

Anatomy

1	Course name	Anatomy
2	Course Code	PH 108
3	Course type: /general/specialty/optional	General
4	Accredited units	1 credits
5	Educational hours	1 hours/week/THEORY
6	Pre-requisite requirements	Biology
7	Program offered the course	Department of Biomedical Science
8	Instruction Language	English
9	Date of course approval	12/2021

Brief Description:	This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body, such as nervous, cardiovascular, endocrine systems. Also the subject provides the basic knowledge on the structure and functions of the respiratory, digestive, urinary and reproductive systems. It deals with structure and functions of and lymphatic, skeletal and muscular systems. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.
Textbooks required for this Course:	1- Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
Course Duration	28 weeks
Delivery	Lecture-based, Group interaction and discussion, Self-directed activities, Active participation. Lectures (Tools: board, data show, models and discussion). The lectures were added on the internet site of the faculty to be available to the students all the time as learning.
Course Objectives:	Upon completion of this course the student should be able to 1. Explain the gross morphology, structure and functions of various organs of the humanbody. 2. Describe the various homeostatic mechanisms and their imbalances. 3. Identify the various tissues and organs of different systems of human body. 5. Appreciate coordinated working pattern of different organs of each

	system	
Course Assessments	- Midyear exam	20%
	- Quizzes, reports, presentation	20%
	- Final theoretical exam	60%
	- Total	100%
Content Breakdown Topical Coverage	Content Breakdown Topical Coverage	
Session 1 (Week 1)	Unit I: Nervous system: <ul style="list-style-type: none"> • Sections of the nervous system, the most important structural and functional differences of the sympathetic and parasympathetic nerves • -Spinal-cerebral nerves 	
Session 2 (Week 2)	<ul style="list-style-type: none"> • Physiology of nerve impulses and reflex arc • Cerebrospinal fluid, its composition, characteristics, cycle, functions, medical importance • Some neurological diseases (cerebral and vascular accidents, Parkinson's disease) 	
Session 3 (Week 3)	Unit II: Cardiovascular system: <ul style="list-style-type: none"> • Its components and most important functions • Hemoglobin in terms of its composition, types, characteristics, and importance • Blood clot and its formation steps • Blood groups and their medical importance • Anemia and its types. 	
Session 4 (Week 4)	<ul style="list-style-type: none"> • The most important anatomical features of the heart and its function • Heart cycle, heart capacity and factors affecting it • Circulation and the most important changes that occur to the circulatory system before and after birth. 	
Session 5 (Week 5)	Unit III: Endocrine system: <ul style="list-style-type: none"> • Definition of hormones and their types • The mechanism of the effect of hormones on tissues and the relationship of primary and secondary messengers to receptors • How to control the secretion of hormones? 	
Session 6 (Week 6)	<ul style="list-style-type: none"> • Study of the following glands from an anatomical point of view, their secretions, the functions of these hormonal secretions, and how to control the secretions: • The pituitary gland, pineal gland, thyroid and parathyroid glands, thymus gland, parathyroid glands, pancreas, testes and ovaries are studied within the reproductive system. 	
Session 7 (Week 7)	Unit IV: Urinary system: <ul style="list-style-type: none"> • Its parts and functions • How urine is formed in the renal tubules and the urea cycle 	

Session 8 (Week 8)	Unit V: Reproductive system: <ul style="list-style-type: none"> • Its parts (male and female and its general functions) • Steps in the formation of sperm and eggs • Menstrual cycle, fertilization, pregnancy and how to regulate it • Fetal development
Session 9 (Week 9)	Unit VI: Respiratory system: <ul style="list-style-type: none"> • Its parts, most important characteristics and functions • Respiratory volumes and lung capacity • Inhale and exhale steps • Steps for the transfer of gases (O₂, CO₂) between tissues and lungs and the factors affecting the saturation of blood with gases and then poisoning by CO.
Session 10 (Week 10)	<ul style="list-style-type: none"> • Regulating breathing (control centers of the nervous system) • Adaptation of the body to the change in altitude (diving and climbing to high areas)
Session 11 (Week 11)	Midyear exam
Session 12 (Week 12)	
Session 13 (Week 13)	
Session 14 (Week 14)	
Session 15 (Week 15)	Unit VII: Digestive system: <ul style="list-style-type: none"> • Its parts and general functions • The most important changes that occur to carbohydrates, fats and protein as a result of digestion in the alimentary canal
Session 16 (Week 16)	<ul style="list-style-type: none"> • The role of the appendices of the alimentary canal (liver and pancreas) in the digestive process
Session 17 (Week 17)	<ul style="list-style-type: none"> • Absorption of indigestible substances • Metabolism and energy release (anaerobic and aerobic respiration)
Session 18 (Week 18)	Unit VIII: Lymphatic system: <ul style="list-style-type: none"> • Its parts, its role, and its importance • Specialized and non-specialized immune systems, cellular and humoral immunity
Session 19 (Week 19)	Unit IX: Integumentary system: <ul style="list-style-type: none"> • Structure and function
Session 20 (Week 20)	Unit X: the skeletal system: <ul style="list-style-type: none"> • The most important features of bones, their general functions, and their medical importance • Distinctive superficial signs of bone. • Bone shapes (types).
Session 21 (Week 21)	<ul style="list-style-type: none"> • Study of the spine in terms of the intervertebral discs (their structure and function), as well as the most important superficial anatomical differences for the vertebrae of the five regions of the spine. • The most important differences between the male and female structure.
Session 22 (Week 22)	<ul style="list-style-type: none"> • Studying the development of the middle ear Ossicles in humans and comparing them with other vertebrates • joints

	<ul style="list-style-type: none"> • Factors affecting bone growth • Brief indication of some diseases of the skeletal system (disc herniation, kyphosis and lordosis)
Session 23 (Week 23)	Unit XI: the muscular system: <ul style="list-style-type: none"> • The most important differences between smooth, skeletal, and cardiac muscles • General muscle functions • Physiology of muscle contraction, sliding filament theory and its comparison with smooth muscle contraction
Session 24 (Week 24)	<ul style="list-style-type: none"> • Cardiac muscle as a conduction organ • Muscular fatigue and muscle energy sources • Muscle cramps • Some muscle diseases (myalgia and myasthenia gravis)
Session 25 (Week 25)	Review
Session 26 (Week 26)	Review
Session 27 (Week 27)	
Session 28 (Week 28)	
Final theoretical exam	
Attendance Expectations	Students are expected to attend every session of class, arriving on time, returning from breaks promptly and remaining until class is dismissed. Absences are permitted only for medical reasons and must be supported with a doctor's note.
Generic Skills	The faculty is committed to ensuring that students have the full range of knowledge and skills required for full participation in all aspects of their lives, including skills enabling them to be life-long learners. To ensure graduates have this preparation, such generic skills as literacy and numeric, computer, interpersonal communications, and critical thinking skills will be embedded in all courses.
Course Change	Information contained in this course outline is correct at the time of publication. Content of the courses is revised on an ongoing basis to ensure relevance to changing educational employment and marketing needs. The instructor will endeavor to provide notice of changes to students as soon as possible. Timetable may also be revised.

