake

Identify nature and sources of somatostatin.
Describe the control of somatostatin secretion.
Identify the physiological effects of somatostatin and its relationship to glucagon and insulin.
State and explain the effects of tumors of the delta cells producing excess somatostatin on:
a) Body weight
b) Plasma insulin and glucagon levels
c) Blood glucose

Review the roles played by insulin, glucagon, growth hormone, Glucocorticoids, thyroid hormones and catecholamines on blood glucose.
State the types and give a brief review of possible causes of diabetes mellitus (Juvenile-type I and maturity onset-type-II).
State the common symptoms and signs and late complications of diabetes mellitus.
Describe the physiological explanation of:
a)Hyperglycemia, glucosuria and polyuria.
b)Dehydration
c)Ketoacidosis
d)Electrolyte disturbances
e)Atherosclerosis

State and explain the physiological bases of the treatment of diabetes mellitus
State and explain the effects of excess glucagon secretion on:
a)Body weight
b)Skin
c)Blood glucose
d)Plasma amino acids
e)Urinary nitrogen
State and explain the consequences of glucagon deficiency.

Distinguish between the two types of hyperinsulinism: hyperglycemia and hypoglycemia
Describe the role of the endocrine system in post-traumatic stress disorder (PTSD)
Describe causes and management of metabolic syndrome.

b).Outcomes:

Students carrying out this course may:

Serve in teaching courses in hospital/ university and/ or other institutions related to endocrine diseases
Work for an organization/ society/ association struggling for the control of endocrine diseases.
Join a job in emergency services related to endocrinology programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for endocrine disorders
Serve in nutrition study programs involving care about the endocrine disorders.
Have an employment related to toxicological studies for endocrine disorders.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to endocrine disorders.
Embark in supplying biochemicals, instruments and other items related to endocrine disorders to biomedical/ biological/ health related institutions.
Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to endocrine disorders.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate endocrine diseases.
Do a job/ study in national survey/ statistical records for endocrine disorders.
Join a endocrine study in basic, clinical or research programs.
Carry out work in endocrine lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.

Get involved in further research programs leading to either PhD or clinical / applied medical specializations
Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

25.1.2. Detailed Contents:

Lecture No.1
General functions of the endocrine system.
Relationship between endocrine and neural physiology.

Lecture No. 2
Types of secretions/hormones.
Regulation of hormone secretion.

Lecture No.3
Mechanisms of hormone action.
i)Receptors.
ii)Intracellular pathways of hormone action.
iii)Second messengers.
iv)Transcriptional or translational effects.

Lecture No. 4
Responsitivity to hormone.
Hormone transport.
Hormone disposal.

Lecture No.5,6 and 7
The Hypothalamus and Pituitary Gland:
Functional anatomy.
Hypothalamic function.
Anterior pituitary hormones.
i)Thyrotropic hormones.
ii)Adrenocorticotropic hormone.
- Synthesis , secretion & actions of ACTH.
Secretion and actions of other proopiomelanocortin peptides.
- Clinical syndromes of ACTH dysfunction.

Lecture No.8
The Hypothalamus and Pituitary Gland: (continued)
Gonadotrophic hormones.
i)Secretion of LH and FSH.
ii)Feedback regulation of gonadogropins.
iii)Abnormalities in secretions.

Lecture No.9
The Hypothalamus and Pituitary Gland: (continued)
Growth hormone (somatotropin).
Synthesis and release of HGH.
i)Secretion of HGH.
ii)Mechanism of HGH action.
iii)Overall role of HGH in substrate flows.
iv) HGH dysfunction.
Prolactin.
i)Secretion of prolactin.
ii)Biological effects of prolactin.
iii) Prolactin dysfunction.

Lecture No.10 and 11
The Hypothalamus and Pituitary Gland: (continued)
Posterior Pituitary Hormones.
i)Secretion of ADH.
ii)Actions of ADH.
iii)Oxytocin secretion and actions.
iv) Posterior pituitary hormone dysfunction.

Lecture No. 12
Whole body metabolism and the hormones of the pancreatic islets:
Metabolic interrelationships among carbohydrates, protein, and fat.
Quantitative aspects of carbohydrate metabolism .
Quantitative aspects of protein metabolism .
Quantitative aspects of lipid metabolism .

Lecture No.13
Functional anatomy of pancreatic islets.
Insulin.

i) Structure and synthesis.
ii)Regulation of secretion.
iii)Hormone actions: intracellular mechanisms.
iv)Actions on flow of fuels.
- Carbohydrate metabolism.
- Protein metabolism.
- Fat metabolism.

Glucagon
i)Structure and synthesis.
ii)Regulation of secretion.
iii)Hormone actions.

Lecture No.14

The insulin glucagon ratio and metabolism.
i)Fasting
ii)Exercise
iii)The newborn period
iv)Carbohydrate intake
v) Protein intake
vi)Fat intake

Lecture No.15

Somatostatin secretion and action
Pancreatic polypeptide.
Pancreatic islet cell dysfunction.
i)Obesity.
ii)Glucagon.
iii)Somatostatin.

Lecture No. 16

Pathophysiology of insulin:
Diabetes mellitus and hyperinsulinism as major dysfunction of pancreatic islets.

Lecture No.17

Endocrine Regulation of Calcium and Phosphate Metabolism:
Calcium and phosphate pools and turnover.
Bone dynamics.
The parathyroid glands.
i)Synthesis and release of PTH.
ii)PTH actions.

Lecture No.18

Endocrine Regulation of Calcium and Phosphate Metabolism: (continued)
Calcitonin.
i)Synthesis and release.
ii)Actions
Vitamin D and its metabolism.

Lecture No.19

Endocrine Regulation of Calcium and Phosphate Metabolism: 3
Integrated hormonal regulation of calcium and phosphate.
Hormonal dysfunction.
i)PTH.
ii)Vitamin D.

Lecture No.20

The Thyroid Gland:
Synthesis and release of thyroid hormones.
Regulation of thyroid gland activity.
Metabolism of thyroid hormones.
Relationship between hormone metabolism and hormone action.

Lecture No. 21 and 22

The Thyroid Gland (continued)
Intracellular actions of thyroid hormones.
Whole body actions of thyroid hormone on metabolism.
Thyroid hormone and sympathetic nervous system activity.
Thyroid hormone effects on growth and development.
Thyroid dysfunction.

Lecture No.23

The Adrenal Glands:
The adrenal cortex.
i)Synthesis of adrenocortical hormones.

- Glucocorticoids
- Androgens and Estrogens.
- Mineralocorticoids.

ii)Inhibitors of adrenocortical hormone synthesis.
iii)Metabolism of adrenocorticosteroids.
iv)Regulation of zona fasciculate and zona reticularis functions.

Lecture No.24,25 and 26

The Adrenal Glands: (continued)
i)Actions of Glucocorticoids.
- Effects on metabolism.
- Other effects: Bone, inflammatory and immune responses.

ii)Actions of adrenal androgens.
iii)Regulation of zona glomerulosa function.
iv)Actions of aldosterone and other Mineralocorticoids.
v)Clinical syndromes of adrenocortical dysfunction.
- Hyper function.
- Hypo function
- Biosynthesis defects.

Lecture No.27 and 28

The Adrenal Glands: (continued)
The adrenal medulla.
i)Synthesis and storage.
ii)Metabolism of catecholamines.
iii)Regulation of adrenal medullary secretion.
iv)Actions of catecholamines.
v)Therapeutic usage and endocrine implications.
vi)Pathological secretion of catecholamines.
Pineal Gland and Thymus.

Lecture No.29 and 30

Classification of diabetes mellitus (DM); common features; chronic features of untreated DM
Risk factors, causes and pathophysiology of DM, Physiological bases of treatment.
Symptoms, diagnosis, causes, pathophysiology and management of metabolic syndrome,
Posttraumatic stress disorder (PTSD)-causes and treatments, and the role of hypothalmic-pituitary-adrenal axis (HPA axis).

25.1.3. Practicals:

Experiment 36 (Endo)
To determine fasting (FBS) and random (RBS) blood sugar levels in Rats by using spectrophotometric estimation
Experiment 37 (Endo)
To determine the basal metabolic rate (BMR) of experimental Rat.
Experiment 38 (Endo) To demonstrate the method of examination of a human subject for thyroid abnormalities. Using the illustrated charts and multimedia presentation.
Experiment 39 (Endo)
To observe the effect of exercise on blood glucose level using glucometer and treadmill.
Experiment 40 (Endo)
To observe the effect of glucocorticoids on blood glucose level of the rat by spectrophotometric estimation.
Experiment 41 (Endo)
To observe the effect of thyroxine on the blood glucose level of rats by spectrophotometric estimation.
Experiment 42 (Endo)
To perform glucose tolerance test using Rats by spectrophoto-metric estimations.

