The University of Burdwan

Syllabusfor3-YearDegree/4-Year Honours in Zoology

Under Curriculum and Credit Framework for Undergraduate Programmes (CCFUP) AS PER NEP, 2020

Witheffectfrom2023-2024

SEMESTERWISE&COURSEWISECREDIT&MARKSDISTRIBUTIONSTRUCTUREUNDER CCFUP as per NEP, 2020

Semester	Course Type	Course Title with Code	Credit	Lect.	Tuto.	Pract./ Viva	Full Marks	Distribution of Marks		
								Theory	Pract./ Viva-voce	Internal Assessment
I	Major/DS Course(Core)	**ZOOL1011: Non-Chordates**	4	3		1	75	40	20	15
	Minor Course	**ZOOL1021: Non-Chordates**	4	3		1	75	40	20	15
	Multi/Inter disciplinary	**ZOOL1031: Introduction to Animalia**	3	2	1	0	50	40	00	10*
	Ability Enhancement Course (AEC) [L_1-1MIL]	Arabic/Bengali/ Hindi/Sanskrit/ Santali/Urduor Equvlnt.Course fromSWAYAM/ Anyother UGC-recognizedplatform	2	2	0	0	50	40	0	10
	Skill Enhancement Course (SEC)	**ZOOL1051: Apiculture/ Vermiculture**	3	2	1	0	50	40	0	10**
	Common Value Added (CVA)Course	**VAC1061:** Environmental Science/Education	4	3	0	1	100	60	20	20
	Total		**20**				**400**			

*Internal Assessment of 10 marks in case of Multi/Inter Disciplinary will be based on Practical Portion of the course concerned.

**Internal Assessment of 10mark sin case of SEC will be based on Practical Portion of the course concerned.

Semester	Course Type	Course Title with Code	Credit	Lect.	Tuto.	Pract./ Viva	Full Marks	Distribution of Marks		
								Theory	Pract./ Viva-voce	Internal Assessment
II	Major/DS Course (Core)	**ZOOL2011: Chordates**	4	3		1	75	40	20	15
	Minor Course	**ZOOL2021: Chordates**	4	3		1	75	40	20	15
	Multi/Inter disciplinary	**ZOOL2031: Applied Zoology I**	3	2	1	0	50	40	00	10*
	Ability Enhancement Course (AEC)[L1-1]	**ENGL2041: (Functional English)**	2	2	0	0	50	40	00	10
	Skill Enhancement Course (SEC)	**ZOOL2051: Sericulture/ Aquarium Fish keeping**	3	2	1	0	50	40	00	10**
	Common Value Added (CVA) Course	**VAC2061:** Understanding India/ Digital& Technological Solutions/Health& wellness, Yoga Education, sports& Fitness	4	3	0	1	100	80/60	00/20	20
	Total		**20**				**400**			

*InternalAssessmentof10marksincaseofMulti/InterDisciplinarywillbebasedonPracticalPortionof the course concerned.

**InternalAssessmentof10marksincaseofSECwillbebasedonPracticalPortionof the course concerned.

Semester	Course Type	Course Title With Code	Credit	Lect.	Tuto.	Pract. /Viva	Full Marks	Distribution of Marks		
								Theory	Pract. /Viva voce	Internal Assessment
III	Major/DS Courses (Core)	**ZOOL3011:** Biochemistry	5	4	0	1	75	40	20	15
		ZOOL3012: Cell Biology	5	4	0	1	75	40	20	15
	Minor Course (Voc. Edn. & Trng.)	**…..3021:**	4	3	1	0	75	60	00	15
	Inter/ Multi Disciplinary	**ZOOL3031:** Applied Zoology	3	2	1	0	50	40	0	10
	Ability Enhancement Course (AEC) [L1-2 MIL]	**3041:** (Arabic/Bengali/ Hindi/Sanskrit/Santali/Urduor Equvlnt. Course from SWAYAM/Any Other UGC-recognized platform)	2	2	0	0	50	40	0	10
	Skill Enhancement Courses	**ZOOL3051:** Animal Husbandry and Management OR **ZOOL3051:** Medical Diagnostics	3	2	1	0	50	40	0	10
	Total		**22**				**375**			

IV	Major/DS Courses (Core)	**ZOOL4011:** Animal Physiology	5	4	0	1	75	40	20	15
		ZOOL4012: Disease Biology	5	4	0	1	75	40	20	15
		ZOOL4013: Comparative Endocrinology	5	4	0	1	75	40	20	15
	Minor Course	**ZOOL4021:** Wildlife Conservation	4	3	0	1	75	40	20	15
	Minor Course (Other than Zoology)	**……4021:**	4				75			15
	Ability Enhancement Course (AEC) [EngL2-2]	ENGL **4041:** (Language& Creativity)	2	2	0	0	50	40	0	10
	Total		**25**				**425**			

ZOOL1011:NON-CHORDATES

OBJECTIVES OF THE STUDY: The main objective of this syllabus is to acquaint the students about the diversityof animals (invertebrates) of this universe especiallytheir taxonomic position of animal kingdom as well as their physiology and organ system.

SLNO.	TOPICS(Credits: 3)	TOTAL NO. LECTURES (45)
1	**Unit1:BasicsofAnimalClassification** Definition:Classification,Systematics,andTaxonomy, CodeofZoological Nomenclature.	2
2	**Unit2:ProtistaandMetazoa** **Protozoa:**GeneralCharacteristicsandSchematic Classificationup to phylum (Levine etal. 1980) Locomotionin*Amoeba*,Conjugationin*Paramoecium*	5
3	**Unit3:Porifera** Generalcharacteristicsandschematicclassificationuptoorder (Hyman,1951) CanalSystemandSpiculesOfSponges	5
4	**Unit4: Cnidaria** Generalcharacteristicsandschematicclassification upto class(RuppertandBarnes.1994); Metagenesis of *Obelia*, CoralReefTypesAndFormation	4
5	**Unit5:Ctenophora** GeneralCharacteristicsonly	1
6	**Unit6:Platyhelminthes** Generalcharacteristicsandschematicclassificationuptoclass (RuppertandBarnes1994)	2
7	**Unit7: Nematoda** Generalcharacteristicsandschematicclassificationuptoclass (RuppertandBarnes, 1994)	2
8	**Unit8: Annelida** Generalcharacteristicsandschematicclassification upto class(RuppertandBarnes1994),Metamerism, Nephridia: StructureAnd Function	4
9	**Unit9: Arthropoda** Generalcharacteristicsandschematicclassification upto class(Ruppert & Barnes, 1994), Vision In Insects, MetamorphosisinLepidopteraninsect	6
10	**Unit10:Onychophora** EvolutionarySignificance	2

11	**Unit11:Mollusca** Generalcharacteristicsandschematicclassification upto class(RuppertandBarnes1994),ModificationOf foot Nervoussystemandtorsionin Gastropods	5
12	**Unit12:Echinodermata** Generalcharacteristicsandschematicclassificationupto class(RuppertandBarnes1994),WaterVascularSystemof *Asteroidea*,StructureOf TubeFeet,LarvalformsinEchinodermata	4
13	**Unit13:Hemichordata** General characteristics phylum Hemichordata, Relationshipofnon-chordatesand chordates.	3

SuggestedReadings:

1. Anderson,D.T.(Ed.)(2001).InvertebrateZoology.2ndEd.OxfordUniversity
2. Press.Barnes,R.D.&Ruppert,E.E.,(1994).InvertebrateZoology.6th Ed.BrooksCole.
3. Barrington,E.J.W.(1981).InvertebrateStructureandfunction.2nd Ed.ELBS&Nelson.Black welder,R.E.,(1967).Taxonomy-ATextandreferencebook.JohnWiley&Sons.
4. Brusca, R. C. & Brusca, G. J. (2002). Invertebrates. 4th Ed. Sinauer Associates...Dhami.S andJ.K.Dhami– Invertebrate Zoology–S.Chand and Co.
5. Hickman, C.P.Jr.,F.M.Hickuman and L.S.Roberts,1984.Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065pp.Hyman, L.H.(1951).The Invertebrates (Vol-I).McGraw Hill Book Company.
6. Jordan,E.L.&Verma,P.S.(2006).InvertebrateZoology.S.Chand&CompanyLtd.NewDelhi.
7. Kapoor,V.C.(2008).Theoryandpracticeofanimaltaxonomy.6th Ed.Oxford& IBH PubKotpal,R.L.,1988–1992.(AllSeries)Protozoa,Porifera,Coelentereta,Annelida, Arthropoda, Mollusca, Echinodermata,–Rastogi Publications, Meerut – 250002.
8. Mayr,E.(1969).PrinciplesofSystematicZoology.TataMcGraw-Hill.
9. Mayr,E.&Ashlock,P.D.(1991).PrinciplesofSystematicZoology.2nd Ed.,McGraw-Hill. Meglitsch,P.A. & Schram, F.R. (1991). Invertebrate Zoology. Oxford University Press.
10. Chaki,Kundu,SarkarIntroductiontoGeneralZoology.Vol1.NewCentral Book Agency (P) LTD.
11. Parker,T.J.&Haswell,W.(1972).TextBookofZoology,VolumeI.MacmillanPress,London.
12. Pechenik, J.A. (1998). Biology of the Invertebrates,4th Ed.McGrawHill.RuppertE.E.,Fox,R.&BarnesR.D.(2003). Invertebrate Zoology: A Functional Evolutionary Approach. 7th Ed. Brooks Cole.
13. Sinha, K.S., Adhikari,S., & Ganguly, B.B. Biology of Animals. Vol .I .New Central Book Agency. Kolkata.