Histology

1	Course name	Histology
2	Course Code	PH107
3	Course type: /general/specialty/optional	General
4	Accredited units	2 credits (1 lecture + 1 lab / week)
5	Educational hours	1 hour/week/Theory, 2 hours/ week/ lab
6	Pre-requisite requirements	Biology
7	Program offered the course	Biomedical science department
8	Instruction Language	English
9	Date of course approval	12/2021

Brief Description:	Histology: In this course the student will study the technique of microscopic use, the basic and general introduction to histology of the following systems: - Cell, types of tissues, CVS, GIT, genitourinary systems, respiratory system, immune system, endocrine and male and female systems.
Textbooks required for this Course:	1) Junqueira, L. C. and J. Carneiro, Basic Histology, tenth edition. Norwalk: Appleton & Lang; Last edition. 2) Eroschenko, V. P., di Fiore's Atlas of Histology with Functional Correlations, ninth edition. Philadelphia: Lippincott Williams & Wilkins; Last edition. 3) Text Basic Histology by Luiz Carlos 11th ed. (2005)
Course Duration	28 weeks
Delivery	- Lectures (Tools: board, data show). -Tutorials and group discussions. -Assignments (if applicable). -Videos. - Practical classes (Lab experiments+ computerized experiments simulation).
Course Objectives:	1. To understanding the technique in use of microscope. 2. Classify the types of tissues. 3. To study and differentiate between blood cells and bone marrow cells. 4- Understand and demonstrate the interrelations of the organ systems to each other.

	5- State the functions of the exocrine and endocrine glands.	
Course Assessments	Midyear exam	20%
	Quizzes, reports, presentation	10%
	Practical continuous assessment, exam	10%
	Final Practical exam	20%
	Final theoretical exam	40%
	Total	100%
Content Breakdown Topical Coverage	Content Breakdown Topical Coverage	
Session 1 (Week 1)	Unit I: Introduction and methods of study: - Microscopes and micro technique	
Session 2 (Week 2)	Unit II: Cytology: I- Cell structure: a) Cytoplasm. b) Organoids	
Session 3 (Week 3)	c) Cytoskeleton. d) Cell inclusions:	
Session 4 (Week 4)	II- Cell division and cell death .	
Session 5 (Week 5)	Unit III: Epithelial tissues: A- General characteristics. B- Classification of epithelia:	
Session 6 (Week 6)	C- Surface modifications and cell junctions. D- Functions of epithelial tissues.	
Session 7 (Week 7)	Unit IV: Connective tissues: A- General characteristics and classification. B- Cells, ground substance and fibers.	
Session 8 (Week 8)	Unit V: Cartilages: General characteristics and classification.	
Session 9 (Week 9)	Unit VI: Bones: A- General characteristics and classification	
Session 10 (Week 10)	B- Cell and matrix C- Structure of compact and spongy bones.	
Session 11 (Week 11)	Midyear exam	
Session 12 (Week 12)		
Session 13 (Week 13)		
Session 14 (Week 14)		
Session 15 (Week 15)	Unit VII: Blood: A- General structure (cells, plasma, and stains)	
Session 16 (Week 16)	B- Erythrocytes, leukocytes, and blood platelets	
Session 17 (Week 17)	C- Bone marrow	
Session 18 (Week 18)	Unit VIII: Muscular tissues: A- General characteristics and classification	
Session 19 (Week 19)	B- Skeletal, smooth, and cardiac muscles	

Session 20 (Week 20)	Unit IX: Nervous tissue: A- General structure. B- Neurons. C- Neuroglia. D- Nerve trunk and ganglia
Session 21 (Week 21)	Unit X: Cardiovascular system: Cardiovascular system: A- General structure of the blood vessels. B- structure of the arteries, veins, and capillaries.
Session 22 (Week 22)	Unit XI: Lymphatic system: A- Immune system. B- Lymph node, spleen, thymus gland, and tonsil
Session 23 (Week 23)	Unit XII: Integumentary system (skin and its appendages): A- General structure B- Appendages and glands C- Functions of skin
Session 24 (Week 24)	Unit XIII: Respiratory system A- Conducting portion (Nose, Nasopharynx, Trachea Bronchus & Bronchioles) A- General structure of lung
Session 25 (Week 25)	Unit XIV: Digestive system A- General structure of esophagus, stomach, small and large intestine, rectum, anus, liver, and pancreas. B- Glands associated with the digestive tract (Salivary glands, Pancreas, Liver & Gall bladder.
Session 26 (Week 26)	Unit XV: Urinary system A- Structure & Function of the (kidney & nephron) B -Histology of the nephron (filtration, absorption & excretion). C - Structure of the (Ureter, Bladder & Urethra).
Session 27 (Week 27)	Unit XVI: Endocrine system A -General structure of the Pituitary gland, Adrenal, Thyroid, Parathyroid, Islet of Langerhans & Pineal glands.
Session 28 (Week 28)	Unit XVI: Male reproductive system: A -Excretory genital ducts-Excretory genital glands (Seminal vesicles, Prostate & Cowper'sglands) Female reproductive system: A-General structure of ovary, Oviduct, Uterus & Vagina. B -Stages of follicle development.-Ovulation
Final theoretical exam	
Practical work	PART II: PRACTICAL Histology (One lab / week) <ol style="list-style-type: none"> 1. Light Microscope 2. EM of cell organelles 3. Epithelium 4. Connective tissues 5. Cartilage 6. Bone 7. Blood

	<ul style="list-style-type: none"> 8. Muscles 9. Neural tissue 10. Blood vessels 11. Lymphatic tissue 12. Spleen 13. Digestive system 14. Skin
	Final Practical Exam
Attendance Expectations	Students are expected to attend every session of class, arriving on time, returning from breaks promptly and remaining until class is dismissed. Absences are permitted only for medical reasons and must be supported with a doctor's note.
Generic Skills	The faculty is committed to ensuring that students have the full range of knowledge and skills required for full participation in all aspects of their lives, including skills enabling them to be life-long learners. To ensure graduates have this preparation, such generic skills as literacy and numeric, computer, interpersonal communications, and critical thinking skills will be embedded in all courses.
Course Change	Information contained in this course outline is correct at the time of publication. Content of the courses is revised on an ongoing basis to ensure relevance to changing educational employment and marketing needs. The instructor will endeavor to provide notice of changes to students as soon as possible. Timetable may also be revised.