25.2. Reproductive physiology

Course	Practical	Theory	Total CH

Reproductive physiology	1	2	3

25.2.1. Objectives:

At the end of this course, students are expected to have clear knowledge of the essential elements of male and female reproductive physiology including: sex determination, sex differentiation, spermatogenesis, sperm viability, male sex hormones, ovarian structure and hormones changes from birth to menopause, female sexual cycles, ovarian and placental hormones, pregnancy, parturition and lactation, contraception, important pathophysiological correlations.

At the completion of this lecture, students are expected to be able to:
Describe the basis of genetic sex determination.
Describe the essential elements of sex differentiation of gonads, ducts, and external genitalia and brain.
Outline the hormonal control of the onset of puberty.
Outline the genetics of sex differentiation .
Describe developmental changes that accompany puberty in both sexes.
State the principal causes of precocious and delayed puberty.
Describe the functional anatomy of male primary and secondary sex organs.
State the essential elements of male gametogenesis.
Identify the roles of various accessory sex organs in spermatogenesis, sperm viability and transport.
Identify factors affecting sperms that diminish their viability and efficacy in achieving fertilization.
Explain the effects of hypo- and hypergonadism on body growth.
Describe how testosterone is secreted, transported and inactivated.
Identify the principal target organs controlled by testosterone.
Describe the functional anatomy of female primary and secondary sex organs.
Describe the changes that occur in the ovary and its hormones before birth, after birth, during adolescence and reproductive life and at the menopause.
Discuss the normal menstrual cycle, its hormonal characteristics and the sequential uterine changes that characterize the different stages.
State and explain major menstruation abnormalities.
List the main hormones secreted by the ovary and describe their functions, sites of action and feedback control.
Outline the intracellular action of estrogens and their function.
Describe the hormonal function of the mature ovarian follicle and of the corpus lutetium.
List the steps leading up to fertilization and state their normal timing and location.
Outline the hormonal and nutritive functions of the placenta, timing of its formation and decline.
Outline the physiological actions of estrogens and progesterone.
State the hormonal and mechanical factors involved in parturition.
Give a concise account of the physiology of lactation.
Perform an immunological test for diagnosis of pregnancy and interpret the results.
Give a concise account of the physiology of certain natural and artificial contraceptive methods.

b).Outcomes:
Students carrying out this course may:
Serve in teaching courses in hospital/ university and/ or other institutions related to reproductive diseases
Work for an organization/ society/ association struggling for the control reproductive diseases.
Join a job in emergency services related to reproductive programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for reproductive disorders
Serve in nutrition study programs involving care about the reproductive disorders.
Have an employment related to toxicological studies for reproductive disorders.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to reproductive disorders.
Embark in supplying biochemicals, instruments and other items related to reproductive disorders to biomedical/ biological/ health related institutions.
Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to reproductive disorders.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate reproductive diseases.
Do a job/ study in national survey/ statistical records for reproductive disorders.
Join a reproductive study in basic, clinical or research programs.
Carry out work in reproductive lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.
Get involved in further research programs leading to either PhD or clinical / applied medical specializations

Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

25.2.2. Detailed Contents:

Lecture No. 1, 2, and 3

Physiological Anatomy of Testis
Embryology and Histology of Testis
- Parenchyma of Testis
- Structure of Seminiferous Tubules

Lectures No. 4, 5,and 6
Functions of Testis
Gametogenic Function of Testis (Spermatogenesis)
- Regulation of Spermatogenesis
- Endocrine Function of Testis/Role of inhibins and activins
- Functions of Testosterone in fetal / adult life
- Regulation of Testosterone Secretion

Lectures No. 7
Effects of Extirpation of Testis :
Lecture No.8 and 9
Male Reproductive Act
- Physiological anatomy of penis
- Erection, Emission, Ejaculation, Male climacterics
- Role of PDE Inhibitors

Lecture No.10 &11
- Structure and function of Seminal Vesicles Prostate and Bulbourethral Gland

Lecture No.12
- Semen (WHO criteria for sperm count)

Lecture No.13,14 and15
Disorders of Male Reproductive System
- Hypogonadism
- Hypergonadism
- Male infertility
- Impotence
- Infections of penis and urethra

Lecture No.16
FEMALE REPRODUCTIVE SYSTEM
- Embryology of the female Reproductive system.
- Female Reproductive Organs.
- Foliculogenesis.
- Sexual life in Female (puberty)

Lecture No.17
Ovary
- Structure of ovary
- Female sex hormones (estrogen/progesterone)

Lecture No.18 &19
Menstrual Cycle
- Ovarian, uterine, vaginal and cervix changes during menstrual cycle Growth factor
- Hormonal regulation of ovarian/uterine changes during menstrual cycle
- Abnormalities associated with menstrual cycle

Lecture No.20
Ovulation
- Process of ovulation
- Determination and significance of ovulation

Lecture No.21
Menopause in Female (Climacteric)
- Cause of menopause
- Changes during menopause

Lecture No.22 &23
Disorders of Female Reproductive System
- Female Infertility
- Pelvic inflammatory disease
- Vulvar dystrophies
- Imperforate hymen
- Disorders of uterine body, uterine tubes, ovary and cervix

Lecture No.24 &25

Pregnancy
- Fertilization of ovum
- Implantation
- Sex determination
- Structural and metabolic changes, changes in physiological systems

Lecture No.26

Parturition
- Stages of parturition and mechanism of labor
- Role of hormones, uterus and cervix in parturition
- Abnormal labor

Lecture No.27 &28

Breast and Lactation
- Development of mammary glands
- Role of hormones in growth of mammary gland
- Lactation
- Disorders of breast

Lecture No.29 &30

Contraception (Fertility Control)
- Natural, Chemical and mechanical methods
- Oral contraceptives
- Intrauterine contraceptive devices
- Surgical (sterilization) methods
- Abortion

25.2.3. Practicals:

Experiment 31 (Repro)
To perform pregnancy test on a urine sample from a pregnant woman.
Experiment 32 (Repro)
To determine the chemical constituents of a given sample of milk.
Experiment 33 (Repro)
To study various phases of menstrual cycle using illustrated chart or multimedia presentation.
Experiment 34 (Repro)
To study the physiology of male reproductive system and sperm motility by using charts and multimedia presentation
Experiment 35 (Repro)
To study various Contraceptive Measures using multimedia presentation

25.3. Neuromuscular physiology

Course	Practical	Theory	Total CH
Neuromuscular physiology	1	1	2

25.3.1.Objectives:
At the end of this course, students are expected to have clear knowledge of the fundamentals of excitability, the nerve action potential and its physiological characteristics; synaptic transmission; excitation and contraction of skeletal and smooth muscles as well as neuromuscular transmission, pathophysiology of muscle cramp and impaired neuromuscular transmission.

At the completion of this lecture, students are expected to be able to:
Define resting membrane potential and recognize it as the basis of excitability.
Describe how it is demonstrated.
State the factors responsible for its genesis and maintenance and their relative importance.
State the factors which affects its value.
Draw an annotated diagram of nerve action potential and explain the ionic bases of its parts.
Distinguish between types of ion channels.
Describe, with the aid of diagrams, the propagation of action potentials in myelinated and non-myelinated nerves.
State and explain important physiological principles that govern nerve function (strength-duration relationship; all-or-none law).
Describe physiological properties of mixed nerves - velocity of impulse conduction and the compound action potential.
Describe the functional anatomy of the synapse and explain the electrical and ionic events in synaptic transmission.

