

ZOO-3101 DIVERSITY OF INVERTEBRATES		Credit Hrs. 3(2-1)
Week	Topics	Assignment/Quiz
Week 1	Introduction <ul style="list-style-type: none"> • Classification of Organisms: • Evolutionary Relationships and Tree Diagrams: • Patterns of organization 	
Week 2	Animal-Like Protists: The Protozoa <ul style="list-style-type: none"> • Introduction to Protozoans • General characteristics and classification • Major protozoan groups (e.g., Mastigophora (Leishmania, Trypanosomiasis, Giardiasis 	
Week 3	<ul style="list-style-type: none"> • Amoebozoa (Entamoeba histolytica), Ciliophora (Balantidium coli, Apicomplexa (Plasmodium, Toxoplasmosis), Euglenozoa) • Modes of locomotion (pseudopodia, cilia, flagella) • Feeding mechanisms and nutrition • Reproduction and life cycles <p>Ecological roles of protozoans</p>	
Week 4	Multicellular and Tissue Levels of Organization Phylum Porifera <ul style="list-style-type: none"> • Characteristics and classification of Porifera (sponges) • Anatomy, Physiology, and Ecology of Parazoa • Modes of reproduction in sponges <p>Ecological roles and importance of sponges</p> <ul style="list-style-type: none"> • 	Assignment#1
Week 5	Phylum Cnidaria (Coelenterate) and Phylum Ctenophore:	

	<ul style="list-style-type: none"> • Introduction to Radiata • Characteristics and classification of Cnidaria (e.g., hydroids, jellyfish, corals) and Ctenophora (comb jellies) • 	
Week 6	<ul style="list-style-type: none"> • General structure and function of cnidarians and ctenophores • Modes of reproduction in cnidarians and ctenophores <p>Ecological roles and importance of cnidarians and ctenophores</p>	Quiz #1
Week 7	<p>The Triploblastic and with Acoelomate Body Plan</p> <p>Phylum Platyhelminthes</p> <ul style="list-style-type: none"> • Introduction to Protostomes • Major protostome groups (e.g., Platyhelminthes, Nematoda, Mollusca, Annelida, Arthropoda) • Characteristics and classification of Platyhelminthes • 	
Week 8	Mid Term	
Week 9	<ul style="list-style-type: none"> • Anatomy and physiology of flatworms, Reproduction and development • Ecological roles and parasitism 	Assignment#2
Week 10	<p>Phylum Mollusca</p> <ul style="list-style-type: none"> • Characteristics and classification of Mollusca • Anatomy and physiology of Mollusca • Reproduction and development <p>Ecological roles and economic importance</p> <ul style="list-style-type: none"> • 	

Week 11	<p>Phylum Arthropoda</p> <ul style="list-style-type: none"> • Characteristics and classification of Arthropoda • The Hexapods and Myriapods: <p>Anatomy and physiology of insects, myriapods crustaceans and chelicerates</p>	Quiz #2
Week 12	<p>Phylum Arthropoda</p> <ul style="list-style-type: none"> • Characteristics and classification of of insects, myriapods crustaceans and chelicerates • Comparative Analysis and Evolutionary Trends, of protozoans, parazoans, radiates, and protostomes 	
Week 13	<p>Phylum Arthropoda</p> <p>Evolutionary trends and phylogenetic relationships</p> <p>Phylum Nematoda</p> <ul style="list-style-type: none"> • Characteristics and classification of Nematoda 	
Week 14	<ul style="list-style-type: none"> • Anatomy and physiology of nematodes <p>Reproduction and development</p>	
Week 15	<p>Phylum Annelida</p> <ul style="list-style-type: none"> • Characteristics and classification of Annelida • Anatomy and physiology of annelids • Reproduction and development <p>Ecological roles and importance</p>	
Week 16	<p>Phylum Echinoderms</p> <ul style="list-style-type: none"> • General characteristics of Echinoderms • Water vascular system • Maintenance Functions, Locomotion, feeding, and respiration • Regeneration and Reproduction 	

	<ul style="list-style-type: none">• Evolutionary Significance of Echinoderms• Evolutionary history, Classification, Diversity within Echinoderms	
Week 17	Terminal Examination	

IDC-3102 Diversity of plants		Credit Hrs. 3(2-1)
Weeks	Topic of Lecture	
1 st	Origin, diversity, and evolution of life	
	Origin, diversity, and evolution of life	
2 nd	life forms, structure, reproduction, and ecological significance of: Viruses	
	life forms, structure, reproduction, and ecological significance of: Viruses,	
3 rd	life forms, structure, reproduction, and ecological significance of: Bacteria	
	life forms, structure, reproduction, and ecological significance of: Bacteria	
4 th	life forms, structure, reproduction, and ecological significance of: cyanobacteria	Assignment #1
	life forms, structure, reproduction, and ecological significance of: cyanobacteria	
5 th	life forms, structure, reproduction, and ecological significance of: Fungi	
	life forms, structure, reproduction, and ecological significance of: Fungi	
6 th	life forms, structure, reproduction, and ecological significance of: Algae	Quiz #1
	life forms, structure, reproduction, and ecological significance of: Algae	
7 th	Diversity and adaptation of Bryophytes on land environment	
	Diversity and adaptation of Bryophytes on land environment	
8 th	Midterm	
9 th	Habit, habitat, and reproduction of Hepaticopsida (Liverworts)	Assignment #2
	Habit, habitat, and reproduction of Hepaticopsida (Marchantia)	
10 th	Habit, habitat, and reproduction of Anthoceroopsida (Anthoceros)	
	Habit, habitat, and reproduction of Anthoceroopsida (Anthoceros)	
11 th	Habit, habitat, and reproduction of Funaria	Quiz #2
	Habit, habitat, and reproduction of Funaria	
12 th	Pteridophytes (Fossils and fossilization)	
	Psilopsida (Psilotum)	
13 th	Lycopsida (Selaginella)	
	Lycopsida (Selaginella)	

14 th	Sphenopsida (Equisetum)	
	Sphenopsida (Equisetum)	
15 th	Pteropsida (Marsilea)	
	Seed habit and evolution of the leaf	
16 th	Distinguishing features, diversity, and life cycle of gymnosperms	
	Distinguishing features, diversity, and life cycle of angiosperms	
17 th	Terminal Eamination	

GEN-3103		Quantitative Reasoning-I	Credit Hrs. 3(3-0)
Week	Topics	Assignment/Quiz	
Week 1	<ul style="list-style-type: none"> Number systems and basic arithmetic operations 		
Week 2	<ul style="list-style-type: none"> Units, unit conversions, dimensions 		
Week 3	<ul style="list-style-type: none"> Area, perimeter, and volume calculations 		
Week 4	<ul style="list-style-type: none"> Rates, ratios, proportions, and percentages 	Assignment#1	
Week 5	<ul style="list-style-type: none"> Types and sources of data; measurement scales 		
Week 6	<ul style="list-style-type: none"> Tabular and graphical presentation of data; exercises on number knowledge 	Quiz #1	
Week 7	<ul style="list-style-type: none"> Basics of geometry: lines, angles, circles 		
Week 8	Midterm		
Week 9	<ul style="list-style-type: none"> Basics of geometry: polygons and their properties 	Assignment#2	
Week 10	<ul style="list-style-type: none"> Sets and set operations Relations, functions, and their graphs 		
Week 11	<ul style="list-style-type: none"> Exponents, factoring, and simplifying algebraic expressions 	Quiz #2	
Week 12	<ul style="list-style-type: none"> Population, sample, measures of central tendency 		
Week 13	<ul style="list-style-type: none"> Measures of dispersion and data interpretation 		
Week 14	<ul style="list-style-type: none"> Rules of counting: multiplication principle, permutations, combinations 		
Week 15	<ul style="list-style-type: none"> Basic probability theory and examples 		
Week 16	<ul style="list-style-type: none"> Introduction to random variables and their probability distributions 		
Week 17	Terminal Examination		