Biochemistry

1	Course name	Biochemistry
2	Course Code	PH 202
3	Course type: /general/specialty/optional	General
4	Accredited units	3 units (2 hrs./week theoretical 2 hrs./week practical)
5	Educational hours	4 hours / week
6	Pre-requisite requirements	Biology and organic chemistry
7	Program offered the course	Department of Pharmaceutical chemistry
8	Instruction Language	English
9	Date of course approval	12/2021

Brief Description:	The course is designed to give students the important foundations of biochemistry. This course focuses on processes occurring at a molecular level. It focuses on what's happening inside human cells, studying components such as carbohydrates, lipids, proteins, and organelles. Also the course covers enzymes, haem metabolism, vitamins, and nucleotides and nucleic acids. In addition, it includes practical part (preparation of buffers, quantitative and qualitative test of the above topics)	
Textbooks required for this Course:	<ol style="list-style-type: none"> 1. Marks' Essentials of Medical Biochemistry A Clinical Approach. By Michael Lieberman and Alisa Peet. Michael Tully. 2. Practical Textbook of biochemistry for medical students. By DMVasudevan and Subir Kumar Das. jaypeebrother's medical publishers. 3, Oraby's illustrated reviews of Biochemistry. 4. Biochemistry Research International. www.hindawi.com/journals/bri 	
Course Duration	28 weeks	
Delivery	<ul style="list-style-type: none"> - Lectures (Tools: board, data show). -Tutorials and group discussions. -Assignments (if applicable), seminars, researches and posters. -Videos. - Practical classes (Lab experiments+ computerized experiments simulation). • The lectures are added on the internet site of the faculty to be available to the students all the time as an e-learning. 	
Course Objectives:	By the end of the course, students should be able to:	
Course Assessments	Midyear exam	20%
	Quizzes, reports, presentation	10%
	Practical continuous assessment, exam	10%
	Final Practical exam	20%
	Final theoretical exam	40%
	Total	100%
Content Breakdown Topical Coverage	Content Breakdown Topical Coverage	
Session 1 (Week 1)	Properties of water and buffers: Water and acid base balance. Buffer, acidosis, and alkalosis	
Session 2 (Week 2)	Chemistry of carbohydrates: Definition and classification of carbohydrates. Different types of complex carbohydrates.	
Session 3 (Week 3)	Carbohydrate metabolism: - Pentose phosphate pathway, its importance, deficiency of G6PDs -Preparatory step, and rate limiting step	
Session 4 (Week 4)	- Gluconeogenesis: gluconeogenic substances, gluconeogenesis pathway and its regulation	
Session 5 (Week 5)	- Tricarboxylic acid cycle: It's reactions, functions, role in metabolism and ATP production by respiratory chain and regulation	
Session 6 (Week 6)	Chemistry of lipids: -Lipid classification -Physical properties - Reactions of fatty acid	

Session 7 (Week 7)	-Types of lipid: i- phospholipids, ii- glycolipids iii- lipoproteins iv- triacylglycerol v- cholesterol -Lipoproteins
Session 8 (Week 8)	Lipid metabolism: Biosynthesis of fatty acids and Ketone bodies
Session 9 (Week 9)	Biosynthesis and catabolism of triglycerides, phospholipids
Session 10 (Week 10)	Oxidation of fatty acids, α -, β - oxidation,
Session 11 (Week 11)	Midterm Exam
Session 12 (Week 12)	
Session 13 (Week 13)	
Session 14 (Week 14)	
Session 15 (Week 15)	Protein chemistry: - Protein digestion - Absorption of amino acids Amino Acids definition - Structure of proteins - Globular Proteins Fibrous Proteins
Session 16 (Week 16)	- Urea Cycle - Reactions of the urea cycle - Origin of ornithine - Regulation of the urea cycle - Function of the urea cycle during fasting
Session 17 (Week 17)	Protein metabolism: - Nitrogen Metabolism - Catabolism of Amino Group Nitrogen
Session 18 (Week 18)	- Catabolism of Carbon Skeleton of Amino Acids - Biosynthesis of Amino Acids
Session 19 (Week 19)	-Amino Acids: Conversion to Specialized Products - Disorders of Amino Acid Metabolism
Session 20 (Week 20)	Enzymes: -Properties of enzymes - Mechanism of Enzyme Catalysis -Michaelis–Menten kinetic theory of enzyme action
Session 21 (Week 21)	- Regulation of enzyme activity - Isoenzymes Enzymes in Clinical Diagnosis
Session 22 (Week 22)	Haem metabolism: - General Characteristics of Porphyrins - Biological Significance of Porphyrins - Synthesis of Haem
Session 23 (Week 23)	-Disorders of Porphyrin Metabolism: Porphyria - Haem Breakdown - Jaundice