Distinguish between graded - and action potentials.
Apply the principles of transmission to common neuromuscular junction disorders and clinical applications such neuromuscular relaxants in anesthesia.
Classify muscles, structurally and functionally.
Describe the structural organization of skeletal muscle from whole muscle to the level of the contractile filaments (sarcomere).
Describe the biochemical composition of skeletal muscle and state the function of the contractile and regulatory proteins.
State the sliding filament mechanism and describe the band changes that accompany shortening contractions.
Describe the cross-bridge theory of force generation and state the key biochemical reactions that occur during contraction and relaxation.
Describe, with the aid of a diagram, the process of excitation-contraction coupling.
State the electrical characteristics of skeletal muscle and contrast them with those of nerve.
Describe the major mechanical properties of skeletal muscle.
Perform an experiment with an isolated nerve-muscle preparation (dissection and technical details about equipment-not required) to demonstrate simple muscle twitch, temporal and spatial summation and fatigue.
Relate the above mechanical properties to in-vivo situations.
Describe the length-tension relationship at sarcomere and whole muscle levels and load-velocity relationship and relate both to in-vivo situations.
Distinguish between isometric, isotonic and lengthening contractions and apply them to in-vivo situations.
State the principal lever actions of muscles.
State & explain the factors responsible for the level of force production in- vivo.
State the pathophysiology of muscle cramps.
Draw an annotated diagram of the neuromuscular junction and describe the process of neuromuscular transmission.
State the pathophysiological bases of impaired neuromuscular transmission with myaesthenia gravis as an example.
Outline the sources, use and output of energy during skeletal muscle contraction.
Classify smooth muscle.
Describe the structure and functional characteristics of visceral smooth muscle and compare them with those of skeletal muscle.
Draw an annotated diagram of the skin.
State the protective, sensory , secretory , &absorptive functions of the skin
State the role of the skin in the regulation of body temperature.

b).Outcomes:
Students carrying out this course may:
Serve in teaching courses in hospital/ university and/ or other institutions related to muscular and neuromuscular diseases
Work for an organization/ society/ association struggling for the control of muscular and neuromuscular diseases.
Join a job in emergency services related to muscular and neuromuscular programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for muscular and neuromuscular disorders
Serve in nutrition study programs involving care about the muscular and neuromuscular disorders.
Have an employment related to toxicological studies for muscular and neuromuscular disorders.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to muscular and neuromuscular disorders.
Embark in supplying biochemicals, instruments and other items related to muscular and neuromuscular disorders to biomedical/ biological/ health related institutions.
Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to muscular and neuromuscular disorders.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate muscular and neuromuscular diseases.
Do a job/ study in national survey/ statistical records for muscular and neuromuscular disorders.
Join a muscular and neuromuscular study in basic, clinical or research programs.
Carry out work in muscular and neuromuscular lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.
Get involved in further research programs leading to either PhD or clinical / applied medical specializations
Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

25.3.2.Detailed Contents:

Lecture No. 1

Membrane potentials of excitable cells; ionic bases.
Genesis and maintenance of nerve membrane potential.
Action potentials, nerve action potential, ionic bases of excitation and conduction, ion channels, physiological characteristic of nerve function.

Lecture No. 2 &3
Muscle mass ,muscle fiber, Myofibril, Sarcomere.
Lecture No. 4&5
Actin/ Myosin molecules.
Tropomyosin/Troponin Molecules
Lecture No. 6
Sarcotubular System
Lecture No. 7
Properties of Skeletal Muscles and Muscle Tone
Lecture No. 8
Electro-mechanical, Physical, Chemical and Thermal changes during muscular contraction .
Lecture No. 9
Structure of Neuromuscular Junction .
Lecture No. 10
Neuromuscular Transmission.
Release and mode of action and fate of Acetylcholine
End Plate and Miniature End Plate potential
Neuromuscular Blockers
Motor Unit
Lecture No. 11
Disorders of Skeletal Muscles.
Lecture No. 12
Smooth Muscles .
Structure of smooth muscle
Types of smooth muscle fibers
Electrical activity, contractile process, and nerve supply to smooth muscle
Neuromuscular junction of smooth muscle
Lecture No. 13&14
Disorders of Smooth Muscle, Electromyography and Muscles Endurance .
Lecture No. 15
Physiology of the skin.
Histolologic structural consideration.
Skin appendages .
General function of the skin.
Physiology of the skin.(continued)
Protective functions.
Sensory functions.
Role of the skin in the regulation of body temperature.
Secretory functions .
Absorptive functions.

25.3.3.Practicals:

Experiment 43
To observe neuromuscular junction, excitation-contraction coupling and sliding of myofilaments that occurs during muscle contraction by using multimedia presentation and charts.
Experiment 44
To demonstrate the kymographic recordings for the following phenomena using frog's isolated sciatic nerve-gastrocnemius muscle preparation
a. Simple muscle twitch, b.Tetanus, c. Fatigue
Experiment 45
To demonstrate muscle tone, tension, isometric and isotonic contraction in human subject by using simple & noninvasive methods
Experiment 46
To observe changes in motor unit recruitment upon different degrees of voluntary contraction of biceps muscle by using the technique of electromyography

25.4. Neurophysiology

Course	Practical	Theory	Total CH

Neurophysiology	1	3	4

25.4.1. Objectives:

At the completion of this course, students should be able to:

List and describe the structural components of a synapse.
Know the difference between electrical and chemical transmission.
Describe the mechanism of conduction of an action potential across a chemical synapse.
Describe the types, ionic basis and characteristics of local events at the synapse.
Identify and describe examples of neurotransmitter of the four chemical classes.
Describe the functional importance of chemical synapses.
Define sensation.
Describe the importance of sensation to man.
List the different types of sensation.
Describe the components of the sensory pathway.
Identify the structure of receptors and their role in transduction.
Describe how the nature, location and intensity of stimuli are coded in the sensory system.
Describe the dorsal column and spinothalamic components of cutaneous sensation and their functional importance.
Describe cutaneous sensation from the skin through the spinal cord to the sensory cortex.
Define pain and identify the stimuli that cause it.
Describe the nature and characteristics of pain receptors.
Describe the transmission of pain to the spinal cord and to the sensory cortex.
Describe the principles of pain modulation as occurs in the spinal cord-especially roles of collaterals &from dorsal column and descending projections.
Identify the characteristics of visceral pain and the concept of referred pain.
Describe the physiological basis of pain relief.
Identify the major divisions of the cerebral cortex.
Appreciate the importance of the cerebral cortex to man and clinical application.
Describe the sensory and motor functions of the cortex. for each function, attention must be paid to the characteristics and main areas.
Discuss the integrated or association functions of the cerebral cortex, e.g. stereognosis.
Describe the importance of the cerebral cortex in speech.
Identify the role of the cerebral cortex in memory.
Identify the role of the cerebral cortex in consciousness and understand the basis of EEG its application.
Describe the concept of cerebral dominance and localization of function.
Apply the above mentioned principles to understand cortical function in disease.
Describe the importance of the motor system as an effector system.
List the different types of motor neurons in the spinal cord and their function.
Define motor unit and know the types of motor units in relation to function of muscles.
Describe final common pathway and its importance in the motor system.
Identify the afferents in muscle, i.e. muscle spindle and tendon organ with regard to:

- Structure and innervation.
- Connection to the nervous system.
- Importance.

Define muscle tone and its functional importance.
Define reflex, know the components of the reflex arc, and the functional importance of reflexes.
Identify the descending motor projections from the motor cortex and brain stem and their importance.
Identify the concept of upper motor neuron & lower motor neuron, their functional importance and to be able to differentiate between upper motor and lower motor neuron lesions.
Identify the difference and the regulation of voluntary and postural movements.
Explain the functional disturbance in spinal cord lesions.
Describe the functional organization of the Basal ganglia and the major afferent and efferent connections.
Describe the main findings in basal ganglia lesions, e.g. Parkinson's disease.
Summarize the functions of the basal ganglia.
Identify the functional organization of the cerebellar cortex and deep nuclei.
Describe the role of the cerebellum in co-ordination of voluntary movement and postural control.
Be able to use physiological principles of cerebellar function to explain the presentation of cerebellar disorders.
Identify the functional importance of the hypothalamus.
Describe the importance of the hypothalamus to the endocrine system, feeding, water balance, etc.
Identify the principles of thermoregulation, the role of the hypothalamus and to apply the above principles to the diagnosis and management of thermoregulatory disorders such as heat stroke.
Identify the major subdivisions of the autonomic nervous system – sympathetic & parasympathetic divisions.
Identify the functional importance of each division.
Name and describe some major autonomic reflexes such as defecation, micturition , papillary reflexes.

