Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE
(AUTONOMOUS)
CHENNAI - 600 039

(Accredited by NAAC at level "B")

B.Sc. (Advanced Zoology and Biotechnology)

FOR CANDIDATES ADMITTED FROM 2022-23 ONWARDS

Syllabus

Under Choice Based Credit System

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)

PG AND RESEARCH DEPARTMENT OF ZOOLOGY

Based on UGC – Learning Outcomes-Based Curriculum Framework
Course Structure under Choice Based Credit System

(For the candidates admitted from the academic year 2022-2023 onwards)

Sem .No	Part No.	Course	Subject code	Course Title	Ins. Hrs/Week	Credit	Exam Hrs	Marks		Total
								Int	Ext	
I	I	LC - I	22UAFTA1	General Tamil - I	6	3	3	25	75	100
	II	ELC - I	22UACEN1	Communicative English - I	4	3	3	50	50	100
	III	CC - I	22UAAZC1	Invertebrata	6	4	3	25	75	100
	III	CCP *	Even Sem.	**Practical – I Invertebrata and Chordata**	3	-	-	40	60	100
	III	AC - I	22UAPBA1	Allied Botany – I	4	4	3	25	75	100
	III	ACP *	Even Sem.	**Allied Botany Practical**	3	-	-	40	60	100
	IV	NME - I		Non Major Elective-I Subjects offered by the other department	2	2	3	25	75	100
	IV	SBE - I	22UAPLS1	Professional English for Life Science - I	2	3	3	50	50	100
				Total	**30**	**19**				
II	I	LC - II	22UBFTA2	General Tamil - II	6	3	3	25	75	100
	II	ELC - II	22UBCEN2	Communicative English - II	4	3	3	50	50	100
	III	CC - II	22UBAZC1	Chordata	6	4	3	25	75	100
	III	CC - III	22UBAZC2	**Practical – I Invertebrata and Chordata**	3	4	3	40	60	100
	III	AC - II	22UBPBA2	Allied Botany – II	4	4	3	25	75	100
	III	ACP - III	22UBPBA3	**Allied Botany Practical**	3	2	3	40	60	100
	IV	NME - II		Non Major Elective-II Subjects offered by the other department	2	2	3	25	75	100
	IV	SBE - II	22UBPLS2	Professional English for Life Science - II	2	3	3	50	50	100
				Total	**30**	**25**				
III	I	LC - III	22UCFTA3	General Tamil - III	6	3	3	25	75	100
	II	ELC - III	22UCLTS1	Language Through Literature - I	4	3	3	50	50	100
	III	CC - IV	22UCAZC1	Cell Biology and BioTechniques	6	4	3	25	75	100
	III	CCP**	Even Sem.	**Practical - II-Cell biology and Genetics**	3	-	-	40	60	100
	III	AC - IV	22UCCHA1	Allied Chemistry – I	4	3	3	25	75	100
	III	ACP**	Even Sem.	**Allied Chemistry Practical**	3	-	-	40	60	100
	IV	EVS	22UCEVS1	Environmental Studies	2	2	3	25	75	100
	IV	SBE - III	22UCSBE3	SS III – Personality Enrichment	2	3	3	40	60	100
				Total	**30**	**18**				
IV	I	LC - IV	22UDFTA4	General Tamil - IV	6	3	3	25	75	100
	II	ELC - IV	22UDLTS2	Language Through Literature - II	4	3	3	50	50	100
	III	CC - V	22UDAZC1	Genetics	6	4	3	25	75	100
	III	CC - VI	22UDAZC2	**Practical - II-Cell**	3	4	3	40	60	100

Sem .No	Part No.	Course	Subject code	Course Title	Ins. Hrs/Week	Credit	Exam Hrs	Marks		Total
								Int	Ext	
				biology and Genetics						
	III	AC - V	22UDCHA2	Allied Chemistry – II	4	3	3	25	75	100
	III	ACP - VI	22UDCHA3	**Allied Chemistry Practical**	3	4	3	40	60	100
	IV	VBE	22UDVBE1	Value Based Education	2	2	3	25	75	100
	IV	SBE - IV	22UDSBE4	SS IV - Computer Basics and Office Automation	2	3	3	40	60	100
	V	Extension	22UDEXT1	Extension Activities	-	1	-	-	-	-
				Total	**30**	**27**				
V	III	CC - VII	22UEAZC1	Biotechnology	4	4	3	25	75	100
	III	CC - VIII	22UEAZC2	Microbiology and Immunology	5	4	3	25	75	100
	III	CC - IX	22UEAZC3	Environmental Biology	5	4	3	25	75	100
	III	CC - X	22UEAZC4	Animal physiology	5	4	3	25	75	100
	III	CCP***	Even Sem.	**Practical - III- Animal Physiology, Biotechnology and Developmental biology**	3	-	-	40	60	100
	III	CCP***	Even Sem.	**Practical - IV- Environmental Biology, Immunology and Microbiology**	3	-	-	40	60	100
	III	CEC - I	#	One from the Elective-I Subjects	5	5	3	25	75	100
				Total	**30**	**21**				
VI	III	CC - XI	22UFAZC1	Developmental Biology	5	4	3	25	75	100
	III	CC - XII	22UFAZC2	Evolution	4	4	3	25	75	100
	III	CC - XIII	22UFAZC3	Applied Zoology	5	4	3	25	75	100
	III	CC - XIV	22UFAZC4	**Practical - III- Animal Physiology, Biotechnology and Developmental biology**	3	4	3	40	60	100
	III	CC - XV	22UFAZC5	**Practical - IV- Environmental Biology, Immunology and Microbiology**	3	4	3	40	60	100
	III	CEC - II	##	One from the Elective-II Subjects	5	5	3	25	75	100
	III	CEC - III	###	One from the Elective-III Subjects	5	5	3	25	75	100
				Total	**30**	**30**				
				Total Credits	**180**	**140**				

***Practicals at the end of second semester**

**** Practicals at the end of fourth semester**

***** Practicals at the end of sixth semester**

CORE ELECTIVE COURSES:

Elective-I (Any one subject of the following Core Elective chosen by the candidate)		**Elective-II** (Any one subject of the following Core Elective chosen by the candidate)		**Elective-III** (Any one subject of the following Core Elective chosen by the candidate)	
***Sub. Code**	**Core Elective Courses**	****Sub. Code**	**Core Elective Courses**	****Sub. Code**	**Core Elective Courses**
22UEAZE1A	Biostatistics and Biochemistry	22UFAZE2A	Medical Laboratory techniques	22UFAZE3A	Aquaculture
22UEAZE1B	Bioinformatics	22UFAZE2B	Wild Life Biology	22UFAZE3B	Poultry and Dairy Science

The following Non-Major Elective Coursesoffered by Zoology Department to Other Department.

NON MAJOR ELECTIVE COURSE:

I Semester (Any one subject of the following Non Major Elective chosen by the candidate)		**II Semester** (Any one subject of the following Non Major Elective chosen by the candidate)	
@Sub. Code	**Non Major Elective**	**@@Sub. Code**	**Non Major Elective**
22UAAZN1A	Economic Zoology	22UBAZN2A	Public Health and Hygiene
22UAAZN1B	Poultry Farming and Management	22UBAZN2B	Dairy Farming

The Following Allied Courses Offered by the Zoology Department to B.Sc Plant Biology and Plant Biotechnology AND B.Sc Chemistry

1. **Allied Zoology-I**
2. **Allied Zoology-II**
3. **Allied Zoology-II (Practicals)**

SEMESTER-I

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

First Semester				
Course Title		**INVERTEBRATA**		
Course Code		**22UAAZC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC – I	**Core**	**4**	**6**	**25+75**

Courseobjectives

- To understand the taxonomy and classification of animals.
- To identify the animals of invertebrate phyla and to recognize their distinguishing features.
- To appraise the diversity of animals and to understand their functional morphology and their adaptations
- To understand how different structural peculiarities acclimatize and adapt the animals to physiological and environmental fluctuations.

Unit I: Classification of Animal kingdom and Protista (18Hours)

Concept of five kingdom classification. Introduction to Protista and Animal kingdom - Systems of classification and nomenclature - levels of organization - Types of coelom and symmetry.

Protista : General characters of Protista and Classification (upto order) with examples.

Type study**:** Paramecium

General topics**:** Protozoan parasites - Life cycle of *Plasmodium*and*Entamoebahistolytica*, Locomotion in Protozoa, Nutrition in Protozoa

UNIT-II : Porifera and Coelenterata(18 Hours)

Phylum Porifera : - GeneralCharacters and Classification(upto order) with examples TypeStudy-Leucosolenia

Phylum Coelenterata- GeneralCharacters and Classification(upto order) with examples TypeStudy-Obeliageniculate, Salient features of *Ctenophora*

General topics - Canal systemin Sponges, Polymorphism in coelenterates, Types of Corals and Coral reefs

UNIT-III: Platyhelminthes and Aschelminthes (18 Hours)

Phylum Platyhelminthes -GeneralCharacters and Classification(upto order) with examples. TypeStudy-Taeniasolium

Phylum Aschelminthes -GeneralCharacters and Classification(upto order) with

examples. TypeStudy-Ascaris

General Topics - Nematode parasites , Parasitic adaptations

Unit – IV: Arthropoda and Annelida (18 Hours)

Phylum Annelida - GeneralCharacters and Classification (upto order) with examples

TypeStudy- Neries

Phylum Arthropoda - GeneralCharacters and Classification(upto order) with examples

TypeStudy- Prawn

General Topics : Metamerism in Annelida, Mouth parts of insects, Peripatus and its affinities, Custacean larva and their significance, Salient features of Arachnida

Unit – V: Mollusca and Echinodermata(18 Hours)

Phylum Mollusca: -GeneralCharacters and Classification(upto order) with examples

Type study – Freshwater mussel

Phylum Echinodermata -GeneralCharacters and Classification (upto order) with examples. TypeStudy-Asterias (Star fish)

General Topics: Torsion in gastropods , Economically important Molluscans, Water Vascular system in Echinoderms,. Larval forms of Echinoderms

Text Books :

1. Ekambaranatha Ayyar and T.N. Ananthakrishnan, Manual of Zoology Vol – I , Part I &IIS.Viswanathan Pvt. Ltd. Chennai..
2. Kotpal RL, Agarwal SK & Khetarpal RP Invertebrates, Rastogi Publications, Meerut.
3. Jordan and Verma Invertebrate Zoology S. Chand and Co, New Delhi

Reference Books:

1. Barnes, R.D. Invertebrate Zoology (1982) 6th Edition. Holt Saunders International Edition.
2. Anderson TA, Invertebrate Zoology, Oxford University Press, New Delhi.
3. Barrington EJW, Invertebrate Structure and Functions. English Language Book Society.
4. Hyman LH, The Invertebrates (6 Volumes). McGraw-Hill Companies Inc. NY

Web Resources

https://archive.org/details/zoologyofinverte00ship.
https://www.nationalgeographic.com/animals/invertebrates/
https://greatbarrierreef.org/
https://on.natgeo.com/3kofFtg

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Interpret the changes in the animal organisation from unicellular to multicellular complex body plan.	**K1, K2**
CO2	To differentiate the hierarchy change from unicellular organization to multicellular forms with distinct morphological and physiological changes (e.g., poriferans to coelentrates)	**K2, K4**
CO3	To illustrate the structure, function and parasitic adaptation in helminthes and characterize annelids.	**K1, K2**
CO4	To identify and classify Arthropoda and compare it as the largest of all other phylum, understand Mollusca with structural and functional details.	**K1,K2**
CO5	Classify and characterize Echinoderms with their evolutionary relationships, affinities to chordates	**K2,K3**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6–**Creating**.**		

CO-PSOMapping(CourseArticulationMatrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	3	3	2
CO2	3	3	3	2	2	3
CO3	2	2	2	3		2
CO4	3	3	2	3	2	3
CO5	3	2	3		3	3
Total	**13**	**13**	**12**	**11**	**10**	**13**
Average	**2.6**	**2.6**	**2.4**	**2.2**	**2**	**2.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

SEMESTER-II

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Second Semester				
Course Title		**CHORDATA**		
Course Code		**22UBAZC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC –II	**Core**	**4**	**6**	**25+75**

Courseobjectives:

- To understand the taxonomy, interrelationship and evolution of animals.
- To identify the classes of vertebrate animals and recognize their distinguishing features
- Toperceive general idea of adaptations of chordates.
- To study the verasatile diversity and behaviour of these vertebrate animals

UNITI Prochordates and Pisces (18 Hours)

GeneralCharacters of Prochordates and classification ; Chordates - Classification (upto order) with examples , Agnatha- General characters, Salient features Cyclostomes

Prochordates and Pisces : Type study: Amphioxus ,Scoliodon

General Topics: Affinities of Hemichordates, Retrogressive metamorphosis in Ascidia, Accessoryrespiratoryorgans in fishes, Migration in fishes

UNITII Amphibia(18 Hours)

Amphibians-General characters and classification upto order with examples

Type study- Frog

General Topics : Parental care in Amphibians, Metamorphosis in Amphibians, Limbless Amphibians

UNITIIIReptilia(18 Hours)

Reptilia-Generalcharactersandclassification upto order with examples

Typestudy-Calotes

General Topics : Skull of Reptiles, Identification of PoisonousandnonpoisonoussnakesofsouthIndia, Poison Apparatus and Biting mechanism

UNIT IV Aves (18 Hours)

Aves- General characters and classification upto order with examples

Type study- Pigeon

General Topics : Flight adaptations in birds, Migration in birds, Salient features of Archaeopteryx, Flightless birds

UNITV Mammals(18 Hours)

Mammals-Generalcharactersandclassification upto order with examples

Type study-Rabbit

General Topics : Egg laying mammals,

Pouched mammals, Dentition in mammals,

Aquatic mammals

Text Books :

1.Ekambaranatha Ayyar and T.N. Ananthakrishnan, Manual of Zoology Vol – II, S. Viswanathan Pvt. Ltd. Chennai..

2.Kotpal RL Mordern Text Book of Zoology Vertebrates, Rastogi Publications, Meerut.

Reference Books:

1.Young, J.Z. 1950. Life of Vertebrates. Clarendon Press, Oxford, UK.

2.Pough Harvey F, Christine M .Janis and John B. Heiser .2002. Vertebrate Life, Pearson Education Inc. New Delhi.

3. Verma PS, Chordate Zoology, S Chand Publishers, New Delhi

Web Resources

www.ucmp.berkeley.edu/**chordata**/**chordata**.html

https://www.kolkatabirds.com/citibirds.html
https://animaldiversity.org/accounts/Columba_livia/

http://www.biologydiscussion.com/zoology/amphibians/class-amphibian-characters-and-classification-animal-kingdom/69912

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Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	To explain the characteristics changes from invertebrates to Prochordates and Chordates.	**K1,K2**
CO2	To differentiate jawless fishes from other fish forms. Students will be able to illustrate fish physiology with neat labeled diagram	**K2, K3**
CO3	To explain the morphology of amphibians with neat labeled diagrams the importance of Parental care in Amphibia. To classify Reptilia and study its structural pecularities. Identification methods for poisonous or non- poisonous by analyzing its characters	**K1, K4**
CO4	Outline the special characters of birds with reference to their respiration, flight adaptations Critically analyze the characters of Archaeopteryx with reptiles and birds.	**K1,K2**
CO5	Discuss giving reasons mammalia as the highest form of vertebrates with reference to advancement. Compare and contrast Prototheria, Metatheria and Eutheria	**K1**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	2	2
CO2	2	3	2	3		3
CO3	3	2	3	2	3	2
CO4	3	3	2	3	2	3
CO5	3	3	3	2	3	3
Total	**14**	**14**	**12**	**12**	**10**	**14**
Average	**2.8**	**2.8**	**2.4**	**2.4**	**2**	**2.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Second Semester				
Course Title		**PRACTICAL I: INVERTEBRATA AND CHORDATA**		
Course Code		**22UBAZC2**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CCP- III	**Core**	**4**	**3**	**40+60**

Course Objectives:

- Understand the anatomy and organ system of animals through dissections and mounting of easily available invertebrate and vertebrate animals.
- View the various museum specimens and study the characters of the organisms belonging to different taxa.