Session 24 (Week 24)	Vitamins: <ul style="list-style-type: none"> - Classification and nomenclature - Sources, daily requirements - Deficiency of Vitamins - Water-soluble vitamins - Fat-soluble vitamins
Session 25 (Week 25)	Xenobiotic: <ul style="list-style-type: none"> - Definition of xenobiotic - Metabolism of xenobiotic
Session 26 (Week 26)	Nucleotides and nucleic acids: Nucleotides: Chemistry and Biological Significance <ul style="list-style-type: none"> -Purine Metabolism -Pyrimidine Metabolism
Session 27 (Week 27)	<ul style="list-style-type: none"> -Structure of DNA -Physical Properties of DNA -DNA as Genetic Material -Replication, translation, transcription, and repair
Session 28 (Week 28)	<ul style="list-style-type: none"> -RNA Structure, Synthesis, and Processing -General features of RNA -Types of RNAs
	Final theoretical Exam.
Practical work (one/week)	Practical Part: <ol style="list-style-type: none"> 1. Preparation of Buffers, different types of buffer in the human body. 2. Qualitative test of carbohydrates. 3. Quantitative test of carbohydrates. 4. Clinical cases. 5. Review and practical reports. 6. Qualitative tests of Lipids. 7. Quantitative tests of Lipids. 8. Clinical cases. 9. Qualitative tests of proteins. 10. Quantitative tests of proteins
	Final practical exam
Attendance Expectations	Students are expected to attend every session of class, arriving on time, returning from breaks promptly and remaining until class is dismissed. Absences are permitted only for medical reasons and must be supported with a doctor's note.
Generic Skills	The faculty is committed to ensuring that students have the full range of knowledge and skills required for full participation in all aspects of their lives, including skills enabling them to be life-long learners. To ensure graduates have this preparation, such generic skills as literacy and numeric, computer, interpersonal communications, and critical thinking skills will be embedded in all courses.

Pharmaceutical Microbiology I

1	Course name	Pharmaceutical Microbiology I
2	Course Code	PH207
3	Course type: /general/specialty/optional	Specialty
4	Accredited units	3 units
5	Educational hours	(2 theory + 2 Practical)
6	Pre-requisite requirements	Biology
7	Program offered the course	Department of Biomedical Science
8	Instruction Language	English language
9	Date of course approval	12/2021

Brief Description:	The course will provide detailed insights into basic concepts and the differences between different classifications of microbiology. structure and function of microbes (cellular structures, metabolism, microbial growth, and its requirements and how to control it), microbial genetics, prokaryotes versus eukaryotes. This course also provides a comprehensive explanation of the microbial diversity (bacteria, viruses, fungi, and parasites) that are medically important and shows how they are defined, named, classified and reproduced, as well as of the different types of virulence factors used by pathogens to cause the diseases..
Textbooks required for this Course:	Microbiology an Introduction,9 th edition; (2004).Tortora GJ, Funke BR & Case CL. (Pearson International edition) Medical Microbiology, 23 rd edition; (2004). Jawetz E., Melnick JL &Adelberg's E. Lange Middle East edition Additional Resources: Lectures Notes
Course Duration	28 weeks
Delivery	1. Lectures (Tools: board, data show). 2. Practical classes (Lab experiments+ computerized experiments simulation) 3. Assignments, reports and power point presentation thesis. 4. Construction of illustrated posters.
Course Objectives:	<ol style="list-style-type: none"> 1- Introduction to the nature of general microbiology and be familiar with the different branches and classification of microbiology. 2- Focus on the major differences between Prokaryotes and Eukaryotes 3- Know the differential identification pigments of microorganisms, understand the mechanism of action of those pigments, and identify bacteria through biochemical reactions. Plus, how to name and classify microorganisms 4- Understanding the structure and morphology of bacteria and their reproduction types, growth requirements and the growth curve and metabolism 5- Understanding the principles of microbial genetics and genetic study techniques 6- Be familiar with the medically important Gram-negative and Gram-positive pathogenic bacteria and related disease 7- Focus on the medically important human pathogenic viruses and related diseases and understand their types, replication, and different classification 8- Focus on the medically important human pathogenic fungi and parasites and related diseases <p>In general: At the end of course the student will be able to</p> <ol style="list-style-type: none"> 1- Illustrate the concept of Microbiology, different microorganisms and their relation with the human diseases 2- Identify the isolated microorganisms and give the medical information about. 3- The student will have acquired knowledge and critical understanding of basic facts, principles and theories related to bacterial genetics.

	<p>4- The student will be able to analyze unexpected results while dealing with microbes in terms of changing their characteristics and explain the abnormality at the level of microbial genetics.</p> <p>5- The student will have acquired the skill of using the microscope.</p> <p>6- The student will be able to interpret the results and find and assess the information of different microbial diseases quickly and reliably</p> <p>7- The student will be able to use the internet to search and prepare reports and do a presentation</p>	
Course Assessments	Midyear exam	20%
	Quizzes, reports, presentation	10%
	Practical continuous assessment, exam	10%
	Final Practical exam	20%
	Final theoretical exam	40%
	Total	100%
Content Breakdown Topical Coverage	Content Breakdown Topical Coverage	
Session 1 (Week 1)	Introduction to General Microbiology <ul style="list-style-type: none"> • Different branches of Microbiology • History of Microbiology • Classification and nomenclature of microorganisms 	
Session 2 (Week 2)	Study of Prokaryotes; Classification(taxonomy) of the Prokaryotes <ul style="list-style-type: none"> - Morphology, arrangement and structure of the bacterial cell - The bacterial spore, The process of spore formation, Spore germination and outgrowth Classification of bacteria, bacterial morphology and structure of bacterial cells. Prokaryotic cells versus Eukaryotic Cells (structure & organelles functions)	
Session 3 (Week 3)	Bacterial nutrition and metabolism and growth requirements Physical Requirements • Chemical Requirements, Growth factors, Nutritional classification of microorganisms	
Session 4 (Week 4)	Bacterial growth: Bacterial growth curve, generation time, measurement of bacterial growth.	
Session 5 (Week 5)	Bacterial growth control: Antiseptic versus disinfectants (types & mechanisms) Sterilization methods: <ul style="list-style-type: none"> - Heat sterilization (dry, moist) - Cold sterilization (radiation, gas, filtration). 	
Session 6 (Week 6)	Different bacterial stains: <ul style="list-style-type: none"> • (Gram stain, Acid-fast stain.... etc) • Principles and reactions 	