ClassificationtobefollowedfromBarnesandRuppert1994,6thEdition.

NON-CHORDATESPRACTICAL
(Credit:1)

1. SpotIdentificationof*Amoeba,Euglena,Paramoecium*. Fullmarks:20

2. SpotIdentificationof*Sycon*,Neptune'sCup,*Obelia,Pennatula,Fungia,*

3. SpotIdentificationandSignificanceofadult *Taeniasolium*and*Ascarislumbricoide*s.

4. Spotidentificationofthefollowingspecimens.

Annelids-*Nereis,Pheretima,Hirudinaria*

Arthropods-*Bombyx,Periplaneta,Apis,Anopheles,*Culex.

Molluscs- *Pila, Lamellidens, Sepia, Octopus,*

Echinoderms- *Pentaceros/Asterias, Ophiura, Echinus,Antedon*

Hemichordata-*Balanoglossus*

5. Dissection–Digestivesystemandnervoussystemof*Periplaneta*sp.

6. MountingOfthefollowingspecimens—Mouthparts of cockroach, Whole Mount: Mosquito.

1. Dissection(FromitemNo.5) anyone	(7x1=7)
2. SpotIdentification(anythreefromitemno.1,2,3,and4.)	(3x2=6)
3. MountingOneItemfromitemno.6	(5x1=5)
4. LaboratoryNoteBook	(2)

SuggestedReadings:

1. ChatterjeeandChatterjeePracticalZoology.

2. Ghosh,K.C.andManna,B.(2015):PracticalZoology,NewCentral Book Agency, Kolkata.

3. Sinha,J.K.,Chatterjee,A.K.andP.ChattopadhyayAdvancedPracticalZoology.

CourseOutcomes:

At the end of the syllabus students learn the Systematic and biology of non-chordates through their adaptive features and their body organization. Comprehend the identification of species and their evolutionary relationships.

ZOOL1021:NON-CHORDATES

OBJECTIVES OF THE STUDY: The main objective of this syllabus is to acquaint the students with the diversity of animals (invertebrates) of this universe especially their taxonomic position of the animal kingdom as well as their physiology and organ system.

SL NO.	TOPICS(Credits: 3)	TOTALNO. OF LECTURES (45)
1	**Unit1:BasicsofAnimalClassification** Definition:Classification,SystematicsandTaxonomy.Codes ofZoologicalnomenclature.	2
2	**Unit2:ProtistaandMetazoa** **Protozoa:**General characteristicsand schematic classificationuptophylum(Levineetal.1980)Locomotion in *Amoeba*,Conjugationin*Paramoecium.*	5
3	**Unit3:Porifera** Generalcharacteristicsandschematicclassificationuptoclass (Hyman,1951).Thecanalsystemin sponges.	5
4	**Unit4:Cnidaria** Generalcharacteristicsandschematicclassificationuptoclass (RuppertandBarnes.1994)Metagenesisof*Obelia*,Coralreef diversity,andconservation.	4
5	**Unit5:Ctenophora** Generalcharacteristicsonly	1
6	**Unit6:Platyhelminthes** Generalcharacteristicsandschematicclassificationuptoclass (RuppertandBarnes 1994).	2
7	**Unit7:Nematoda** Generalcharacteristicsandschematicclassificationuptoclass (RuppertandBarnes1994).	2
8	**Unit8: Annelida** Generalcharacteristicsandschematicclassification upto class(Ruppertand Barnes1994)Metamerism in Annelida, Nephridia:Structureandfunction	4
9	**Unit9:Arthropoda** Generalcharacteristicsandschematicclassificationuptoclass (RuppertandBarnes.1994)Visionininsects,Metamorphosis inLepidopteraninsects.	6
10	**Unit10:Onychophora** Evolutionarysignificance	2

11	**Unit11:Mollusca** Generalcharacteristicsandschematicclassificationuptoclass (RuppertandBarnes1994),Modificationoffoot, Nervous systemand torsionin Gastropoda.	5
12	**Unit12:Echinodermata** Generalcharacteristicsandschematicclassificationuptoclass (RuppertandBarnes1994),Watervascularsystemof starfish.	4
13	**Unit13:Hemichordata** GeneralcharacteristicsofphylumHemichordata, Relationshipofnon-chordatesand chordates	3

SuggestedReadings:

1. Anderson, D.T. (Ed.) (2001). Invertebrate Zoology. 2nnd Ed. Oxford University Press. Barnes, R. D. & Ruppert, E. E., (1994). Invertebrate Zoology. 6th Ed. Brooks Cole.
2. Barrington,E.J.W.(1981).InvertebrateStructureandFunction.2nd Ed.ELBS& Nelson.Blackwelder,R.E.,(1967).Taxonomy-Atextandreferencebook.John Wiley & Sons.
3. Brusca,R.C.&Brusca,G.J.(2002).Invertebrates.4th Ed.SinauerAssociates... DhamiP.SandJ.K.Dhami–InvertebrateZoology–S.ChandandCo.
4. Hickman, C.P. Jr., F.M. Hickuman and L.S. Roberts, 1984. Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065pp. Hyman, L. H. (1951). The Invertebrates (Vol-I). M McGraw-Hill c. Book Company.
5. Jordan,E.L.&Verma,P.S.(2006).InvertebrateZoology.S.Chand&CompanyLtd.NewDelhi.
6. Kapoor,V.C.(2008).Theoryandpracticeofanimaltaxonomy.6th Ed.Oxford& IBHPub Kotpal, R.L., 1988 – 1992. (All Series) Protozoa, Porifera, Coelentereta, Annelida, Arthropoda, Mollusca, Echinodermata, – Rastogi Publications, Meerut – 250 002.
7. Mayr,E.(1969).PrinciplesofSystematicZoology.TataMcGraw-Hill.
8. Mayr, E. & Ashlock, P.D.(1991).PrinciplesofSystematicZoology.2ndEd.,McGraw-Hill. Meglitsch, P. A. & Schram, F. R. (1991). Invertebrate Zoology. Oxford UniversityPress.
9. Chaki,Kundu,SarkarIntroductiontoGeneralZoology.Vol1.NewCentralBookAgency (P)LTD.
10. Parker,T.J.&Haswell,W.(1972).TextBookofZoology,VolumeI. Macmillan Press, London.
11. Pechenik,J.A.(1998).BiologyoftheInvertebrates,4th Ed.McGrawHill. RuppertE.E.Fox,R.&BarnesR.D.(2003).InvertebrateZoology:A Functional Evolutionary Approach. 7th Ed. Brooks Cole.
12. Sinha,K.S.,Adhikari,S.,&Ganguly,B.B.BiologyofAnimals.Vol.I.NewCentralBook Agency. Kolkata.

