Master of Science (M.Sc.) IN HUMAN PHYSIOLOGY

Mission of the program:

To train and graduate professionals with advanced knowledge, research and teaching skills in the field of physiology to meet the needs of the community.

Objectives of the program

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

- Fill the gap in physiology lecturers in the market of labor in KSA
- Pursue their post graduate studies. i.e. graduates will be able to get enrolled in postgraduate (Ph.D.) studies easily abroad & locally.
- Fill the gaps of technical staff in the undergraduate laboratories by participating in delivering practical sessions as part of their training .

By completing the M.Sc. degree in Human Physiology, the candidates are expected to:

1. Confidently be knowledgeable about basic human physiology.
2. Be able to get more information about different physiology topics from all sources: periodicals, internet and information technology. etc. Students should also be able to present information using written and/or verbal language.
3. Apply the research methodologies in Physiology and related researches.
4. Perform a scientific research under guidance for small research projector.
5. Develop the skills and competency to conceptualize, design, write and communicate a thoughtful, persuasive research proposal if possible, to address a public health concern.
6. Perform research on human and /or experimental animals and be capable to present his/her results in a form of thesis.
7. Be able to write scientific papers and present it 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 provided by the department to the undergraduate students of all health faculties.
11. Fill the gap for the need of basic medical scientists in KSA.

Targeted groups

1. MBBS degree holders.
2. Graduates from laboratory medicine, dentistry, pharmacy, veterinary, science (physiology) and other faculties with adequate physiology courses can be admitted after passing a qualifying examination.

A Qualifying exam to be performed should suit different candidates with

different specialties who are applying for the MSc program.

Training area

Candidates will perform their own practical sessions in the laboratories to gain their skills.

They will also be involved in conducting some of the practicals & tutorials for the undergraduates' students.

Targeted fortnightly reading

Each fortnight a **different topic of physiology will be studied in depth**. Copies of relevant recent articles will also be provided with two short written tasks each week that contribute the continuous assessment. Also, a **journal club** is to be carried out every month. This should be regular and students should know **how to write a paper** through this and **how to criticize** a **paper** to be better though it is published if applicable.

M.Sc. Information for Prospective Candidates

The course leading to master's 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.

Instructional methods:

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

Resources available:

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

   There is also a chance to invite visiting professors who are known international figures in the field of physiology to participate in provision of the program.

***Assessment* and Evaluation:**

The examination at the end of the course must be taken by all students, even those who have done exceptionally well on the continuous assessment. The examinations must be passed for the M.Sc. to be awarded. They are held in the department of physiology, Faculty of Medicine, and consist of a multiple-choice question paper, single best answer (MCQ- SBA) and Objective Structured Practical Examination (OSPE). An oral exam is to be conducted for discussion of the research project.

The examiners consist of the academic staff and external examiners who will be involved in reviewing theory and practical parts. The external examiners will also be responsible for evaluating the dissertation.

A formative assessment is planned to be carried out toward the end of each one or two courses

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 measure the overall gain and access of the M.Sc programme and to be sure that the passed candidates (At least 60%) are able to face and handle the most common physiological problems they will face in their practice.
The dissertation will be evaluated by an external examiner (see below).

Summative Evaluation and Grading

Final grades are based on grades earned for each of the periodical exams, the lab exams and

final theory exam.

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

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

The research project 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 weights of each part of the evaluation will be: (**WAITING APPROVAL**)

1. **30%** **End of courses theory exam.**
2. **20%** **Practical (OSPE) exam.**
3. **10%** **Assignments (paper writing), journal clubs**

3. **15%** **Educational courses**

4. **25%** **Research project.**

Running of the course:

The course is 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 content and conduct.

Work involved on the course:

The M.Sc. in human physiology is only awarded by the faculty of medicine to those who have demonstrated 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.

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 are to be given. Relevant articles are provided. Reading are focused each week on that subject.