	<ul style="list-style-type: none"> • Microbial biochemical reactions
Session 7 (Week 7)	Different types of culture media (constituents and characteristics) (Enrichment growth media, differential media and selective media) <ul style="list-style-type: none"> - Bacterial biochemical reaction
Session 8 (Week 8)	All medical important human pathogenic Gram-positive Staphylococci bacteria and related disease with virulence factor
Session 9 (Week 9)	All medical important human pathogenic Gram-positive Streptococci bacteria and related disease with virulence factor
Session 10 (Week 10)	Clostridium, Corynebacterium, Bacillus, Enterococcus, and Pneumococcus
Session 11 (Week 11)	Midyear exam
Session 12 (Week 12)	
Session 13 (Week 13)	
Session 14 (Week 14)	
Session 15 (Week 15)	Medical important human pathogenic Gram-negative Enterobacteriaceae bacteria and related disease with virulence factor
Session 16 (Week 16)	Continue to Medical important human pathogenic Gram-negative bacteria and related disease with virulence factor (Pseudomonas, Vibrio, Campylobacter and Helicobacter, Brucella, Yersinia, Acinetobacterbaumannii, etc)
Session 17 (Week 17)	Acid fast bacteria: Mycobacteria species with related diseases and virulence factor
Session 18 (Week 18)	Unusual bacteria and related diseases with virulence factor <ul style="list-style-type: none"> • -Spirochetes (Treponema, Borrelia.) • -Moraxella • -Mycoplasma, Rickettsiae. • -Chlamydia
Session 19 (Week 19)	Workshop (Assignment, discussion and presentation)
Session 20 (Week 20)	Microbial Genetics: <ol style="list-style-type: none"> Nucleic acid types, Structure and Function (DNA & RNA) Differences between DNA & RNA Protein synthesis (Replication, transcription & translation)
Session 21 (Week 21)	Continue to Microbial Genetics. <ol style="list-style-type: none"> Changes in Genetic Material (Mutation • Types of Mutations • Mutagens)
Session 22 (Week 22)	Continue to Microbial Genetics. <ol style="list-style-type: none"> Genetic Transfer and Recombination (Plasmids and Transposons <ul style="list-style-type: none"> • Transformation in Bacteria • Conjugation in Bacteria • Transduction in Bacteria, Genetic Mechanisms of Drug Resistance in Bacteria) Blotting Techniques • Polymerase Chain Reaction (PCR) • Gene Therapy
Session 23 (Week 23)	Study of Virology: Types, classification, structures characteristics & replication of viruses
Session 24 (Week 24)	Continue to virology:

	Medically important human pathogenic viruses and related diseases
Session 25 (Week 25)	Study of Mycology: Types, classification, structures characteristics & replication of fungi
Session 26 (Week 26)	Continue to Mycology: Medically important human pathogenic fungi and related diseases
Session 27 (Week 27)	Study of parasites: common classification, and characteristics of parasites
Session 28 (Week 28)	Continue to parasites: Medically important human pathogenic fungi and related diseases .
	Final theoretical Exam
Practical work (one/week)	1-Laboratory regulations: -Equipment and aids in microbiology labse.g. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, 2-Use of microscope: -Examination of stained smears. Examination of wet preparations. 3. Sterilization of glassware, preparation and sterilization of media. 4-Culture media: -Basic, enriched, selective and differential media. Agars and broth. Aerobic and anaerobic cultures 5-Bacteriological subculture techniques: purification of culture. 6-Microbiological stains I: Preparation of smears. Simple stain. Negative stain. 7-Microbiological stains II: -Gram stain. Acid fast, capsule and spore stain. 8-Systematic bacteriology: -Morphology and staining of microorganisms of medical importance. -Culture characteristics. -Biochemical tests. 9. Microbiological assay of antibiotics by cup plate method and other methods 10. Motility determination by Hanging drop method. 11. Sterility testing of pharmaceuticals.
	Final Practical Exam
Attendance Expectations	Students are expected to attend every session of class, arriving on time, returning from breaks promptly and remaining until class is dismissed. Absences are permitted only for medical reasons and must be supported with a doctor's note.
Generic Skills	By the end of the course the students will have the full range of knowledge and skills required for full participation in all aspects of their lives, including skills enabling them to be life-long learners. To ensure graduates have this preparation, such generic skills as literacy and numeric, computer, interpersonal communications, and critical thinking skills will be embedded in this course
Course Change	Content of the courses is revised on an ongoing basis to ensure relevance to changing educational employment and marketing needs. The instructor will endeavor to provide notice of changes to students if happen. Timetables also will be revised continuously.

Clinical biochemistry

1	Course name	Clinical Biochemistry
2	Course Code	PH 304
3	Course type: /general/specialty/optional	General
4	Accredited units	3 units (2 hrs./week theoretical 2 hrs./week practical)
5	Educational hours	4 hours / week
6	Pre-requisite requirements	Biology, pathology and organic chemistry
7	Program offered the course	Department of Pharmaceutical chemistry
8	Instruction Language	English
9	Date of course approval	12/2021

Brief Description:	Clinical biochemistry is the division of laboratory medicine that deals with the measurement of chemicals (both natural and unnatural) in blood, urine and other body fluids. The subject deals with study of acid-base balance of the body, normal and abnormal serum levels of electrolytes, enzyme, hormones and CBC levels.	
Textbooks required for this Course:	1- Clinical biochemistry. By GawMurphy cowanetal. 4 th edition. Elsvier 2. Clinical Biochemistry: An illustrated color text. By Allan Gaw, Michael J Murphy, Rajeev Srivastava, Robert A Cowan, and Denis St J O'Reilly. Elsevier Ltd 3. Basic Concepts in Clinical Biochemistry: A Practical Guide. By Vijay Kumar, Kiran Dip Gill. Springer Nature. 4. Clinical Biochemistry: Lecture Notes. By -Peter Rae, MikeCrane, Rebecca Pattenden. John Wiley & Sons Ltd	
Course Duration	28 weeks	
Delivery	<ul style="list-style-type: none"> Lecture-based, Group interaction and discussion, Use of video technique, practical classes. 	
Course Objectives:	By the end of the course, students should be able to: <ol style="list-style-type: none"> Study of the biochemical composition of the human body. Summarizing changes in biochemical indicators of diseases Understand the mechanism of metabolism and the changes associated with different disease states. Explanation of ways to ensure the quality of medical laboratories. performance and the interpretation of the various results. Determining the accurate description of changes in blood chemistry and describing the disease and its origin. 	
Course Assessments	Midyear exam	20%
	Quizzes, reports, presentation	10%
	Practical continuous assessment, exam	10%
	Final Practical exam	20%
	Final theoretical exam	40%
	Total	100%
Content Breakdown Topical Coverage	Content Breakdown Topical Coverage	
Session 1(Week 1)	Unit I: Introduction: (3 hr.) <ol style="list-style-type: none"> Definition of clinical biochemistry laboratory The use of the laboratory The interpretation of results Reference intervals Specimen collection 	
Session 2(Week 2)	Unit 2-Fluid, electrolyte balance adrenal functions (9hrs.) <ol style="list-style-type: none"> Concept and vocabulary types of buffering system. acid-base homeostasis.(alkalosis and acidosis) 	
Session 3(Week 3)	<ol style="list-style-type: none"> Hypernatremia and hyponatremia Hyperkalemia and hypokalemia 	
Session 4(Week 4)	Unit 3. Investigation of renal function: (6 hr) <ol style="list-style-type: none"> Functions of the kidney 	