GEN-3104 Introduction to Environmental Science Credit Hrs. 3(2-1)		
Week	Topics	Assignment/Quiz
Week 1	1. The human environment: The litho, bio, and hydro spheres,	
Week 2	the nature and composition of natural waters,	
Week 3	2. Pollution: definition, classification, and impact on habitats	
Week 4	i. Air pollution: Sources and effects of various pollutants (inorganic, organic),	Assignment#1
Week 5	ii. control, and remediation	
Week 6	iii. . Photochemical smog, Smog,	Quiz #1
Week 7	iv. Acid rain: 1. Theory of acid rain, 2. Adverse effects of acid rain. Chlorofluorocarbons and their effects.	
Week 8	Midterm	
Week 9	v. Water pollution: Major sources of water pollution and its impact.	Assignment#2
Week 10	vi. Prevention, control remediation, Heavy metal pollution. Tanneries. Hospital waste, Treatments of sewage, sludge, and polluted waters.	
Week 11	Soil pollution: major sources of soil pollution and its impact. Prevention, control remediation. Noise pollution.	Quiz #2
Week 12	Sources of Noise pollution, remedies of noise pollution	
Week 13	3. Ozone layer: Formation	
Week 14	Mechanism of depletion Effects of ozone depletion	
Week 15	Greenhouse effect: causes,	
Week 16	impacts	
Week 16	Terminal Examination	

GEN-3105		Functional English	Credit Hrs. 3(3-0)
Week	Lecture	Topics	Activity
Week 1	Lecture 1	Introduction To Grammar: Role of Grammar in Communication, Course Overview	
	Lecture 2	Sentence Elements: Subject, Verb, Object, Complement, Predicate, Sentence Agreement	
	Lecture 3	Parts of Speech: Noun, Pronoun, Verb, Adjective, Adverb, Conjunction, Interjection, Preposition Noun: Proper Noun, Common Noun, Abstract Noun, Concrete Noun, Collective Noun, Compound Noun, Countable Noun, Uncountable Noun	
Week 2	Lecture 1	Pronoun: Personal Pronoun, Possessive Pronoun, Indefinite Pronoun, Relative Pronoun, Intensive Pronoun, Demonstrative Pronoun, Interrogative Pronoun, Reflexive Pronoun	
	Lecture 2	Adjective: Descriptive, Demonstrative, Possessive, Interrogative, Indefinite, Compound Adjectives, Adjectives of Number or Adjectives Of Quantity (Definite Numeral Adjectives, Indefinite Numeral Adjectives, Distributive Numeral Adjectives) Verb: Action Verb, Compound Verb, Transitive and Intransitive Verb, Auxiliary Verb, Modal Verb, Phrasal Verb, Regular, Irregular Verbs	
	Lecture 3	Adverb: Adverb of Manner, Adverb of Time, Adverb of Place Prepositions: Types of Preposition (Functional Types: Preposition of Time, Preposition of Place, Preposition of Direction/Movement) Types of Preposition (on the Basis of Structure): Double Prepositions, Compound Prepositions, Participle Prepositions, Phrase Prepositions	
Week 3	Lecture 1	Conjunction: Coordinating Conjunction, Correlative Conjunction, Subordinating Conjunction	
	Lecture 2	Interjection: Emotive Interjection, Volitive Interjection, Cognitive Interjection	
	Lecture 3	Articles: Definite and Indefinite, Usage Rules, Exceptions Parts of Speech: Practice- Identification, Correction Exercises	
Week 4	Lecture 1	Sentence Structure: Sentence Basics (Simple, Negative, Interrogative); Types By Structure: Simple,	Assignment#1

		Compound, Complex, Compound-Complex; Types by Function: Declarative, Interrogative, Imperative, Exclamatory	
	Lecture 2	Tenses: Present, Past and Future Tense: Rules and Exercises	
	Lecture 3	Voice: Active and Passive: Introduction, Definition of Voice, Transformation Rules for all Tenses, Passive of Imperatives	
Week 5	Lecture 1	Voice Practice: Conversion Exercises, Correcting Passive Misuse	
	Lecture 2	Unified Sentences in English: Definition, Coherence, Unity, Logical Flow	
	Lecture 3	Unified Sentences (Continued): Use Of Transitional Devices, Maintaining Paragraph Unity	
Week 6	Lecture 1	Phrases: Introduction, Structure and Types: Noun, Verb, Adjective, Adverb, Prepositional Phrases Phrase Practice: Usage in Writing, Combining Phrases	Quiz #1
	Lecture 2	Clauses: Introduction Difference between Clause and Phrase	
	Lecture 3	Types of Clause: Independent Clause, Dependent Clause Types Of Dependent Clauses: Noun, Adjective, Adverb Clauses with Examples	
Week 7	Lecture 1	Punctuation (Basics): Full Stop, Comma, Question Mark, Exclamation Mark	
	Lecture 2	Advanced Punctuation: Semicolon, Colon, Apostrophe, Quotation Marks, Parentheses	
	Lecture 3	Advanced Punctuation (Continued): Brackets, Braces, Dash, Hyphen, Ellipsis	
Week 8	Midterm		
Week 9	Lecture 1	Spelling Rules: Common Spelling Rules (E.G., -le/-ei, Silent Letters, Homophones), Doubling Consonants, Silent Letters (Kn, Wr, Gh)	
	Lecture 2	Spelling Rules (Continued): Suffixes (-Ing, -Ed, -Able), Confusing Pairs (Their/There/They Are, Affect/Effect)	Assignment#2
	Lecture 3	Reading Comprehension: Definition, Levels of Comprehension, Principles/Rules of Comprehension	
Week 10	Lecture 1	Reading Comprehension (Continued): Literal, Inferential	
	Lecture 2	Reading Comprehension (Continued): Evaluative Reading; Skimming and Scanning Techniques	

	Lecture 3	Comprehension Practice: Exercises On Reading between and Beyond the Lines, Answering Questions	
Week 11	Lecture 1	Discussion Skills: Introduction and Importance	
	Lecture 2	Discussion Skills (Continued): Strategies-Turn-Taking, Active Listening, Using Transitions, Asking Clarifying Questions, Agreeing/Disagreeing Politely	Quiz #2
	Lecture 3	Discussion Practice-Topics: Narrating Past Events, Comparing Ideas, Expressing Opinions	
Week 12	Lecture 1	Listening Skills: Introduction, Types of Listening: Active, Reflective, Critical, Appreciative, Empathetic; Common Listening Barriers	
	Lecture 2	Listening Practice: Note-Taking, Summarizing Audio/Video Clips, Identifying Key Ideas	
	Lecture 3	Listening Practice: Listening to Documentaries for Main Ideas	
Week 13	Lecture 1	Translation Skills: Introduction Types of Translation: Literal, Contextual, Idiomatic, Communicative	
	Lecture 2	Translation Skill: Basic Rules for Urdu to English Translation and Sentence Structure	
	Lecture 3	Translation Practice: Urdu To English Sentence and Paragraph Translation	
Week 14	Lecture 1	Paragraph Writing: Introduction, Parts of a Paragraph: Topic Sentence, Supporting Details, Coherence, Conclusion	
	Lecture 2	Paragraph Practice: Descriptive, Narrative, Argumentative Paragraphs with Transitions	
	Lecture 3	Presentation Skills: Introduction, Types of Presentations: Informative, Persuasive, Demonstrative	
Week 15	Lecture 1	Types of Presentations (Continued): Motivational, Instructional, Impromptu	
	Lecture 2	Structure and Tips For Effective Presentations	
	Lecture 3	Presentation Techniques: Verbal/Non-Verbal Communication, Visual Aids	
Week 16	Lecture 1	Presentation Techniques (Continued): Slide Design, Tone, Pace	
	Lecture 2	Student Presentations (Prepared): Delivering Informative or Persuasive Talks with Feedback	