Revise the sources of blood supply to the brain.
Appreciate the importance of cerebral circulation to neural function and the effect of decreased blood flow to function.
Identify the importance of glucose and O_2 in cerebral metabolism and the clinical applications.
Describe the regulation of cerebral circulation.
Identify and describe, the formation, composition, circulation, drainage function, clinical applications of CSF.
Describe the concept of blood-brain, brain - CSF barriers, clinical importance.
Appreciate the effect of raised intracranial pressure on function, blood pressure, BP and pulse.
Identify and appreciate various methods used in clinical examination of head; Physical, neurological, Neuropsychological and clinical tests.
Describe different types of headaches and identify their relation with different type of brain tumors.
Identify the various types of brain vascular disorders.
Know about psychological functions of brain and their disorders.
Be familiar with such psychological Problems as emotional disorders, hallucinations and delusions, psychosis and their treatment.
Describe sleep as an active and rhythmic neural process, its daily requirements and phylogeny, types of sleep and neural mechanism of sleep-awake cycle.
Identify the brain parts involved in sleep e.g. RAS, Raphe nuclei, and nucleus of solitary tract, supra charismatic nucleus and neurotransmitters involved in sleep.
Learn about psychophysiology of dreaming, its intensity gradient and control, passage of time in dreams and erection cycles during sleep.
Apply above principles to the neural examination, assessment and pathophysiology of the common neuropsychological disorders for presentation.
Define insomnia and identify it as a symptom and not disease.
Describe disruption of sleep with aging, psychophysiology of disrupted sleep and effect of medication on sleep.
Identify the effects of dreaming, night terror, nightmares and terrifying dreams on human behavior.
Describe the concept of Narcolepsy, sleep apnea , hyposomnia and cerebral blood flow, due to infratentorial and supratentorial lesions, metabolic coma and determination of cerebral death.
Identify the elementary forms of learning (non-associative).
Differentiate between conditioned and unconditioned stimuli and learning, learning of predictive relationship.
Appreciate behavior and environmental events as operant conditioning.
Be familiar with conditioning as a therapeutic technique; classical and systematic desensitization, operant conditioning and behavioral problems.
Define memory and its two main types.
Be familiar with reflexive or declarative learning and memory.
Describe the neural basis of memory: memory stages, long-term memory and plastic changes in the brain, localization of memory traces, reflexive and declarative memories and neural limits.

b).Outcomes:

Students carrying out this course may:

Serve in teaching courses in hospital/ university and/ or other institutions related neurological diseases
Work for an organization/ society/ association struggling for the control of neurological diseases.
Join a job in emergency services related to neurological programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for neurological disorders
Serve in nutrition study programs involving care about the neurological disorders.
Have an employment related to toxicological studies for neurological disorders.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to neurological disorders.
Embark in supplying biochemicals, instruments and other items related to neurological disorders to biomedical/ biological/ health related institutions.
Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to neurological disorders.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate neurological diseases.
Do a job/ study in national survey/ statistical records for neurological disorders.
Join a neurological study in basic, clinical or research programs.
Carry out work in neurological lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.
Get involved in further research programs leading to either PhD or clinical / applied medical specializations
Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

25.4.2. Detailed content:

Lecture No. 1, 2, &3

Neurons

Properties of neurons
Cell bodies
Axons and dendrites
The nerve impulse (Action Potential)
Types of nerves
The synapse and neurotransmission

Lecture No. 4, 5, 6, &7

Neuroglia, Receptors, Synapse
Reflex activity, Type of reflexes, pathological reflexes
Membranes covering the brain and spinal cord (The Meninges)
Ventricles of brain and the Cerebrospinal fluid

Lecture No. 8, 9, &10

Pathophysiology of Central Nervous System

Pyogenic and viral infections
Creutzfeldt-Jakob disease
Myalgic encephalitis

Lecture No. 11,12,13&14

Brain

Blood supply to brain (Blood Brain Barrier)
Cerebrum including Basal Ganglia, Thalamus, Hypothalamus, Internal Capsule
Brain Stem (Medulla Oblongata, Pons, Mid Brain)
Cerebellum, posture and equilibrium

Lecture No. 15, 16,17 &18

Disorders of Brain

Increased intracranial pressure
Cerebral edema
Hydrocephalus
Acceleration/deceleration injuries
Cerebral hypoxia
Stroke
Dementia
Parkinson's disease

Lecture No. 19, 20,21&22

Spinal Cord

Gray matter
White matter
Spinal Tracts
Hemisection of Spinal Cord
Tran section of Spinal Cord (Spinal Shock)

Lecture No. 23,24, &25

Disorders of Spinal Cord

Motor neurons lesions
Sensory neurons lesions
Mixed motor and sensory conditions
Demyelinating disease(Multiple sclerosis, acute disseminating encephalomyelitis)
Phenylketonuria

Lecture No. 26,27,&28

Peripheral Nervous System

Cranial nerves
Spinal nerves

Lecture No. 2 9, &30

Disorders of Peripheral Nervous System

Neuropathies
Neuritis

Lecture No. 31, &32

Autonomic Nervous System

Sympathetic nervous system
Parasympathetic nervous system

Lecture No. 33,&34

Functions of Autonomic Nervous System

Effects of autonomic stimulation
Afferent impulses from viscera

Lecture No. 35, &36
Response of Nervous Tissue to Injury

Neuron damage
Neuron regeneration
Neuroglia damage
Neurotoxicity

Lecture No. 37, & 38
Physiology of Sleep

Lecture No. 39,40,41,&42
Higher Intellectual Functions

Learning
Memory
Conditioned reflexes
Speech

Lecture No. 43,44, &45
Physiology of Pain

Components of Pain
Pathway of Pain Sensation
Visceral Pain
Referred Pain
Neurotransmitters involved in Pain
Control of Pain Sensation

25.4.3. Practicals:

Experiment 47 (Neuro)
To examine sensory system in patients of peripheral neuropathy
Experiment 48 (Neuro)
To examine motor system in patients with hemiplegia
Experiment 49 (Neuro)
To examine superficial reflexes in patients with upper motor neuron lesion
Experiment 50 (Neuro)
To examine deep reflexes in patients with lower motor neuron lesion
Experiment 51 (Neuro)
To perform cerebeller examination in patients with ataxia
Experiment 52 (Neuro)
To examine facial (7^{th} cranial) nerve in patients with Bell's palsy
Experiment 53 (Neuro)
To perform neurological examination in patients with meningitis
Experiment 54 (Neuro)
To understand the effect of myelin and axon diameter on nerve action potential (conduction velocity, amplitude of action potential) by using simulation physiology lab & multimedia.

25.5. Special senses

Course	Practical	Theory	Total CH
Special senses	1	1	2

25.5.1.Objectives:

At the completion of this course, students should be able to:
Identify the functions of the eye.
Identify the functional importance of the various layers and structures in the eye.

Revise the principles of optics as applied to the eye and use these to understand the mechanism of the errors of refraction and their management.
Identify the structure of the retina, the location of the rods and cones.
Describe the mechanism of vision and colour vision.
Understand the concept of accommodation and adaptation to light.
Identify the visual pathway, visual fields and visual reflexes and their clinical importance.
Describe the importance of both smooth and skeletal muscles to function of the eye.
Understand the above mentioned principles to explain various aspects of vision.
List the main functions of the ear.
Describe the functional importance of the external middle and inner ear.
Identify the principles of sound as applicable to hearing.
Describe the role of various parts of the ear in hearing.
Identify the structure and function of the organ of Corti.
Trace the auditory pathway to the direction of sound.
Describe how one is able to localize the direction of sound.
Apply above principles to understand the disorders - e.g. deafness and how to examine for hearing.
Identify the structure of the vestibular receptors, and their function.
Discuss the physiology of posture, with emphasis on the efferents, integration and efferent control.
Understand the presentation of vestibular disorders, e.g. nystagmus, ataxia etc.
Identify the functional significance of the system.

b).Outcomes:
Students carrying out this course may:
Serve in teaching courses in hospital/ university and/ or other institutions related to special senses diseases
Work for an organization/ society/ association struggling for the control special senses diseases.
Join a job in emergency services related to special senses programs.
Join a pharmaceutical company manufacturing/ supplying drugs/ chemicals/ biochemicals etc for special senses disorders
Serve in nutrition study programs involving care about the special senses disorders.
Have an employment related to toxicological studies for special senses disorders.
Involve in cybernetics/ bioelectronics and such other programs for manufacturing instruments related to special senses disorders.
Embark in supplying biochemicals, instruments and other items related to special senses disorders to biomedical/ biological/ health related institutions.
Start his/ her own business for manufacturing biochemicals/ instruments required to various institutions related to special senses disorders.
Work in publication companies/ media or establishing his/ her own publication setups for the mission to eradicate special senses diseases.
Do a job/ study in national survey/ statistical records for special senses disorders.
Join a special senses study in basic, clinical or research programs.
Carry out work in special senses lab in related institutions.
Work as a technician if not interested for further training/ studies
Serve in a biological, biomedical and / or health related institutions.
Work in a medical/ applied medical/ biomedical/ research laboratory.
Get involved in further research programs leading to either PhD or clinical / applied medical specializations
Enter in a society/ organization involved in environmental Physiology/ health studies projects/ or jobs