NONCHORDATEPRACTICAL(Credit:1)
Fullmarks:20

1.SpotIdentification:Eitherfrommuseumspecimenorfromphotograph

GroupI:*Amoeba,Euglena,Paramecium,Sycon,Obelia,Physalia, Aurelia,Taeniasolium,Ascarislumbricoides,Nereis,Hirudinaria*

Group II:*Macrobrachium, Scylla, Carcinoscorpius, Trigoniulus, Chiton, Patella, Loligo, Sepia, Pentaceros Ophiura, Echinus, Balanoglossus*

2. Dissection–Digestiveandnervoussystemofcockroach.

3. Mounting:Mouthpartsofcockroach

4. Temporarystainingandmountingofanyzooplankton

1. Dissection(FromitemNo.5)	6
2. Spotidentification(twofromeach group)	(4x2)=8
3. Mounting(From3and4)	4
4. LaboratoryNotebook	2

SuggestedReadings:

1. ChatterjeeandChatterjeePracticalZoology

2. Ghosh,K.C.andManna,B.(2015):PracticalZoology,NewCentral Book Agency, Kolkata

3. Sinha,J.K.,Chatterjee,A.K.andP.ChattopadhyayAdvancedPracticalZoology

Course Outcomes:

At the end of the course students will learn about the systematics and biology of non-chordates through their adaptive features and body organization and comprehend the identification of species and their evolutionary relationships.

ZOOL1031:INTRODUCTIONTOANIMALIA

Objectivesofthe Course:

- Thespecificlearninggoalsforgeneralzoologicaloverview oftheanimalworldistoprovidestudentswith a working knowledgeoffundamentalconceptsthat willhelp in furtherunderstanding ofthecourse curriculum for further advanced studies, interests and works.
- Thisbasiccoursemakesstudentsfamiliarwithanimalclassificationschemesandassociatedtaxonomic group diagnostic features.
- Thiswillalsohelpindevelopingandunderstandingandabilitytoapplybasiczoologicalprinciples.

UNIT	TOPIC(CREDIT3)	TOTALNUMBEROF CLASSES
1	Briefideaaboutanimalkingdom;generalcharactersand BasicfeaturesofKingdomProtistauptoPhyla	**2**
2	OutlineclassificationandgeneralbasiccharactersofPhylum Porifera, Cnidaria, Platyhelminthes,Nemathelminthes, Annelida,Arthropoda,MolluscaandEchinodermataupto Class	**16**
3	GeneralfeaturesofClassesPisces,Amphibia,Reptiles,Aves andMammals	**12**
4	Basicideaoflifecyclesofbutterflyandanyonecommon Carp	**2**
5	Basicand brief ideaaboutecosystem, population, community,habitsandhabitats;typesofadaptations	**5**
6	Overview of differentinteractionsamonganimalslike competition andpredation.Commensalism, parasitism, mutualism,symbiosis,amensalism with examples	**8**
	Allexamplesshouldbecommonnames.	**45**

PRACTICAL **FM:10**

InternalAssessmentof10marksincaseofMulti/InterDisciplinarywillbebasedonPractical Portionofthecourseconcerned.

1. Visittozoologicalgardenoranimalmuseum,preparationofprojectreportofthevisit.(7)
2. Preparationofananimalalbumtakinganyfouranimalsas subjects.(3)

ZOOL1051:APICULTURE

Objectives of the Course: The objective of this SEC course is to know the basic concepts ofbeekeeping by undergraduate students, and beginners. Students will get knowledge about different bees, culture techniques, honey harvesting, and knowledge diseases enemies of honey bees. The knowledge gained by the students can be utilized in the field or even to start their own enterprise after completion of the course.

SLNO.	TOPICS(Credits: 3)	TOTAL NO. LECTURES (45)
1.	Historyandimportanceofapiculture;the systematicpositionofbees; differentspeciesofcommonhoneybeesandtheir Description.	**5**
2.	Thelifecycleofthehoneybee; general morphologyandanatomyof differentcastesofhoneybees;emphasisonmouthparts;Non-Apis bee species.	**6**
3.	StructureOfDifferentBeehivesOrHoneycomb;colonial Organization;beelanguageandcommunications.	**4**
4.	MethodsOfKeeping:Indigenousmethodsandits Disadvantages.	**3**
5.	Apiary:selectionofgoodapiary site;selectionofgoodbee.	**3**
6.	ModernmethodsofApiculture:Discoveryofthemovablehive; LangstrothandNewtonhive;descriptionofmodernmovable beehive;accessoryequipmentusedinbeekeepingindustry. Extractionofhoney;importantpointsregardingthehandlingof bees.	**6**
7.	ProductsofApiculture: Honey,wax,etc., chemical Compositions;use;otherproductslikepropolis,royaljelly,apitoxin, etc.	**4**
8.	DiseasesAndEnemies:parasiticdiseases; otherenemies.	**4**
9.	TypesofBeekeeping,economics:Stationaryandmigratory; EconomicsOfBeekeeping,thepositionofthisindustryfromthe Indianperspective.	**5**
10.	EntrepreneurshipinApiculture:Beekeepingasa sourceof employmentandlivelihood;theroleofKVICforbeekeepingin India;proposalpreparationforfunding.	**5**

ReferenceBooks:

1.HandbookofEconomicZoology.JawaidAhsanandS.P.Sinha, S.C. Publication. Vinesh: A Text Book of apiculture (SEC) Dr. Hem Raj. S. Vinesh & Co.

2. SaraApiculture.K.V.Jayashree,C.S.Tharadevi,N. Arumugam.

3. TextbookofApiculture(Beekeeping).D.K.Belsaraet.al.HimalayaPublishing House. Modern Textbook of Zoology Invertebrates. R. L. Kotpal.

4. Biology of Animal. Ganguly, Sinha, Adhikari. New Central Book Agency.ApicultureICARPDFBook,AgriMoon.com.FreeDownload.

APICULTUREPRACTICALFullMarks:10

InternalAssessmentof10marksinca theseofSECwillbebasedonPracticalPortionof 06
course concerned.
Visitpharm/labandsubmit report:
Viva-voce: 04

Course Outcomes:

1. Getcompleteknowledgeofhoneybeesandtheirdifferent casts.
2. Getknowledgeaboutartificialbeehiveandtheirusesforapiculture.
3. Toknowaboutdifferentdiseasesonenemiesofhoneybees.
4. Abletoknowthetechniquesofhoneyextractionandhandlingof honeybees.
5. Getabriefideaaboutentrepreneurshipin Apiculture.

ZOOL1051:VERMICULTURE

Objectives of the Course: Vermiculture is the study Commercial application of technologies that utilize earthwormsfor degrading waste organic materials for sanitation and agricultural re-use.

Earthwormsdegradeorganicwastematerialsandconvertthemintovermicompost.Themainobjectiveof this course is to provide the students with knowledge of vermitechnology and its application in agriculture as well as entrepreneurship.

SL NO.	TOPICS(Credits:3)	TOTALNO.OF LECTURES(45)
1.	Earthworm Morphology and Anatomy: TaxonomicPosition,externalfeatures,internalanatomy.	5
2.	HabitatEcologyandreproduction: Burrowers, Casts,nocturnal,poikilothermic,ecologicalgrouping, Epigeicsp.,Endogenics., Anecics.	**5**
3.	Descriptionofsomeimportant earthworm sp:*Eiseniafetida,Eudriluseugeniae, Lumbricusrubellus.*	**5**
4.	ImportanceOfEarthwormInAgriculture:RoleOf Earthwormtoincreasefertilityofsoil.	**5**
5.	VermitechnologyandVermiculture: Definition, HistoryAtDifferentcountriesandIndia.	**5**
6.	Vermiculture:Methods,wormery,breedingtechnique, indooroutdoorculture,mono-andPolycultureAnd Meritsand Demerits.	**7**
7.	VermicompostingOfWastes:Different Methods, storage. Vermiwash:preparationandapplication.	**4**
8.	DiseasesandPredators/pathogenofearthworm. MaintenanceWormeries.	**4**
9.	Marketingand Futureperspective:Marketingthe products of Vєmiculture,qualitycontrol,marketing and techniques, der study, advertisement, packing andtransport,an d financial support.	**5**

ReferenceBooks:

1. Edward,C.A.andBohlen,P.J.BiologyandEcologyandEarthworm.ChapmanHall.NY,USA.
2. SultanAhmedIsmail.TheEarthwormBook.OtherIndia Press.
3. BhatnagarandPatla.EarthwormVermicultureandvermicomposting.KalyaniPublishers,New Delhi.
4. Sara'sVermitechnology,M.S.Lekshmy,R.Santhi.
5. ModernTextBookofZoology,Invertebrates.R.L.Kotpal.