	Lecture 3	Student Presentations (Impromptu): On-The-Spot Speaking, Timing, Confidence-Building	
Week 17		Terminal Examination	

GEN-3106 Application of Information and Communication Technology Credit Hrs. 3(2–1)			
Week	Topics (Theory)	Practical Work	Assignment/ Quiz
Week 1	Introduction to ICT, Scope, and Components (hardware, software, networks, cloud storage)	Basic computer usage, file management (creating folders, naming conventions)	
Week 2	ICT in Daily Life: Use in education, business, governance, healthcare, etc.	Cloud storage: Google Drive, Dropbox, OneDrive – uploading, organizing, and sharing files	
Week 3	Emerging technologies and future trends	Web exploration: Effective searching using Google, Bing (search operators, filters)	
Week 4	Formal Communication Tools: Gmail, Outlook & Netiquette	Send professional emails, attach files, apply formatting, set auto-reply	Assignment #1
Week 5	MS Word: Basics, formatting, document creation	Hands-on with MS Word: Create letter, resume, formatted report	
Week 6	MS Excel: Data entry, formulas, functions, charts	Hands-on with MS Excel: Budget sheet, formulas, basic chart creation	Quiz #1
Week 7	MS PowerPoint: Slide design, presentation techniques	Create a presentation on ICT tools in education (insert media, animations)	
Week 8	Midterm		
Week 9	Google Workspace: Docs, Sheets, Slides overview	Create a document using Google Docs, collaborate in real-time	Assignment#2
Week 10	Evernote & OneNote: Note-taking and organization tools	Use OneNote/Evernote to create categorized notes, to-do lists	
Week 11	Video Conferencing Tools: Zoom, Meet, Teams	Setup a meeting, share screen, chat, use breakout rooms	Quiz #2
Week 12	LMS and Online Education: Moodle, Google Classroom, Coursera	Practice logging in, submitting assignments, participating in discussion forums	
Week 13	ICT in Health: Fitness apps and Telemedicine	Explore Google Fit or Samsung Health; simulate booking on Sehat Kahani	
Week 14	Online Banking & E-Commerce	Simulate wallet setup (JazzCash), explore Daraz.pk features	
Week 15	Digital Citizenship, Cyberbullying, Intellectual Property	Group discussion & case study on online harassment and plagiarism	
Week 16	Ethics in ICT, Content Authenticity, and Misinformation	Final practical assessment: Document + presentation + cloud storage submission	
Week 17	Terminal Examination		

3rd Semester

GEN-4301		Islamic Studies	Credit Hrs. 2(2-0)
Week	Lecture No.	Topic	Activity
Week 1	Lecture 1	• قرآن پاک کا تعارف، فضائل ، اعجاز	
	Lecture 2	• قرآن پاک کا نزول قرآن ، جمع و تدوین	
Week 2	Lecture 3	• علوم قرآن: علم تفسیر ، ماخذ تفسیر	
	Lecture 4	• علم اسباب نزول، علم ناسخ و منسوخ	
Week 3	Lecture 5	• سورہ حجرات آیت (01 تا 09)	
	Lecture 6	• سورہ حجرات آیت (10 تا 18)	
Week 4	Lecture 7	• سنت و حدیث کا تعارف: معنی و مفہوم، اقسام	Assignment#01
	Lecture 8	• تاریخ تدوین حدیث	
Week 5	Lecture 9	• سنت کی اُنیسی حیثیت	
	Lecture 10	• منتخب متون احادیث کا مطالعہ: حدیث نمبر 1-05	
Week 6	Lecture 11	• منتخب متون احادیث کا مطالعہ: حدیث نمبر 10-5	Quiz # 01
	Lecture 12	• منتخب متون احادیث کا مطالعہ: حدیث نمبر 15-10	
Week 7	Lecture 13	□ منتخب متون احادیث کا مطالعہ: حدیث نمبر 20-15	
	Lecture 14	□ پیدائش سے بعثت تک نبی کریم ﷺ کی زندگی کے اہم واقعات	
Week 8	Midterm		
Week 09	Lecture 15	□ نبی پاک ﷺ کی مکی زندگی کے اہم واقعات	
	Lecture 16	□ نبی پاک ﷺ کی مدنی زندگی کے اہم واقعات	Assignment# 02

Week 10	Lecture 17	□ خلافت راشدہ (حضرت ابو بکر صدیق رضی اللہ عنہ و حضرت عمر رضی اللہ عنہ کے دور کی اہم خصوصیات	
	Lecture 18	□ خلافت راشدہ (حضرت عثمان رضی اللہ عنہ و حضرت علی رضی اللہ عنہ کے دور کی اہم خصوصیات	
Week 11	Lecture 19	□ عقائد: ایمانیات ثلاثہ (ایمان باللہ، ایمان بالرسالت اور ایمان بالآخرت) (الف)	Quiz # 02
	Lecture 20	□ عقائد: ایمانیات ثلاثہ (ایمان باللہ، ایمان بالرسالت اور ایمان بالآخرت) (ب)	
Week 12	Lecture 21	□ فقہ کا تعارف: پس منظر	
	Lecture 22	□ فقہی مسالک کا تعارف	
Week 13	Lecture 23	□ نماز: اہمیت، طریقہ نماز، مسائل نماز (الف)	
	Lecture 24	□ نماز: اہمیت، طریقہ نماز، مسائل نماز (ب)	
Week 14	Lecture 25	□ روزہ: اہمیت، مسائل روزہ	
	Lecture 26	□ زکوٰۃ: اہمیت، مسائل زکوٰۃ	
Week 15	Lecture 27	□ حج اور عمرہ: اہمیت، طریقہ کار، مسائل (الف)	
	Lecture 28	□ حج اور عمرہ: اہمیت، طریقہ کار، مسائل (ب)	
Week 16	Lecture 29	□ جہاد: اہمیت، مقاصد جہاد، اداب جہاد (الف)	
	Lecture 30	□ جہاد: اہمیت، مقاصد جہاد، اداب جہاد (ب)	
Week 17	Terminal Examination		