Fees for the course:

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

Application for the course:

Applicants should complete the recommended application form and forward it to: The Deanship of Graduate Studies, Umm Al-Qura University, Abdia, Holly Makkah, KSA,

The structure (Map) of the program:

Semester (1): Total credit hours: 15

Physiology courses:

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

Semester (2): Total credit hours: 14

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

Semester (3): Total credit hours: 12

Core courses:

Course	Practical	Theory	Total CH	Duration(weeks)
Contemporary physiology	1	1	2	2
Biostatistics			2	Long.
Research methodology			2	Long.
Ethics			1	Long.
Instructional & evaluation methods			3	Long.
Integrated physiology topics		1	2	3
Self-paced learning		-	-	3
Total			**12**	15

Semester (4): RESEARCH PROJECT. Total credit hours: 10

Course	Practical	Theory	Total CH	Duration(weeks)
Project			10	Long.
Total			10	15

Total: 41 Credit Units in addition to the research project. i.e. 51 C.H.

Detailed Physiology courses

Semester (1):

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

Objectives**:**

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

At the end of this course the student will also 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 appreciate their roles in blood transfusion. Also, 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 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 can calculate the third.

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) constituent 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.

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.

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 Microhematocrit tube and centrifuge respectively.

Course	Practical	Theory	Total CH
Cardiovascular physiology	1	3	4

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 disturbed physiology underlying some major cardiovascular problems such as heart failure and cardiac ischaemia. In addition, during this course, the student 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.

Specific Objectives:
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.

Distinguish between the three types of cardiac muscle cells (pacemaker, conducting, contracting) which generate the force of systole.

Identify the functional role of intercalated disks and the all or none principal as it applies to the heart.

Describe the nervous supply of the hart 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.

Use the E.C.G. in order to identify common cardiac abnormalities (conduction defects, arrhythmia's and Ischemic heart disease).

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.

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.

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 toheart 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.

Identify the magnitude of lymph flow, determinant factors for lymph flow and the mechanism of actions of lymphatic pumps.

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 venoconstriction 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.

Course	Practical	Theory	Total CH
Respiratory physiology	1	2	3

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

Objectives:
By the end of this course, students are expected to:
Identify the major functions of the respiratory system.
Describe the symbols used in respiratory system.
Identify the essential gas laws as applied to gas transport and diffusion of gases across membranes.
Describe the functional anatomy of airways and lungs.
Identify the basic mechanisms of ventilation - inspiration and expiration, role of thoracic cage in ventilation.
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 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.
Explain changes in lung volumes in health and disease - e.g. effect of exercise, airway obstruction, emphysema etc.
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.

Course	Practical	Theory	Total CH
Gastrointestinal physiology	1	2	3

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.

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 pathophysiology of gastric and duodenal ulcers.

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.

Semester (2):

Course	Practical	Theory	Total CH
Renal physiology	1	2	3

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 chapter, 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 hemodialysis in the management of renal failure.

Course	Practical	Theory	Total CH
Endocrine physiology	1	2	3

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 chapter, 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.

Course	Practical	Theory	Total CH
Reproductive physiology	1	2	3

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 chapter, 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.

Course	Practical	Theory	Total CH
Neuromuscular physiology	1	1	2

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 chapter, 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.

Course	Practical	Theory	Total CH
Neurophysiology	**1**	**3**	**4**

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.

Course	Practical	Theory	Total CH
Special senses	**1**	**1**	**2**

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.

Semester (3):

Core courses:

Course	Practical	Theory	Total CH
Contemporary physiology	0	3	3

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

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

This course will be given by experts in the field (from other departments in the faculty and university) and cover what researches would need during their thesis and writing manuscripts later on.

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

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

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 randomized 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.

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

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 proposal and consent forms that meet the basic criteria for Um Alqura 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

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

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

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

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

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

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.

INTEGRATED TOPICS IN HOMEOSTASIS AND ENVIRONMENT

INTEGRATED TOPICS IN CARDIOVASCULAR PHYSIOLOGY

INTEGRATED PHYSIOLOGY TOPICS IN ENERGY METABOLISM

TOPICS IN INTEGRATED RENAL PHYSIOLOGY

INTEGRATED TOPICS IN PULMONARY AND DIVING PHYSIOLOGY

INTEGRATED TOPICS IN GASTROINTESTINAL PHYSIOLOGY

INTEGRATED TOPICS IN NEUROPHYSIOLOGY

INTEGRATED TOPICS IN ENDOCINE AND REPRODUCTIVE PHYSIOLOGY

Semester (4):
Core courses:

Research Project			10	Long.
Total			10	

Total credit hours: 10

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