6. Lee,K.E.Earthworm:Theirecologyandrelationshipwithsoilandlanduse.Academic Press,Sydney.

7. Singh,Keshav.ATextbookofVermicompost,Vermiwash,and Biopesticides. Publisher- Biotech, marketed by Meripustak.

8. National Institute of Industrial Research, (2010): The Complete Technology Book on Vermiculture and Vermicompost, Published by National Institute Industrial Research,Delhi-7, India.

VERMICULTUREPRACTICAL

FullMarks:10

InternalAssessmentof10marksincaseofSECwillbebasedonPractical Portionofthe course concerned

Visitpharm/labandsubmit report: 06
Viva-voce: 04

Course Outcomes:

1. TheCoursehass broadscopeforEmployability.
2. Students will gather knowledge on soil earthworms; their characteristic features, occurrence,andtheirinfluenceonsoilfertilityandsolidwastemanagementareincluded.
3. StudentswillgatherknowledgeonVermicompostingtechnologyinrespectofthegloballevelas well as the Indian perspective.
4. ApplicationofVermicultureproductsandtheirbenefitsinagriculturepractice.

ZOOL2011:CHORDATES

OBJECTIVES OF THE STUDY: This course is designed to give a learner the fundamental understanding of the diversity of Phylum Chordata with emphasis on their origin, key characteristics, classification, distribution, and function. This course will make the students enlightened with the concept of diversity, organization, adaptation, and taxonomic status of Chordates. The course will give an understanding of the systemic physiology of chordates. There will be a discussion about the affinities of chordates to different groups.

SL NO.	TOPICS(CREDIT:3)	TOTAL NO. OF LECTURES (45)
1	**OriginofChordata** DipleuraconceptandtheEchinodermtheoryof Chordata	**2**
2	**IntroductiontoChordates** Generalcharacteristicsandoutlineclassification ofPhylum Chordata Upto livingSubclasses Advanced features of Vertebrates over ProtochordataRetrogressive MetamorphosisIn *Ascidia* FeedingMechanismIn*Branchiostoma*	**2** **2** **1** **1**
3	**Agnatha** Generalcharacteristicsandclassificationof CyclostomesuptoSub-class	**2**
4	**Pieces** General characteristics and classification of Chondrichthyes and Osteichthyes Upto Subclasses Accessory respiratoryorgans and swimbladderin fishesOsmoregulation And ParentalCareinfishes	**2** **2** **2**
5	**Amphibia** General characteristics and classification upto livingSub-classesMetamorphosisandParentalcare inAmphibia	**2** **2**
6	**Reptilia** General characteristics and classification upto livingSub-classes General featuresofpoisonous andnon-poisonous snakes PoisonApparatusAndBitingMechanismIn Snakes	**2** **2** **2**

7	**Aves** General characteristicsandclassificationupto livingSub-classesExoskeletonandmigrationin BirdsPrinciplesandaerodynamicsofflightin Birds	**2** **2** **1**
8	**Mammalia** Generalcharacteristicsandclassificationuptoliving Sub-classes AffinitiesofPrototheria ExoskeletalderivativesofMammals EcholocationinBatand Whale Adaptiveradiationinmammalswithreference ToLocomotoryOrgans.	 **2** **2** **2** **2** **2**
9	**ZoogeographicalRealms** DistributionofBirdsandMammalsdifferent realms	**2** **2**

Referencebooks:

1. Arora,M.P.ChordataI.HimalayaPubHouse.
2. Chatterjee,A&ChakrabortyC.S.ApproachtoaTextBookofZoologyNirmala Library, Kolkata.
3. Jordan,E.L.&Verma,P.S.(2006).InvertebrateZoology&Chordate Zoology.. S.Chand & Company Ltd. New Delhi.
4. Kardong,K.V.(2002).Vertebrates:ComparativeAnatomy,functionevolution.Tata McGraw Hill.
5. Kent,G.C.&Carr,R.K.(2001).ComparativeanatomyoftheVertebrates.9th.McGrawHill.
6. Kotpal,R.L.,1988-1992,(AllSeries) Protozoa, Romer, A.S. & Parsons, T.S. (1986). The vertebrate body. 6th Ed. Saunders College Pub.
7. Saxena,R.A.&Saxena,S.CooperativeAnatomyinVertebrates.VivaPublication.
8. Sinha,K.S.,Adhikari,S.,Ganguly,B.B.BiologyofAnimals.Vol.I,II. New Central Book Agency. Kolkata.
9. Young,J.Z.(2004).TheLifeofVertebrates.3rd Edition.Oxforduniversitypress.

CHORDATESPRACTICAL(Credit:1)

1. SpotIdentification of **FullMarks:20**

a. Protochordate:*Balanoglossus,Branchiostoma*

b. Agnatha:*Petromyzon*,Hagfish

c. Fish:*Scoliodon,Sphyrna,Pristis,Torpedo,Labeo,Catla,Cirrhinus,Anabas, Ctenopharyngodon,Heteropneustes,Clarias,Exocetus,Echenis*

d. Amphibia*:Necturus,Bufo,Hyla,Axolotollarva,Tylototriton*.

e. Reptilia:*Chelone,Varanus,Mabuya,Draco,Vipera,Naja,Hydrophis.*

f. Mammalia:Bat,*Funumbulus.*

2. Temporarystainingandmountingofcycloidandctenoid scales.

3. IdentificationofPoisonousandnon-poisonoussnake.

4. Powerpointpresentationonthestudyofanytwoanimalsfromtwodifferentclasses by students. Power point Submission and demonstration.

ExaminationPattern:

1. Spotidentification(6fromItem)	(6×2) =12
2. Stainingandmounting(1fromitem 2)	(1×4) =04
3. LaboratoryNoteBook-	02
4. Powerpointpresentation-----	02

SuggestedReadings:

ChatterjeeandChatterjee:PracticalZoologyGhosh,K.C.andManna,B.(2015): Practical Zoology, New Central Book Agency, Kolkata.

Course Outcomes:

The students will get knowledge to explain the diversity of Protochordates and chordates. Identify the taxonomic position of chordates, their diversity, and their distribution. Gain insights about economic importance and significance Pieces and Pisciculture. Identify and distinguish between poisonous and non-poisonous snakes by observing characteristic features. Students gain knowledge about the composition and significance of venom. Gain insights About The Structural specialties of birds which will help them for Poultry (commercial application). Adaptive radiation of Mammals Willgivetheinsightintodiversityanddistributionof Mammals.

ZOOL2021:CHORDATES

OBJECTIVES OF THE STUDY: This course is designed to give a learner the fundamental understanding of the diversity of Phylum Chordata with emphasis on their origin, key characteristics, classification, distribution and functioning. This course will make the students enlightened with the concept of diversity, organization, adaptation andtaxonomic status of Chordates.Thecourse will give the understanding of systemic physiology of chordates. There will be discussion about the affinities of chordates to different groups.

SLNO	TOPICS(CREDIT:3)	TOTALNUMBEROF LECTURES:45
1	**OriginofChordata:** DipleurulaconceptandtheEchinodermtheory	2
2	**IntroductiontoChordates** GeneralcharacteristicsandoutlineclassificationofPhylum Chordatauptolivingclasses. AdvancedfeaturesofVertebratesover Protochordates.	2
3	**Agnatha** Generalfeaturesandoutlineclassificationuptoclasses(Young, 1981).	1
4	**Pieces** GeneralfeaturesandoutlineClassificationuptoSubclasses (Romer,1959). Accessoryrespiratoryorgansinfishes. Osmoregulationinfishes.	8
5	**Amphibia** GeneralfeaturesandoutlineClassificationuptolivingorders (DuellmanTrueb,1986). MetamorphosisandParentalcareinAmphibia	8
6	**Reptilia** GeneralfeaturesandoutlineClassificationuptolivingSubclass (Young,1981). VenomtypesandBitingmechanisminvenomous snakes. Clinicalsymptomsofsnake bite.	8
7	**Aves** GeneralfeaturesandoutlineClassificationuptoorders(Young, 1981). Migrationin birds.	8
8	**Mammalia** GeneralfeaturesandoutlineClassificationuptoSubclasses (Young,1981). Adaptiveradiationinprimatesdependsuponfood. EcholocationinBat	8

Referencebooks:

1. Arora,M.P.ChordataI.HimalayaPub House
2. Chatterjee,A&ChakrabortyC.S.TextBookofZoology,NirmalaLibrary, Kolkata.
3. Jordan,E.L.&Verma,P.S.(2006).ChordateZoology.S.Chand&CompanyLtd.NewDelhi.
4. Kardong,K.V.(2002).Vertebrates:Comparativeanatomy,functionevolution.TataMcGrawHill.
5. Kent,G.C.&Carr,R.K.(2001).ComparativeanatomyoftheVertebrates. 9thEd.McGrawHill.
6. Romer,A.S.&Parsons,T.S.(1986).Thevertebratebody.6th Ed.SaundersCollegePub.
7. Saxena,R.A.&Saxena,S.ComparativeAnatomyVertebrates.VivaPublication.
8. Sinha,K.S.,Adhikari,S.,&Ganguly,B.B.BiologyofAnimals.Vol.I, II.NewCentralBookAgency. Kolkata.
9. Young,J.Z.(2004).TheLifeofVertebrates.IIIEdition.OxfordUniversitypress.