GEN-4302		Entrepreneurship	Credit Hrs. 2(2-0)
Week No.	Lecture No.	Topic	Activity
Week 01	Lecture 01 Lecture 02	Introduction to Entrepreneurship Definition and concept of entrepreneurship Why to become and entrepreneur?	
Week 02	Lecture 03 Lecture 04	Entrepreneurial process Role of entrepreneurship in economic development.	
Week 03	Lecture 05 Lecture 06	Entrepreneurial Skills Characteristics and qualities of successful entrepreneurs . Stories of success and failures of entrepreneurs.	
Week 04	Lecture 07 Lecture 08	Areas of essentials entrepreneurial skill and ability, such as creative and critical thinking. Innovation and risk taking abilities of entrepreneurs	Assignment 01
Week 05	Lecture 09 Lecture 10	Opportunities recognition and idea generation Opportunity identification, evaluation and exploitation Innovation, idea generation techniques for entrepreneurial ventures	
Week 06	Lecture 11 Lecture 12	Marketing and sales <ul style="list-style-type: none"> ● Target market identification and segmentation ● Four P's of Marketing 	Quiz #1
Week 07	Lecture 13 Lecture 14	Developing a marketing strategy Branding	
Week 08		Mid Term	
Week 09	Lecture 15 Lecture 16	Financial Literacy: Basic concepts of income, savings and investments Basic concepts of assets, liabilities and equity	
Week 10	Lecture 17 Lecture 18	Basic concepts of revenue and expenses Overview of cash-flows.	Assignment #2
Week 11	Lecture 19 Lecture 20	Overview of banking products Islamic models of financing	
Week 12	Lecture 21 Lecture 22	Sources of funding for startups(angel financing) Debt and equity financing	Quiz #2
Week 13	Lecture 23 Lecture 24	Team Building for Startups:	

		Characteristics and features of effective teams. Features of effective teams	
Week 14	Lecture 25 Lecture 26	_Team building and effective leadership for startups <u>Regulatory Requirements to Establish Enterprises in Pakistan:</u> Types of enterprises (e.g., sole proprietorship,)	
Week 15	Lecture 27 Lecture 28	Partnership, private limited companies. Intellectual property rights and protection	
Week 16	Lecture 29 Lecture 30	Regulatory requirements to register and enterprise in Pakistan, with special emphasis on export firms. Taxation and financial reporting obligation.	
Week 17		Terminal examination	

GEN-4303 Quantitative Reasoning-II Credit Hrs. 3(3-0)		
Week	Topics	Assignment/Quiz
Week 1	<ul style="list-style-type: none"> • Introduction to logic; importance of logical reasoning 	
Week 2	<ul style="list-style-type: none"> • Inductive, deductive, and abductive reasoning approaches 	
Week 3	<ul style="list-style-type: none"> • Propositions, arguments (valid and invalid) 	
Week 4	<ul style="list-style-type: none"> • Logical connectives, truth tables 	Assignment#1
Week 5	<ul style="list-style-type: none"> • Propositional equivalences and logical fallacies 	
Week 6	<ul style="list-style-type: none"> • Venn diagrams; predicates and quantifiers; reasoning exercises 	Quiz #1
Week 7	<ul style="list-style-type: none"> • Introduction to deterministic models 	
Week 8	<ul style="list-style-type: none"> • Midterm 	
Week 9	<ul style="list-style-type: none"> • Using linear functions for real-world modeling 	Assignment#2
Week 10	<ul style="list-style-type: none"> • Modeling with systems of linear equations and solutions 	
Week 11	<ul style="list-style-type: none"> • Elementary introduction to derivatives in modeling 	Quiz #2
Week 12	<ul style="list-style-type: none"> • Linear growth and decay models • Exponential growth and decay models 	
Week 13	<ul style="list-style-type: none"> • Introduction to probabilistic models; bivariate analysis and scatter plots 	
Week 14	<ul style="list-style-type: none"> • Simple linear regression model and correlation analysis 	
Week 15	<ul style="list-style-type: none"> • Basics of estimation and confidence intervals • Hypothesis testing: z-test and t-test basics 	
Week 16	<ul style="list-style-type: none"> • Statistical inference in decision making 	
Week 17	<ul style="list-style-type: none"> • Terminal Examination 	

BOT-4304 Plant Systematics, Anatomy and development Credit Hrs. 3(2-1)

Week	Contents	
1	Introduction to Plant Systematics: aims & importance	
	Classification: artificial, natural & phylogenetic systems	
2	Modern systematics & APG overview	
	Nomenclature: binomial system & Latin names	
3	ICBN – principles	
	Morphology — root, stem & leaf	
4	Morphology — inflorescence & flower types	Assignment #1
	Placentation & fruits	
5	Diagnostic families I: Ranunculaceae, Brassicaceae, Fabaceae, Rosaceae	
	Diagnostic families II: Euphorbiaceae, Cucurbitaceae, Solanaceae	
6	Diagnostic families III: Lamiaceae, Apiaceae, Asteraceae	Quiz #1
	Monocot families: Liliaceae, Poaceae	
7	Integration: Taxonomy & Morphology	
	Introduction to Plant Anatomy & scope	
8	Midterm	
9	Plant tissues overview	Assignment #2
	Parenchyma & Collenchyma	
10	Sclerenchyma, trichomes & stomatal types	
	Xylem — structure & function	

11	Phloem — structure & function	Quiz #2
	Meristems: types, stem & root apices	
12	Primary structure: root, stem & leaf	
	Vascular cambium & activity	
13	Secondary growth in dicot stem	
	Periderm & bark types	
14	Wood characteristics: annual rings, sapwood, heartwood	
	Softwood vs Hardwood	
15	Early development: <i>Capsella bursa-pastoris</i>	
	Anther structure, Microsporogenesis	
16	Ovule, Megasporogenesis & Megagametophyte	
	Endosperm formation, Parthenocarpy & Polyembryony	
17	Terminal	

CHM 4305 Physical Chemistry		Credit Hrs. 4(3-1)
Week	Topics	Assignment/Quiz
Week 1	General characteristics of gases. Gay Lussacs law, ideal gas equation	
	Kinetic Mol. Theory of gases, Molecular velocities	
	Ideal and real gases. Deviation of gases from ideality	
Week 2	Derivation of the kinetic gas equation, Molecular collision	
	Collision diameter, Liquefaction, and critical phenomenon of gases	
	Mean free path, the van der Waals equation for gases	
Week 3	Gen. Characteristics of liquids, Surface tension, and viscosity	
	Parachor, Rheochor and their applications	
	Specific and molar refraction and their applications	
Week 4	Refractive index, Optical activity, specific rotation	Assignment #1
	Dipole moment and molecular structure	
	Gen. Characteristics of solids, types of solids	
Week 5	Habit of crystal, Isotropy and Anisotropy	
	Crystal lattice, Unit cell, Crystal systems	
	Bragg's equation, Bravais lattices	
Week 6	X-ray crystallography of NaCl crystals	Quiz#1
	Introduction to quantum mechanics, Bohr model and its defects	
	Classical mechanics and its failure, the De Broglie equation	
Week 7	Dual nature of matter	
	Heisenberg uncertainty principle and its limitations	
	Wave function and derivation of the Schrodinger wave equation	
	Quantum numbers, electronic configuration, atomic orbitals, and Quantization	
Week 8	Midterm	
Week 9	Introduction to thermodynamics, System, Surroundings, State and State function, Boundary, Internal energy, Extensive intensive properties	Assignment#2
	First law of thermodynamics, Enthalpy, Entropy	
	Relationship between Enthalpy and Free energy change	
Week 10	C _p and C _v and their relationship	
	2 nd law of thermodynamics, Change in free energy and eq. constant	