	<ul style="list-style-type: none"> b. Glomerular function c. Principal of GFR d. Renal tubular function
Session 5(Week 5)	<ul style="list-style-type: none"> e. Acute renal failure f. Chronic renal failure f. Tubular dysfunction g. Specific proteinuria h. Glycosuria
Session 6(Week 6)	Unit 4-Blood Biochemistry and Clinical enzymology (6hrs) <ul style="list-style-type: none"> a. Acid base metabolic disorders b. Blood gases and respiratory disorders
Session 7(Week 7)	<ul style="list-style-type: none"> c. plasma protein and enzymes of clinical significance d. Immunoglobulin and acute phase proteins
Session 8(Week 8)	Unit 5. Endocrinology and diabetes (15 hrs.) <ul style="list-style-type: none"> a. Biochemical regulators b. Hormone structure c. Assessment of endocrine Control d. Types of endocrine control
Session 9(Week 9)	<ul style="list-style-type: none"> a. <u>Pituitary function</u> (Anterior & Posterior pituitary hormones b. Pituitary tumors c. Hypopituitarism d. Growth disorders and acromegaly e. Growth hormone insufficiency
Session 10(Week 10)	<ul style="list-style-type: none"> a. Thyroid biochemistry and thyroid disorders (- Goiter, Grave's disease, hypothyroidism, hyperthyroidism). b. Adrenal biochemistry and adrenal disorders (Hypofunction and Hyperfunction of the adrenal cortex)
Session 11(Week 11)	Midyear Exam
Session 12(Week 12)	
Session 13(Week 13)	
Session 14(Week 14)	
Session 16(Week 16)	<ul style="list-style-type: none"> a. Gonadal functions and dynamic functions tests b. g. Hypothalamic–pituitary–gonadal axis c. h. Disorders of male sex hormones d. Disorders of female sex hormones
Session 17(Week 17)	Glucose metabolism and diabetes mellitus: <ul style="list-style-type: none"> a. Insulin b. Diabetes mellitus c. Factor affecting blood glucose level d. Diagnosis and monitoring of diabetes mellitus
Session 18(Week 18)	Unit 6. GIT biochemistry (3 hr) <ul style="list-style-type: none"> a. Enzyme analysis b. Fecal analysis
Session 19(Week 19)	Unit 7. Plasma enzyme in diagnosis: (3 hr) Introduction, assays of enzymes, and enzymes of diagnostic value
Session 20(Week 20)	Unit 8. Clinical biochemistry of the Liver (6 hrs.) <ul style="list-style-type: none"> a. Liver function tests and liver enzyme b. bilirubin metabolism c. Jaundice and liver diseases: acute and chronic liver diseases.

Session 21(Week 21)	c.Viral Hepatitis: investigation and interpretation of lab findings
Session 22(Week 22)	Unit 9. Plasma lipid & Lipoprotein: (3 hr) a. Chemical classification of plasma lipid & atherogenic profiles. b. Classification of plasma lipoproteins, metabolism, & their function
Session 23(Week 23)	Unit 10-Clinical biochemistry of CVS(3 hrs.) a. Myocardial infarction. b. Cardiac markers c. Hypertension
Session 24(Week 24)	Unit 11. Clinical biochemistry of skeleton(3 hrs.) a. Calcium regulation, calcium status and bone metabolism b. Bone diseases, osteoporosis and rickets c. Hyperuricemia and gout d. Risk factors.
Session 25(Week 25)	Unit 12. Hematology: (3 hr) a. Red & white blood cells b. Blood cells production(site of production, hematopoiesis) c. Anemias d. leukemias
Session 26(Week 26)	Unit 13. Special topics (9 hrs.) a. Paediatric biochemistry biochemistry of Pregnancy and Clinical Gynecology c. Point of care testing (POCT)
Session 27(Week 27)	d. DNA diagnosis e. Tumor markers
Session 28(Week 28)	f. Therapeutic drug monitoring g. Fetal monitoring, prenatal diagnosis and Newborn screening
	Final theoretical exam.
Practical work (one/week)	Practical Part: 1. Common Clinical Laboratory Hazards and Waste Disposal 2. Blood Collection 3. Quality Control in Laboratory 4. Determination of blood acidity and alkalinity (blood gases). Case history 5. Investigation & case history 6. Estimation of Urea in Serum and Urine 7. Determine Urea Clearance 8. -Estimated GFR. Case history 9. Review 10. Biochemical tests in liver function. Case history 11. RBS, FBS, OGTT. Case history 12. Lipid Profile in Serum Sample. Case history 13. CBC, blood types, Laboratory investigation of iron disorders, Case history 14. Biochemistry testing in calcium disorders or bone disease 15. Dynamic function tests (Insulin stress test, GnRH test, OGTT with GH, Measurement, TRH test,) 16. Pituitary function, Case history 17. Tests of growth hormone Insufficiency, -Case history 18. Thyroid function tests. -Case history 19. Assessing the Hypothalamic-Pituitary-adrenocortical, Axis function. - Case history.

	20. -Synacthen tests – Dexamethasone, - suppression tests, - Case history. 21. Urine analysis and fecal analysis
	Final practical Exam
Attendance Expectations	Students are expected to attend every session of class, arriving on time, returning from breaks promptly and remaining until class is dismissed. Absences are permitted only for medical reasons and must be supported with a doctor's note.
Generic Skills	The faculty is committed to ensuring that students have the full range of knowledge and skills required for full participation in all aspects of their lives, including skills enabling them to be life-long learners. To ensure graduates have this preparation, such generic skills as literacy and numeric, computer, interpersonal communications, and critical thinking skills will be embedded in all courses.