CHORDATEPRACTICAL
(Credit:1)Full marks:20

1. Spot Identification: Either from Museum specimen or from photograph Group I: *Branchiostoma,Petromyzon,Sphyrna,Pristis,Torpedo,Labeo,Parexocoetus,Tylototriton, Duttaphrynus, Polypedates*

GroupII:*Lissemys,Chamaeleo,Draco,Daboia,Lycodon,Ptyas,,Naja,Passer,Psittacula, Alcedo,Pteropus, Funambulus, Suncus*

2. Temporarystainingandmountingofcycloidandctenoid scales.
3. Fishmarketsurveytostudydifferentfishspeciesandpreparationofasurveyreport.

1. Spotidentification(Threefromeachgroup)	(6×2)=12
2. Stainingand mounting	(04)
3. LaboratoryNotebook	(02)
4. SurveyReport	

SuggestedReadings:

1. ChatterjeeandChatterjee:PracticalZoology
2. Ghosh,K.C.andManna,B.(2015):PracticalZoology,NewCentralBookAgency,Kolkata

Course Outcomes:

The students will get knowledge to explain the diversity of Protochordates and chordates, identify the taxonomic position of chordates, their diversity and distribution. They will gain insight into the economicimportanceandsignificanceofPiecesandPisciculture,andidentifyanddistinguishbetween poisonous and non-poisonous snakes by observing characteristic features. Students will gain knowledge about the composition and significance of venom and the structural specialties of birds which will help them with Poultry (commercial application)? Adaptive radiation of Mammals willgive them insight into the diversity and distribution of Mammals.

ZOOL2031:APPLIEDZOOLOGYI

SLNO.	TOPICS(Credits:3)	TOTAL NO.OF LECTURES (45)
1	**Chapter1.Sericulture:** • HistoryandpresentstatusofsericultureinIndiaandWest Bengal. • MulberryAndNon-mulberryspeciesin India. • MulberryCultivation. • Morphologyandlifecycleof *Bombyx mori*. • Silkworm RearingTechniques:Processing of cocoon,reeling. • SilkwormDiseases-pestsandtheircontrol. **Chapter2.Apiculture:** • IntroductionandpresentstatusofapicultureinWest Bengal. • SpeciesofhoneybeesinIndia,lifecycleof*Apis indica* • ColonyOrganization,divisionoflabourand communication. • Beekeepingasanagro-basedindustry;methods and equipment's: indigenous methods, extraction appliances,extractionhoneyfromthecomband processing. • Beepasturage,honeyandbeeswaxandtheiruses • PestsandDiseasesofBeesandTheirManagement.	**22** **23**

Books&Suggested Readings:

1. Eikichi,H.(1999).SilkwormBreeding(TranslatedfromJapanese).Oxford& IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G.(2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
3. Oxford&IBHPublishingCo.Pvt.Ltd.,New Delhi.
4. Mahadevappa,D.,Halliyal,V.G.,Shankar,D.G.andBhandiwad,R.,(2000).MulberrySilk
5. ReelingTechnologyOxford&IBHPublishingCo.Pvt.Ltd.,New Delhi.
6. Roger,M(1990).TheABCandXyzofBeeCulture:AnEncyclopediaofBeekeeping,Kindle Edition.
7. ShuklaandUpadhyaya(2002).EconomicZoology,RastogiPublishers.
8. YadavManju(2003).EconomicZoology,DiscoveryPublishingHouse.
9. JabdePradipV(2005).TextbookofappliedZoology,DiscoveryPublishingHouse,NewDelhi.
10. Cherian&RamachandranBeekeepingin-SouthIndianGovt.Press, Madras.
11. Sathe,T.V.VermicultureandOrganicfarming.
12. Bard.J(1986).HandbookofTropical Aquaculture.
13. Santhanam,R.A.Manualof Aquaculture.
14. Zuka.R.1andHamiyn(1971).Aquariumfishesand plants
15. Jabde,P.V.(2005)TextBookofAppliedZoology:Vermiculture,
16. AnimalDisease-BairagiK.N.AnmolPublicationsPvt.Ltd2014
17. EconomicsOfAquaculture-Singh(R.K.P)-DanikaPublishingCompany2003
18. AppliedandEconomicZoology(SWAYAM) webhttps://swayam.gov.in/nd2_cec20_ge23/preview

CourseBookspublishedinEnglishandBengalimaybeprescribedbythe Universities and Colleges

APPLIE)ZOOLOGYPRACTICAL

FullMarks:10

InternalAssessmentof10marksincase ofMulti/InterDisciplinarywillbebasedonPractical Portion of the course concerned.

Visitanypharm/labandsubmit report: 06
Viva-voce : 04

Course Outcomes:

1. ComprehensiveKnowledgeofdifferentaspectsofappliedZoology.
2. UnderstandingaboutCultureprocessesandrearingofdifferenteconomically important animals.
3. Toknowaboutdifferentdiseasesonenemiesofeconomicallyimportantanimals.
4. Getabriefideaabouttheadvantagesandlimitationsof differenteconomicallyimportant animals.

ZOOL2051:SERICULTURE

Objectives of the Course: The syllabus for Sericulture at undergraduate SEC according to NEP has been framed. The main objective of framing this new syllabus is to give the students a proper understanding of Sericulture. Students will get knowledge about mulberry plant cultivation, different silkworms, culture techniques, silk production, and the knowledge of diseases and enemies ofsilkworms. The students can be utilized the knowledge in starting their own enterprise after completion of the course.

UNIT	TOPICS(Credits: 3)	TOTAL NO.OF LECTURES (45)
1.	HistoryOfSericulture;thesystematicpositionofsilkmoths; different speciesofsilkmoths,theirdescription.	**5**
2.	BiologyofMulberryPlants:DescriptionMulberry.SalientFeaturesof familyMoraceae;Phyto-geographyandsystematicofthe genus *Morus*L.AndIts Species; Morphologyandanatomyofmulberryplant;Differentcultivarsof mulberry;FloralBiologyofmulberry:Structureofmaleandfemale flowers,catkins	**6**
3	MulberryCultivation:ProcessesOfCultivation,irrigationprocess, applicationoffertilizerbothinorganicandorganiclikes vermicomposting. DiseasesofmulberryplantsLeaf:Leafspot,Powderymildew,Leaf Rust,Leaf Blight. DiseasesOfMulberryRoot:Rootrotdisease,Rootknot disease. PestmanagementofMulberryplants,MajorandMinor:Name,pattern attack,preventionand control.	**6**
4.	SilkwormMorphology:oftheegg,larva,pupa,adultof*Bombyx mori*. SilkwormAnatomy *Bombyxmori*:DigestiveSystem:Larva, Circulatorysystem:Larva,pupa,adult,NervousSystem:Larva,adult, SilkGland:Larva,ReproductiveSystem:Adult.	**5**
5.	SilkwormDiseasesof*Bombyxmori*:Protozoandisease,Bacterial Disease,Fungaldisease,ViralDisease,Sotto SilkwormPestsof*Bombyxmori*:Uzifly,Ants,DermestidBeetles.	**5**
6.	MulberrySilkwormRearing:Modelrearinghouse,Rearing appliances,disinfection,disinfectants,bedcleaning,feedingofworms.	**6**