	Entropy Change in phase transitions, Concept of Gibbs and Helmholtz Free energy	
Week 11	Intro to Kinetics, rate, rate law order and molecularity, Velocity constant	Quiz#2
	Elementary and complex reactions Zero, 1 st , and second order reactions	
	Derivation of the kinetic equation for 1st and second order reactions when initial conc of both are same	
Week 12	Methods of determining the rate of reaction.	
	Arrhenius equation, Lindemann's theory of unimolecular reaction	
	Transition state theory for Bimolecular reaction	
Week 13	Basic Electrochemistry, Conductors, insulators Electrolytic and electronic Conduction, Electrochemical cells and types	
	Specific conductance and its measurement, Cell constant and its determination	
	Molar and Equivalent conductance, Ostwald dilution law, Faraday's law of electrolysis with significance	
Week 14	An introduction to surface chemistry Absorption, adsorption and type, Applications of Adsorption	
	Characteristics and factors of adsorption, Catalysis, types, and characteristics Enzyme catalysis,	
	Freundlich and Langmuir Adsorption Isotherms	
Week 15	Intro and types of solutions Concentration units of solutions	
	Molecular interactions in solutions, Zeo and Azeotropic mixtures, Ideal and Non-Ideal solutions, Raoult's Law	
	Colligative properties and their determination	
Week 16	Determination of colligative properties	
Week 17	Terminal examination	

ZOO-4306 Principle of Animal Life-II		Credit Hrs. 3(2-1)
Weeks	Topic of Lecture	Activity
1 st	Cell Division: <ul style="list-style-type: none"> • Cell cycles • Mitosis and meiosis----- 	
2 nd	<ul style="list-style-type: none"> • Mitosis and meiosis • control of the cell cycle. 	
3 rd	Inheritance Patterns: <ul style="list-style-type: none"> • Mendelian genetics • Inheritance patterns 	
4 th	<ul style="list-style-type: none"> • Inheritance patterns 	Assignment #1
5 th	<ul style="list-style-type: none"> • gene, structure, chemical composition and types 	
6 th	Chromosomes and Gene Linkage: <ul style="list-style-type: none"> • Eukaryotic chromosomes; linkage and crossing over 	Quiz #1
7 th	<ul style="list-style-type: none"> • Chromosomal aberrations. 	
8 th	Midterm Examination	
9 th	Molecular Genetics: Cellular Control: DNA: the genetic material	Assignment #2
10 th	DNA replication in prokaryotes and eukaryotes Control of gene expression in eukaryotes	
11 th	gene mutation recombinant DNA and applications of genetic technologies	Quiz #2
12 th	Animal Behaviour: <ul style="list-style-type: none"> • Behavior and its types, proximate and ultimate causes • Anthropomorphism 	

	<ul style="list-style-type: none"> • development of behavior; learning; factors controlling animal behavior • communication • behavioral ecology <p>social behavior</p>	
13 th	<p>Evolution:</p> <ul style="list-style-type: none"> • Historical Perspective: <p>Theories of evolution: Lamarckism and natural selection, neo lamarckism, Darwinism, and neo-Darwinian</p>	
14 th	<p>Evolution and Gene Frequencies:</p> <ul style="list-style-type: none"> • Hardy-Weinberg principle • evolutionary mechanisms: population size, genetic drift, gene flow 	
15 th	<ul style="list-style-type: none"> • de Vries mutation theory and rates of evolution, • polymorphism; species and speciation • molecular evolution • mosaic evolution 	
16 th	<p>Terminal</p>	

5th Semester

ZOO-5501	Cell Biology	Credit Hrs. 3(2-1)
Week	Topics	Assignment/Quiz
Week 1	<ul style="list-style-type: none">• Introduction to Cell Biology• Cell theory Introduction to Microscopy	
Week 2	<ul style="list-style-type: none">• Plant vs Animal Cells• Prokaryotic vs Eukaryotic Cells• Microscopy continued• Gram staining	
Week 3	<ul style="list-style-type: none">• Cell Membrane: Structural models• Chemical composition & functions• Gram staining	
Week 4	<ul style="list-style-type: none">• Endoplasmic reticulum• Golgi bodies• Identification of cell organelles (prepared slides)	Assignment #1
Week 5	<ul style="list-style-type: none">• Ribosomes• Mitochondria• Lysosomes• Organelles identification continued	
Week 6	<ul style="list-style-type: none">• Peroxisomes• Nucleus: structure & function• Chromatin• Detection & quantitative estimation of DNA	
Week 7	<ul style="list-style-type: none">• Cytoskeleton: structure, types & functions• Detection & quantitative estimation of RNA	
Week 8	Midterm Examination	
Week 9	<ul style="list-style-type: none">• Cellular transport: diffusion, osmosis, facilitated & active transport• Osmosis & diffusion demonstrations	Assignment #2
Week 10	<ul style="list-style-type: none">• Cellular transport: endocytosis & exocytosis	
Week 11	<ul style="list-style-type: none">• Cell Cycle: phases & regulation• Mitosis: stages• Study of mitotic	Quiz #2

	stages (prepared slides)	
Week 12	<ul style="list-style-type: none"> • Mitosis significance • Study of mitotic stages (prepared slides) 	
Week 13	<ul style="list-style-type: none"> • Meiosis: stages, significance • Comparison with mitosis • Study of meiotic stages (prepared slides) 	
Week 14	<ul style="list-style-type: none"> • Errors in cell division (aneuploidy, nondisjunction) • Preparation & staining of histological slides 	
Week 15	<ul style="list-style-type: none"> • Integrated topic: coordination of organelles in a living cell • Histological slide preparation & staining 	
Week 16	• Terminal Examination	

ZOO-5502		Animal Physiology	Credit Hrs. 4(3-1)
Week	Topics	Assignment/Quiz	
Week 1	Neuro-muscular physiology: Cellular homeostasis, resting and action potential, synaptic transmission,		
Week 2	muscle contraction, general sensory mechanism, cutaneous sensation, audition, vision, taste, olfaction, the motor control system, sleep and consciousness.		
Week 3	Muscles: Structure, types, components, muscle proteins, molecular basis of muscle contraction: sarcoplasmic reticulum and role of calcium,		
Week 4	muscle action potentials, isometric and isotonic contraction, leverage factor, muscle fatigue.	Assignment#1	
Week 5	Cardiovascular Physiology: <ul style="list-style-type: none"> Vessels, heart, electrocardiography, cardiac rate, rhythm, and conduction disturbances, heart as a pump 		
Week 6	cardiodynamics, hemodynamics, cardiac output and venous return, control of cardiovascular system, responses to stress.	Quiz #1	
Week 7	Respiratory physiology: <ul style="list-style-type: none"> Respiratory mechanics, gas exchange between atmosphere and the body, 		
Week 8	Midterm		
Week 9	gas transport, pulmonary circulation, respiratory control, hypoxia.	Assignment#2	
Week 10	Renal Physiology: <ul style="list-style-type: none"> Body fluid compartment, renal tubular function, renal clearance, glomerular filtration and GFR, reabsorption and secretion, 		

Week 11	<ul style="list-style-type: none"> composition of urine, formation of dilute and concentrated urine, effect of ADH, Aldosterone and Atrial Natriuretic Factor on renal Physiology. 	Quiz #2
Week 12	Gastrointestinal Physiology: <ul style="list-style-type: none"> Digestive system, the oral cavity, composition of saliva, pharynx, oesophagus, the stomach, regulation of gastric juice, 	
Week 13	<ul style="list-style-type: none"> small intestine, liver, regulation of bile, pancreatic and intestinal enzymes and their regulation, the colon, absorption of nutrients. 	
Week 14	Temperature Regulation: <ul style="list-style-type: none"> Temperature classification of animals; Temperature relation of ectotherms in freezing and cold and warm and hot environment; 	
Week 15	Costs and benefits of ectothermy; Temperature relations of heterotherms and endotherms; Dormancy: Sleep, Torpor, Hibernation and Estivation.	
Week 16	<ul style="list-style-type: none"> Terminal Examination 	