I. DISSECTION

1. Cockroach**or** Prawn - Digestivesystem and Nervoussystem
2. Bony Fish - Digestivesystem

II. MOUNTING

1. Mouthpartsof Mosquito
2. Mouthpartsof Cockroach
3. Prawn-appendages (maxilla, mandible, maxillepeds and uropod)
4. Shark- Placoid scales
5. Bony fish – Cycloid and Ctenoid scales

III.SPOTTERS

A.Classifygivingreasons:

Paramecium,Scypha,Obelia,Taenia solium, Nereis, Prawn,Sea star,Balanoglossus,Amphioxus,Shark, Frog, Calotes**,** Pigeon,Rabbit

B-Drawlabelledsketches:

Obeliamedusa, Tape worm T.S, NereisT.S,Bipinnarialarva,Quillfeather of pigeon

C-CommentonBiologicalsignificance:

Entamoeba,Paramecium-Conjugation,Plasmodium, Ascaris, Madrepora, Tubiphora, Heteronereis.Peripatus, Naupliuslarva, Glochidium larva, Echineis, Exocetus, Hippocampus, Hyla, Sea snake, Cobra, Russel'sviper, Bat

D–Relatestructureandfunction:

Sponge–Spicules .Sponge–Gemmule.*Taenia*–Scolex Neries–Parapodium *Penaeus*–Petasma.Starfish- Tubefeet,

E-OsteologyandDentition:

Frog - Skull, Vertebral column, Pectoralgirdle , Pelvicgirdle, Fore limb and Hind limb

Pigeon- Synsacrum, Rabbit–Dentition

Text Books

1.Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced Practical Zoology, Books & AlliedLtd;

2.Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.

3.Lal ,S. S, 2016 . Practical Zoology Chordates, Rastogi Publications.

4.Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand and Company

5.Verma, P. S. 2010. A Manual of Practical Zoology: Chordates, S Chand and Company

Web Resources

http://www.biologydiscussion.com/invertebrate-zoology/cockroach/dissection-of-cockroach-with-diagram-zoology/45031
https://sciencing.com/shrimp-nervous-system-17846.html
https://biology4isc.weebly.com/morphology-and-anatomy-of-cockroach.html
https://www.carolina.com/teacher-resources/Interactive/dissection-buying-guide/tr42204.tr
https://opentextbc.ca/biology/chapter/15-1-digestive-systems/

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Compare and examine the structure and function of the different systems in Cockroach and prawn	**K2,K4**
CO2	Demonstrate and illustrate the structural organization of mouth parts in insects	**K2,K3**
CO3	Mount the scales of fishes and identify its types	**K1,K5**
CO4	Identify and utilize the knowledge of classification in the identification of specimens of biological importance	**K3,K5**
CO5	To identify the skeletal structures of vertebrate animal frog based on osteology specimens	**K3,K4**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , K6–**Creating.**		

CO-PSOMapping(CourseArticulationMatrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	2
CO2	3	2	3	2	3	3
CO3	2	2	3	3	2	
CO4	3	3	3	2	3	2
CO5	2		2	3	3	2
Total	**13**	**12**	**14**	**13**	**15**	**12**
Average	**2.6**	**2.4**	**2.8**	**2.6**	**3**	**2.4**

PRACTICAL EXAMINATION FOR MAJOR

***Practical Examination will be conducted during the end of EVEN SEMESTER (second , fourth and sixth semesters). Each practical with 3 hours duration.**

MARK DISTRIBUTION (END SEMESTER PRACTICAL EXAMINATION)

PRACTICALS : 50 MARKS

RECORD: 10 MARKS

TOTAL: 60 MARKS

QUESTION PAPER PATTERN FOR PRACTICALS

1.MAJOR PRACTICAL QUESTION – 20 MARKS

2.MINOR PRACTICAL QUESTION - 15 MARKS

3.SPOTTERS 5 X 3 = 15 MARKS

4.RECORD 10 MARKS

SEMESTER-III

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Third Semester				
Course Title		**CELL BIOLOGY AND BIOTECHNIQUES**		
Course Code		**22UCAZC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC -IV	**Core**	**4**	**6**	**25 + 75=100**

Course Objectives

- To perceive an insight to prokaryotic and eukaryotic cell structure and the ultra-structure of cellular components.
- To Know the structures of biomembranes and sub-cellular organelles.
- To develop an idea of how cellular components are used to generate and utilize energy in cells.
- Understands the structural organization of chromosomes, DNA and the mechanism of protein synthesis and processes involved in cell division.
- Toexposestudents tovarious instrumentationused in biology laboratory
- To demonstrate techniques biochemical techniques used in separation of biomolecules

UNIT–I : Cell structure, Plasma membrane and Cell organelles(18 Hours)

Celltheory– Prokaryotic and eukayotic cell ,Plasmamembrane–Models, ultrastructureandfunctions.Cell junctions -Ultrastructure and functions of Endoplasmic reticulum, Golgi complex, Lysosomes and Centrioles

UNIT–II: Mitochondria,Nucleus and Cell division (18 Hours)

Mitochondria- Ultrastructure and functions, Structureandfunctions of Nucleusand Nucleolus – Cell division-Mitosis, Meiosis and Interphase nucleus. Cell cycle. CancerBiology- Types of cancer and properties of cancer cells , Apoptosis

UNIT–III : Chromosomes, DNA and Protein synthesis (18 Hours)

Chromosomes – Structure, types, Giant chromosomes (Polytene and lampbrush), DNA structure and function - Chromatin – Nucleosome – DNA Replication in prokaryotes and eukaryotes. Ultra structure, function and types of ribosomes, Types and Structure of RNA - Genetic code- Protein synthesis in prokaryotes – Post transcriptional modifications (Outline)

UNIT-IV: Cytological Techniques(18 Hours)

Cytological Techniques - Tissue Fixation,Embedding,SectioningandStaining. Cell

fractionation - Isolationofsub-cellularcomponents. Principles and working mechanism of light, phase-contrast and electron microscopes (SEM &TEM).

UNIT V : Biochemical Techniques(18 Hours)

Centrifuge – Principle and Working mechanism - Types of centrifugation

Chromatography – Principles, Types (Paper and Thin Layer Chromatography) and Applications, Electrophoresis-Principle, Types (Paper and Agarose Gel) and Applications, Principles and Uses of Colorimeter, Principle and Components of UV-VIS Spectrophotometer.

Text Books :

1. Verma,P.S. And Agarwal,V.K. Cytology 8th Edition S.Chand and Co.
2. Gupta P.K. – Cell And Molecular Biology, Rastogi Publication, Meerut
3. Veer Bala Rastogi – Introduction To Cell Biology, Rastogi Publication, Meerut
4. Veerakumari,L. 2005Bioinstrumentation,MJPPublishers,Chennai.

Reference Books:

1.Karp, G. 2010. Cell And Molecular Biology: Concepts And Experiments. 6th Edition. John Wiley & Sons. Inc.

2.De Robertis, E.D.P. And De Robertis, E.M.F. 2006. Cell And Molecular Biology. 8th Edition. Lippincott Williams And Wilkins, Philadelphia.

3.Cooper, G.M. And Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th Edition. Asm Press & Sunderland, Washington, D.C.; Sinauer Associates, Ma.

4.Becker, W.M., Kleinsmith, L.J., Hardin. J. And Bertoni, G. P. 2009. The World Of The Cell. 7th Edition. Pearson Benjamin Cummings Publishing, San Francisco

Web Resources

https://www.microscopemaster.com/organelles.html
https://rsscience.com/cell-organelles-and-their-functions/
https://www.biologymad.com/cells/microscopy
https://en.m.wikipedia.org/wiki/chromatography

http://www.ibiblio.org/virtualcell/index.htm

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Get an overview of the structure of cell, its structural components and their functions, Recall the structure and explain the functions of plasma membrane, mitochondria , lysosomes ribosome and endoplasmic reticulum	**K1, K2**
CO2	Understand Concepts of cancer and apoptosis, Describe and relate the structure and functions of nucleus,understand cell division and its process and the events of cell cycle	**K2,K3**
CO3	Understand the chromatin structure, ultrastructure and macromolecular organisation of DNA and RNA, its replication, RNA structures and Recall the Central Dogma the molecular machinery involved in protein synthesis. Interpret the processes and significance of transcription, translation and post – transcriptional and – translational modifications	**K1,K3**
CO4	To understand the techniques and principles involved in histology, To know the working mechanism and compare the compound and electron microscopes.	**K2, K3**
CO5	Explain the principle and applications of spectrophotometer, Illustrate the process of centrifugation and chromatography, Classify and distinguish the types of electrophoresis	**K2,K3**

K1 **– Remembering ,** K2**– Understanding ,** K3 **–Applying ,**K4 **–Analysing ,** K5**–Evaluating ,** K6**–Creating**

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2		3	2	3
CO2	3	2	2	3	2	3
CO3	3	3	2	3	2	2
CO4	3	3	2	3	2	3
CO5	3	3	2	3	2	3
Total	**15**	**13**	**8**	**15**	**10**	**14**
Average	**3**	**2.6**	**1.6**	**3**	**2**	**2.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Third Semester				
Course Title		**Environmental Studies- Common paper**		
Course Code		**22UCEVS1**		
Course No	Course Category Core / Elective Theory / Practical	No of Credits	No of hrs /week	Total marks (Internal + External)
EVS	**Theory**	**2**	**2**	**25 + 75 = 100**

Course Objectives

Students gain knowledge on the fundamental concepts, mechanism and importance of environment and ecosystem. This course provides the consciousness and awareness about the significance of our environment, to save and protect the nature.

Unit I: Scope and importance of Environmental Science : 6 Hours

Definition, Multidisciplinarynature of environmental science, scope and importance; global environmental problems.

Unit II: Ecosystems: 6 Hours

Concept of an ecosystem. Structure and function of an ecosystem.producers, consumers and decomposers. Energy flow in the ecosystem. Food chains, food webs and ecological pyramids.

Unit III: Biodiversity and its conservation: 6 Hours

Introduction - Definition: Value ofbiodiversity: consumptive use, productive use. India as a mega-diversity nation, Hot-spots ofbiodiversity. Brief account on biodiversity conservation.

Unit 4: Environmental Pollution: 6 Hours

Definition- Cause, effects and control measures of:- a)Air pollution, b) Water pollution Solid waste Management : Causes, effects and controlmeasures of urban and industrial wastes. Role of an individual in prevention of pollution.

Unit 5: Social Issues and the Environment: **6 Hours**

Water conservation, rain water harvesting. Climate change, global warning, acid rain, ozone layer depletion, nuclear accidents. Waste land reclamation. ·

Text Books:

1. Arindam Ghosh, 2022, Environmental Studies, Generic publications
2. Chauhan, B.S., 2015. Environmental studies, Second edition. Laxmi publications
3. Erach Bharucha, 2021, Textbook of Environmental Studies for Undergraduate Courses, Orient Blackswan Pvt Ltd
4. Rajagopalan, R. 2015., Environmental Studies, Oxford University Press
5. Sharma, PD., 2017. Ecology and Environment, Rastogi Publications

Reference Books:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publications Ltd. Bikaner.
2. Bharucha Brach, 2017, The Biodiversity of India, Mapin Publishing Pvt. Ltd
3. Cunningham, W. P., Cunningham, M.A. and Saigo, B. W., 2006. Environmental sciences, Nineth edition. Mc Graw- Hill higher education,
4. Odum, E.P., 1971. Fundamentals of ecology, Third edition. W.B. Saunders company, Philadelphia
5. Subramanyam, N.S. and Sambamurthy, A.V., 2000. Ecology. Narosa publishing house,

Web resources:

1. 1.https://www.sbsc.in/pdf/resources/1588750812_Unit_1_Introduction_to_environmental_studies.pdf
2. https://nitsri.ac.in/Department/CHEMISTRY/EVS_MATERIAL_2.pdf
3. 3.https://www.tripurauniv.ac.in/Content/pdf/StudyMaterialsDetail/BA%203rd%20Semester/BA-3RD(FNDC)-Environmental%20Studies.pdf
4. https://aissmschmct.in/wp-content/uploads/2020/08/BSC-HS-Sem-III-Environment-Science-I-HS-307-Chapter-1.pdf

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignment

Course Outcomes (COs):

Upon completion of this course, the students

CO code	Course Outcomes	K-levels
CO1	Explain the structure, functions and Recallthe energy flow in the ecosystem.	**K1 , K2**
CO2	Demonstrate the interactions among the physical, chemical and biological components.	**K2**
CO3	Determine the types, distribution of Biodiversity in India and its benefits on society and methods adopted for biodiversity conservation.	**K3**
CO4	Identify the sources, effects and control measures of various types of Pollution.	**K3**
CO5	Outline the environment legislations in India for sustainable development.	**K2**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**–Creating		

CO- PSO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3		2	1	2
CO2	3	2		1		2
CO3	3	3		2	1	3
CO4	3	2	3	3	2	3
CO5	3	2	2	3	2	3
Total	15	12	5	11	6	13
Average	3	2.4	1.0	2.2	1.2	2.6

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SEMESTER IV

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Fourth Semester				
Course Title		**GENETICS**		
Course Code		**22UDAZC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal+External)**
CC -V	**Core**	**4**	**6**	**25+75=100**

Course Objectives

- Understands the basic principles of inheritance at cellular and organismal levels.
- Understands the concepts of classical genetics at organism level and patterns of heredity
- Understandsthe phenomena of molecular genetics
- Understands the mechanism of mutation, chromosomal abberations and how mutations bring changes in phenotype of an organism
- Understands the applications of genetics in plant and animal breeding

UNIT–I :Mendelian Genetics and Gene Interactions(18 Hours)

Mendelian inheritance–LawsofMendel–Monohybrid and Dihybridexperiments - Backand TestCross.Interactionofgenes–Complimentaryand Supplementaryfactors,Epistasis (Dominant and Recessive) andLethalgenes in man - Multiplealleles-Bloodgroupinheritancein man. Polygenic inheritance (Skin colour in man) Complete, Incompletedominance (Feather colour in fowl) and Co-dominance (ABO blood group)

UNIT–II : Linkage , Crossing over and Sex determination (18 Hours)

Linkage-Complete and Incomplete linkage-Linkagein*Drosophila*-linkage groups-Crossing Over-Types and Mechanism, Chromosome mapand its construction,Sex determination - Chromosomal theory, Barr bodies, Genic balance mechanism and environmental determination of sex

UNIT–III : Inheritance(18 Hours)

Sex linked Inheritance - X and Y linked inheritance in man.Chromosomal variation (Euploidy, Aneuploidy, Monosomy and Nullisomy). Syndromes (Down's, Kleinfelter's and Turner's syndromes).Non disjunction -Types, Gynandromorphs. Cytoplasmic inheritance - Plasmagenes - Shell coiling in *Limnaea* and Kappaparticlesin*Paramecium*

UNIT–IV:Genes, Mutation and Chromosomal Abberations(18 Hours)

Gene concept–Gene Structure- Cistron,Recon, Muton, Split gene (Exons and Introns), Promoter sequence-Generegulation-Lacoperon model.Mutation-Typesofmutation-Molecularbasisofmutation-Single gene mutation - Sickle cell anemia- Physical and chemical mutagens. Chromosomalstructuralaberrations. Inbornerrorsofamino acid metabolism (Phenylketoneuria, Alkaptoneuria and Albinism)

UNIT–V: Applied Genetics(18 Hours)

AppliedGenetics–Inbreeding–Out-breeding-Heterosis-Eugenics,Euphenicsand Euthenics.Pedigree analysis - Geneticcounseling – Aim, Objectives and Applications .