	Rearingoflarvae:techniquesofrearingofdifferentstagesof larvae.	
7.	Harvestingofcocoon:Sexdeterminationofcocoon,harvestingof cocoon.	**3**
8.	PostCocoonAndSilkCollectionTechnology:CocoonStifling(sun drying,steamstifling,hotairstifling)andstorage. Deflossing,cocoonriddling,mixingorblending, cocoon cooking,brushing. TypesOfReelingMachines,reelingoperation,reelingendformation. Degumming,bleaching,dyeingsilkyarn. Twisting,Reeling,Re-reeling,lacing,skeiningandtestingofrawsilk material WeavingOf silk.	**5**
9.	EntrepreneurshipSericulture:SericultureSourceOfEmploymentand livelihood;theroleofCSBinsupportingandguidingentrepreneurship.	**4**

ReferenceBooks:

1. Charsley,S.R.(1982).CultureandSericulture.AcademicPressInc.NewYork,U.S.A.
2. FAOManuals-IMulberryCultivation.FAO Rome.
3. Ganga,G.,andJ.SulochanaChetty.(1991)AnIntroductiontoSericulture.Oxford&IBH Publishing Company.
4. Jayaram,H.(2005)MulberryCultivationandPhysiology.CentralSilkBoard,Bangalore.
5. SilkwormCropProtection,CentralSilkBoard,Bangalore,India.
6. Govindan, R.;Ramakrishna Naika and Sannappa, B.(2004) Advances in Disease and Pest Management in Sericulture. Seri Scientific Publishers, Bangalore.
7. Jolly,M.S.,Chowdhury,S.NandSen.(1975).Non-mulberrySericultureinIndia.CentralSilkBoard,Bombay,India.
8. WebsiteofCSB:https://silks.csb.gov.in/una/wp-ontent/themes/Common_District/una/sgf-frame.html

SERICULTURE PRACTICAL

FullMarks:10

InternalAssessmentof10marksincaseofSECwillbebasedonPracticalPortionof the course concerned.

IdentificationofanyonestageofMulberrysilkworm with characters. : 02

Visitsericulturefarmandsubmit reports. 05

Viva 03

Course Outcomes:

1. GetCompleteKnowledgeofSilkwormsandtheirdifferenttypes.
2. Getknowledgeabouttechnologyofsilkwormcultureandmakingofsilk.
3. ToKnowAboutDifferentDiseasesOnEnemiesOfSilkworms.
4. GetaBriefIdeaaboutentrepreneurshipin Sericulture.

ZOOL2051:AQUARIUMFISHKEEPING

Objectives of the Course: Thecoursewillimpartbasicknowledgeoftheornamentalfishindustry and inculcate its scope as an avenue for career development as an entrepreneur or as an aquari- culturist.

1. Studentswillbeabletoknowthefundamentalsofaquariumfishindustry.
2. Studentswillunderstandthebiologicalfeaturesofaquariumfishes.
3. Studentwillgettoknowthefoodandfeedinghabitsofaquariumaquariumfishes.
4. StudentWillGetAwareAbouttheTransportationofFish
5. Studentswillhave'hands-on'experiencethroughexposuretotechnology,production, functioning, operation of an aquarium in the ornamental fish farms, hatcheries, and fish feed production plant as study tours or field visits.

SLNO.	TOPICS(Credits: 3)	TOTALNO. OF LECTURES (45)
1.	**IntroductiontoAquariumFishKeeping** ThepotentialscopeofAquariumFishIndustryasCottageIndustry, ExoticandEndemicspeciesofAquariumFishes	4
2	**TypesofAquaria**(Salinity,Temperature,SpeciesSelection & Location) 1. AquariumSetupandAccessories. 2. Aquarium Filters and types of filtration methods (Mechanical, Chemical&Biological–NitrogenCycle);Precautionstobetakenfor an ideal aquarium;3.Criteria Of Selection For Aquarium Fishes	8
3	**BiologyOf Aquarium Fish** AquariumFishbiology(Breeding, Feeding economicimportanceetc), sexualdimorphismofFreshwaterandmarineaquariumfish.	4
4	**AquariumFishes** 1. Freshwater ornamental fishes-Guppy, Goldfish and Angelfish. 2. Brackishornamentalfishes-BlackMolly,Swordtail&Rayfish. 3. Marineornamentalfishes-Anemonefish,Moorish l, id(Butterfly fish.	8

5	**FoodAndFeedingOfAquariumFishes** 1. UseofLiveFishFoodOrganisms(Advantages And Disadvantages Of Live food), 2. PreparationAndCompositionOfFormulatedFish Feeds 3. AquariumFishAsLarval Predator	6
6	**AquariumFishDiseases** Parasitic,Bacterial,Viral,Protozoan,Fungal&DeficiencyDiseases.	4
7	1. BreedingHabits. 2. Hatchingandproductionofmonosex fishes.	3
8	**MaintenanceofAquarium** GeneralAquarium maintenance; Water quality requirements: MaintenanceandTemperaturecontrol;Budgetforsettingup an Aquarium/ornamental Fish Farm as a Cottage Industry	3
9	**Fish Transportation** 1. LiveFish Transport. 2. Conditioning,Packagingandforwarding hnique tec and a quarantine methods. 3. Factorsassociatedwithlivefishtransport.	3
10	**Maintenance** 1. GeneralAquariummaintenance. 2. BudgetforsettinguponAquariumFishFarmas ttage a (Industry.	2

AQUARIUMFISHKEEPINGPRACTICAL

FullMarks:10

Internal Assessment of 10 marks in case of SEC will be based on Practical Portion of thecourse concerned.

1. Study of different species of Aquarium fish and biology (Breeding, Feeding Economic importance etc.) of exotic and endemic fish (Guppy, Molly, Sword tail, Goldfish, Angel fish, Bluemorph, Anemone fish, Butterfly fish).(Phylum, Class, Subclass, Genus). 1X3=3

2. Towriteaprojectproposalforsettingupasmallaquariumfishkeepingasacottageindustryto a fundingagencyforself-employmentofyouthsorforhelpingpoorfarmeis;aftervisiting a farm/enterprise. 5

3. Vivavoce 2

RecommendedBooks:

1. Jhingran,V.G.(1982)FishandFisheriesinIndia.HindustanpublicationCorp,India.
*Pandey,K.
2. J.P.Shukla(2013)FishandFisheries.RastogiPublication.
3. Aquarium:FishKeepingCBLSrivastavaPublishedbyKitabMahal
4. Marine Aquarium (Fish: Keeping and Breeding Themin Captivity) Boruchowitz,Davie.PublishedbyChelseaHousePublications(1998)
5. AquariumSettingUp(Fish:KeepingandBreedingTheminCaptivity)Axelrod,Herbert R.PublishedbyChelseaHousePublications(1998)
6.TheTropicalFreshwaterAquariumProblemSolver:PracticalandExpertAdviceonKeepingFishand Plants Sand ford, Gina Published by Voyageur Press (MN)(1998)

Course Outcomes:

1. KnowaboutBasicneedstosetupanaquarium,i.e.,dechlorinatedwater reflector, filters, scavenger, aquatic plants etc. and the ways to make it cost-effective.
2. Managefishdiseases.
3. Preparetheproperdosageofdifferentkindsofnaturalandsyntheticfishfeed.
4. DevelopPersonalSkillsIntheMaintenanceof Aquarium.
5. BecomeawareofAquariumascommercial,decorativeitemsandofscientificvalues.

SEMESTER-III
MAJOR/DSCOURSES(CORE)

ZOOL3011:BIOCHEMISTRY

Objectives of the study: The objective of this study is to foster enthusiasm among students for Biochemistry, highlighting its significance within the broader context of Zoology. Through this course, learners will gain an understanding of the fundamental chemistry that drives biological processes, enabling them to independently address challenges in both biology and chemistry. The curriculum covers the analysis of molecular structure andfunction, as wellasthemyriadchemicalreactionsoccurringwithinlivingcells. It aims toigniteasense of curiosity in students, encouraging them to explore the intricate mechanisms of various biomolecules and their interconnections. This program also seeks to motivate students to pursue advanced studies in Biochemistryand related interdisciplinary fields, thereby equipping them with the skills necessary for both salaried and entrepreneurial ventures.