ZOO-5503		Genetics	Credit Hrs. 4(3-1)
Weeks	Topic of Lecture	Activity	
1 st	<ul style="list-style-type: none"> • Introduction Classical, molecular and population Genetics Multiple Alleles: blood groups and coat color in rabbits. Genetics of Rh factor and Erythroblastosis Foetalis. 		
2 nd	<ul style="list-style-type: none"> • Chromosomal Basis of Inheritance: Chromosomal theory of inheritance Interaction of genes, Epistasis, Lethality and Pleiotropism 		
3 rd	<ul style="list-style-type: none"> • Chromosomal Aberrations Changes in chromosomal number, Euploidy, aneuploidy (Klinefelters syndrome, and Turners syndrome, Down syndrome and Edwards syndrome). Structural changes, insertion, deletion (Cri du chat syndrome), duplication, Inversion and translocation 		
4 th	<ul style="list-style-type: none"> • Pedigree Analysis: Normal human chromosome complement; Karyotyping. Sex-determination and Sex-linkage: Sex determination in animals and humans, Sex linked (Hemophilia, muscular dystrophy, color blindness), sex influenced and sex limited traits, Prenatal Diagnosis: Amniocentesis and choriovillus sampling - Ultrasound scanning and Fetoscopy. Genetic counselling, Eugenics and Euthenics 	Assignment 1	
5 th	<ul style="list-style-type: none"> • Chromosome mapping Linkage, recombination (crossing over) and Chromosome mapping in eukaryotes. 		
6 th	<ul style="list-style-type: none"> • Molecular Genetics: Gene Concept (classical and modern), Genetics of Viruses and Bacteria, Transposons, Mutation and DNA repair 	Quiz 1	
7 th	<ul style="list-style-type: none"> • Molecular Genetics: Molecular Genetic Analysis, Regulation of Gene Expression in Prokaryotes, Gene Regulation in Eukaryotes, 		
8 th	Mid Term Exam		
9 th	<ul style="list-style-type: none"> • Molecular Genetics: Genetic basis of diseases, like cancer, Genetic control of animal development. Study of blood group polymorphisms in local population 	Assignment 2	
10 th	<ul style="list-style-type: none"> • Molecular Genetics: The genetic control of the Vertebrate Immune System, 		

11 th	<ul style="list-style-type: none"> • Recombinant Technology <p>The Techniques of Molecular Genetics (elements of genetic engineering), PCR</p>	Quiz #2
12 th	<ul style="list-style-type: none"> • Human Genetics; Single and Multifactorial Disorders: Autosomal anomalies, Pseudoautosomal genes, 	
13 th	<ul style="list-style-type: none"> • Human Genetics; Single gene disorders: Gene mutation and disorders; autosomal single gene disorders (Complex Inheritance Patterns, Polygenic traits- Cleft lip and cleft palate, 	
14 th	<ul style="list-style-type: none"> • Human Genetics; inborn errors of metabolism such as Phenylketonuria, alkaptonuria). 	
15 th	<ul style="list-style-type: none"> • Population Genetics: Hardy-Wienberg equilibrium, Systematic and Dispersive pressures, Inbreeding and heterosis 	
16 th	<ul style="list-style-type: none"> • Assignments checking and presentations 	
17 th	Terminal Exam	

ZOO-5504		Animal Ecology	Credit Hrs. 3(2-1)
Week	Topics	Assignment/Quiz	
Week 1	<ul style="list-style-type: none"> • Introduction to Animal Ecology 		
Week 2	<ul style="list-style-type: none"> • Historical Background of Animal Ecology, 		
Week 3	<ul style="list-style-type: none"> • Fundamentals of Ecology 		
Week 4	<ul style="list-style-type: none"> • Ecology of Terrestrial animals and aquatic animals 	Assignment#1	
Week 5	<ul style="list-style-type: none"> • Ecological Population: Growth rate and Age structure of animal population 		
Week 6	<ul style="list-style-type: none"> • Factors affecting Population, 	Quiz #1	
Week 7	<ul style="list-style-type: none"> • Measurement of Population Dynamics Lifetables and K-factor analysis 		
Week 8	Mid Term		
Week 9	<ul style="list-style-type: none"> • Population in Animal Ecology: Population, Population Cycle, 	Assignment#2	
Week 10	<ul style="list-style-type: none"> • Animal Population Control Population Cycles in A Predator-Prey System, Demography 		
Week 11	<ul style="list-style-type: none"> • Basic global ecosystems: Atmosphere, Hydrosphere, Lithosphere, Ecosphere 	Quiz #2	
Week 12	<ul style="list-style-type: none"> • Community Ecology: Basic concepts, Community analysis, Ecotones, Inter-population interactions. Competitions (Resources Contributing to Competition among Organisms) 		
Week 13	<ul style="list-style-type: none"> • Exotic and Invasive species (Biological Invasion) 		
Week 14	<ul style="list-style-type: none"> • An overview of major ecosystem of the world: Marine, Estuarine, Freshwater, Wetlands, Tundra, Forest, Grassland and Desert 		
Week 15	<ul style="list-style-type: none"> • Ecological niche: Basic concepts and types. 		
Week 16	<ul style="list-style-type: none"> • Applied Ecology: Resources and their ecological management (Mineral, Agricultural and Forest, 		

	Range management, Desalination and weather modification, Landscape and Land use) <ul style="list-style-type: none">• Behavioral Ecology	
Week 16	Terminal Examination	

ZOO-5505		Research Methods and Reports	Credit Hours: 2(2-0)
Weeks	Topic of Lecture		
1st	Introduction to Course		
	Flow chart of research process		
2nd	The procedure of Hypothesis Development 1		
	The procedure of Hypothesis Development 2		
3rd	The procedure of Hypothesis Testing		
	Introduction to Research design		
4th	Basic Principles of research design		Assignment#1
	Principle of Randomization		
5th	Principle of Replication		Quiz #1
	Principle of Local Control		
6th	Introduction to Sampling Design		
	Some of the sampling designs		Assignment#2
7th	Some of the remaining sampling designs		
	The sampling designs		Quiz #2
8th	Midterm exam		
9 th	Introduction to Experimental Designs		
	Informal Experimental Design 1 Informal Experimental Design 2		
10th	Informal Experimental Design 3, Formal Experimental Design 1		
	Formal Experimental Design 2, Formal Experimental Design 3		
11th	Formal Experimental Design 4+5		

	Scientific Writing; Types of Scientific Documents, Synopsis, Thesis, Original Research Article, Review article, Proposal,etc	
12th	Writing introduction	
	Review of Literature	
13th	Methodology section of synopsis, thesis, and research article	
	Writing of Results Section	
14th	Writing of Discussion section	
	Lecture on Abstract and conclusion Writing	
15th	Formation, and writing of References in different formats	
	Selection of a journal for publication, journal categories, impact factor, Indexing agencies	
16th	How to submit an article, all submission requirements, including Ethical approval proof, authors contribution, agreements, etc	
17th	Terminal Examination	