Text Books :

1. P.S.Verma and Agarwal,V.K. 2004. Genetics. 8 Th Edition S.Chand and Co.
2. Meyyan RP Fundamentals of Genetics, Saras Publication, Nagercoil

Reference Books:

1.Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). 8th Ed. Principles Of Genetics. Wiley India.

2.Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley And Sons Inc.

3.Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. 9th Edition. Benjamin Cummings.

4.Russell, P. J. (2009). Genetics- A Molecular Approach. 3rd Edition. Benjamin Cummings.

5.Primrose SB, Twyman R. Principles of gene manipulation and genomics. John Wiley & Sons

6.Strickberger MW, Genetics, Pearson publishers

Web Resources

https://www.toppr.com/guides/biology/principles-of-inheritance-and-variation/sex-determination/
https://www.khanacademy.org/science/high-school-biology/hs-molecular-genetics/hs-rna-and-protein-synthesis/a/hs-rna-and-protein-synthesis-
www.ncbs.res.in
www.omim.org

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Examine the inheritance of mendelian traits, gene interactions, multiple alleles and polygenic inheritance	**K2,K3**
CO2	Explain the concept of crossing over, linkage and chromosome mapping, Illustrate the mechanism chromosomal determination of sex in man	**K1,K4**
CO3	Understand the inheritance of sex linked genes,non-disjunction leading to chromosomal variations and associated syndromes	**K2,K3**
CO4	List the types of mutation and explain its biological effects. Analyse the mechanism of alterations in chromosomal structures	**K1,K2,K4**
CO5	Identifies the merits and demerits of inbreeding and outbreeding .Analyze the need of prenatal diagnosis and apply it for management of genetic disorders. Identifies the need for genetic counselling	**K1,K2 ,K4**
K1-Remembering, **K2**-Understanding, **K3**-Applying, **K4**-Analyzing, **K5**-Evaluating, **K6**-Creating.		

CO- PSOMapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	2	3
CO2	3	3	2	3	2	3
CO3	3	3	2		2	2
CO4	3	3		3	2	2
CO5	3	3	3	3	2	3
Total	**15**	**15**	**9**	**12**	**10**	**13**
Average	**3**	**3**	**1.8**	**2.4**	**2**	**2.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Fourth Semester				
Course Title		**PRACTICAL II - CELL BIOLOGY AND GENETICS**		
Course Code		**22UDAZC2**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CCP – VI	**Core**	**4**	**3**	**40+60=100**

Course Objectives

- To focus the microscope and to use ocularand stage micrometer, camera lucida
- Prepare and observe the chromosome arrangement during cell division
- Gain knowledge in the various types of cells and tissues by viewing through prepared slides
- Know the male and female karyotype
- To view the polytene chromosome in chironomous larva

CELL BIOLOGY

1. UseofMicroscopes-Lightmicroscope,CameraLucida

2.Micrometry– Stage andOcularMicrometer – Calibration

2.Human Bloodsmearpreparation– To study types of blood cells

3.DifferentialCountofWBC -To study different types of leucocytes

4.Countingof RBCandWBCusingHaemocytometer (Demonstration)

5.Mountingofbuccalepitheliumandobservinglivingcellsusingvitalstaining.

6.MitosisinOnionroottipsquash preparation to observe cell division

7.Studyofpreparedslidesofhistology

a.Columnarepithelium	b.Ciliatedepithelium	c.Glandulareepepitheli
d. Connectivetissue	e.CartilageT.S.	f.BoneT.S.
g.Cardiactissue	h.Striatedmuscle	i.Nonstriatedmuscle
j.Nervoustissue	k.OvaryT.S.	l.TestisT.S.

GENETICS

1. Study of Mendelian traits in Human – Gene Interaction -Attached ear lobe, Rolling tongue,Widow's peak,Bent little finger, Straight and Curly hair trait (Expression of dominant and recessive gene to be studied among the students of the class and results tabulated)
2. Morphology of male and female Drosophila - Sex identification of Drosophila- Sex comb and abdominal segment
3. ObservationofcommonmutantsofDrosophila – Vestigial wing, Bar eye, White eye,Ebony body (Photographs / slides)
4. Identificationof humanbloodgroups and its inheritance

5. Squash preparation of polytene chromosome from salivary gland of Chironomous larva
6. Study of NormalKaryotype–Human MaleandFemale-Photographs

Text Book

1.M.M. Trigunayat 2019 A Manual of Practical Zoology: Biodiversity, Cell Biology, Genetics & Developmental Biology Scientific Publishers (India)
2.Dr.Renu Gupta, Dr. Seema Makhija ,Dr. Ravi and Toteja 2018 Cell Biology: Practical manual Prestige Publishers

Web Resources

https://vlab.amrita.edu/?sub=3&brch=77
http://cbii-au.vlabs.ac.in/
https://www.ibiology.org/biology-techniques/

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Identify the types of blood cells and to analyse their functions	**K2, K3,K4**
CO2	Identify the mitotic cell division and the stages of cell separation in onion root tips	**K2,K3**
CO3	Identify different types of cells from prepared slides	**K1,K2,K4**
CO4	Outline the life cycle of Drosophila melanogaster and identify its mutant forms	**K3,K4**
CO5	Interpret karyotypes, identify blood groups and giant chromosomes	**K2,**
K1 **– Remembering ,** K2**– Understanding ,** K3 **–Applying ,**K4 **–Analysing ,** K5**– Evaluating ,** K6**–Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	3	2
CO2	3	3	2	3	3	3
CO3	2	3	2	3	2	3
CO4	3	2	3	3	3	3
CO5	3	2	3	2	3	2
Total	**14**	**12**	**13**	**13**	**14**	**13**
Average	**2.8**	**2.4**	**2.6**	**2.6**	**2.8**	**2.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

PRACTICAL EXAMINATION FOR MAJOR

***Practical Examination will be conducted during the end of EVEN SEMESTER (second , fourth and sixth semesters). Each practical with 3 hours duration.**

MARK DISTRIBUTION (END SEMESTER PRACTICAL EXAMINATION)

PRACTICALS : 50 MARKS

RECORD: 10 MARKS

TOTAL: 60 MARKS

QUESTION PAPER PATTERN FOR PRACTICALS

1.MAJOR PRACTICAL QUESTION - 20 MARKS

2.MINOR PRACTICAL QUESTION - 15 MARKS

3.SPOTTERS 5 X 3 = 15 MARKS

4.RECORD 10 MARKS

SEMESTER V

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Fifth Semester				
Course Title		**BIOTECHNOLOGY**		
Course Code		**22UEAZC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC– VII	**Core**	**4**	**4**	**25+75=100**

Course Objectives

- Gains an idea of rDNA technology and its applications
- To gain knowledge of the fundamentals of modern Molecular techniques
- Gains an insight to the current applications of biotechnology and its advances in arenas of medical, microbial, environmental, bioremediation, agricultural, animal and forensics.
- Able to understand how microbes are used in production of enzymes .

UNITI - Recombinant DNA technology(12 Hours)

Introductionto Biotechnology - Tools used in genetic engineering- Restriction enzymes andligases. Cloning Vectors–Types,plasmids(pBR 322,),Linkers and adaptors , Genecloningin*E.coli*. Screening of recombinants.Applications of recombinant DNA technology in medicine - Commercial Production of Insulin. Human Genome Project

UNITII - Techniques in Biotechnology(12 Hours)

DNA isolation methods- Types of PCR- Real time PCR - Polymerase chain reaction technique and its application-Southern,Western and Northern Blotting techniques and its application.DNA finger printing and its application.RAPD, RFLP, FISH, DNA probes and diagnosis. DNA sequencing by Sanger's method.

UNITIII - Applications of Biotechnology (12 Hours)

Productionof singlecellprotein from microbes. Production of alcoholic beverages and organic acids.Biofertilizers-Rhizobium,Azotobacter.Biopesticides(Bacillusthuringiensis).Biogas production – Biofuels - Biopolymers(XanthanGum,PHB).

Biologicalprocessfor wastewatertreatment. Bioremediationof Xenobiotics,hydrocarbons, Oil spills (Superbugs), Transgenic animals and their advantages

UNITIV- Enzyme Biotechnology (12 Hours)

Microbial production and application of enzymes – Bioenzymes-Productionofindustrialenzymes(proteases,amylases,lipases, cellulases).Ribozymes-Artificial enzymes - Immobilization of enzymes -Methods and its application. Biosensors

UNITV- Animal Tissue Culture (12 Hours)

Animal cell tissue culture –Applications, Requirements and Culture media – Primary culture. Steps involved in mammalian cell culture- *He la* and *W I38* cell lines – Maintenance of cell lines – Techniques and Application of organ culture. Animal cloning – Dolly. Cryobiology – Methods of cryopreservation.

Text Books :

1.Glick, B.R. And Pasternak, J.J. (2009). Molecular Biotechnology- Principles And Applications of Recombinant DNA. 4th Edition. ASM Press, Washington, USA

Reference Books:

1. Butler, M. (2004). Animal Cell Culture and Technology: The Basics. Ii Edition. Bios Scientific Publishers.
2. Brown TA. Gene cloning. London: Chapman and Hall; 1995.
3. Primrose SB, Twyman R. Principles of gene manipulation and genomics. John Wiley & Sons

Web Resources

https://www.mybiosource.com/learn/gene-transfer-technique/
https://www.tsijournals.com/articles/world-history-of-modern-biotechnology-and-its-applications.html
https://www.bio-rad.com/en-in/applications-technologies/related-links?ID=NISQRI4VY
http://www.ncbi.nlm.nih.gov/
http://www.hhmi.org/biointeractive

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Understands to assess the molecular tools,enzymes involved in rDNA Technology. gene transfer technique, host cell and selection strategy to synthesize a gene and to produce multiple copies by cloning	**K1,K2,K4**
CO2	Demonstrate the skill to analyze the concepts and principles of modern techniques in experimental biotechnology Relate the principle of blotting, gene sequencing and micro array techniques with genome analysis	**K1,K2, K4**
CO3	Understands the applications of biotechnology in various fields	**K1, K2, K3**
CO4	Elaborate and discuss the prospects microbial production of enzymes	**K1, K2, K3**
CO5	Demonstrate and understands the animal tissue culture techniques	**K2,K4**

K1-Remembering, **K2**-Understanding, **K3**-Applying, **K4**-Analyzing, **K5**-Evaluating, **K6**-Creating.

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	1	2
CO2	3	3	2	2	3	1
CO3	3	2	3	3	2	1
CO4	2	3	2	2	3	2
CO5	3	3	2	2	2	1
Total	**14**	**14**	**12**	**11**	**11**	**11**
Average	**2.8**	**2.8**	**2.4**	**2.2**	**2.2**	**2.2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Fifth Semester				
Course Title		**MICROBIOLOGY AND IMMUNOLOGY**		
Course Code		**22UEAZC2**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC– VIII	**Core**	**4**	**5**	**25+75=100**

Course Objectives

- To create an awareness about the classification, diversity, organization, application and pathogenicity of the microorganisms.
- Understands the various microbial culture techniques and its handling.
- Understands how microbes are used in various industries for generation of various products related to day to day life.
- Provides an insight to the cellular components involved in the immunity.
- Understands the mechanism, types and concepts regarding immune response.

UNIT–I-Classification of Microorganisms and Bacterial Cell Structure(15 Hours)

ScopeofMicrobiology-Whittaker'sFive- kingdomconcept-Classificationofmicroorganisms,SalientfeaturesofBacteria,Virus,Algae,Fungi.Ultra Structure of bacterial cell-chemical composition of Bacterial cell wall – Structure of bacteriophage-Viroids and Prions

UNIT –II-BacterialGrowth and Culture (15 Hours)

Sterilization techniques - Culture of bacteria- Types of culture media - characteristics of bacterial colonies - methods ofmaintenance ofculture. Bacterialgrowth –Growth curves. Factors influencing bacterial growth. Stainingtechniques- Simple and Differentialstaining(Gram,Acid-fast,Flagellar)

UNIT– III-Applied Microbiology (15 Hours)

Bio- fermenters and its role in mass culture **–** Methods of fermentation - Basics concepts of Probiotics - Culture of yeast and its economic importance**.-** Microbes in various food products- Milk products (Fermented Milkcurd,butterandcheese), Preservation of milk. Microbes in Food spoilage. Microbial Nitrogen fixation

UNIT–IV:Components of immune system (15 Hours)

Immunity–Types - Innate and Acquired Immunity, Cells of immune system - Primary and secondary lymphoid organs . Antigens - Epitopes, Paratope, Haptens ,Adjuvants. Immunoglobulins –Types, Structure and biological functions . Primary and secondary Immune Response . Antigen-antibody reaction (Agglutination, Precipitation, Complement fixation) . Production and applications of monoclonal antibodies.

UNIT–V-Mechanism of Immune action (15 Hours)

Mechanism of Cell mediated and Humoral immunity (Activation of T cell and B cell), Basic concepts of major histocompatibility complex.- HLA typing- Basic properties and functions of Cytokines, Interferons and complement proteins. Types of hypersensitivity.

Vaccines–Types of vaccines-Immunization schedule

Text Books :

1. Dubey RC and Maheshwari DK, A Textbook of Microbiology, S. Chand Publishers, New Delhi.
2. Mani A, Selvaraj A.M , Narayanan L.M , Arumugam A, Microbiology, Saras Publication, Nagercoil.
3. Chakravarthy,A.K.1996.Immunology,TataMcGrawHill,NewDelhi.

Reference Books:

1.PelczarJr.M.J.ChanE.C.S.andKreigN.R.2001Microbiology–McGrawHillInc. NewYork.

2.StainerR.Y.,IngrahamJ.L.,WheelisM.L.andPainterP.R.1999GeneralMicrobiology–MacmillanEducationLtd.London.

3.Ahmed,N.,F.M.QureshiandO.Y.Khan,2001.IndustrialenvironmentalBiotechnology, HorizonPress.

4.RoittI.M.2000.EssentialImmunology.BlackwellScientificPublishers.

5.Kuby,J.1999,ImmunologyW.H.FreemanandCompany,NewYork.

6.Willey JM, Sherwood L, Woolverton CJ. Prescott's microbiology. Singapore: McGraw-Hill.

7.Delves PJ, Martin SJ, Burton DR, Roitt IM. Essential immunology. John Wiley & Sons.

Web Resources

http://archives.microbeworld.org/microbes/
http://www.bioedonline.org/
www.immunologylink.com
http://www.proimmune.com

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Outline, classify and assesS the structure of microbes	**K1,K2**
CO2	To assess the microbial growth requirements and maintenance of different microorganisms	**K2,K3**
CO3	Explain and identify the role of pathogen in water and food spoilage and to assess various food preservation methods	**K2,K3,K4**
CO4	Understand, types of Immunity,identifies the structure and function of lymphoid organs and Lymphoid Cells. Analyse the structure, types and properties of antigens and immunoglobulins	**K1,K2, K4**
CO5	Interprets Humoral and Cell mediated immune response Explain antigen – antibody reactions and its clinical application, Identifies the strategies for developing vaccine and explain the importance of monoclonal antibodies Compares the types of vaccine and Vaccination schedule	**K2, K3,K4**
K1-Remembering, **K2**-Understanding, **K3**-Applying, **K4**-Analyzing, **K5**-Evaluating, **K6**-Creating		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2		1
CO2	3	2	3	2	1	
CO3	3	3	3	2	3	2
CO4	3	3	3	3	2	1
CO5	3	3	3	3	3	2
Total	**15**	**14**	**14**	**12**	**11**	**10**
Average	**3**	**2.8**	**2.8**	**2.4**	**2.2**	**2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Fifth Semester				
Course Title		**ENVIRONMENTAL BIOLOGY**		
Course Code		**22UEAZC3**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC– IX	**Core**	**4**	**5**	**25+75=100**

Course Objectives

- Develops awareness about the environment and the interaction of various components.
- Understand about various ecosystems.
- Develops an appreciation for the role of organisms in biological communities, abnd their ecological interactions
- Understands the various habitats of the ecosystems and its management.
- To create an awareness about the biodiversity and need for its conservation.