25.5.2. Contents:

Lectures 1, 2
Physiological Anatomy of Human Eye
- Orbital cavity
- Conjunctiva
- Lacrimal gland
- Eyeball (Layers)
- Fundus Oculi
- Intraocular Fluid/Pressure
- Structure of Lens
- Ocular Muscles and their movement

Lecture 3, 4
Visual Process, chemical and electrical basis of Visual Process
- Neural basis of Visual Process
- Structure and function of Rods and Cones
- Rhodopsin, Phototransduction, Photosensitive pigments in Cones
- Light and Dark Adaptation
- Night Blindness

Acuity of Vision
Visual Acuity diagnostic Tests

Lectures 5, 6
Field of Vision
Binocular and Monocular Vision
Visual field and Retina
Blind Spot, Diplopia
Lecture 7
Pupillary Reflexes
Direct and indirect Light reflexes
Pathway for light reflex
Ciliospinal reflex
Mechanism, pathway, range and amplitude of accommodation reflex
Lecture 8
Color Vision
Visual spectrum and Spectral colors
Theories of Color Vision
Simultaneous and Successive Contrast
Positive and Negative After Image
Color Blindness
Lecture 9
Errors of Refraction
Ametropia
Myopia
Hypermetropia
Anisometropia
Astigmatism
Presbiopia
Cataract
Contact lens
Lecture 10
Physiological anatomy of Human Ear
External Ear
Auricle, External Auditory Meatus
Middle Ear
Tympanic Cavity/Membrane
Auditory Ossicles
Auditory Tube
Internal Ear
Cochlea
Compartments of Spinal Canal
Organ OF Corti
Lecture 11
Auditory Pathway
Auditory receptors
First, Second, Third Order Neurons
Cortical Auditory centers and their functions
Lecture 12
Mechanism of Hearing
Role of Tympanic membrane, Ossicles and Eustachian tube in auditory conduction
Cochlear microphonic and endolymphatic potential
Action potential in auditory nerve fibers
Appreciation of loudness of sound and localization of sound
Lecture 13
Auditory defects
Types and causes of auditory defects
Conduction and nerve deafness
Rinne's and Weber's test
Audiometry
Lecture 14
PHYSIOLOGY OF GUSTATION (SENSATION OF TASTE)
Situation and structure of taste buds
Neural basis of Taste pathway
Mechanism of stimulation of taste receptors

Discrimination of different taste sensations
Generator potential
Abnormalities of taste sensation including Ageusia, Hypogeusia, Dysgeusia, Taste blindness

Lecture 15

PHYSIOLOGY OF OLFACTION (SENSATION OF SMELL)

Olfactory receptors
Neural basis of olfactory pathway
Generator potential in olfactory receptor
Classification of odor
Threshold of olfactory sensation and adaptation
Abnormalities of olfactory sensation including Anosmia, Hypo and Hyperosmia.

25.5.3. Practicals:

Experiment 55 (Sp. senses)
To examine a case with defective hearing
Experiment 56 (Sp. Senses)
To examine occulomotor (3rd cranial) nerve in patients with ptosis
Experiment 57 (Sp. Senses)
To examine visual acuity in patients with myopia and hyperopia
Experiment 58 (Sp.Senses)
To Determine accommodation power, color vision, blind spot, visual field and diplopia in human eye

26. Detailed Physiology courses- Semester 3

26.1. Contemporary physiology

Course	Practical	Theory	Total CH
Contemporary physiology	0	3	3

26.1.1. Objectives:

This course aims the students to provide with the most recent information of body functions either published in form of research articles or available in the latest editions of the world class established physiology books with specific reference to:

- Molecular and cell physiology
- Body fluids and homeostasis
- Blood and Cardio-pulmonary physiology
- Gastro-intestinal and Renal (including acid-Base) physiology
- Endocrine and Reproductive physiology
- Muscular and Neurophysiology

One specific topic having high significance in Advanced Human Physiology will be selected to be taught in Semester-3 (e.g. Membrane Biology, Aging, Neuroeducation, Apoptosis, Stem Cell Technology, Molecular Immunophysiology, Radiobiology, Molecular Biology, Reproductive Technology, Psychoneuroimmuology, Bioinformatics (Computational Physiology), Psychophysiology, Biotechnology, Nanobiotechnology etc etc).

26.2. Biostatistics

Course	Practical	Theory	Total CH	Duration(weeks)
Biostatistics			2	Long.

This course will be taught by experts in the field (from other departments in the faculty and university) and will be covered according the research topics given to the students for their research project/ and writing manuscripts later on.

26.2.1.Objectives:

At the completion of this course, students should be able to:

Identify basic definition and concepts in biostatistics
Describe the different types of measurements and scales
Describe grouping data, and frequency distribution
Compute measures of central tendency (mean, median, mode, percentiles)
Compute measure of dispersion (range, variance, standard deviation)
Identify bias, and randomness of sample selection
Apply the concept of estimation, point and interval estimates, precision, error, and accuracy in interpreting the results of measurements.
Conduct hypothesis testing for, means,
Compare paired data, and find p-values with interpretation and conclusions.
Conduct hypothesis testing for proportions
Conduct hypothesis testing for variance, and ratio of variances.
Understand the ideas behind significance tests
Compute confidence intervals for means
Compute confidence intervals for proportions
Compute confidence intervals for variance, and ratio of variances
Compute confidence intervals for ratio of variances
Compute the power of a test, and control type II error by determining appropriate sample size
Identify ANOVA technique
Describe the randomized complete block design
Describe the repeated measures design, and the factorial experiment
Describe linear regression
Understand the meaning of correlation
Compute the strength of relationships between variables using correlation coefficient, and describe multiple regressions
Perform chi-square statistics for analysing categorical data
Apply nonparametric tests on classification and ranked data
Compute the relative risk and odds ratio and their interpretations
Describe logistic regression
Compare survival of two groups, and assess results and predictors of survival
Perform different statistical tests using a statistical software package
Calculate descriptive statistics and other statistical tests using Excell program

26.2.2.Contents:

Lecture 1:
Introduction to biostatistics, some basic concepts
Lecture 2:
Types of results: counts, measurements, and measurement scales
Lecture3:
The normal distribution, grouped data and frequency distribution
Lecture 4:
Descriptive statistics: measures of central tendency (mean, median, mode, percentiles)
Lecture 5:
Descriptive statistics: measure of dispersion (range, variance, standard deviation)
Lecture 6:
Fairness in sampling, bias, and randomness
Lecture 7:
Estimation: point and interval estimates, choosing an appropriate estimator
Lecture 8:
Hypothesis testing for a single and two population means
Lecture 9:
Paired comparisons
Lecture 10:
Hypothesis testing for a single and two population proportions
Lecture 11:
Hypothesis testing for a single variance and a ratio of two variances
Lecture 12:
Ideas behind significance tests
Lecture 13:
Confidence intervals for the difference between means

Lecture 14:
Confidence intervals for the difference between proportions
Lecture 15:
Confidence intervals for the variance of a normally distributed population
Lecture 16:
Confidence intervals for the ratio of variance of two normally distributed populations
Lecture 17:
Power of a test and type II error, determining sample size to control type II error
Lecture 18:
Analysis of variance (ANOVA): the completely randomized design
Lecture 19:
The randomized complete block design
Lecture 20:
The repeated measures design, the factorial experiment
Lecture 21:
Linear regression
Lecture 22:
What correlation means
Lecture 23:
Correlation and multiple regressions
Lecture 24:
Chi-square distribution and Chi-squared tests
Lecture 25:
Nonparametric tests
Lecture 26:
Relative risk and odds ratio
Lecture 27:
Logistic regression
Lecture 28:
Survival analysis
Lecture 29:
Demonstration of how to run statistical analysis in a statistical software package
Lecture 30:
Excel program and its statistical applications.

26.3. Research methodology

Course	Practical	Theory	Total CH	Duration(weeks)
Research methodology			3	Long.