Pharmaceutical Microbiology II

1	Course name	Pharmaceutical Microbiology II
2	Course Code	PH307
3	Course type: /general/specialty/optional	Specialty
4	Accredited units	3 units (3 theory + 2 Practical)
5	Educational hours	5 hours/week
6	Pre-requisite requirements	Microbiology II
7	Program offered the course	Bachelor Degree in Pharmaceutical Sciences
8	Instruction Language	English language
9	Date of course approval	12/2021

Brief Description:	This course provides learning opportunities for understanding the principles of immunology and being familiar with the role of the immune system in health well-being. In addition, this course is taught pathogenicity (the mechanisms by which the microbes cause the diseases). Also, this course explains the phenomena of biofilm and the mechanisms by which the pathogens resist antimicrobial agents, and how the antimicrobial agents fight the pathogens. Furthermore, this course is concerned with providing knowledge about how to explore new antimicrobial agents from microbes to kill other microbes by use of fermentation and recombinant DNA techniques..
Textbooks required for this Course:	<ol style="list-style-type: none"> 1. Pharmaceutical biotechnology Fundamental and application, 5th Edition. Daan J.A. Crommelin, Robert D. Sindelar, Bernd Meibohm Editors. Springer 2. Pharmaceutical biotechnology Concept and application. Gary Walsh. John Welly&Sons.Ltd 3. Microbiology an Introduction,9th edition; (2004).Tortora GJ, Funke BR & Case CL. (Pearson International edition) 4. Additional Resources: Lectures Notes
Course Duration	28 weeks
Delivery	<ol style="list-style-type: none"> 1. Lectures (Tools: board, data show). 2. Practical classes (Lab experiments+ computerized experiments simulation) 3. Assignments, reports and power point presentation thesis. 4. Construction of illustrated posters.

Course Objectives:	<p>At the end of course the student will be able to</p> <ol style="list-style-type: none"> 1. explain the nature and definitions of immunology, illustrate the concept of immunology and its function and describe the differences between the innate and the acquired immune system. 2. The student will be able to explain the microbial mechanism by which microbes cause disease and to explain the properties of biofilms and their effect on medicine and industry. 3. The student will be able to explain the concept and importance of industrial pharmaceutical microbiology. 4. . The student will be able to explain the basics of fermentation techniques and their importance in exploring new pharmaceutical substances of interest. 5. The student will be able to demonstrate the technique of cloning and gene expression and its importance in the exploration of new pharmaceutical materials of interest. 6. The student will have acquired the skill of using the microscope. 7. The student will be able to interpret the results and find and assess the information of different microbial diseases quickly and reliably. 8. The student will be able to use the internet to search and prepare reports and do a presentation. 													
Course Assessments	<table border="1"> <tr> <td>Midyear exam</td> <td>20%</td> </tr> <tr> <td>Quizzes, reports, presentation</td> <td>10%</td> </tr> <tr> <td>Practical continuous assessment, exam</td> <td>10%</td> </tr> <tr> <td>Final Practical exam</td> <td>20%</td> </tr> <tr> <td>Final theoretical exam</td> <td>40%</td> </tr> <tr> <td>Total</td> <td>100%</td> </tr> </table>	Midyear exam	20%	Quizzes, reports, presentation	10%	Practical continuous assessment, exam	10%	Final Practical exam	20%	Final theoretical exam	40%	Total	100%	
Midyear exam	20%													
Quizzes, reports, presentation	10%													
Practical continuous assessment, exam	10%													
Final Practical exam	20%													
Final theoretical exam	40%													
Total	100%													
Content Breakdown Topical Coverage	Content Breakdown Topical Coverage													
Session 1 (Week 1)	General introduction to immunology													
Session 2 (Week 2)	Innate immune system (cells, functions and mechanisms)													
Session 3 (Week 3)	Acquired immune system(cells, functions and mechanisms)													
Session 4 (Week 4)	Autoimmune diseases and Hypersensitivity													
Session 5 (Week 5)	Workshop session / scientific activity/ presentation													
Session 6 (Week 6)	Introduction in microbial Pathogenicity & predispose factors of infection with True and Opportunistic pathogens													
Session 7 (Week 7)	<p>Microbial Portal of entry and portal of exit and specificity of portals to specific microbes and microbial virulence factor</p> <p>Major steps of pathogenicity & minimum infectious dose (MID) & Strategies of microbe to evade the host defense</p>													
Session 8 (Week 8)	<p>Classification of antimicrobial agents according to the microbial biology</p> <p>Mode of action of antibiotics against pathogenic bacteria, bacteriostatic and bactericide concept and</p>													
Session 9 (Week 9)	Assessment of minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC)													
Session 10 (Week 10)	Workshop session / scientific activity/ presentation													
Session 11 (Week 11)														

Session 12 (Week 12)	Midyear exam
Session 13 (Week 13)	
Session 14 (Week 14)	
Session 15 (Week 15)	Strategies and predispose factors of bacterial resistance. (Miss use & over use of antibiotics, capsules, cell wall components, antigenic variation)
Session 16 (Week 16)	Biofilm: definition, origin, characteristics, stages of biofilm development, Quorum Sensing and dispersal
Session 17 (Week 17)	Antibiofilm agents (natural and synthetics)
Session 18 (Week 18)	Biofilm risk on medicine and industry and types of anti-biofilm agents (natural and chemical)
Session 19 (Week 19)	Rate of Microbial Death and Conditions influencing the Effectiveness of Antimicrobial Agent Activity.
Session 20 (Week 20)	Workshop (Assignment, discussion and presentation)
Session 21 (Week 21)	History, medical importance and general introduction to pharmaceutical biotechnology (Fermentation and type of fermentation & Recombinant DNA) Fermentation: (fermenter, Media, Batch/continuous/feed batch fermentation) and differences between fermenter and Bioreactor
Session 22 (Week 22)	Fermentation Production of vinegar (slow process, quick process, and natural fermentation and uses of vinegar), and alcohol
Session 23 (Week 23)	Fermentation Production of vitamins and amino acids
Session 24 (Week 24)	Fermentation Production of organic acid; Lactic acid
Session 25 (Week 25)	Fermentation Production of organic acid; Acetic acid
Session 26 (Week 26)	Fermentation production of antibiotics, steroids
Session 27 (Week 27)	Production of vaccines from microbes
Session 28 (Week 28)	Gen cloning (recombinant DNA)
	Final theoretical exam
Practical work (one/week)	1-Laboratory regulations: -Equipment and aids in microbiology labs. 2-Determination of minimum inhibitory concentration(MIC) 3- Determination of minimum bactericidal concentration (MBC) 4-Assessment of bacterial sensitivity to antibiotics. 5- Assessment of bacterial resistance to antibiotics. 6- Practicing the fermentation technique
	Final practical exam
Attendance Expectations	Students are expected to attend every session of class, arriving on time, returning from breaks promptly and remaining until class is dismissed. Absences are permitted only for medical reasons and must be supported with a doctor's note.
Generic Skills	By the end of the course the students will have the full range of knowledge and skills required for full participation in all aspects of their lives, including skills enabling them to be life-long learners. To ensure graduates have this preparation, such generic skills as literacy and numeric, computer, interpersonal communications, and critical thinking skills will be embedded in this course
Course Change	Content of the courses is revised on an ongoing basis to ensure relevance to