UNIT–I : Components of Ecosystem(15 Hours)

Components of ecosystem: Environmental factors - Abioticfactors– Soil,LightandTemperature as ecological factors. Limiting factors- basic concepts - Leibig's law of minimum - Shelford's law of tolerance. Biotic factors **–** Animal relationships – Symbiosis, Commensalism,Mutualism, Antagonism,Predation,ParasitismandCompetition.

UNIT–II : Nutrient cycles and Ecosystem Interactions (15 Hours)

Biogeochemicalcycles– Water, Nitrogen, Sulphur , Carbon, Phosphorus andOxygen. Ecosystem–Pondecosystem–Primaryandsecondaryproduction–Foodchain–Food web– Trophiclevels–Energyflow–EcologicalPyramids

UNIT-III : Population and Community Ecology (15 Hours)

CommunityEcology–Typesofcommunities–Characteristicsofcommunity– Stratification–Ecotone–Edgeeffect–Ecologicalniche– Ecologicalsuccession.PopulationEcology-Characteristics affecting population – Densitydependentfactors - Population dynamics and Growth curves

UNIT–IV: Habitat Ecology and Waste Management (15 Hours)

Habitat Ecosystem: Characteristic features and faunal adaptations in Freshwater (Lotic and Lentic), Marine, Estuarine, Mangrove, Tundra, Savanna, Caves, Forest and Desert ecosystems.Significance and Conservation of wetlands, Ecological effects of dams, hydroelectric projects. Management of Solid waste, Plastic waste, Medical waste and e-waste.

UNIT–V : Biodiversity Conservation and Management (15 Hours)

Wild life conservation and management - Significance, causes of extinction, Conservation of Indian Endangered species and threatened species- Red data book- IUCN, WWF, CITES. Biodiversity hot spots in India. Brief out lines of Indian laws of conservation. Community reserves, Biosphere reserves, National parks, Sanctuaries and Tiger reserves in India. Human animal conflicts.Biodiversity Act of India.

Green chemistry – Designing a green synthesis - Basic principles of green chemistry. Organic farming and its merits. Concepts of carbon footprints.

Text Books :

1. Verma PS, & Agarwal VK, Environmental Biology: Principles of Ecology, S Chand Publishers, New Delhi.
2. Sharma PD, Elements of Ecology, Rastogi Publications, Meerut.

Reference Books:

1. Chapman JL & Reiss MJ, Ecology: Principles and Applications, Cambridge University Press, New Delhi.
2. Odum EP, Fundamentals of Ecology, W.B Saunders College Publishing, Philadelphia.
3. Caughley G, Sinclair AR. Wildlife ecology and management. Blackwell Science.
4. Divan S, Rosencranz A. Environmental law and policy in India: Cases, materials and statutes. New Delhi: Oxford University Press

Web Resources

https://www.nature.com
https://www.amazon.in/Ecology-Book-Ideas-Simply-Explained/.../024135...
https://video.nationalgeographic.com/video/environment
www.sanctuaryasia.com
www.iaszoology.com

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Illustrate the components of ecosystem , abiotic/biotic interactions and symbiotic relationships and explainthestructureandimpactofbiogeochemicalcycles	**K1, K2**
CO2	Analyze and interprets the concept of community and population	**K1, K2**
CO3	Develops idea on the dynamics of ecosystem and energytransformationsacrosstrophiclevels in different ecosystems	**K2, K4**
CO4	Gain knowledge on habitat ecosystem , perceives ideas to on waste management and design principles of green chemistry	**K3, K4**
CO5	Interpret the importance of biodiversity and its conservation and relate the impact of mankind on the ecological balance	**K1, K2, K4**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating.**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	2	3	3	2
CO2	3	2	2	3	3	2
CO3	3	2	2	3	3	2
CO4	3	3	2	3	3	3
CO5	3	2	2	3	3	3
Total	**14**	**10**	**10**	**15**	**15**	**12**
Average	**2.8**	**2**	**2**	**3**	**3**	**2.4**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Fifth Semester				
Course Title		**ANIMALPHYSIOLOGY**		
Course Code		**22UEAZC4**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC– X	**Core**	**4**	**5**	**25+75=100**

Course Objectives

- To familiarise with the principles and basic facts of nutrition, digestion and respiration.
- To give an insight about the cellular basis of physiological functions in animals with reference to circulation and excretion
- To give an idea about the regulation of nervous and musclefunctions in mammals .
- Understands the receptors involved in sensory functioning of the vertebrate system
- To create an awarenessto the students about how the structure-function relationships synchronise with endocrine functioning

Unit-I :Nutrition and Respiration (15 Hours)

Nutrition: Nutrients- Minerals – Macrominerals (Phosphorus, Calcium, Sodium and Potassium) Microminerals- (Zinc, Selenium, Cobalt,iron, iodine, Magnesium) . Vitamins – Fat and Water soluble vitamins- Biological functions and their deficiency. Types of nutrition. Digestion and absorption of carbohydrates, proteins and fats in the alimentary canal of man.

Respiration : Respiratory pigments- structure of haemoglobin, Transportation of gases - Bohr effect - Regulation of respiration - bronchitis, asthma - Physiological effects of smoking

UNIT II : Circulation and Excretion (15 Hours)

Blood- composition and functions,Lymph, Mechanism of blood clotting. Types of Hearts – Heartbeat and pace maker – Cardiac cycle – ECG - Pulse and blood pressure.Diagnosis of heart diseases - angiogram, angioplasty - Cardiac abnormality- Atherosclerosis, myocardial infarction

Excretion : Excretory products, Urea cycle , Nephron structure and mechanism of urine formation in mammals. Renal disorders – Nephritis, renal calculi. Dialysis and kidney transplantation.Osmo-regulation in fishes.

UNIT III : Muscle and Nerve Physiology (15 Hours)

Properties of Muscle - Types of muscles - Ultra structure of striated muscle fibre, muscle proteins - rigor mortis - Physiological and biochemical events in muscle contraction.

- Structure of Neuron - types of neurons - nerve impulse propagation through myelinated and non-myelinated nerve fibres. Neurotransmitters - Reflex action - Nerve disorders - epilepsy, Alzheimer's disease, Parkinson's disease

Unit IV :Sensory Physiology(15 Hours)

Sense organs - Receptors - Classification of receptors- Structure of eye, physiology of vision, visual elements and pigments, photochemistry of vision - Eye defects – myopia, hyperopia, presbyopia, astigmatism, cataract - Structure of ear and mechanism of hearing - Hearing impairments – deafness, labyrinthine disease - Chemoreceptors - Olfactory, gustatory and tactile sense organs

UnitV Endocrine glands and Reproductive Physiology(15 Hours)

Endocrine glands in man –Pituitary,Thyroid, Parathyroid, Pancreas, Adrenals, Testis and Ovary – Hormonesecretion, Biological functions and Disorders (Acromegaly, Gigantism, Dwarfism, Goitre, Graves disease, Cretinism, Myxedema, Diabetes mellitus) - Feed-back mechanism of endocrine axis. Hormones in pregnancy, parturition and lactation.

Text Books :

1. Nagabhushanan, R., Kaobarkar M.S. And Sarojini, R. (1983). A Text Book Of Animal Physiology, Oxford IBH Publishing Co., New Delhi.
2. Arumugam N &.Mariakuttikan A Animal Physiology Saras Publications, Nagercoil
3. Tyagi BS, Agarwal VK &Verma PS Animal Physiology S. Chand Publishers, New Delhi.

Reference Books:

1.Best And Taylor. (1990). Physiological Basis Of Medical Practice. Wilkins Co. ·
2.Eckert, R. And D. Randell. (1987). Animal Physiology, Cbs Publishers And Distributors N. Delhi. ·
3.Ganong, W.F. (2003), Review of Medical Physiology, Mcgraw Hill, New Dellhi. ·
4.Guyton, A.C. (1981). Text Book of Medical Physiology, W.B. Saunders Co

Web Resources

https://www.stem.org.uk/resources/collection/3931/animal-physiology
https://animalphys4e.sinauer.com
www.physiology.com

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Understand the functions of important physiological systems , their physiologicalresponses and disorders associated due to organ malfunctioning	**K1,K2**
CO2	Identifies the digestive enzymes and absorption process of food. Summarize the circulatory pathway, clotting mechanism and cardiac cycle	**K2,K3**
CO3	Analyze the transport of respiratory gases, excretory mechanism	**K3,K4**
CO4	Explain the mechanism of muscle contraction and its energetics and neural conduction	**K1,K3**
CO5	Evaluates the importance of sensory receptor mechanisms. Identifies and explains the endocrine glands , its hormone secretion and biological role	**K2,K4**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating.**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	3	2
CO2	3	2	2	3	2	3
CO3	3	3	2	3	3	3
CO4	2	3	3	2	3	2
CO5	3	3	3	3	3	2
Total	**14**	**14**	**13**	**13**	**14**	**12**
Average	**2.8**	**2.8**	**2.6**	**2.6**	**2.8**	**2.4**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

SEMESTER VI

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**DEVELOPMENTAL BIOLOGY**		
Course Code		**22UFAZC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC– XI	**Core**	**4**	**5**	**25+75=100**

Course Objectives

- To create an awareness to the students about the theories, concepts and basics of embroyology
- Gains idea of gametic cells, fertilization, cleavage, cellular differentiation and development of organs.
- To gain knowledge on the induction, organizers and development of extra embryonic structures.
- To provide adequate explanation to students about the late embryonic developments and post embryonic development and ageing.
- To give an idea about teratogenesis, *invitro* fertilization, stem cells and amniocentesis.

UNIT–I : Gametogenesis and Fertilization (15 Hours)

Theories of embryogenesis- Origin of germ cells - Gametogenesis - Process of Spermatogenesis , Types of Sperms. Structure of mammalian sperm. Oogenesis and structure of mammalian ovum- Types of eggs, Egg membranes (Primary, secondary and tertiary). Fertilization - mechanism, theories and significance. Parthenogenesis (Natural and Artificial) and its significance

UNIT–II : Blastulation and Gastrulation (15 Hours)

Cleavage - Planes and Patterns of cleavage - Factors controlling cleavage – Types of blastula - Blastulation Fate map and its construction,Gastrulation- Morphogenetic movements. Cleavage and gastrulation in frog, chick and mammal (pig)

UNIT III : Organogenesis and Organisers (15 Hours)

Organogenesis – Development of heart, kidney and eye in frog. Organizer concept – Structure – mechanism of induction and competence. Regeneration: Types , events and factors

UNIT IV :Extraembryonic membranes and Stem cells (15 Hours)

Extra embryonic membranes in chick, Foetal membranes in mammals- Placentation in mammals – Types and functions.Stem cells – Types, Embryonic stem cells and its significance.

UNIT–V : Human Reproduction and Reproductive Technology(15 Hours)

Human reproduction –Puberty, adolescence, Menstrual cycle and menopause - Pregnancy – trimester development - Twins – Monozygotic and Dizygotic twins. Teratogenesis

Birth Control - Contraception - Contraceptive methods. Causes for Infertility in human male and female - Assisted Reproductive Technology- Intrauterine insemination (IUI) in human, Artificial insemination (AI) in cattle, IVF – Embryo Transfer and its advantages in human,ICSI, ZIFT, GIFT - Amniocentesis

Text Books :

1. Arumugam NA Text Book of Embryology, Saras Publication Nagercoil.
2. Verma PS and Agarwal VK Chordate Embryology, S. Chand Publishers, New Delhi

Reference Books:

1. Balnisky BI An Introduction to Embryology, W.B. Saunders and Co.
2. BerrilNJ,Kars G(1986). Developmental biology, McGraw Hill
3. Gilbert SF (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
4. Majumdar NN Vetebrate Embryology; Tata McGraw-Hill, New Delhi.

Web Resources

http://www.yourarticlelibrary.com/biology/placentation-in-mammals-definition-development-and-types-biology/4987
https://www.mayoclinic.org/tests-procedures/in-vitro-fertilization/about/pac-20384716

http://www.visembryo.com/baby/index.html
http://www.sdbonline.org/

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Demonstrate the skill of explaining and illustrating the ideas and theories of developmental biology	**K1,K2**
CO2	Illustrate the events that occur during gametogenesis, fertilization. Outline the types and patterns of cleavage	**K1.K2**
CO3	Prediction of various ectodermal, endodermal and mesodermal derivatives relates it to organogenesis	**K1, K2,K3**
CO4	Elaborates and gains knowledge on the placental types, understands about the stem cells and applies its prospects for the current scenario	**K1,K2,K3**
CO5	Identifies the causes for infertility, gains information on the various assisted reproductive technologies.	**K3,K4**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	1	
CO2	3	3	3	2	1	2
CO3	3	2	2	2		1
CO4	3	3	2	3	2	3
CO5	3	3	2	3	3	2
Total	**15**	**14**	**12**	**12**	**10**	**10**
Average	**3**	**2.8**	**2.4**	**2.4**	**2**	**2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**EVOLUTION**		
Course Code		**22UFAZC2**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC– XII	**Core**	**4**	**4**	**25+75=100**

Course Objectives

- To make the students aware of how organic evolution occurred and how the various life forms come into existence.
- To make the students aware of the historical periods during the evolution of earth and status of fauna during the particular era.
- Understands adaptations and its significance in relation to evolution.
- Gains knowledge of the zoogeographic distribution of the various fauna.
- To develop an idea regarding the evolution of man

UNIT I :Origin of life and Evidences for evolution(12 Hours)

Origin of life -Abiogenesis, Biogenesis, Cosmic theory, Biochemical origin of life - Urey and Miller's experiment. Evidences for evolution: Morphological and Anatomical, Embryological, Physiological and Biochemical, paleontological.Fossils and Fossilization - Living and Extinct Fossils. Geological time scale

UNIT–II : Theories of OrganicEvolution(12 Hours)

Lamarckism, Neo Lamarckism, Darwinism, Neo Darwinism with reference to Industrial melanism. New version of mutation theory. Modern Synthetic theory of evolution. Natural selection. Modern concepts of evolutionary forces - Convergent and Divergent evolution

UNIT– III : Adaptation and Isolation(12 Hours)

Adaptation- Adaptive radiation in Darwin's finches. Mimicry and Colouration(Types and significance). Isolation –Types and isolating mechanism.

UNIT–IV: Animal Distribution and Speciation (12 Hours)

Types of animal distribution - Zoogeographical regions – Climatic and faunal peculiarities. Wallace line - Continental Drift. Speciation- Types of speciation - Factors involved in Speciation. Hardy- Weinbergequilibrium –- Factorsaffectinggene frequency. Genetic drift

UNIT-VEvolution of Higher forms(12 Hours)

Evolution of Horseand Evolution of Man - Fossil evidences- Cultural evolution of man

Text Books :

1. Verma PS, & Agarwal VK Cell Biology, Genetics, Evolution and Ecology, S Chand Publishers, New Delhi.
2. Gupta PK, Cytology, Genetics & Evolution, Rastogi Publications, Meerut.
3. Arumugam N Organic Evolution, Saras Publication, Nagercoil.

Reference Books:

1.Barton NH, Briggs DEG, Eisen JA, Goldstein DB and Patel NH, Evolution. Cold Spring, Harbour Laboratory Press.

2,Hall BK & Hallgrimsson B, Evolution, Jones and Bartlett Publishers.