7th Semester

ZOO-6701		Research Methods and Reports	Credit Hours: 2(2-0)
Weeks	Topic of Lecture		
1st	Introduction to Course		
	Flow chart of research process		
2nd	The procedure of Hypothesis Development 1		
	The procedure of Hypothesis Development 2		
3rd	The procedure of Hypothesis Testing		
	Introduction to Research design		
4th	Basic Principles of research design		
	Principle of Randomization		
5th	Principle of Replication		
	Principle of Local Control		
6th	Introduction to Sampling Design		
	Some of the sampling designs		
7th	Some of the remaining sampling designs		
	The sampling designs		
8th	Midterm exam		
9 th	Introduction to Experimental Designs		
	Informal Experimental Design 1 Informal Experimental Design 2		
10th	Informal Experimental Design 3, Formal Experimental Design 1		
	Formal Experimental Design 2, Formal Experimental Design 3		
11th	Formal Experimental Design 4+5		

	Scientific Writing; Types of Scientific Documents, Synopsis, Thesis, Original Research Article, Review article, Proposal,etc	
12th	Writing introduction	
	Review of Literature	
13th	Methodology section of synopsis, thesis, and research article	
	Writing of Results Section	
14th	Writing of Discussion section	
	Lecture on Abstract and conclusion Writing	
15th	Formation, and writing of References in different formats	
	Selection of a journal for publication, journal categories, impact factor, Indexing agencies	
16th	How to submit an article, all submission requirements, including Ethical approval proof, authors contribution, agreements, etc	
17th	Terminal Examination	

ZOO-6702 BIOLOGICAL TECHNIQUES		Credit Hrs. 3(1-2)
Week	Topics	Assignment/Quiz
Week 1	<ul style="list-style-type: none"> • Microscopy: • Principles of light microscopy. Magnification, Resolution, • Types of microscopies (Bright field, Dark field, Phase Contrast) • Confocal Microscopy • Electron microscope: Scanning electron microscope and Transmission electron microscope (SEM and TEM). 	
Week 2	<ul style="list-style-type: none"> • Microscopy • Confocal Microscopy • Electron microscope: Scanning electron microscope and Transmission electron microscope (SEM and TEM). 	
Week 3	<p>Standard unit system for weight, length, volume and Micrometre:</p> <ul style="list-style-type: none"> • Different Measurement systems (length; surface; weight, volume, temperature), Calculations and related conversions • Concentrations- percent volume; ppt; ppm - molarity, normality, molality 	
Week 4	<p>Standard unit system for weight, length, volume and Micrometre</p> <ul style="list-style-type: none"> • Preparation of stock solutions of various strengths • 	Assignment#1
Week 5	<ul style="list-style-type: none"> • Use of stage and ocular micrometers • Calibration of ocular micrometer and measurement of size animal and plant cell and nuclei 	
Week 6	<ul style="list-style-type: none"> • Separation and purification techniques: • Cell fractionation 	Quiz #1

	<ul style="list-style-type: none"> • Centrifugation and its types • Filtration and its types, • 	
Week 7	<ul style="list-style-type: none"> • Chromatography: • Chromatography: Principle, applications, types, • Paper chromatography and thin layer chromatography 	
Week 8	Mid Term	
Week 9	<ul style="list-style-type: none"> • Column chromatography • High pressure liquid chromatography. 	Assignment#2
Week 10	<ul style="list-style-type: none"> • Electrophoresis: Principle, applications and types (Agarose and PAGE). 	
Week 11	<ul style="list-style-type: none"> • Spectrophotometry: • Principle, applications, types • Visible/UV spectrophotometry 	Quiz #2
Week 12	<ul style="list-style-type: none"> • Basic principles of Sampling and Preservation: • Sampling from soil, water, air, plants and animals 	
Week 13	<ul style="list-style-type: none"> • Preservation of dry and wet specimens. • Preservation techniques. lyophilization, preservation in ethanol, formalin etc 	
Week 14	<ul style="list-style-type: none"> • DNA Extraction through various methods 	
Week 15	<ul style="list-style-type: none"> • Polymerase chain reaction (PCR), principle and application • 	
Week 16	<ul style="list-style-type: none"> • DNA sequencing (Sanger and Maxam Gilbert 	
Week 16	Terminal Examination	

ZOO-6703 General Microbiology Credit hours. 3(2-1)		
Weeks	Topic of Lecture	Activity
1 st	The beginnings of Microbiology: Discovery of the microbial world	
	Development of pure culture methods	
2 nd	The scope of microbiology	
	Microbial evolution, systematics and taxonomy: Characterization and identification of microorganisms. Nomenclature and Bergey's manual	
3 rd	Viruses: Bacteriophage and phages of other protests, Replication	
	Viruses of animals and plants: History, structure, composition,	
4 th	classification and cultivation of animal viruses	Assignment #1
	Effect of virus infections on cells, Cancer and viruses	
5 th	Morphology and fine structure of bacteria: Size, shape and arrangement of bacterial cell, Flagella and motility, Pili, Capsules, sheaths -----	
	Structure and Chemical composition of cell wall-----	
6 th	Cytoplasmic membrane, protoplast, cytoplasm, nuclear material	Quiz #1
	The Cultivation of Bacteria: Nutritional requirements, nutritional types of bacteria,	

7th	Bacteriological media, physical conditions required for growth	
	Choices of media, condition of incubation	
8th	Midterm Examination	
9th	Reproduction and Growth of Bacteria: Modes of cell division, new cell formation, Normal growth cycle of bacteria	Assignment #2
	Quantitative measurement of bacterial growth; direct microscopic count	
10th	Electronic enumeration of cell membranes, the plate count method	
	Membrane filter count, Turbidimetric method	
11th	Determination of nitrogen content, determination of the dry weight of cells	Quiz #2
	The selection of a procedure to measure growth, Importance of measurement of growth	
12th	Pure cultures and cultural characteristics: Natural microbial populations, selective methods	
	Selective methods: Chemical, physical, biological methods, Selection in nature	

13th	Pure cultures: Methods of isolating pure cultures, Maintenance and preservation of pure culture	
	Culture collection, cultural characteristics; colony characteristics, characteristics of broth culture	
14th	Eukaryotic Microorganisms; Algae: Biological and economic importance of algae	
	Characteristics of algae; Lichens	
15th	Fungi: Importance of fungi; Morphology; Physiology and reproduction, Cultivation of fungi	
	Protozoa: Ecology and importance of protozoa. Classification of protozoa	
16th	Terminal Examination	

ZOO-6704 Immunology		Credit Hrs. 3(2-1)
Weeks	Course Content	Assignment / Quiz
1	Introduction: chronological development and scope of immunology Immunity and immune responses	
2	Definitions and types (specific and non-specific). Humoral and cellular immunity	
3	The antigens: structure (simple and complex molecules, proteins and polysaccharides) and immunogenicity	
4	Factors affecting immunogenicity	
5	Immunoglobulin: structure and functions (Lab) Agglutination tests	Assignment 1
6	Classes, subclasses, types and subtypes of immunoglobulins	Quiz 1
7	Synthesis of antibody Theories of antibodies synthesis	
8	Mid Term exam	
9	Introduction to complement system Complement pathways (Classical, alternative and lectin pathway)	Assignment 2
10	Introduction to immunopathology: hypersensitivity reactions, autoimmune diseases and immunodeficiencies	
11	Immunodeficiencies, Primary immunodeficiencies secondary immunodeficiencies	Quiz 2
12	Hypersensitivity reactions: Type I hypersensitivity and anaphylaxis .	