Credits 5(Theory:4,Practical:1)
FullMarks 75(Theory:40+Internal15;Practical:20) **Numberof Lectures:** 60

Sl. No.	Topics/Contents	Classes
1.	**Water:**Uniqueproperties,weakinteractionsinaqueoussystems,ionizationofwater, buffers,waterasareactantandfitnessoftheaqueousenvironment.	3
2.	**Carbohydrates:**StructureandBiologicalimportanceofCarbohydrates: Monosaccharides,Disaccharides,Polysaccharides.Derivativesof Monosaccharides. Carbohydratemetabolism:Glycolysis,Citricacidcycle,Pentosephosphate pathway,Gluconeogenesis.	10
3.	**Protein**:GeneralandElectrochemicalpropertiesofα-aminoacids;Essentialandnon-essentialaminoacidsandtheirphysiologicalimportance.Structuresandclassification ofproteins. Proteinmetabolism:Transamination,Deamination,Ureacycle.	15
4.	**Lipid:**StructureandSignificanceoflipids:Physiologicallyimportantsaturatedand unsaturatedfattyacids,Tri-acylglycerol's,Phospholipids,Sphingolipid,Glycolipids, Steroids.Lipidmetabolism:β-oxidationoffattyacids.	10
5.	**Nucleicacid:**Structure:Purinesandpyrimidines,Nucleosides,Nucleotides,Nucleic acids.TypesofDNAandRNA,ComplementarityofDNA,Hypo-Hyperchromaticityof DNA.	10
6.	**Enzymes:**Nomenclatureandclassification;Cofactors;Specificityofenzymeaction; Isozymes.Mechanismofenzymeaction;Enzymekinetics;DerivationofMichaelis-MentenEquation,Lineweaver-Burkplot;Factorsaffectingrateofenzyme-catalyzed reactions;Enzymeinhibition;AllostericenzymesandtheirFactorsaffectingrateofenzyme-catalyzedreactions.	10
7.	**OxidativePhosphorylation:**Redoxsystems;Overviewofthemitochondrialrespiratory chain,MitochondrialUncoupling.	2

1. SuggestedReadings:
2. Cox,M.MandNelson,D.L.(2008).Leininger'sPrinciplesofBiochemistryEdition,W.H.Freemanand Co.NewYork.
3. CampbellandFarrell(2012).Biochemistry.7thEdn.BrooksandCole.

4. Das,D.(2022).Biochemistry.AcademicPublisher.
5. Chatterjee,MNandShinde,R(2012).ATextbookonMedicalBiochemistry.8thEdn.Jaypee Pub., N. Delhi
6. Berg,J.M.,Tymoczko,J.L.andStryer,L(2007).Biochemistry,VIEdition,W.H.Freemanand Co., NewYork.
7. Hames,B.D.andHooper,N.M.(2000).InstantNotesinBiochemistry,IIEdition,BIOS Scientific Publishers Ltd., U.K.
8. Voet.D&Voet.J.G,(2004).Biochemistry–3rdedition,2004,JohnWiley&Sons,Inc.
9. Jain,J.L.,JainmSandN.Jain. FundamentalsofBiochemistry.S.ChandPub.N.Delhi
10. Maheswari,N(2008).ClinicalBiochemistry.JaypeePub.,NewDelhi
11. Murray,R.K.,Bender,D.A.,Botham,K.M.,Kennelly,P.J.,Rodwell,V.W.andWell, P.A.(2009).
12. Harper'sIllustratedBiochemistry,XXVIIIEdition,InternationalEdition,TheMcGraw- Hill CompaniesInc.
13. SathyanarayanaU.andChakrapani,(2002).Biochemistry–Books&Allied(P)Ltd,Kolkata
14. ZubayG.L,(1998).Biochemistry–4thedition,McGraw-Hill.

PracticalComponents:

1. Qualitativetestsoffunctionalgroupsincarbohydrates(Benedict'stest),proteins(Biuret'stest),andlipids (Saponificationnumber).
2. TostudytheenzymaticactivityofSalivaryamylase.
3. QuantitativeestimationofproteinbyLowryMethod.
4. PaperchromatographyofAminoacids.(hands-on/virtual).
5. Demonstrationofproteinsamplepreparationandseparationby SDS-PAGE(hands-on/virtual).

PracticalExaminationPattern: **FullMarks:20**

Onequestionfromitems1and2.(6x1=6)
Onequestiononthequantitativetest(fromitem3)(8x1=8)
Onequestionfromitems4and5(4x1=4)
LaboratoryNotebook (2)

OUTCOMEOFTHECOURSE

1. ThistopicisdesignedtohelplearnerstounderstandtheobjectivesofstudyingBiochemistry.
2. Thelearnerwillgetaclearconceptofthestructuresandreactionsofdifferentbiomolecules in the living system.
3. Learnerswillcopewiththefastandfar-reachingadvancementofbiologicalsciencesinthiscenturyand be able to update themselves with the emerging concept of biochemistry.
4. Studentswilldevelopadeepinterestinthissubject,whichisveryimportantfordailylifeandalsofor different competitive examinations.

ZOOL3012:CELLBIOLOGY

***Objectives of the study*:** To give an idea of the different structures involved in cellular organization, both within and outside the cell; outline knowledge of division and signaling at cellular level and a detailed idea of the important subcellular components that are involved in the process of transportation of molecules to and from the cell, as well as synthesis of various proteins and ATP.

Credits 5(Theory:4,Practical:1)
FullMarks 75(Theory:40+Internal15;Practical:20) **Numberof Lectures:** 60

Sl. No.	Topics/Contents	Classes
1.	**Plasma Membrane:** MembraneLipidsandProteins.ArchitectureofPlasmamembraneonthebasisofFluid MosaicModel(SingerandNicolson,1972,Nicolson2014). Transportacrossmembrane:LDLReceptormediatedEndocytosis,Simplediffusion (O_2 andCO_2transport),Facilitateddiffusion(Glucosetransportation,Na^+andK^+ transportation),primaryactivetransport(Na^+-K^+anti-transportation)andsecondaryactive transports(Na^+-glucoseco-transportation).	12
2.	**CellularOrganization:**ExtracellularMatrix:Componentsandtheirrole.Cytoskeleton: BasicstructureanddynamicsofActin,Microtubule,andLamin.Microtubuleassociated motorproteins.Celljunctions:Occludingjunction(tightjunctionandseptatejunction), anchoringjunction(cell-cellandcell-matrix)andcommunicatingjunction(gapjunction)	10
3.	**CytoplasmicOrganelles-I:** EndoplasmicReticulum:StructureandFunction(Co-translationaltranslocationofproteins throughERmembrane,GlycosylationandChaperonemediatedfoldingofprotein). GolgiApparatus:Structureandfunctionsofindividualcompartments,vesiculartransport andcisternalmaturationmodelofGolgi. Lysosome:Structureandfunctions. Proteinsortingandmechanismsofvesiculartransport.	12
4.	**CytoplasmicOrganelles-II:** Mitochondria:Outlinestructure,Mitochondrialrespiratorychain,andgenerationofproton motiveforce.Structureof$F_oF_1$complex,chemiosmoticandBinding-changehypothesesof ATPSynthesis. Nucleus:Nuclearporecomplexandtransportationofm RNAthroughnuclearporecomplex. Nucleosome,solenoid,andzigzagmodelofDNApackaging,nucleolus.	10
5.	**Cell Division:** Cellcycleanditsregulationinvertebrates;roleof cyclins. MitoticandMeioticCelldivisions.Typesandbasicprocess;MTOCanditsrolein chromosomemovement. Cancer:Propertiesofcancercellsinbrief.	10
6.	**Cell Signaling:** Overviewofcellsignalingtransductionpathways;Typesofsignalingmoleculesand receptors(Classificationandexamplesonly). BasicconceptofApoptosis,cytologicalfeaturesofanapopticcell.	6

SuggestedReadings:

1. AlbertBruce,BrayDennis,LevisJulian,RaffMartin,RobertsKeithandWatsonJames(2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.
2. Cooper,G.M.andHausman,R.E.(2009).TheCell:AMolecularApproach.5thEdition.ASMPress and Sunderland, Washington, D.C.; Sinauer Associates, MA.
3. Hardin,J.Bertoni,GandKleinsmith,J.L.(2012).Becker'sWorldoftheCell.8thEdn,Pearson Benjamin Cummings, San Francisco.
4. Harvey,L.(2004).MolecularCellBiology.5thEdn.W.H. Freeman
5. Karp,G.(2008).CellandMolecularbiology:ConceptsandApplication.5thEdn,JohnWiley.
6. Lodish,Berk,Matsudaira,Kaiser,Bretscher,Ploegh,Amon,andMartin(2016)MolecularCell Biology. 8th Edn. W.H. Freeman
7. Pal,A.(2011).TextbookofCellandMolecularBiology3rdEdn,BokksandAllied, Kolkata.
8. Plopper,G,D.Sharp,Siroski,E(2015)Lewin'sCell3rdEdition—Johns&BartlettPublishersPollard and Earnshaw (2007). Cell Biology. 2nd. Edn Saunders.
9. Reed,J.C.,andGreen,D.R.(2011).Apoptosis:PhysiologyandPathology.CambridgeUniv.Press
10. VermaandAgarwal.CellBiology,Genetics,Molecular Biology,EvolutionandEcology.S.Chand Pub,WeinbergR.A.(2014).BiologyofCancer.2ndedition.Garland Science,Taylor,andFranklin.