Web Resources

http://www.earthlife.net

http://ncse.com/evolution

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Identifies the possible ways of origin of life and the relates the evidences for evolution	**K1,K2**
CO2	Analyse the theories of evolution and explains the modern evolutionary thoughts	**K2,K4**
CO3	Identifies the differences of mimicry and coloration, gains knowledge about the isolating mechanisms	**K2,K4**
CO4	Classifies and categorizes the types of geographical distribution of animals and speciation	**K4**
CO5	Predicts the trends in evolution of horse and human evolution and cultural transformation of man	**K1,K2**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3		2		
CO2	3	3		2		2
CO3	3	3	2	2	2	2
CO4	3	3	2	3	2	3
CO5	3	3	2	3	2	2
Total	**15**	**15**	**6**	**12**	**6**	**9**
Average	**3**	**3**	**1.2**	**2.4**	**1.2**	**1.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**APPLIED ZOOLOGY**		
Course Code		**22UFAZC3**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC– XIII	**Core**	**4**	**5**	**25+75=100**

Course Objectives

- To Know the different types of pests affecting crops and pest control methods
- To know the insects of commercial importance and their economically important products
- To gain knowledge of the various types of poultry breeds and their management
- To attain knowledge on the livestock development in India and its future prospects

Unit I–Insect Pests and their control(15 Hours)

Definition of Pest- Causes for insects attaining pest status-Damage and loss due to pests.

Brief account on pests affecting agricultural crops

Rice(Rice stem borer, Rice gall midge, Rice hopper), Sugarcane (Sugar cane leaf hopper, root borer, shoot borer), Cotton (Pink and spotted boll worm), Coconut (Rhinoceros beetle), Vegetables (Red pumpkin beetle, Cabbage butterfly, Hadda beetle (tomatoes and potatoes), Brinjal shoot borer), Insect pests of stored grains (Rice weevil, Khapra beetle (wheat), Pulse beetle). Insect pest control methods (Physical, mechanical, chemical and biological),IPM

UNIT II-Beneficial Insects(15 Hours)

Sericulture- Mulberry and non-mulberry silkworms- common cultivable species- Biology of Bombyx mori- Types of silk. economic importance of silk

Apiculture-Types of Honey bees for rearing- Bee hive products-Chemical composition, nutritional and medicinal value of honey

Economic importance of lac insect

UNIT III– Vermiculture(15 Hours)

Vermiculture- Selection of species for vermiculture –Vermicomposting- Organic resources for vermiculture - Vermicomposting methods (Pit Method and Heap Method)- Harvesting of vermicompost - Factors affecting vermicomposting. Advantages of vermicompost.

UNIT IV –Poultry management(15 Hours)

Breeds of chicken- Indigenous breeds and exotic breeds (American, Asiatic, English and Mediterranean breeds) - Construction of poultry house-Intensive method of poultry rearing (Deep litter system and Cage system)- Feeding equipments .Incubation of eggs (Natural and artificial). Diseases affecting poultry and their prevention methods.

UNIT V-Dairy,sheep and Piggery farming(15 Hours)

Livestock development in India and its future prospects.Cattle breeds- (Dairy, Draught and Dual purpose breeds). Exotic breeds of cows.Buffalo breeds in India. Indigenous and exotic breeds of sheep for wool and meat production. Piggery - economically important breeds and economic importance

Text Books :

1. B. Vasantharaj David and T. Kumaraswami 1982. Elements of Economic Entomology, Popular Book Depot, Chennai.
2. Sukla, G.S. and Upadhyay, V.B., 2000 Economic Zoology – Rastogi Publications, Meerut, India.
3. Jawaid Ahsan and Subhas Prasad Sinha, 2000 A Handbook On Economic Zoology- S. Chand & Co., Ltd., New Delhi

Reference Books:

1. Nayar, K.K., Ananthakrishnan, T.N. and B.V. David,V 1992 General And Applied Entomology Tata Mcgraw, New Delhi,

3. P.G. Fenemore Manual. Silkworm Rearing. FAO Agricultural Service Bulletin, Rome

3 Ashok Kumar and Prem Mohan Nigam, 1991 Economic and Applied Entomology Emkay Publications, New Delhi.

4.Shammi, Q.J. And Bhatnagar, S., 2002 Applied Fisheries: Agrobios (India), Jodhpur - India.

5.Keith Wilson, N.D.P., 2005 A Handbook of Poultry Practice - Agrobios (India), Jodhpur - India.

6.Banerjee, G.C. 1992 Poultry -3rd Edition - Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Web Resources

https://www.bioscience.com.pk/topics/zoology/item/628-economic-zoology
https://study.com/academy/lesson/class-insecta-characteristics-orders.html
https://texasinsects.tamu.edu/insect-orders/
https://extension.psu.edu/beekeeping-honey-bees
https://www.karnataka.gov.in/sericulture/
http://www.epa.gov/
http://www.vegetableipmasia.org/index

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Demonstrate the skill to explain all concepts pertaining to zoology and human welfare	**K1, K2**
CO2	Discuss the important agricultural pests affects crops and methods of their control.	**K3, K4**
CO3	Outline the life cycle of honeybees, silkworms and lac insects and list their products , and their economic value	**K3**
CO4	To gain skills and knowledge on poultry breeding and poultry farm maintenance	**K2, K4**
CO5	Understand dairy animals management, the breeds and economic importance	**K1, K2**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	3
CO2	2	2	2	3	3	3
CO3	3	3	2	3	3	2
CO4	3	2	2	2	3	3
CO5	3	2	3	2	3	3
Total	**14**	**11**	**11**	**13**	**15**	**14**
Average	**2.8**	**2.2**	**2.2**	**2.6**	**3**	**2.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**PRACTICAL III : Animal Physiology, Biotechnology and Developmental Biology**		
Course Code		**22UFAZC4**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CCP– XIV	**Core**	**4**	**3**	**40+60=100**

Course Objectives

- Understand the physiological process of digestion and analyse excretory products through simple experiments
- Gainsexperience on qualitative analysis of sugars
- Learn the various developmental stages of frog and chick and types of placenta
- Gain Knowledge on electrophoresis, PCR technique and blotting techniques

ANIMAL PHYSIOLOGY

1.SurveyofDigestiveenzymesincockroach(mid gut region) – Demonstration

2.Detectionof nitrogenouswasteproductsinfishtank water,frogtankwater,birdexcreta andmammalianurine.

3.Effect of temperature or pH on Ptyalin activity in human saliva

4.Estimation of Haemoglobin by Sahli's Haemoglobinometer.

5.Qualitativeanalysisofcarbohydrates(Glucose,Fructose and Lactose)

6.Qualitativeanalysisofamino acids(Tyrosine and Tryptophan)

7.UseofKymographunit and B.P.apparatus.

BIOTECHNOLOGY

1.Demonstartion of Agarose gel Electrophoresis technique

2.Blotting techniques- Southern blotting, Northern Blotting and Western blotting (Demonstration)

3.DemonstrationofPCRtechnique

4.Visittobiotechnology industries and laboratory-reporttobesubmitted along with record

DEVELOPMENTALBIOLOGY

Studyofthefollowingpreparedslides,museumspecimens,materials and photographs.

1. Sectionsof mammalian testisandovaryshowingthematurationstagesofgametes.
2. SlidesofmammalianSpermandOvum.
3. StudyofEggtypes–Frog'segg,Hen'segg.
4. Slidesofcleavagestages,blastula,gastrulaoffrog.
5. Slidesofdifferentstagesofchickembryo- 24 Hours,48 Hours,72hoursand96Hours.
6. PlacentaofsheepandMan.

Text Books

1.P.S.Verma and P.C.Srivastava- 2012 Advanced Practical Zoology - S.Chand Publishing Company Pvt.Ltd.

2.P.Ramadass and A.Wilson Aruni 2007 Practical Biotechnology Jaypee Publishing

3.A. Gibbs , 2006 A Practical Guide to Developmental Biology Ane/Oxford Exclusive

Web Resources

https://www.notesonzoology.com/practical-zoology/developmental-stages-of-chick-embryo-zoology/3043
https://vlab.amrita.edu/?sub=3&brch=63
https://www.asbmb.org/education/online-teaching/online-lab-work

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	To perform, report on basic experiments in physiology, Analyzeandcomparedifferenttypesofexcretoryproductsinanimals ofdifferent habitats, report on pyalin activity in human saliva in realtion to temperature or pH	**K1, K4**
CO2	Assessthehaemoglobincontent and to know how to read theblood pressure	**K4**
CO3	Demonstration of PCR and blotting technique	**K2,K3**
CO4	Identify the structure of gametes and developmental stages of frog and chick	**K1, K4**
CO5	To gain knowledge on the types of placenta	**K3**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	2	3
CO2	2	2	3	3	2	2
CO3	2	3	2	2		2
CO4	3	2		2	3	3
CO5	2	2	1	2	2	3
Total	**12**	**12**	**12**	**13**	**12**	**13**
Average	**2.4**	**2.4**	**2.4**	**2.6**	**2.4**	**2.6**

PRACTICAL EXAMINATION FOR MAJOR

***Practical Examination will be conducted during the end of EVEN SEMESTER (second , fourth and sixth semesters). Each practical with 3 hours duration.**

MARK DISTRIBUTION (END SEMESTER PRACTICAL EXAMINATION)

PRACTICALS : 50 MARKS

RECORD: 10 MARKS

TOTAL: 60 MARKS

QUESTION PAPER PATTERN FOR PRACTICALS

1.MAJOR PRACTICAL QUESTION – 20 MARKS

2.MINOR PRACTICAL QUESTION - 15 MARKS

3.SPOTTERS 5 X 3 = 15 MARKS

4.RECORD 10 MARKS

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**PRACTICAL IV- ENVIRONMENTAL BIOLOGY, MICROBIOLOGY AND IMMUNOLOGY**		
Course Code		**22UFAZC5**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CCP– XV	**Core**	**4**	**3**	**40+60=100**

Course Objectives

- Analyse the important ecological parameters in different water samples and can interpret the significance of these parameters.
- Know the adaptations of the organsims with respect to their environment.
- Acquire knowledge in media preparations and important microbiological techniques.
- Know the techniques available to study antigen- antibody reactions.

ENVIRONMENTALBIOLOGY

1. EstimationofO_2,salinity,freeCO_2,Carbonatesandbicarbonatesinwatersamples.
2. Use of Rain guage, Maximum &minimum thermometer, Hygrometer, Anemometer and Barometer.
3. Adaptationsofaquaticandterrestrialanimalsbasedonstudyofmuseumspecimens-rocky, sandy,muddyshoreanimals,flyingandburrowinganimals.
4. Studyof naturalecosystemandfieldreportofthevisit to be submitted along with record

MICROBIOLOGY

1.Sterilization techniques

2.Mediapreparation-Broth,agar,slants,plating

3.Spotters:*Staphylococcusaureus,E.coli,Rhizopus,Aspergillusflavus,A.niger,Pencillium, Candidaalbicans.*

4.Instruments-Autoclave,cultureplate,Inoculationchamber

5.Staining:Simpleanddifferentialstaining of bacteria-To identify gram positive and gram negative bacteria

6.Examination of milk-Methyl blue reduction test.

IMMUNOLOGY

1. Antigen and antibody reactions - Haemagglutination- using human blood groups.
2. Immunoelectrophoresis (Demonstration)
3. ELISA (Demonstration)
4. Study of prepared slides- Histology ofThymus, Spleen, Bone marrow and Lymph node

Text Books

1.P.S.Verma and P.C.Srivastava- 2012. Advanced Practical Zoology - S.Chand Publishing Company Pvt.Ltd.
2.R.C.Dubey and D.K.Maheshwari 2010. A Text book of Practical Microbiology S.Chand Publishing Company

Web Resources

https://www.microbiologyresearch.org/content/journal/micro

http://www.columbia.edu/itc/sipa/envp/louchouarn/courses/env-chem/Lab2.htm
https://wrrc.umass.edu/research/projects/acid-rain-monitoring-project/analysis-method-ph-and-alkalinity
amp/s/pharmawiki.in/autoclave-sterilization-principle-working-pdf

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Analyse the watersamplesfor,O2,salinity,carbonates and bicarbonates	**K4**
CO2	Identify a few ecological instruments and study its importance	**K2, K3**
CO3	Know about theadaption ofrocky shoreand sandyshoreanimals	**K3**
CO4	Perform sterilization technique, media preparation and identify the difference between Gram positive and Gram negative bacteria , Examine the quality of milk	**K1,K2**
CO5	Perform demonstration of agglutination reaction. Comparehistologyofdifferent immune tissues	**K2,K3**
K1-**Remembering**, K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	2	2
CO2	2	2	3	2		2
CO3	2	3	1	3	3	3
CO4	3	3	2	3	2	3
CO5	2	2	3	2	2	3
Total	**12**	**13**	**12**	**13**	**11**	**13**
Average	**2.4**	**2.6**	**2.6**	**2.6**	**2.2**	**2.6**

PRACTICAL EXAMINATION FOR MAJOR

***Practical Examination will be conducted during the end of EVEN SEMESTER (second , fourth and sixth semesters). Each practical with 3 hours duration.**

MARK DISTRIBUTION (END SEMESTER PRACTICAL EXAMINATION)

PRACTICALS : 50 MARKS

RECORD: 10 MARKS

TOTAL: 60 MARKS

QUESTION PAPER PATTERN FOR PRACTICALS

1.MAJOR PRACTICAL QUESTION – 20 MARKS

2.MINOR PRACTICAL QUESTION - 15 MARKS

3.SPOTTERS 5 X 3 = 15 MARKS

4.RECORD 10 MARKS

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**BIOSTATISTICS AND BIOCHEMISTRY**		
Course Code		**22UEAZE1A**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC-I	**Elective**	**4**	**5**	**25+75=100**

Course Objectives

- To understand the basic concepts of classification of statistical data and presentation of data
- Analyse statistical data to interpret research problems by students 't' test, F test and Chi square test
- To understand the biomolecules, its classification and structure.
- To understand the basic metabolic processoccurring in cells.

UNIT–I :Classification and Presentation of data(15 Hours)

Biostatistics – Definition and Scope – Collection of Data (Primary and secondary). Variable - Discrete and Continuous. Presentation of Data - Classification and Types of classification, Tabulation – Types of Tables. Diagrams and graphs - Bar diagram(Simple and Multiple), Pie diagram, Frequency diagram : histograms, frequency polygon , frequency curve, Ogives, line graphs. Characteristics of frequency distribution.

UNIT–II : **Measures of Central tendency and Dispersion(15 Hours)**

Measures of Central tendency - Mean, Median, Mode - Weighted Arithmetic mean (Individual, Discrete and Continuous). Measures of Dispersion - Range, Mean deviation , Standard deviation and Standard error

UNIT-III : Correlation and Regression (15 Hours)

Correlation and its Types , Regression and Regression Equations ,and Regression lines. Samples – Principle and Sampling methods. Test of significance – large and small sample test – test for proportions - Student's – t test, F test, Chi square - test

UNIT– IV: Biomolecules and Enzymes (15 Hours)

Classification of Carbohydrates – Monosaccharides, Oligosaccharides, Disaccharides, Polysaccharides. Structure of carbohydrates with reference to (glucose, fructose, lactose, maltose and sucrose).

Classification of amino acidsand proteins (Fibrous, Globular, Simple, Conjugated) - Structure of proteins (Primary, secondary and tertiary)

Classification of lipids - Simple lipids (Fats and Waxes), Compound lipids (Phosholipids and Glycolipids) and Fatty acids (Saturated and Unsaturated)

Enzymes- Classification and Mechanism of enzyme action - Factors influencing enzyme action,

UNIT–V: Cell Metabolism(15 Hours)

Carbohydrate Metabolism - Glycolysis and Krebs cycle. Electron transport chain and formation of ATP. Glycogenesis, Glycogenolysis, Gluconeogenesis. Protein metabolism – Decarboxylation, Deamination and Transamination. Fat metabolism - Beta-oxidation of fatty acids.

Text Books :

1. Gurumani,N.2004,Introductionto Bio-statistics,M.J.P.Publishers,Chennai.

2. Veerakumari,L. 2005Biochemistry,MJPPublishers,Chennai

3. Ambika Shanmugam, Biochemistry for medical students

Reference Books:

1.RangaswamyR.A.,1995.TextbookofAgricultureStatistics,NewAgeInternational Publishers.