26.3.1.Objectives:

At the completion of this course, students should be able to:

Identify the concept of research and how knowledge is acquired
Perform a literature review, systematic examination and interpretation of the literature
Select an appropriate research topic, define selection criteria, and identify published data
Formulate a research hypothesis
Explain the importance of the research topic. Write a budget plan, and develop a time schedule to achieve the project.
Construct experimental designs, and identify when to use quasi-experimental design.
Explain the very important concepts of control in conducting experimental research.
Identify internal and external validity concepts.
Identify phase II, phase III trials, and the randomized controlled study as a tool to test efficacy of intervention against a controlled condition.
Identify various sources of data and methods of data collection
Identify the various factors involved in surveys
Set up questionnaire designs and questions
Test reliability or consistency of questionnaires using repeated testing, parallel-form, and split-half methods, as well as performing Kappa statistics using statistical software.
Identify sampling technique and randomness
Understand the choice of measurement scale, and design measurements to be relatively free of random error (precise) and free of systemic error (accurate)

Determine of a sample size
Design various types of cohort studies
Design cross-sectional and case-control studies
Discuss observational studies and avoid false association that occur due to chance, bias, and confounding factors
Design a randomised blinded trial
Determine whether a test is useful, reproducibility, accuracy, feasibility, costs, and risks
Identify advantages and disadvantages of using existing data
Use qualitative research methods for descriptive data
Evaluate a research to determine if a program's goals and objectives have been achieved
Recognize measures of disease frequency (the ratio, proportion, rates, incidence, prevalence and absolute risk)
Recognize absolute and relative health indicators (indices): morbidity rates, mortality rates, measures of morbidity, and properties of an ideal index
Identify concept of screening, types of diseases appropriate for screening, and criteria for screening test, sensitivity and specificity of screening test
Identify the importance of community and international research, to establish a collaboration, in spite of, challenges of distance, culture differences and funding constraints
Know how to present data, prepare figures, and tables
Write a plan of a research project that specifies the theory to be tested, the necessary observable data and how data will be collected, and analyzed.

26.3.2. Contents:

Lecture 1:
Introduction to concept of research
Lecture 2:
Conducting a literature review
Lecture 3
Selecting a research topic
Lecture 4:
How to formulate a viable research question
Lecture 5:
Significance and justification of the research, budget consideration, and time schedule
Lecture 6:
Conducting experimental and quasi-experimental research
Lecture 7:
Control in experiments
Lecture 8:
Internal and external validity
Lecture 9:
The randomized controlled trial
Lecture 10:
Types of variables
Lecture 11:
Sources of data and data collection
Lecture 12:
Survey: characteristics, flow plan, and design
Lecture 13:
Questionnaire design and construction, and reliability testing
Lecture 14:
Sampling techniques
Lecture 15:
Planning the measurement: precision and accuracy
Lecture 16:
Sample size
Lecture 17:
Designing a cohort study: prospective cohort, retrospective cohort, case-cohort, and multiple cohort studies
Lecture 18:
Designing cross-sectional and case-control studies
Lecture 19:
Enhancing causal inference in observational studies
Lecture 20:
Designing a randomised blinded trial
Lecture 21:

Designing studies of diagnostic tests
Lecture 22:
Utilizing existing data bases
Lecture 23:
Qualitative research methods
Lecture 24:
Evaluation research
Lecture 25:
Measurement of disease frequency
Lecture 26:
Health indicators
Lecture 27:
Screening
Lecture 28:
Community and international studies
Lecture 29:
Techniques for data presentation
Lecture 30:
Writing a research proposal

26.4. Ethics

Course	Practical	Theory	Total CH	Duration(weeks)
Ethics			1	Long.

26.4.1.Objectives:

At the completion of this course, students should be able to:

Identify a historical background on the emerging of values related to scientific research
Describe where ethical principles are translated into responsible actions of individual scientists and the social implications of research
Describe ethical rules for author, reviewer, science writer, and a acknowledgement
Identify scientific misconduct, plagiarism, fraud, and scientific integrity
Describe rules of publication ethics and authorship
Understand the correct management of research data. Prepare a set of guidelines relevant to the handling of data, and determine the area of responsibility of the researcher
Identify the proper management of the fund, and comply with funding agency laws, rules, and policies
Describe what the intellectual property encompasses, and its basic types, and know to comply with University policies that relate to intellectual property
Describe the circumstances in which conflict of interest might occur in research. State the relationships that require disclosure
Identify safety considerations associated with experimental research, and apply guidelines on use of biological or chemical hazards in research
List the principles that must be adhered to in conducting research on animals. Prepare an application for use of animal subjects in research that meets criteria for Um Alqura University approval
List basic principles on the use of human subjects in research. Describe mechanisms for accountability and enforcement. Develop a research University approval. Identify vulnerable subjects who are covered by special rules
Define mentoring, and the responsibilities of a mentor and a mentee.
Identify the roles and responsibilities of Ethics committees
Prescribe research ethics from the Islamic view

26.4.2.Contents:

Lecture 1: proposal and consent forms that meet the basic criteria for Um Alqura
History and values relating to research and scholarship
Lecture 2:
Social responsibility, scientific integrity and ethical misconduct
Lecture 3:
Ethics for author, editor, reviewer, acknowledgement, and science writer

Lecture 4:
Plagiarism, omitting citation, and violation of accepted research practices
Lecture 5:
Ethics for publication/printing, copyright, redundant publication, and scientific advertisement
Lecture 6:
Research data management: the responsible collection, retention, sharing, and interpretation of data
Lecture 7:
Proper fund management and the good compliance with funding agency laws, roles, and policies
Lecture 8:
Ethics of Intellectual property
Lecture 9:
Conflict of interest and commitment
Lecture 10:
Environmental health and safety
Lecture 11:
Animal subjects
Lecture 12:
Human subjects
Lecture 13:
Mentor/trainee responsibilities
Lecture 14:
Responsibilities of Research Ethics Committees
Lecture 15:
Research ethics from Islamic prospective

26.5. Learning/Instructional methods

Course	Practical	Theory	Total CH	Duration(weeks)
Learning/Instructional methods			2	Long.

26.5.1. Objectives:

Identify assessment concepts and ideas.
Identify students, staff, and program evaluation.
Describe goals of assessment, standards, and valuate student learning outcomes.
Describe the major learning theories, and explain the differences between them
Describe what to learn and how to learn, and the best environment to achieve learning outcomes. Describe the content and its organization sequence, and decide educational strategies to be adopted
Decide the teaching methods to be used, prepare assessment of students' progress and of the teaching program, and manage the curriculum.
Define objectives of the undergraduate program, specify the core content, decide the modes of delivery, assessment, and plan to evaluate the curriculum prospectively.
Identify characteristics of post-graduate education; recognize the role of trainer and interactive supervision and evidence-based postgraduate education.
Describe the special considerations in training, the rule of trainer, and interactive supervision
Prescribe steps to make continuing professional development more effective
Describe the clear role and structure of the lecture, define aims and objectives with an explicit lesson plan, use of visual or technical resources
Describe the reasons and the advantages of using small-group education; evaluate and assess small-group work at the level of group and at the level of its individual members.
Identify the importance of distance education, and keep up to date with new techniques, describe the key areas in distance learning
Describe the application, planning, benefits and pitfalls of student tutor or peer-assisted learning
Define out-come based curriculum, and what the students should get from the course, implement design assessment methods to explore how learning improved student performance.
Decide how much time allocated for self-learning in the curriculum, protect time for self-learning in the timetable, and provide appropriate learning resources
Use problem-based learning, and describe characteristics of an effective PBL group
Describe the concept of integration of learning across the disciplines of medical courses, and describe Horizontal and vertical integration
Identify core curriculum planning, contents and outcomes, and promote active involvement of students in their own education

Describe instruction design; consider the outcomes to be achieved in terms of concepts and principles, and the tasks in terms of steps or stages. Identify innovative instructional methods, multimedia, mind map, etc.
Describe the schema approach as an alternative framework for building on existing knowledge and check that the new knowledge is constructed as intended.
Prepare study guides, and describe the beneficial role of study guides
Identify uses of virtual learning environments (VLEs)
Describe advantages, disadvantages, rules, and regulation of VLEs
Identify the simulation-based medical education (SBM) modalities, applications, and its benefits and rationale, and strategies related to it
Identify E-learning, the on-line delivery of course content, content development, online tutoring or mentoring, bulletin boards, and the management of e-learning.
Recognize that students need to grasp the concepts and principles, identify that learning is interactive, exciting and in context. Understand the traditional and modern approaches
Communicate with students, colleagues, and staff. Select and operate the most appropriate communication method for a given task. Use effective teaching methods.
Describe how students can be supported, and the areas needed support, know how to organize a tutor scheme.
Build study skills, identify resources for study, learning style, different approaches of learning, review and assessment of learning, and promote desirable learning habits.
Describe the role of educational leadership to improve student learning. Use staff development programs and activities to promote organizational change
Describe standards for teaching and scholarship, and criteria for scholarly teaching, select appropriate methods relative to goals, develop a vision and strategy for change
Describe quality assurance procedures and accreditation process as tools to improve the quality of higher education

26.5.2. Contents:

Lecture 1:
Overview of learning theories

Lecture 2:
Curriculum development: what is a curriculum, identifying the need, establishing the learning outcomes, agreeing and organising the content, deciding the educational strategy

Lecture 3:
Deciding the teaching methods, preparing the assessment, communication about the curriculum, promoting an appropriate educational environment, managing the curriculum

Lecture 4:
The undergraduate curriculum: defining the content, delivery of the curriculum, assessment,
Curriculum structure, evaluation, and who should plan the curriculum?