	changing educational employment and marketing needs. The instructor will endeavor to provide notice of changes to students if happen. Timetables also will be revised continuously.
--	---

Pharmaceutical Biotechnology

1	Course name	Pharmaceutical biotechnology
2	Course Code	PH 401
3	Course type: /general/specialty/optional	2 hours theory
4	Accredited units	2 units
5	Educational hours	2 hours/week
6	Pre-requisite requirements	Biology
7	Program offered the course	Department of biomedical science
8	Instruction Language	English
9	Date of course approval	12/2021

Brief Description:	<ul style="list-style-type: none"> • Biotechnology has a long promise to revolutionize the biological sciences and technology. • Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. • Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. • Biotechnology has already produced transgenic crops and animals and the future promises lot more. • It is basically a research-based subject. 	
Textbooks required for this Course:	<ol style="list-style-type: none"> 1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C. 2. RA Goldshy et. al., : Kuby Immunology. 3. J.W. Goding: Monoclonal Antibodies. 4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry. 5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio. 6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication. 7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi 	
Course Duration	28 weeks	
Delivery	<ul style="list-style-type: none"> • Lecture-based, Group interaction and discussion, Use of video technique, practical classes. 	
Course Objectives:	<p>Upon completion of the subject student shall be able to;</p> <ol style="list-style-type: none"> 1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries 2. Genetic engineering applications in relation to production of pharmaceuticals 3. Importance of Monoclonal antibodies in Industries 4. Appreciate the use of microorganisms in fermentation technology 	
Course Assessments	Midyear exam	20%
	Quizzes, reports, presentation	10%
	Practical continuous assessment, exam	10%
	Final Practical exam	20%
	Final theoretical exam	40%
	Total	100%
Content Breakdown Topical Coverage	Content Breakdown Topical Coverage	
Session 1 (Week 1)	Unit I (10 Hours) a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.	
Session 2 (Week 2)	c) Biosensors- Working and applications of biosensors in Pharmaceutical	

	Industries. d) Brief introduction to Protein Engineering. e) Use of microbes in industry. Production of Enzymes- General consideration -Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.
Session 3 (Week 3)	f) Basic principles of genetic engineering.
Session 4 (Week 4)	g) Brief introduction to PCR.
Session 5 (Week 5)	h) Study of cloning vectors, restriction endonucleases and DNA ligase. i) Overview protein and protein chemistry.
Session 6 (Week 6)	j) Protein extraction and protein purification (chromatography)
Session 7 (Week 7)	k) protein assay and electrophoresis (agarose and SDS-PAGE)
Session 8 (Week 8)	Unit II (10 hours) a. Florescence protein, FRET and using fluorescence in measurement drug protein interaction.
Session 9 (Week 9)	b) Recombinant protein
Session 10 (Week 10)	c) Recombinant DNA technology. Application of genetic engineering in medicine. c) Application of r DNA technology and genetic engineering in the production of: i) Interferon ii) Vaccines- hepatitis- B
Session 11 (Week 11)	Midyear exam
Session 12 (Week 12)	
Session 13 (Week 13)	
Session 14 (Week 14)	
Session 15 (Week 15)	iii) Hormones-Insulin.
Session 16 (Week 16)	d) Brief introduction to PCR
Session 17 (Week 17)	Unit III (10 Hours) Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins b) Structure and Function of MHC
Session 18 (Week 18)	c) Hypersensitivity reactions, Immune stimulation and Immune suppressions. d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity..
Session 19 (Week 19)	e) Storage conditions and stability of official vaccines
Session 20 (Week 20)	f) Hybridoma technology- Production, Purification and Applications g) Blood products and Plasma Substitutes
Session 21 (Week 21)	Unit IV (08Hours) a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting. b) Genetic organization of Eukaryotes and Prokaryotes
Session 22 (Week 22)	c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.
Session 23 (Week 23)	d) Introduction to Microbial biotransformation and applications.
Session 24 (Week 24)	e) Mutation: Types of mutation/mutants.

Session 25 (Week 25)	Unit V (07 Hours) a) Fermentation methods and general requirements, study of media, equipments,sterilization methods, aeration process, stirring.
Session 26 (Week 26)	b) Large scale production fermenter design and its various controls. c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid,Griseofulvin,
Session 27 (Week 27)	c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid,Griseofulvin,
Session 28 (Week 28)	d) Blood Products: Collection, Processing and Storage of whole human blood, driedhuman plasma, plasma Substitutes.
	Final theoretical Exam.
Practical work (one/week)	<ol style="list-style-type: none"> 1. Competent bacteria (Top 10 and BL21). 2. Insert plasmid in competent bacteria. 3. protein production and purification (affinity column). 4. Assay protein.
	Final Practical Exam
Attendance Expectations	Students are expected to attend every session of class, arriving on time, returning from breaks promptly and remaining until class is dismissed. Absences are permitted only for medical reasons and must be supported with a doctor's note.
Generic Skills	The faculty is committed to ensuring that students have the full range of knowledge and skills required for full participation in all aspects of their lives, including skills enabling them to be life-long learners. To ensure graduates have this preparation, such generic skills as literacy and numeric, computer, interpersonal communications, and critical thinking skills will be embedded in all courses.