2.S.P.Gupta2011.PracticalStatistics.9th edition

3. J.L.Jain2009.Fundamentalsof biochemistry.Nitin,SunjayJainBooks.

4.E.E.ConnandP.K.Stump.OutlinesofBiochemistry-JohnwileyandSonspublications.

5. Harper'sIllustratedBiochemistry-28thEdition:McGraw-Hill Medical;

Web Resources

https://opentextbc.ca/anatomyandphysiology/chapter/24-2-carbohydrate-metabolism/
https://www.amboss.com/us/knowledge/Lipids_and_fat_metabolism

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Explaintheprocessof collection,classification, tabulationandpresentationofdata.	**K1,K2**
CO2	Describes andcalculatemean,median,mode,standard deviationandCo-efficientofvariance	**K3,K4**
CO3	Understands and calculates Karlpearson's correlation coefficient, simple linear regression. test of significance and calculates Student t test and Chi-square test to draw inference on the given data	**K2,K3**
CO4	Explainthestructureandclassificationof carbohydrate,proteinsandlipids, Explain the reactions of Glycolysis, TCA cycle, Glycogen metabolism, GluconeogenesisandHMP Shunt explainstheclassificationofenzymesand theirmechanismofenzymeaction	**K1,K2,K3**
CO5	Understands thebiochemical reactionsinaminoacid metabolism,Ureacycle, and βoxidation offattyacid	**K2,K3**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	3	2
CO2	3	3	2	3	2	3
CO3	3	2	3	3	3	3
CO4	3	3	2	3	3	2
CO5	2	3	3	2	3	3
Total	**14**	**14**	**13**	**13**	**14**	**13**
Average	**2.8**	**2.8**	**2.6**	**2.6**	**2.8**	**2.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**BIOINFORMATICS**		
Course Code		**22UEAZE1B**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC-I	**Elective**	**4**	**5**	**25+75=100**

Course Objectives

- Students shall learn the basic principles and concepts of integrating biology with information technology
- Gains knowledge on the scope, aim, objectives and futuristic approach of bioinformatics
- Gains information from biological databases and to use this information in computer aided drug designing
- Perceives ideas about the various tools used in bioinformatics to identify sequences
- Understands the importance of genomics, proteomics and metabolomics

Unit I : Computer networking (15 Hours)

Computer networking LAN, WAN, MODEM and Fiber Optics Networks – Introduction to Internet, WWW, NICNET, ERNET, VSNL, ISDN.

Unit II : Scope of Bioinformatics (15 Hours)

Evolution of Bio-informatics - Potentials of bio- informatics -Human Genome Project - bio-informatics in India-Future in Bio-informatics. Scope of Bio-informatics - Useful Bio-informatics sites- Bio-informatics and Pharmaceutical industry - Bio-informatics orientation in IT industry. Applications of bioinformatics

Unit III : Biological Databases (15 Hours)

Database – Definitions – Biological database – NCBI- Primary Database (EMBL, Genbank, DDBJ) – Protein Databases (SWISS – PROT, TREMBL, NRL – 3D PIR MIPS); - Secondary databases (PROSITE, PFAM, BLOCKS, PRINTS IDENTIFY)–Composite databases (NRDB, OWL MIPSX); - Protein structure databases (PDB, MMDB).

Unit IV : Sequence Analysis Tools (15 Hours)

Introduction to sequence analysis tool- Sequence alignment- Pair wise alignment – Local and global alignment – BLAST, FASTA, Multiple Sequence Analysis (MSA). Clustal W, Clustal X

Unit V : Applications of Genomics, Proteomics and Metabolomics (15 Hours)

Microarrays , Data analysis tools and methods - Genomics DNA sequencing, applications Proteomics- Tools and applications (brief account), Metabolomics- Tools and applications

Text Books :

1. S.C. Rastogi, Mendiratta, P. Rastogi. 2005. Bioinformatics: Method & Applications. Genomics, Proteomiocs & Drug Discovery. Prentice Hall Of India, New Delhi.
2. Mani and Vijayaraj. 2004. Bioinformatics: A Practical Approach. Aparna Publications, India. Higgins And Taylor. 2000.

Reference Books:

1. T.K. Attwood and D.J. Parry, 2004. Smith, Introduction to bioinformatics, Pearson Education Ltd., New Delhi.
2 Arthur M. Lesk, 2003. Introduction to bioinformatics, Oxford University Press, New Delhi.
3 .Sundara Rajan and R. Balaji, 2002, Introduction to Bioinformatics, Himalaya Publishing House, New Delhi.
4 .Irfan A. Khan and Atiya Khanum,2002. Emerging trends in Bioinformatics, Ukaaz Publications, Andhra Pradesh

Web Resources

https://anil.cchmc.org/BioInfoRes.html
https://www.roseindia.net/bioinformatics/bioinformatics_resources.shtml

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Hands on Training on usage of bioinformatics tools

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Understands and categorizes the computer networks	**K2,K4**
CO2	Explains the aim, scope, objectives of bioinformatics , identifies its need in pharmaceutical industry	**K2,K3**
CO3	Categorizes the different biological databases	**K4**
CO4	Identifies the sequence analysis tools and its usage in sequence search	**K3,K4**
CO5	Examines the applications of proteomics, genomics and metabolomics	**K4,K3**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	1
CO2	3	3	2	3	1	2
CO3	2	2	3	2	2	2
CO4	2	3	2	2	3	3
CO5	2	2	3	2	2	2
Average	**2.4**	**2.4**	**2.4**	**2.4**	**2**	**2**
Total	**12**	**12**	**12**	**12**	**10**	**10**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**MEDICALLABORATORYTECHNIQUES**		
Course Code		**22UFAZE2A**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC-II	**Elective**	**4**	**5**	**25+75=100**

Course Objectives

- Learn the maintenance laboratory equipments/ tools, safety hazards and precautions.
- Understands methods of collection of specimens and preparation of clinical reports
- Understands the importance sterilization, laboratory precautions and first aid
- To gain knowledge about pathology and laboratory tests of infectious diseases, inherited and life style diseases

UnitI : Good Laboratory Practice(15 Hours)

Introduction and scope - Good Laboratory Practice (GLP). Records and Preparation of reports. Cleaning, maintenance and care of glasswares. Sterilization methods- (Flame, Steam, Chemical, Pressure). Safety precautions and first aid treatment for superficial wounds, burns, chemical poisoning, contamination of infected microbiological specimens and electric shock. Disposal of specimens and infected materials

Unit-II : Haematology (15 Hours)

Collection of specimens and samples (blood, urine, stool, semen, CSF, sputum). Blood smear preparations. Haematological tests –Clinical significance of total RBC , WBC , Differential count , Platelet count and Haemoglobin content - Red cell indices and its significance (MCV, MCH and MCHC). Methods and clinical significance of ESR, PCV, Clotting time, Bleeding time and Prothrombin time.Liver Function Test- Enzymes (SGOT, SGPT) and Bilirubin (Total and Direct).

UnitIII : Routine Laboratory Analysis (15 Hours)

Urine Analysis (Routine examination and analysis for albumin, glucose, ketones, bile pigments, Microscopical examination).Analysis of stools –Routine examination – Macroscopic and microscopic examination for parasites- Concentration techniques - Sedimentation and Flotation methods. Pregnancy test . Analysis of semen, Sputum and cerebrospinal fluid.

UnitIV : Laboratory Test for Microbial diseases (15 Hours)

Microbial, protozoan and helminth diseases – A brief study on Causative organism, Symptoms and Clinical test as mentioned

Bacterial diseases – Tuberculosis (Skin test-Mantoux, Sputum smear study), Typhoid (Widal test)

Viral disease – AIDS (HIV antibodies screening, CD4 count), Hepatitis B (HBsAg)

Protozoans – Amoebic dysentery (Stool Examination), Malaria (MP and MF Smear study and Quantitative buff test (QBC) for MP and MF).

Helminth parasites- Filariasis (Smear test, Circulating filarial antigen and Antibody detection IgG)

Unit V: Laboratory Test for Inherited and lifestyle diseases (15 Hours)

Brief study on Cause, Symptoms and Clinical test for the following diseases as mentioned

Life style disease -

Cardiac disorders (ECG, Echocardiography and lipid profiles).

Diabetes (Fasting blood glucose, Glycated haemoglobin (HbA1c), Urine analysis for urine sugars, ketone bodies and albumin)

Auto immune disease – Rheumatoid arthritis (C-reactive protein, Rheumatoid factor,RF)

Cancer- Liver cancer (alpha fetoprotein), GI tract cancer (CA19.9), Ovarian cancer (CA125) and Breast cancer (CA15.3).

Text Books :

1.Mukherjee K.L. 2003. Medical Laboratory Technology – A Procedure Manual For Routine Diagnostic Tests, Vol. I, II & III . Jayepee Brothers, New Delhi

Reference Books:

1. Baker F.J. And Silverton R.E 1998. Introduction To Medical Laboratory Technology. Hodder Arnold Publication.

Web Resources

www.csmls.org
http://www.nlm.nih.gov/medlineplus
https://www.healthline.com/health/urinalysis
https://www.cancer.ca/en/cancer-information/diagnosis-and-treatment/tests-and-procedures/stool-test/?region=on
https://www.healthline.com/health/pregnancy/tests
https://ocw.mit.edu/courses/health-sciences-and-technology/hst-071-human-reproductive-biology-fall-2005/lecture-notes/

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Seminars, Clinical Lab visit

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Explainsafelaboratorypractices, sterilization techniques understandprotocolsandprocedurestocollectclinicalsamples, familiarize in handlingclinicalequipment and to evaluatethesafetyprecautionswhilehandlingclinicalsamples	**K1,K2**
CO2	Evaluate the characteristicsof urine, stool , semen , CSF and sputum clinicalsamples for their abnormalities	**K5**
CO3	To identify appropriatediagnosticmethodsforevaluationofcommonhematologicdisorders,liver function andinterpretclinicalparameters	**K3,K4**
CO4	Explain, examine and discuss the etiological agent causing infectious diseases and its clinical manifestations	**K2,K3**
CO5	To understandtheimportanceofprognosisanddiagnosis and control measures of diseases occurring due to life style modifications	**K2,K5**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	2	3	3	2	3	2
CO3	2	2	3	3	2	3
CO4	3	2	3	2	3	3
CO5	3	3	2	3	3	2
Total	**13**	**13**	**14**	**13**	**14**	**13**
Average	**2.6**	**2.6**	**2.8**	**2.6**	**2.8**	**2.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**WILD LIFE BIOLOGY**		
Course Code		**22UFAZE2B**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC-II	**Elective**	**4**	**5**	**25+75=100**

Course Objectives

- Understands and acquire knowledge on various aspects of wildlife biology and
- habitat ecology
- To sensitize the students to the need for conservation of wildlife
- Understands the impacts of land use and environmental management decisions on ecosystems and society
- To familiarize with laws and regulations that influence how natural resources are used and protected

UNIT-I : Wildlife and its importance (15 Hours)

Definition, Wildlife concept and its perspective – Importance and need for management of wildlife in India.

UNIT-II : Wildlife Ecology (15 Hours)

Wildlife ecology – Productivity of ecosystem, energy flow in an ecosystem, ecological niche, biodiversity, animal and habitat interaction – effects of habitat, climate, food availability, patterns of habitat, utilization and dispersion (home range).

UNIT-III : Wild life Tourism (15 Hours)

Wildlife toursim – Viewing of wild animals – Plannning and Execution of field surveys – Sampling methods – Capture and Handling of Wild animals – Role of NGO'S in wild life protection and management

UNIT-IV : Wildlife and Healthcare (15 Hours)

Healthcare of wildlife – factors of disease dissemination in wildlife; Infectious diseases - Viral, bacterial, protozoan, helminthes, and their impact on wildlife; AnimalHealth monitoring

UNIT – V : Wildlife Habitat (15 Hours)

Capturing and marking techniques – live trapping birds and mammals, chemicals

immobilization, methods of marking. Zoological parks and sanctuaries in India – wildlife administration and legislation – administrative setup (central and state).Wildlife protection act 1972 and its amendments.

Text Books :

1.Giles, R.H. 1984. Wildlife management techniques. The wildlife society, Washington and

Natraj. Publishers, Dehra Dun.

2.Saharia, V.B. 1982. Wildlife in India. Natraj Publishers, Dehra Dun.

Reference Books:

1.Agarwal, V.P.1980. Forest in India. Oxford and IBH publishing co., New Delhi.
2. Davis, M. 1981. Infectious diseases of wild mammals. The IOWA state.

Web Resources

http://www.worldwildlife.org/
http://www.wwfindia.org/

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Seminars

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Understands the importance and need for wild life management	**K2**
CO2	Perceives an idea of the wild life ecosystem	**K2, K3**
CO3	Identifies wild life tourism spots and analyses the wild life field surveys	**K3**
CO4	Identifies the diseases affecting wild animals and their impact on wild life	**K3**
CO5	Assess the various wild life sanctuaries and fauna inhabiting the sanctuaries, explains the laws related to wild life protection	**K1, K2**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2		2	2
CO2	3	3	3	1	1	2
CO3	3	2	1	2	1	2
CO4	3	3	1	2	1	2
CO5	3	3	2	1	1	1
Total	**15**	**14**	**9**	**6**	**6**	**9**
Average	**3**	**2.8**	**1.8**	**1.2**	**1.2**	**1.8**

Level of Correlation between PSO's and CO's
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**AQUACULTURE**		
Course Code		**22UFAZE3A**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC-III	**Elective**	**4**	**5**	**25+75=100**

Course Objectives

- Tounderstand fisheries and fishery resources of India.
- Gain information aboutthebiologyofthefishes and their management
- Gains knowledge fisheryresourcesandtheirsustainable utilization.
- Understands the preservation andprocessingmethods .
- Gains information on the fisheries organizations involved in aquaculture in India

Unit – I : Aquaculture Practices (15 Hours)

Introduction to aquaculture - scope and export importance. Different culture practices - Extensive, semi intensive, intensive. Types of culture - Monoculture, Monosex culture, Polyculture. Criteria for selection of site and species for aquaculture practices.

Unit – II : Fish farm Design and Brood Stock Management (15 Hours)

Fish farm design and construction - Hatchery technology of fish and shrimps - Typesof fishponds(breedingpond, hatcheryunit,brooderspond,nursery pond, stockingpondandrearing pond)– Maintenanceandmanagementofdifferentponds. Brood stock management – larval rearing techniques - seed packing and transportation -.Feeds forcultivablespecies– natural,supplementaryandartificialfeeds.

Unit – III : Methods of Fish Culture (15 Hours)

Culture methods - Integrated fish farming - Paddy cum Pokkali fish culture, pen culture, cage culture, race way culture, sewage fed fish culture. InducedbreedinginIndianmajorcarps– Livefeedculture(RotifersandArtemia)–Carpculture (polyculture/Compositefishculture).

Unit-IV : Prawn and Oyster Culture (15 Hours)

Cultureof marineandfreshwaterprawn . Mariculture practices - Molluscan culture – edible oyster (mussel) and pearl oyster, seaweed culture.Preservationandprocessingoffishandprawn. Problems associated with aquaculture - Man made hazards, Economic factors

Unit-V : Fish Diseases and its Management (15 Hours)

Commonfish diseases(bacterial,viraland parasiticdiseases)– Cause, Preventionandtreatment. Organizations involved in aquaculture - CMFRI, CIFA, CIBA, MPEDA and TANUVAS

Text Books :

1.V.G.Jhingran,1991.FishandfisheriesofIndia,HindustanPublishingCorporation, Delhi.

2.Shanmugam,K.1990.FisheryBiologyandAquaculture,HindustanPubCorporation, NewDelhi.