13	Type II, type III and type IV hypersensitivity	
14	Autoimmunity: pathogenesis of autoimmunity Different autoimmune diseases	
15	Introduction to transplant immunology Types of transplants and allograft rejection	
16	Application of immunological phenomenon in experimental biology	

ZOO-6705		Wildlife and biodiversity	Credit Hrs. 3(2-1)
Week	Topics	Assignment/Quiz	
Week 1	<ul style="list-style-type: none"> Biodiversity, levels of biodiversity, status of biodiversity 		
Week 2	<ul style="list-style-type: none"> Importance of biodiversity, causes of biodiversity, conservation of biodiversity 		
Week 3	<ul style="list-style-type: none"> In-situ and ex-situ conservation, biotechnological intervention in biodiversity conservation 		
Week 4	<ul style="list-style-type: none"> Introduction of Wildlife of Pakistan 	Assignment#1	
Week 5	<ul style="list-style-type: none"> Importance, Distribution of wildlife 		
Week 6	<ul style="list-style-type: none"> Status and values of wildlife 	Quiz #1	
Week 7	<ul style="list-style-type: none"> Overall discussion about course 		
Week 8	Midterm		
Week 9	<ul style="list-style-type: none"> IUCN species status categories, 	Assignment#2	
Week 10	<ul style="list-style-type: none"> Endangered and endemic species of Pakistan 		
Week 11	<ul style="list-style-type: none"> Protected areas of Pakistan, categories of protected areas 	Quiz #2	
Week 12	<ul style="list-style-type: none"> Ramsar sites ,captive breeding 		
Week 13	<ul style="list-style-type: none"> International laws on wildlife 		
Week 14	<ul style="list-style-type: none"> Convention on wildlife, CBD, CMS, CITES 		
Week 15	<ul style="list-style-type: none"> Presentations/ discussion with students 		
Week 16	<ul style="list-style-type: none"> Presentation/ discussion 		
Week 16	Terminal Examination		

ZOO-6707		Endocrinology	Credit Hrs. 3(2-1)
Week	Topics	Assignment/Quiz	
Week 1	<p>An overview of general concepts and principles of endocrinology:</p> <ul style="list-style-type: none"> • The endocrine system; Type of hormones; Endocrine and nervous system relationship; • General principles in function, interaction, nature, synthesis, transport of hormones • General concept of feedback, biorhythms, pathology and assessment of endocrine function 		
Week 2	<p>Hypothalamus and pituitary:</p> <ul style="list-style-type: none"> • Hypothalamic hormones: Origin, chemistry and actions; Anterior pituitary & hormones 		
Week 3	<ul style="list-style-type: none"> • Hypothalamic pituitary regulation, General chemistry, Physiological action and metabolism of prolactin-growth hormone family, glycoprotein hormone family, corticotrophins and other prolactin. • opiomelanocortin peptides; posterior pituitary: Release, regulation and actions of vasopressin and oxytocin • 		
Week 4	<p>Thyroid gland:</p> <ul style="list-style-type: none"> • Anatomy and histology of gland; Formation and secretion of thyroid hormones <p>Thyroid hormones in peripheral tissues, Regulation and factors affecting thyroid function.</p> <ul style="list-style-type: none"> • . 	Assignment#1	
Week 5	<p>Calcitropic and mineral metabolism hormones: Chemistry, physiological actions and metabolism of parathyroid hormone, calcitonin and calciferous; Homeostasis of calcium, phosphate and magnesium</p>		

Week 6	Pancreatic hormones and regulatory peptides of the gut: <ul style="list-style-type: none"> • Anatomy and histology for sources of the hormones • Chemistry, physiological roles and mechanism of action of insulin and glucagon 	Quiz #1
Week 7	<ul style="list-style-type: none"> • Chemistry, physiological roles and mechanism of action of insulin and glucagon • Physiological roles of gut peptides. 	
Week 8	Midterm	
Week 9	Adrenal cortex: <ul style="list-style-type: none"> • Steroid biochemistry; Physiological actions of corticoid hormones; Regulation and metabolism of glucocorticoids, mineralocorticoids and adrenal sex steroids. 	Assignment#2
Week 11	Adrenal medulla and catecholamines: <ul style="list-style-type: none"> • Chromaffin cell and organization • Structure of adrenal medulla • Biosynthesis, storage, release and metabolism <p>Adrenergic receptors</p> <ul style="list-style-type: none"> • 	Quiz #2
Week 12	Hypothalamic-Hypophysis-Gonadal axis in Reproduction: <ul style="list-style-type: none"> • Hormonal and neuronal factors and their interactions in ovarian, testicular and other reproductive targets functions. • • 	
Week 13	Testes: <ul style="list-style-type: none"> • Androgenic tissue: Structure and chemistry; Transport, metabolism and mechanism of action. Ovaries: <ul style="list-style-type: none"> • Ovarian hormones: Steroid biochemistry and biosynthesis; Transport, metabolism and mechanism of 	

	action. The interactions in developments in estrous and menstrual cycles.	
Week 14	<p>Endocrinology of pregnancy:</p> <ul style="list-style-type: none"> • Hormones in conception and implantation; Hormonal actions and adaptation in pregnancy and parturition. The interactions in transitions from childhood to reproductive and post-reproductive states. • 	
Week 15	<p>Endocrinology of lactation:</p> <ul style="list-style-type: none"> • Hormones in lactation. <p>Endocrinology of heart, kidney, immune system:</p> <ul style="list-style-type: none"> • Growth and pineal gland. 	
Week 16	<p>Overview of endocrine mechanisms in invertebrates.</p> <ul style="list-style-type: none"> • Study of hormones of invertebrates in concepts of growth, metamorphosis, reproduction and pheromones. • 	
Week 17	Terminal Examination	

ZOO-6719		Neurophysiology		Credit Hrs. 3(2-1)	
Week	Topics	Assignment/Quiz			
Week 1	<ul style="list-style-type: none"> • Foundation of excitability in cell membrane level 				
Week 2	<ul style="list-style-type: none"> • Membrane channels and transport 				
Week 3	<ul style="list-style-type: none"> • The physical basis of neuronal function 				
Week 4	<ul style="list-style-type: none"> • Foundation of excitability in cell membrane level 	Assignment#1			
Week 5	<ul style="list-style-type: none"> • Membrane excitation • resting and action potential 				
Week 6	<ul style="list-style-type: none"> • Communication along and between neurons 	Quiz #1			
Week 7	<ul style="list-style-type: none"> • Nervous system organization in vertebrate (dissection) 	Practical			
Week 8	Midterm				
Week 9	<ul style="list-style-type: none"> • Propagation of action potential • synaptic transmission pre and postsynaptic mechanism 	Assignment#2			
Week 10	<ul style="list-style-type: none"> • Neurotransmitter synthesis release and fate 				
Week 11	<ul style="list-style-type: none"> • Nervous regulation of functional system 	Quiz #2			
Week 12	<ul style="list-style-type: none"> • Learning changes at synapse 				
Week 13	<ul style="list-style-type: none"> • Neurochemical basis of behavior • Organization of sensory receptors 				
Week 14	<ul style="list-style-type: none"> • Physiological basis of receptor function 				
Week 15	<ul style="list-style-type: none"> • Mechanoreceptor • Photoreceptor • Chemoreceptor 				
Week 16	<ul style="list-style-type: none"> • Thermoreceptor • Electroreceptor 				

	<ul style="list-style-type: none">• Nociceptors	
Week 16	Terminal Examination	