Lecture 5:
The post-graduate curriculum: career paths, characteristics of post-graduate education, process of learning, nuts and bolts of the post-graduate curriculum, consolidation of core competencies, and capabilities

Lecture 6:
Special considerations in training, monitoring and evaluation of training programmes, exit outcomes, collaborative curricula

Lecture 7:
Effective continuing professional development: know the audience, know the topic, know the format, know the outcome.

Lecture 8:
Lecture: lectures role, content, components, duration, and format, Presentation, resources, challenges, and feedback

Lecture 9:
Learning in small groups: what is a small group, why small groups, what kind of small-group session, role of the tutor, requirements of a tutor, role of the student, assessment, evaluation, development, and tutor support

Lecture 10:
Distance education: why distance education, the educational approach, the component of distance education

Lecture 11:
Peer-assisted learning (PAL): historical and educational background, advantages of PAL, concerns about PAL, what is involved in a PAL program? how can PAL be used in medical education? When to start when considering a PAL program?

Lecture 12:
Educational strategies: outcome-based curriculum, evaluating outcomes

Lecture 13:
Self-learning: what is independent or self-learning, the importance of independent learning?
trends in independent learning.

Lecture 14:
Problem-based learning (PBL): frameworks and sequences for PBL, characteristics of an effective PBL group, staff development, group dynamics, tutor's role in assessment, evaluating PBL tutorials

Lecture 15:
Integrated learning: types of integration in medical education, the rationale for integrated learning, approaches to integration, achieving integration in medical education

Lecture 16:
Core-curriculum and student-selected components: interrelationship between the core curriculum and student-selected components, the core curriculum, student-selected components

Lecture 17:
Instructional design and innovative instructional methods: learning outcomes, topic and task analysis, creating the conditions for learning, multimedia, mind map, and innovative methods

Lecture 18:
An alternative approach: the schema model and instructional design

Lecture 19:
Study guides: why use study guides, roles for study guides, preparing a study guide

Lecture 20:
Virtual learning environments: managed learning environments, VLE modalitites: on-campus courses and distance courses, participant roles in VLEs, supporting courses with VLes

Lecture 21:
Object orientation and adaptability, security, authentication, interoperability and sharing and identity, rules, regulation and policing of VLE

Lecture 22:
Simulators and simulation-based medical education (SBME): SBME modalities, driving forces of medical simulation, SBME applications, benefits and rationale of simulation

Lecture 23:
E-learning: what is e-learning, myths about e-learning, content development, managing e-learning

Lecture 24:
Curriculum themes: Basic and clinical science, the traditional approach, the modern approach

Lecture 25:
Communication skills: what are communication skills, communication model, How to teach communication skills, prepare for delivering the experience, explain theoretical material, and provide experience

Lecture 26:
Student support: why student support is necessary, how can students be supported, how to organize a tutor scheme

Lecture 27:
Study skills: study plan, resources for study, learning style, review of learning, assessment of learning

Lecture 28:
Educational leadership and staff development: the key to academic improvement, common practices and challenges, designing a staff development program

Lecture 29:
Academic standard: standards for teaching in medical schools, professionalising teaching, broadening the definition of scholarship, criteria for scholarly teaching, assessing scholarly teaching, institutional support for scholarly teaching, the change process and the scholarship of teaching, adaptive leadership for scholarly teaching

Lecture 30:
Quality Assurance and Accreditation: institutional accreditation, assessment, audit, benchmark, certification, competencies, credits, performance criteria, educational effectiveness and efficiency, evaluation, licensing, student learning Outcomes assessment, external review, qualification. External quality assessment, internal quality control, quality management, stages of quality assurance, quality audit: culture and planning.

26.6. Assessment and evaluation

Course	Practical	Theory	Total CH	Duration(weeks)
Assessment and evaluation			1	Long.

26.6.1.Objectives:

Identify assessment concepts and ideas
Describe assessment plan and assessment of achievements and curriculum objectives
Describe skills assessment and behavior assessment
Identify students, staff, and program evaluation
Identify purpose of evaluation: motivation, promotion, certificate & licensing, and protection of community
Perform and choose the best assessment instrument, assess validity, reliability, and feasibility.
Describe principles of assessment, describe formative and summative assessments, describe progress and mastery testing, use global rating scales, and perform student-self assessment.
Describe the various written question formats and when to use and when not to use.

Set a performance assessment examination; develop cases with checklists and rating scales, recruiting and training examiners and standardized subjects.
Describe self-assessment methods
Implement portfolio-based learning and assessment, and describe advantages and disadvantages of portfolio assessment
Describe peer coaching, and peer evaluation
Identify student feedback as a guide to improvement
Describe continuous assessment, classroom assessment and evidence based assessment
Describe goals of assessment, standards, and valuate student learning outcomes

26.6.2. Contents:

Lecture 1:
Introduction to assessment and evaluation: concepts and ideas

Lecture 2:
Assessment plan: assessment of student achievement, and assessment of curriculum objectives

Lecture 3:
Knowledge assessment, skills assessment, and behavior assessment

Lecture 4:
Whom to evaluate

Lecture 5:
Why to evaluate

Lecture 6:
Characteristics of good assessment: reliability, validity, feasibility

Lecture 7:
Current trends in assessment: Formative and summative assessment, the progress test, mastery testing, global rating scales, self assessment

Lecture 8:
Student's traditional assessment: written exams: MCQs, short notes, essays, practical exams OSPE, clinical exams: OSCE, oral exams: subjective

Lecture 9:
Performance assessment: assessing clinical competence

Lecture 10:
Self-assessment

Lecture 11:
Portfolios

Lecture 12:
Peer-assisted learning: peer evaluation, peer coaching

Lecture 13:
Student feedback: internal information to guide improvement, external information for potential students and stakeholders

Lecture 14:
Continuous assessment, classroom assessment, evidence based assessment

Lecture 15:
Goals of assessment: Knowledge-based goals, skills-based goals, and affective goals, translate goals into measurable outcomes, select both curriculum and classroom assessment techniques, choose and implement instructional methods, and conduct assessment and evaluate for measurable student outcomes

26.7. Integrated physiology topics

Course	Practical	Theory	Total CH	Duration(weeks)
Integrated physiology topics		1	2	

26.7.1.Objectives:

This course takes homeostasis and environmental physiology as major themes. Lecture material ranges from cellular processes to the whole organism and interactions with the environment. The course starts by considering cell volume regulation, inter-cellular communication, acid-base balance and the maintenance of a constant internal environment. This is followed by thermal balance, and the problems posed by extreme environments. In general at the completion of this course, students should be able to:

Describe the interrelationships between the cardiovascular, respiratory and renal systems in the human body.
Describe the principal homeostatic mechanisms present in the human body
Analyze the effects of exercise on the human body.
Describe the effects of extreme environments on the human body.
Analyze the relationship between energy intake and body weight.
Provide practical instruction in non-invasive techniques to monitor human cardio-respiratory variables
Describe integration between neuro-endocrine and reproductive functions of human body.
Develop transferable skills particularly in relation to information retrieval, data processing and presentation of scientific material by means of active development of teamwork, time management, communication and information technology skills.
Describe the physiological changes at high altitude, in the space and on diving.

26.7.2. Detailed contents:

26.7.2.1.BASIC CELL PROCESSES AND PHYSIOLOGICAL INTEGRATION

Lectures: 1, 2, & 3

Introduction to Physiological Molecular Interaction
Compartmentation: Cells and Tissues
Energy and Cellular Metabolism
Membrane Dynamics
Communication, Integration biology of eukaryotic systems at molecular, cellular, and systems levels of integration, emphasizing the complementarities of structure and function and physiological mechanisms of regulation at the cellular and molecular level.

26.7.2.2.INTEGRATED TOPICS IN HOMEOSTASIS AND ENVIRONMENT

Lectures: 4, & 5

Physiological factors that affect physical performance.
Integrative physiological systems to deliver fuel and oxygen to the muscle cells.
Ability of muscles to transform chemical energy to mechanical energy
Nutritional state, oxygen uptake and pulmonary ventilation.
Cardiac output and oxygen extraction and the nervous and hormonal mechanisms that regulate these functions.
The ability to survive in a hostile environment.
Somatic and psychological factors include motivation, attitude and will to survive.
Principal environmental factors contribute to adaptation

26.7.2.3.INTEGRATED TOPICS IN CARDIOVASCULAR PHYSIOLOGY

Lectures: 6, 7, & 8

Calibration and validation of systems for accurate measurement of cardiac pressure in physiological systems
Consideration of static and dynamic calibration and measurements.
Factors determining pressure and flow distribution in microcirculation.
Mo**vement of fluids and solutes across the capillary wall**
Assessment of mechanisms underlying water and solute movement across the capillary wall.