Reference Books:

1. MathewLandan,1991.Introductiontoaquaculture,JohnWilayandSonsInc..
2. V.R.P.Sinha,1993. A compendiumofaquacultureTechnologiesfordevelopingcountries, OxfordandIBHPublishingCompanyPVT.Ltd.
3. T.V.R.Pillay–Aquacultureprinciplesandpractives,Fishing newBooks,Blackwell Science Ltd.,Oxford.
4. C.V.KurianandSebastein–PrawnandPrawnfisheriesofIndia,Hindustan Publishing House,NewDelhi.
5. ElvireBalugal,A. 1984.Aquaculturesystemsandpractices–AselectedReview, DayaPublishingHouse,NewDelhi.
6. B.N.Yadav,1995.FishEndocrinology,DayaPublishingHouse,NewDelhi.

Web Resources

http://fishcount.org.uk/farmed-fish-welfare/development-of-intensive-fish-farming

http://www.fao.org/fileadmin/templates/SEC/docs/Fishery/cage/3DAAPM_en.pdf

https://www.tandfonline.com/doi/abs/10.1080/10641262.2010.535046

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Describe different aquaculture practices and to evaluate the freshwater and brackish water resources for aquaculture	**K1, K2**
CO2	To outline the construction of fish hatchery and maintenance of fish ponds	**K3, K4**
CO3	Apply the knowledge of aquaculture in composite fish farming, concept of integrated farming , sewage fed fish culture and the explain induced breeding techniques	**K3, K4**
CO4	Familiarizes the culture practice of prawn, oysters and sea weeds for production and utility	**K3, K4**
CO5	Identify fish diseases and discuss the economic returns of aquaculture	**K1, K2**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	2	2	3	3
CO2	3	2	2	2	3	3
CO3	3	3	2	3	3	3
CO4	3	3	2	2	3	3
CO5	3	3	2	3	3	3
Total	**14**	**13**	**10**	**12**	**15**	**15**
Average	**2.8**	**2.6**	**2**	**2.4**	**3**	**3**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

B.Sc.DegreeProgrammeinAdvanced Zoology and Biotechnology

Sixth Semester				
Course Title		**POULTRY AND DAIRY SCIENCE**		
Course Code		**22UFAZE3B**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC-III	**Elective**	**4**	**5**	**25+75=100**

Course Objectives

- Understand the domestication of fowls
- Know the techniques of rearing and management of various poultry breeds
- Acquire the knowledge on the diseases of poultry and the prophylactic measures
- Know the techniques of rearing and management of various cattle breeds

UNIT I : Commercial Poultry Farming (15 Hours)

Poultry industry in India and World. Poultry population- egg and meat production status- Commercial poultry farming- Nutritive value of egg and meat- Poultry housing and equipment- Location of poultry farm- Systems of rearing.

UNIT II : Broiler Management (15 Hours)

Broiler management (Definition; Housing and equipment; Brooding, feeding and health cover of broilers; Record keeping; Broiler integration)- Layer management (Brooder; Grower and layer management; Culling of layers; Marketing of eggs and meat)-Quail and Turkey management (Feeding; Health cover; Marketing Strategy).Common poultry diseases and their control including bio-security.

UNIT III: Dairy Breeds (15 Hours)

Breeds of dairy cattle and buffaloes (breeds description- exotic- indigenous)- Artificial insemination programme- Dairy cattle management (general principles- housing- water supply- care during pregnancy- care of new born calf) –Dairy cattle nutrition- feeds and fodders- feeding standards.

UNIT IV : Livestock Diseases (15 Hours)

Live stock diseases: Viral diseases – rinderpest, Foot and mouth disease and cow pox. Bacterial diseases – Mastitis, Anthrax, Tuberculosis, Haemorrhagic – septicaemia, Brucellosis. Metabolic disorders – Milk fever, ketosis and bloat. A brief account of external and internal parasites.

UNIT V: Dairy Technology and Marketing (15 Hours)

Dairy Technology & Marketing: Milk – composition and Nutritive value – Techniques to detect milk adulteration – Spoilage of milk – pasteurization of milk – Preparation of Dahi, Butter and Ghee. Role of Co-operative societies in milk production& Marketing.

Text Books :

1.Gopalakrishnan C.A and G.Murley Mohan Lal 1997, Livestock and Poultry enterprises for rural development, Vikash, New Delhi.
2.Gnaanamani M.R., 1998 Modern aspects of commercial poultry keeping, Giri.
3.Banarjee G.C., 1992 Poultry, Oxford and IBH, New Delhi.
4.Sukumar, D.E. 2002 Outline of Dairy Technology, Oxford Uni, New Delhi
5.Revives P.M.and Henderson, 1969 Dairy Cattle Feeding and Management Wiley Estern, New Delhi
6.Eckles C.H nd E.L.Anthony, 2001 Dairy Cattle and Milk Production, Biotech

Reference Books:

1.Chauhan H.V.S. and S.Roy, Poultry diseases, diagnosis and treatment New Age International, 1996.
2.ICAR, 1997 Handbook of Animal Husbandary- The Indian Council of Agricultural Research New Delhi
3.Jeergenson E.M and W.P. Mortenson, 1996 Approved Practices in Dairying, Oxford &IBH, Calcutta.

Web Resources

http://www.poultryhub.org/production/husbandry-management/poultry-behaviour/

http://agritech.tnau.ac.in/animal_husbandry/ani_chick_grower&layer%20mgt.html

https://www.bioscience.com.pk/topics/zoology/item/636-poultry-farming-layers-and-broilers

https://www.dairycouncil.co.uk>pasteurisation

http://dairyprocessinghandbook.com

https://www.galvmed.org>livestock diseases

Methodology of Teaching

Class lectures, Group Discussion, Assignments,

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Understands commercial poultry farming and organizes the management of poultry farm	**K2,,K4**
CO2	Determines methods for the management of broilers , identifies the diseases affecting poultry and develops biosecurity measures for its management	**K3**
CO3	Classifies the different dairy breeds of cattle, outlines the management of a dairy farm	**K2,K3**
CO4	Identifies the bacterial, viral, parasitic and metabolic diseases affecting poultry	**K3,K4**
CO5	Identifies the strategies of dairy technology and categorize the dairy products for marketing	**K3,K4**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	2	2
CO2	3	3	3	2	3	3
CO3	2	2	1	2	1	2
CO4	2	2	2	2	3	1
CO5	3	2	2	1	2	2
Total	**13**	**12**	**10**	**11**	**11**	**10**
Average	**2.6**	**2.4**	**2**	**2.2**	**2.2**	**2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

ALLIED PAPERS

ALLIED THEORY OFFERED FOR

B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY AND B.Sc CHEMISTRY

First Semester				
Course Title		**ALLIEDZOOLOGY – PAPER I (THEORY)**		
Course Code		**22UAAZA1**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
AC-I	**Allied**	**4**	**4**	**25+75=100**

Course Objectives

- Know the general classification of invertebrates and chordates
- Depict the structural diversity of various animal phyla to study their life history and their significance
- Understands the structural organizations of the vertebrate animals

Unit–I: Invertebrata –I (12 Hours)

Introduction:Invertebrata-Generalcharacters of all phylum , Type study and life history of the following.

Protozoa–Typestudy:Paramecium

Porifera–Typestudy: Leucosolenia

Coelenterata–Typestudy:Obeliageniculata

Platyhelminthes-Typestudy:Taeniasolium

Unit–II - Invertebrata –I (12 Hours)

Annelida–Typestudy:Neries

Arthropoda–Typestudy:Prawn

Mollusca–Typestudy:Freshwater mussel

Echinodermata–Typestudy:Seastar

Unit–III - Prochordata and Fishes (12 Hours)

Prochordates–*Amphioxus*–Structureandaffinities

Pisces-Typestudy:Shark (External morphology, Digestive system , Structure of heart, Respiratory system, Urinogenital system and Structure of Brain**)**

Unit–IV- Amphibians and Reptiles (12 Hours)

Amphibia-Typestudy:Frog. (External morphology, Digestive system , Structure of heart, Respiratory system, Urinogenital system and Structure of Brain**)**

Reptilia: Type study -Calotes. (External morphology, Digestive system , Structure of heart, Respiratory system, Urinogenital system and Structure of Brain**)**

Unit–V- Aves and Mammals(12 Hours)

Aves-Typestudy:Pigeon(External morphology, Digestive system , Structure of heart, Respiratory system, Urinogenital system and Structure of Brain**)**

Mammalia-Typestudy:Rabbit. (External morphology, Digestive system , Structure of heart, Respiratory system, Urinogenital system and Structure of Brain**)**

Text Books :

1. EkambaranathaAyyar,MandAnanthakrishnan,T.N.1993,OutlinesofZoology, Vol.IandII,ViswanathanandCo.Madras

Reference Books:

1. P.S.DhamiandJ.K.Dhami–InvertebrateZology–S.ChandandCo.NewDelhi.
2. Jordan,E.K.andP.S.Verma,1993.ChordateZoology,12thedition,S.Chand& Co.Ltd.,Ram Nagar,NewDelhi

Web Resources

http://www.biologydiscussion.com/notes/biology-notes-on-plants-and-animals/48680
https://www.onlinebiologynotes.com/
https://www.khanacademy.org/science/biology/
www.biologicaldiversity.org

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

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CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	To classify the different levels of organization and to study the salient features of various invertebrate phyla	**K1,K2**
CO2	To interpret the organ system and to understand life history with one type study of each invertebrate phyla	**K2,K4**
CO3	To illustrate the salient features of prochordates and identify their inter relationships	**K2,K3**
CO4	To describe the structural organization of shark , frog and calotes	**K2,K3**
CO5	To describe the adaptations and advancement of structural features in birds and mammals	**K2,K4**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO-PSOMapping(Course Articulation Matrix)

CO / PsO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	3	2	3	2
CO2	3	3	2	3	2	3
CO3	3	2	3	2	3	
CO4	3	2	2	3	3	2
CO5	3	2	3	2	3	3
Total	**14**	**13**	**13**	**12**	**14**	**10**
Average	**2.8**	**2.6**	**2.6**	**2.4**	**2.8**	**2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

ALLIED THEORY AND ALLIED PRACTICALS

OFFERED FOR

B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY AND B.Sc CHEMISTRY

Second Semester				
Course Title		**ALLIEDZOOLOGY – PAPER II(THEORY)**		
Course Code		**22UBAZA2**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
AC-II	**Allied**	**4**	**4**	**25+75=100**

Course Objectives

- Understand the structure of animal cell and functions of important cell organelles
- Know the basic concept of inheritance, structure of nucleic acids
- Attain the concept of developmental stages in animals
- Gain knowledge in the physiological functions of Human organ systems.

Unit–I: CellBiology and Genetics (12 Hours)

Structureofanimalcell,Structure and functionofMitochondria,nucleusandnucleolusandGolgibodies. Types and properties of cancer cells.Molecular structure and functions of gene- Multiple alleles with reference to Blood group inheritance in man– Sex linked inheritance XandY linkedinheritance in man.

Unit–II: DevelopmentalBiology (12 Hours)

Gametogenesis –Spermatogenesis and Oogenesis–Structure of mammalian sperm and ovum. Types of eggs- Types of cleavage and morphogenetic movements. Process of cleavage and gastrulation in frog and mammal (pig) - Intrauterine insemination (IUI) and *in vitro* fertilization techniques in human

Unit–III: Human Physiology (12 Hours)

Digestion- Digestion of carbohydrates, proteins and fats.Excretion-Structure and function of Kidney and nephron- Urine formation - kidney failure. Structure of heart, Blood pressure. Heart diseases - Ischemia, Myocardial infarction, Rheumatic heart disease, Stroke. Organ Transplantation.

Unit–IV: Environmental Biology(12 Hours)

Biological effects of light and temperature. Waste management-Methods of sewage and industrial effluents treatment –Solid waste management

Unit-V: Evolution(12 Hours)

Principles of Lamarckism and Darwinism - Neo Darwinism (Industrial melanism). Speciation- Types and Factors responsible for speciation.

Text Books :

1.Verma,P.S.andV.K.Agarwal,2010Reprint,CellBiology,Genetics,MolecularBiology, Physiology,EvolutionandEcology,S.Chand& Co.,NewDelhi

2. Sambasiviah, I,Kamalakara Rao,A.P.AugustineChellapa, S(1983). TextbookofAnimal Physiology,S.Chand& Co,NewDelhi.

3. Verma,P.S.andAgarwal,V.K.(1983).AnimalEcology,S.Chand& Co,NewDelhi.

Reference Books:

1. Verma,P.S.andAgarwal,V.K.and Tyagi,B.S.(1991).ChordateEmbryologyS.Chand&Co, NewDelhi.

2. Rastogi,V.B.andJayaraj,M.S.(2000).TextbookofGenetics,KedarnathRamnathPublishers, Meerut.

3. T.S.Gopalakrishnan,IttaSambasivaiahandA.P.Kamalakararao,1984PrinciplesoforganicEvolution,Pearlpublications,Chennai.

Web Resources

https://www.onlinebiologynotes.com/development-of-chick -embryonic-development/
https://embryology.med.unsw.edu.au/embryology/index.php/Frog_Development
www.omim.org
www.cellbio.com

Methodology of Teaching

Class lectures, Group Discussion, Assignments

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Identifies the various cell organelles of an animal cell to relate its function	**K2, K3**
CO2	Understands the basic processes involved in embryonic development	**K2,K4**
CO3	Analyses the importance of key physiological process in the human body	**K4**
CO4	Identifies methods of environmental waste management and strategiesfor minimization	**K2,K3**
CO5	Gains an insight on the theories of evolution and its relevance to the mechanism of speciation	**K3,K4**

K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	3	3	2	3
CO2	3	3	2	2	3	2
CO3	3	3	3	2	3	3
CO4	2	2	3	3	2	3
CO5	2	3	2		3	2
Total	**14**	**13**	**13**	**10**	**13**	**14**
Average	**2.8**	**2.6**	**2.6**	**2**	**2.6**	**2.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

Second Semester				
Course Title		**ALLIEDZOOLOGY PRACTICAL**		
Course Code		**22UBAZA2**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
ACP-III	**Allied Practical**	**4**	**3**	**40+60=100**

Course Objectives

- To understand the study of organ system in invertebrate and vertebrate animals .
- Dissect invertebrate and vertebrate animals to understand its external and internal anatomical features
- To provide skill based training through simple dissections and mountings to understand the relationships between invertebrates & vertebrates
- Gain knowledge in the morphological structures of various animal phyla by identifying museum specimens

I.Dissection:

1. Cockroach or Prawn :DigestiveandNervoussystem
2.Any Bony fish - Digestive system

II.Mounting:

1. Mouthpartsofcockroach
2. MouthpartsofMosquito
4. Prawn- appendages- (Mandible, maxilla , maxillepeds and uropod)
5. Shark – Placoid Scales

III.Spotters:

Entamoeba , Plasmodium, Paramecium, Paramecium-Conjugation, Sycon, Obeliageniculata Fasciolahepatica(Entire&Transversesection), Taeniasolium(Entire&Transversesection) Neries(Entire&Transversesection), Freshwatermussel, Star fish, Amphioxus, SharkEntire and Placoidscale) . Pigeon(Entire and quill feather), Rabbit

Text Books

Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced Practical Zoology, Books & AlliedLtd;
Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.
Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand

Web Resources

https://biology4isc.weebly.com/morphology-and-anatomy-of-cockroach.html
https://www.steampoweredfamily.com/education/virtual-dissections-

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Analyze the structural details of invertebrates and vertebrates through dissections.	**K4, K5**
CO2	Gains knowledge of mouth parts of insects , appendages of prawn .	**K2, K3**
CO3	Identifies the structure of placoid scale in shark	**K3**
CO4	Identify invertebrate preserved museum specimens in laboratory in relation to external morphology	**K2, K4**
CO5	Identify vertebrates museum specimens in laboratory in relation to external morphology	**K3, K4**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	3	3
CO2	2	3	2	3	2	3
CO3	2	3	2	3	3	2
CO4	3	2	3	2	3	
CO5	2	3	2	3	3	2
Total	**13**	**13**	**12**	**13**	**15**	**12**
Average	**2.6**	**2.6**	**2.4**	**2.6**	**3**	**2.4**

PRACTICAL EXAMINATION FOR ALLIED

***Practical Examination will be conducted during the end of EVEN SEMESTER (second , fourth and sixth semesters). Each practical with 3 hours duration.**

MARK DISTRIBUTION (END SEMESTER PRACTICAL EXAMINATION)

PRACTICALS : 50 MARKS

RECORD: 10 MARKS

TOTAL: 60 MARKS

QUESTION PAPER PATTERN FOR PRACTICALS

1.MAJOR PRACTICAL QUESTION – 20 MARKS

2.MINOR PRACTICAL QUESTION - 15 MARKS

3.SPOTTERS 5 X 3 = 15 MARKS

4.RECORD 10 MARKS

NON-MAJOR ELECTIVES

Non Major Elective-I

First Semester				
Course Title		**ECONOMIC ZOOLOGY**		
Course Code		**22UAAZN1A**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
NME-I	**Non Major Elective**	**4**	**2**	**25+75=100**

Course Objectives

- Understand silkworms rearing and their products.
- Understand the Bee keeping equipments and apiary management.
- Understand dairy animals management, the native breeds and exotic breeds
- know about dairy animals, products and their values

UNIT I- Vermiculture(10 Hours)

Vermiculture- Selection of species for vermiculture –Vermicomposting- Organic resources for vermiculture. Vermicomposting methods (Pit Method and Heap Method) .Harvesting of Compost - Factors affecting vermicomposting . Advantages of vermicompost.

UNIT II-Sericulture and Apiculture(10 Hours)

Mulberry and Non-mulberry silk worms- Biology of Bombyx mori . Types of silk- Silk worm rearing methods (brief study). Types of Honey bees for rearing, Structure of Bee comb. Modern bee hive structure (Langstroth hive and Newton's hive)- Bee Keeping equipments. Nutritional value of honey. Beehive products (Bee wax, Bee venom, Propolis and Royal jelly).

UNIT III- Aquaculture(10 Hours)

Purpose and importance of aquaculture – Types of culture systems (Traditional, Intensive, Semi Intensive and Extensive) - Types of fish pond- (Hatchery, breeding, Nursery, Rearing and Stocking). Types of culture- Monoculture and Polyculture. Culture of major carps**.** Induced breeding in major carps**.**

UNIT IV –Poultry Management(10 Hours)

Breeds of chicken- Indigenous breeds and exotic breeds (American, Asiatic, English and Mediterranean breeds) . Intensive method of poultry rearing (Deep litter system and Cage system) – Poultry rearing – Egg selection and Incubation of eggs (Natural and artificial). Factors involved in brooding.

UNIT V-Dairy Farming (10 Hours)

Livestock development in India and its future prospects. Cattle breeds- (Dairy, Draught and Dual purpose breeds)- Exotic breeds of cows (Jersey). Indigenous and exotic Breeds of goat and sheep in India.

Text Books :

1. G.S. Shulka and V.B. Upadhyay- 2000.Economic Zoology Rastogi Publ.Meerut.

2.Jawaid Ahsan and Subhas Prasad Sinha,2000- A Hand book on Economic Zoology-S.Chand and Company,New Delhi

Reference Books:

1.Ashok Kumar and Prem Mohan Nigam,1991. Economic and Applied Entomology, Emkay Publications,New Delhi

2.Keith Wilson NDP.,2005-A Hand Book of Popultry Practice-Agrobios,Jodhpur India

Web Resources

http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/3072/art06.pdf?sequence=1
http://fishcount.org.uk/farmed-fish-welfare/development-of-intensive-fish-farming
http://www.fao.org/fileadmin/templates/SEC/docs/Fishery/cage/3DAAPM_en.pdf

https://bit.ly/3nYvgSF
http://caa.gov.in/farms.html
http://www.csrtimys.res.in/
http://www.agshoney.com/training.htm

Methodology of Teaching

Class lectures, Group Discussion, Assignments,

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Knowtheeconomicimportanceofanimalfarming	**K1, K2, K3**
CO2	Disseminateinformationoneconomicaspectsofzoology	**K1, K2**
CO3	Toexplorethecultivablebreedsofanimalsforsustainablegrowth	**K3, K4**
CO4	Learnthemoderntechniquesinanimalhusbandry	**K1, K2, K3**
CO5	Todevelopentrepreneurialskillsthroughanimalfarming	**K1, K2**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating.**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	3
CO2	3	2	2	2	2	2
CO3	3	2	2	3	3	3
CO4	2	3	2	3	3	2
CO5	3	3	2	3	3	3
Total	**14**	**12**	**10**	**14**	**14**	**13**
Average	**2.8**	**2.4**	**2**	**2.8**	**2.8**	**2.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

Non Major Elective-I

First Semester				
Course Title		**POULTRY FARMING AND MANAGEMENT**		
Course Code		**22UAAZN1B**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
NME-I	**Non Major Elective**	**4**	**2**	**25+75=100**

Course Objectives

- Understand the domestication of fowls
- Know the techniques of rearing and management of various breed
- Acquire the knowledge on the diseases of poultry and the prophylactic measures

Unit – I : External Features and Breeds of Fowl (10 Hours)

External features of fowls – skeletal system – digestive system – endocrine system – feathers – Respiratory system – reproductive system. Genetics of fowls: Breeds of fowls – inheritance of morphological characters (List of autosomal and sex linked character – breeding methods – systems of breeding – modern method of breeding.

Unit – II : Poultry Housing (10 Hours)

Poultry industry in India– choosing commercial layers and broilers – Poultry housing – deep litter and cage system-merits and demerits.

Unit – III : Management of Chick Rearing (10 Hours)

Practical aspects of chick rearing -brooding management- growers and layers - management of broilers – lighting, summer winter management - debunking.

Unit – IV : Poultry Nutrition (10 Hours)

Poultry Nutrition: Energy - protein and aminoacids -Vitamins – essential organic elements - Non - nutrition feed additives - feed stuffs for poultry - feed formation.

Unit – V : Diseases of Poultry (10 Hours)

Viral, bacterial, fungal and parasitic diseases of poultry. Vaccines and vaccination programme.

Text Books :

1.Gnaanamani M.R., 1998 Modern aspects of commercial poultry keeping, Giri.

2.Banarjee G.C., 1992 Poultry, Oxford and IBH, New Delhi.

3.Chauhan H.V.S. and S.Roy, Poultry diseases, diagnosis and treatment, New Age International, 1996

Reference Books:

1.Gopalakrishnan C.A and G.Murley Mohan Lal 1997, Livestock and Poultry enterprises for rural development, Vikash, New Delhi.

2.John William S. (Ed) 2003. Poultry for sustainable Food Production and livelihood. loyola Publication, Chennai

Web Resources

http://www.poultryhub.org/production/husbandry-management/poultry-behaviour/

http://agritech.tnau.ac.in/animal_husbandry/ani_chik_grower&layer%20mgt.html

https://www.bioscience.com.pk/topics/zoology/item/636-poultry-farming-layers-and-broilers

Methodology of Teaching

Class lectures, Group Discussion, Assignments,

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Identifies the external features of fowl and classifies the breeds of fowl	**K3, K4**
CO2	Develops and builds an idea of construction and maintenance of a poultry house	**K1,K2**
CO3	Illustrates the management of chick rearing	**K2,K3**
CO4	Determines the essential nutrients required for poultry rearing and assess the feed formulation ration	**K2,K3**
CO5	Identifies the bacterial and viral diseases affecting poultry Classifies the vaccine and vaccine programme schedule for a disease free poultry rearing	**K3, K4**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating.**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	2	2
CO2	3	3	3	3	2	3
CO3	2	2	2	2	3	2
CO4	3	3	2	3	3	3
CO5	3	3	2	3	2	3
Total	**14**	**13**	**12**	**13**	**12**	**13**
Average	**2.8**	**2.6**	**2.4**	**2.6**	**2.4**	**2.6**

Level of Correlation between PSO's and CO's
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75

Non Major Elective (II semester)

Second Semester				
Course Title		**PUBLIC HEALTH AND HYGIENE**		
Course Code		**22UBAZN2A**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
NME-II	**Non Major Elective**	**4**	**2**	**25+75=100**

Course Objectives

- Identify current national and global public health problems.
- Aware about the issues of food safety, water safety, vaccination, exercise and obesity, exposure to toxins.
- Frame a public health plan during any epidemic or spread of infectious disease etc.
- Analyze case studies of infant mortality and obesity.
- Assess the health in equalities with regard to gender, race, ethnicity, income etc.

Unit–I : Health Determinants (10 Hours)

Environment and Health: Determinants of health (Physical, mental and social health) - Primary Health care centres in India and its functions
Types of Immunisation- Vaccines- Immunization schedule.

Unit II : Nutrition and Health (10 Hours)

Nutrition and Health: Classification of foods– Carbohydrates, Proteins and fats (Sources and functions) - Balanceddiet. – Protein Malnutrition (Kwashiorkar and Marasmus)
Minerals (Dietary Sources, functions and deficiency) Macrominerals (Phosphorus, Calcium, Sodium and Potassium) Microminerals - (Zinc, Selenium, Cobalt , iron, iodine, Magnesium) . Vitamins – Fat and Water soluble vitamins- Dietary Sources, Biological functions and their deficiency

Unit III : Communicable Diseases (10 Hours)
Communicable diseases: Causative organism, symptoms and modes of transmission.
Bacterial diseases- Whooping cough, Typhoid, Cholera, Tuberculosis, Diptheria.
Viral diseases- Poliomyletis, Mumps,. Measles, Chicken pox, Hepatitis.
Vector borne diseases- Malaria, Filaria and Rabies.

Unit IV : Non-Communicable Diseases (10 Hours)

Non - Communicable Diseases (Causes, symptoms and Management): Hypertension , Coronary heart Disease, Diabetes, Obesity and Cancer
Causes of mental ill-health- Alcoholism and Drug dependence- Prevention

Unit V: Health Organisations and First Aid (10 Hours)

Health Education: Health Services Organisations- (WHO.UNICEF,UNDP,USAID and Indian Red Cross) - Health programmes in India – WHO hygiene procedures
AIDS - Causes, prevention and Management
First aid - Aim , Evaluation of victim and Casualty Treatment

Text Books :

1.Verma S. 1998. Medical Zoology, Rastogi Publications, New Delhi

Reference Books:

1.Park and Park, 1995. Text Book of Preventive and Social Medicine. M/S. Banarsidas Bhanot Publishers, Jabalpur.

Web Resources

http://www.foodnavigator-asia.com/
http://www.foodandnutrition.org/
https://www.ift.org/

http://www.eatright.org/
http://www.who.int/nutrition/en/

Methodology of Teaching

Class lectures, Group Discussion, Assignments, Field-based learning.

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Identify current national and global public health problems	**K2, K3**
CO2	Awareness about the issues of nutrition , health , food safety, water safety and vaccination,	**K2, K3**
CO3	Frame a public health plan during any epidemic or spread of infectious disease , health education and first aid	**K3, K4**
CO4	Assess the health in equalities with regard to gender, race, ethnicity, income and life style	**K2,K4**
CO5	Identifies communicable and non communicable diseases and suggests their preventive measures	**K2,K4**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating.**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	2	3	2	3	3
CO3	3	2	3	3	1	3
CO4	3	3	2	3	2	1
CO5	3	2	2	3	3	2
Total	**15**	**12**	**13**	**13**	**11**	**12**
Average	**3**	**2.4**	**2.6**	**2.6**	**2.2**	**2.4**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit	30
			Grand Total	75

Non Major Elective (II semester)

Second Semester				
Course Title		**DAIRY FARMING**		
Course Code		**22UBAZN2B**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
NME-II	**Non Major Elective**	**4**	**2**	**25+75=100**

Course Objectives

- Understand the domestication of cattles
- Know the techniques of rearing and management of various cattle breeds
- Acquire the knowledge on the diseases of cattle and the prophylactic measures
- Know the techniques of milk and dairy management of various cattle breeds

Unit – I : Dairy Breeds (10 Hours)

Dairy breeds & breeding: Scope of Dairy farming – Dairy breeds of India – cattle & buffaloes – Exotic cattle breeds. Selection of dairy cows. Systems of breeding – Hybrid vigour – grading-up, pure breeding .Merits and demerits of inbreeding and out breeding.Artificial insemination - Semen collection, storage and insemination Techniques.

Unit – II : Dairy Feeds (10 Hours)

Feeding and Nutrition: Structure of digestive system and physiology of digestion. Importance of colostrum feeding. Common cattle feed ingredients and their nutritive values – minerals, feed additives. Fodder preservation methods- hay and silage making. Ration formulation. Computation of balanced ration.

Unit – III : Livestock Diseases (10 Hours)

Live stock diseases: Viral diseases – rinderpest, Foot and mouth disease and cow pox. Bacterial diseases – Mastitis, Anthrax, Tuberculosis, Haemorrhagic septicaemia, Brucellosis. Metabolic disorders – Milk fever, ketosis and bloat. A brief account of external and internal parasites.

Unit – IV:Dairy Technology and Marketing(10 Hours)

Dairy Technology & Marketing: Milk – composition and Nutritive value – Techniques to detect milk adulteration – Spoilage of milk – pasteurization of milk – Preparation of Dahi, Butter and Ghee. Role of Co-operative societies in milk production and Marketing.

Unit – V: Dairy Farm Management (10 Hours)

Farm management: housing and equipment for dairy cows. care and management of newborn calves - technique of producing quality milk.

Text Books :

1.N.S.R. Sasting or C.K.Thamos – Farm Animal Management – Vikas Publishing House P. Ltd., 1976.
2.Dr. A.K. Sachetic – Animal Reproduction and Artificial insemination: NCERT, 1989.
3.M.M. Rai, - Dairy Chemistry and Animal Nutrition – Kalrant Publishers, 1985

Reference Books:

1.G.C. Banerjee – A Text book of Animal Husbandry – Oxford & IBH Publication, New Delhi.
2. GH Schmidt; T.D. Van Vleck, - Principles of Dairy science – Surget Pvt. Ltd., 1982.
3.C.K.Thomas and N.S.R.Sastry, 1990.Dairy Bovine Production, Kalyani Publishers, New Delhi.
4. ICAR, 2002 Handbook of Animal Husbandry- The Indian Council of Agricultural Research, New Delhi.

Web Resources

https://odisharet.com>dairy –farm-project

https://www.dairycouncil.co.uk>pasteurisation

http://dairyprocessinghandbook.com

https://www.galvmed.org>livestock diseases

Methodology of Teaching

Class lectures, Group Discussion, Assignments,

CourseOutcomes(COs):

Uponcompletionofthiscourse,the students

COcode	Course Outcomes	K-levels
CO1	Classifies the different dairy breeds of cattle and identifies the merits and demerits of inbreeding, outbreeding and pure breeding	**K2,K3**
CO2	Determines the dairy feed and interprets the feed formulation and its balanced ration	**K1,K2**
CO3	Analyses the bacterial , viral and parasitic and metabolic diseases affecting livestock	**K2,K3**
CO4	Assess the role of dairy technology in marketing of dairy products	**K3,K5**
CO5	Develops method for construction of a dairy farm and identifies techniques for production of best quality milk	**K3,K4**
K1-**Remembering,** K2-**Understanding,** K3-**Applying,** K4-**Analyzing,** K5-**Evaluating,** K6-**Creating.**		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	3
CO2	2	2	1	2	1	1
CO3	3	3	3	2	2	2
CO4	3	2	2	1	3	2
CO5	3	2	2	2	2	3
Total	**14**	**12**	**11**	**10**	**10**	**11**
Average	**2.8**	**2.4**	**2.2**	**2**	**2**	**2.2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM TAXONOMY BASED QUESTION PAPER PATTERN

Knowledge Level	Section	Marks	Description	Total Marks
K1,K2,K3,K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3,K4	B (INTERNAL CHOICE) EITHER (a) OR (B)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	75