26.7.2.4.INTEGRATED PHYSIOLOGY TOPICS IN ENERGY METABOLISM

Lectures: 9, 10, & 11

Energy sources and sinks, and measurement of metabolic activity.
Metabolic Rate: Activity-related changes-effects on VO2.
Mechanical efficiency on Human body and thermoregulatory effectiveness.
Basics of a feedback control system.
Central thermoreceptors and sources and sinks of heat at rest and during exercise.
Role of hypothalamus as an effector area. Integrated action of central and shell thermoreceptor inputs.
Physiological conservation by piloerection, skin blood vessels and their control.

26.7.2.5.TOPICS IN INTEGRATED RENAL PHYSIOLOGY

Lectures: 12, 13, &14

Starling's forces in relation to kidney function.
Renal regulation of plasma osmolarity: The role of antidiuretic hormone (ADH).
Renal contribution to the regulation of body sodium content. Renal responses to hypovolaemia.

Juxtaglomerular apparatus and pathway of renin - angiotensin - aldosterone system. Interactions between volume and osmolarity.
Body production of hydrogen ions. Arterial pH. Body buffer systems.
Regulation of plasma bicarbonate by the kidney. Metabolic and respiratory disorders and compensatory responses to acid-base disturbances.

26.7.2.6. INTEGRATED TOPICS IN PULMONARY AND DIVING PHYSIOLOGY

Lectures: 15, & 16

Effects on cerebral function and strategies for avoiding/reducing effects.
Oxygen toxicity. Target organs. Mechanisms of free radical damage and free radical scavenging systems in the cell.
Effects of oxygen toxicity on CNS and lungs.
Effects arising from the retention of carbon dioxide.
Narcotic effects of inert gases. Inert gas narcosis.
The gas laws in relation to the diver breathing compressed gas under water.
Solution of inert gas in body tissues, the release of gas during decompression, and the factors associated with gas phase formation
Relationship between gas phase formation and pathological effects.

26.7.2.7.INTEGRATED TOPICS IN GASTROINTESTINAL PHYSIOLOGY

Lectures: 17, & 18

Role of integrated body systems on appetite and body weight regulation.
Central and peripheral glucose-sensitive neurones.
Transient changes in blood glucose precede meal initiation
Peripheral endocrine factors involved in satiety - CCK, bombesin, glucagon.
Administration of exogenous peptide to specific hypothalamic areas
Sensing of appetite and satiety signals by the brain

26.7.2.8.INTEGRATED TOPICS IN NEUROPHYSIOLOGY

Lectures: 19, 20, 21, 22

Nervous controls on the sensory effects of muscle activity
Theories of motor control: behavioral and biomechanical view.
Applied aspects of environmental thermal regulation.
Information processing approaches for human motor learning and the coordination of movement: molecular, cellular, and systemic physiological approach.
Neurobiological basis of human behavior: influence of contextual interference on learning and performance
Sleep deprivation, and sleep disorders on immune, endocrine, cardiovascular, respiratory, and neural systems.
Integrative nature of sleep and circadian rhythms in normal physiological and cognitive function

26.7.2.9.INTEGRATED TOPICS IN ENDOCINE AND REPRODUCTIVE PHYSIOLOGY

Lectures: 23, 24, 25, 26, 27, 28, 29, & 30

Genetic and genomic concepts applied towards understanding the role of genetics in the normal and pathological function of integrated physiological systems.
Analysis and integration of chemical communication by hormones, paracrine, and semi chemicals.
Evolution of reproductive behavior: courtship, mating, fertility.
Integrated pathophysiology of endocrine and reproductive systems involving neurophysiological, molecular, biochemical, and cellular approaches.
Integrative disorders of endocrine organs: hypothalamic, pituitary, thyroid, and adrenal, gonads.
Reproductive toxicology: Effects of environment and behavior on reproductive functions.
Reproductive-neuroendocrinology: development and mechanisms of the hypothalamic-pituitary-gonadal axis.
Integrative experimental approach to elucidate basic mechanisms controlling fertility
Mechanisms of endocrine longevity of reproductive organs.
Neuro-hormonal control of lactation.
Cellular and genetic aspects of Diabetes and Obesity to regulate homeostatic control of glucose metabolism.
Stem cell biology: influence of germ and embryonic stem cells up on gonads including nuclear reprogramming, and epigenetic mechanisms.

27.Detailed Physiology courses- Semester 4

27.1. Project

Project			10	Long.
Total			10	

Total credit hours: 10

27.2. Objectives & Outcomes:

The major objectives of carrying out the research project will be:
-To create further a scientific environment in KSA that may lead via vicious cycle and can attract/ orient others to participate in research programs, research oriented and research-based teaching and technological applications.
- To enable students during and after completing the research projects, to express views and knowledge quite confidently before the audience in national/ international research conferences/ seminars/ symposia / scientific meetings etc.
- To attain confidence and enhancement in communication skills by Carrying out research project
-To obtain opportunities to join internships during or after MSc program. Exposure to various companies, organizations, personnels should provide opportunities for carrying out further research fellowship/ scholarship/ award-related programs, attractive jobs, and further possibilities for acquiring higher studies for the advancement of knowledge and betterment of humanity.
- To meet the renowned scientists, get guidance of a professor of one's own zest, and get contact with highly qualified professors, visiting scientists/ visiting professors, intellectuals, and brilliant scientists during and after the period of carrying out MSc research project is immense pleasure and highly rewarded activity.

28. References

A. Books/ e-books

1.Textbook of Endocrine Physiology, eTextbook by William J Kovacs and Sergio R Ojeda, 6 edition (Due Jul 9, 2019).

2.Cardiovascular Physiology, by David E. Mohrman and Louis Jane Heller,McGraw-Hill Education / Medical, USA; 9 edition (July 6, 2018).

3.Textbook of Medical Physiology, by D Venkatesh and HH Sudhakar, Wolters kluwe, India; 2 edition (2018).

4.Gastrointestinal Physiology, by Leonard R. Johnson, Elsevier, Netherlands; 9 edition (16 Nov 2018).

5.Human Physiology: An Integrated Approach, by Dee Unglaub Silverthorn, Pearson, UK; 8 edition (January 13, 2018).

6.Respiratory Physiology, by Michelle M. Cloutier, Elsevier, Netherlands; 2 edition (05 Oct 2018).

7.Renal Physiology, by Bruce M. Koeppen and Bruce A. Stanton,Elsevier, Netherlands; 6 edition, (24 Nov 2018).

8.Oxford Textbook of Clinical Neurophysiology, by Kerry R. Mills ,Oxford University Press, UK; 1 edition (January 24, 2017).

9.Biostatistics for the Biological and Health Sciences, by Marc M. Triola , Mario F. Triola and Jason Roy, Pearson, UK; 2 edition (January 11, 2017).

10.Essentials of Medical Physiology, by K Sembulingam and Prema Sembulingam, Jaypee Brothers Medical Pub, India; 7 edition (June 2, 2016).

11.Bioethics: principles issues and cases by lewis vaughn, Oxford University Press, UK; 3 edition (July 15, 2016).

12.Textbook of Medical Physiology (Guyton Physiology), by John E. Hall Guyton and Hall, Saunders, USA; 13 edition (June 3, 2015).

13.Human Reproductive Biology, by Richard Jones and Kristin H Lopez , Academic Press, USA; 4 edition, (3rd December 2013).

14.Principles of Neural Science, by Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, Steven A. Siegelbaum, A. J. Hudspeth, McGraw-Hill Education / Medical, USA; 5th edition (October 26, 2012).

15.The student's guide to research ethics, **by Paul Oliver,** Open University Press. UK; **2 edition (2010).**

16.Educational and psychological measurement and evaluation, **by Kenneth D. Hopkins, Allyn and Bacon. Boston, USA; 8 edition (2010).**

17.Physiology of the Special Senses, by Major Greenwood, Nabu Press, USA (2010).

B. List of Electronic Materials, Web Sites, Facebook, Twitter, etc.

A variety of website & internet sources in different areas of physiology/human physiology. An example of these are:-

WWW.physoc.org/

WWW.Pubmed.com

C. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

- Compact discs (CDs) illustrating physiology topics.