PracticalComponents:

1. Basicideaoflightanddarkfieldofmicroscopy(demonstration).
2. Preparationofsquamousepithelialcell(fixationandstaining).
3. Standardizationofocularandstagemicrometerandmeasurementofanycell.
4. Preparationoftemporarystainedsquashofonionroottiptostudyvariousstagesofmitosis.
5. Squashpreparationofgrasshoppertestisandstudyofthevariousstagesofmeiosis.
6. StudyofMitoticindexfromonionroottipcells

ExaminationPattern: **FullMarks:20**

Onequestiononsquashpreparation(fromItemNo.4,5and6)(6X1)=06
Preparation of slide/ measurement (From Item 2and 3) (4X 1) = 04
Identification of stages of mitosis and meiosis cell division (2X4) = 08
Laboratory Notebook ---------- 02

SuggestedReadings:

1. ChatterjeeandChatterjee:PracticalZoology
2. Ghosh,K.C.andManna,B.(2015):PracticalZoology,NewCentralBookAgency,Kolkata
3. Sinha,J.K.,Chatterjee,A.K.andP.Chattopadhyay: AdvancedPracticalZoology

Course outcomes:

1. The students will learn about the different subcellular components-their structure, function and biochemicalproperties,organizationatcellularlevelwithrespecttoextracellularmatrix,cytoskeleton, cell junction, cell signaling and cell division.
2. Theywillalsohaveanoutlineknowledgeofcancercellsandapoptosis.

MULTI/INTERDISCIPLINARY

ZOOL3031: APPLIED ZOOLOGY

***Objectives of thestudy*:**ThestudyprogrammeAppliedZoologyisfocusedontheuseofcombinedmethodsin scientific disciplines of zoology and enables the interconnection of topical issues and scientific approaches in the management of natural resources and their protection. Students of the programme gain theoretical and practical knowledge from the field of data gathering and analysis. Based on the acquired experience, they will be able to formulate progressive procedures and identify trends in sustainable development in the use of natural resources and simultaneously avoid decreased animal welfare and deterioration of the healthconditions of stocked animals, the risk of biological invasions, the occurrence of parasitic diseases and irreversible resource exhaustion.

Credits 3(Theory:3)
FullMarks 50(Theory:40+Internal:10) **Numberof Lectures:** 45

Sl. No.	Topics/Contents	Classes
1	**Fish culture:** Commonfishesusedforculture. Fishingcraftsandgears. Ornamentalfishculture:Freshwaterornamentalfishes-biology,breedingtechniques Constructionandmaintenanceofaquarium:Constructionofhomeaquarium,materialsused, settingupoffreshwateraquaria,aquariumplants,ornamentalobjects,cleaningthe aquarium,maintenanceofwaterquality.controlofsnailandalgalgrowth. Moderntechniquesoffishseedproduction	15
2	**Prawnculture.** Cultureoffreshandmarinewaterprawns. Preparationof farm. Preservationandprocessingofprawn,exportofprawn.	5
3	**Vermiculture** Scopeof Vermiculture. Typesof earthworms. Habitcategories-epigenic,endogenicandanecic;indigenousandexoticspecies. Methodologyofvermicomposting:containersforculturing,rawmaterialsrequired, preparationofbed,environmentalpre-requisites,feeding,harvestingandstorageof Vermicompost. Advantagesofvermicomposting.Diseasesandpestsofearthworms.	12
4	**LacCulture** Historyoflacanditsorganization,lacproductioninIndia.Lifecycle,hostplantsand strainsoflacinsect. Laccultivation:Localpractice,improvedpractice,propagationoflacinsect,inoculation period,harvestingoflac. Laccomposition,processing,products,usesandtheirpests.	13
SuggestedReadings: 1.Eikichi,H.(1999).SilkwormBreeding(TranslatedfromJapanese).Oxford&IBHPublishingCo.Pvt. Ltd., New Delhi.		

2. Ganga,G.(2003).ComprehensiveSericultureVol-II: SilkwormRearingandSilkReeling.
3. Oxford&IBHPublishingCo.Pvt.Ltd.,New Delhi.
4. Mahadevappa,D.,Halliyal,V.G.,Shankar,D.G.andBhandiwad,R.,(2000).MulberrySilk
5. ReelingTechnologyOxford&IBHPublishingCo.Pvt.Ltd.,New Delhi.
6. Roger,M(1990).TheABCandXyzofBeeCulture:AnEncyclopediaofBeekeeping,Kindle Edition.
7. ShuklaandUpadhyaya(2002).EconomicZoology,RastogiPublishers
8. YadavManju(2003).EconomicZoology,DiscoveryPublishingHouse.
9. JabdePradipV(2005).TextbookofappliedZoology,DiscoveryPublishingHouse,New Delhi.
10. Cherian&RamachandranBeekeepingin-SouthIndianGovt.Press,Madras.
11. Sathe,T.V.VermicultureandOrganicfarming.
12. Bard.J(1986).HandbookofTropical Aquaculture.
13. Santhanam,R.A.Manualof Aquaculture.
14. Zuka.R.1andHamiyn(1971).Aquariumfishesand plants
15. Jabde,P.V.(2005)TextbookofAppliedZoology:Vermiculture,Apiculture,Sericulture,Lacculture.
16. AnimalDisease-BairagiK.N.AnmolPublicationsPvt.Ltd2014
17. EconomicsOfAquaculture-Singh(R.K.P)-DanikaPublishingCompany2003
18. 18.AppliedandEconomicZoology(SWAYAM)webhttps://swayam.gov.in/nd2_cec20_ge23/preview

Course outcomes:

AppliedZoologydealswiththeapplicationofZoologicalknowledgeforthebenefitofmankind.Italsodeals with animal world that is associated the economy, health and welfare of human. So,

1. Thestudentscanunderstandconceptsoffisheries,fishingtoolsandsite selection.
2. Canunderstandsaboutparasitesandepidemiologyofparasitesinhumanandanimals,Types ofbreedsin animal farming and poultry farming along with their management.
3. Studentsalsobecomeefficientabout Aquaculturesystems,inducedbreedingtechniquesandpost harvesting techniques.

SKILLENHANCEMENTCOURSE(SEC) ZOOL3051:

ANIMAL HUSBANDRY AND MANAGEMENT

Objectives of the study: The course is aimed with the objective of providing knowledge of the Animal Husbandry, their significance, types & breeds. Modern system of rearing and breeding of animals have been incorporated so that the students will get interest on this topic and also able to start entrepreneurship either for regular earning or for extra earning along with their regular source of income in future.

Credits: 4(Theory:3,Practical:1)
FullMarks: 50(Theory:40+Internal 10) **Numberof Lectures: 45**

Sl. No.	Topics/Contents	Classes
1.	DAIRYSCIENCE:Differentbreedsoflivestockviz,Cattle,Buffalo,Sheep,GoatandPigs bothIndianandexotic.Typesofhousing,spacerequirementof differentcategories of livestockimportanceofsanitationinLivestockfarm. Typesofanimalfarming:Mixedfarming,Integratedfarming,Specializeddairyfarmingand theirrelativeeconomicmerits. Importanceofcleanmilkproduction:Definitionofmilkandcolostrum,Factorsaffecting qualityandquantityofmilk.Legalstandardsofmilk,Sourceofadulterationandits detectioninmilk. Pasteurization,sterilization,homogenization,andtheirimportance.DifferentMilkproducts andothermilkbeverages. Rearingofyoungstocks,importanceofcolostrumfeedinginyoungones,managementof pregnantcows,thegoats,ewes,careandmanagementofbreedingheifersandyoungbulls.	9
2.	POULTRYSCIENCE:DifferentBreedsofchickenformodernpoultryfarming.Broiler chicken,incubationofitseggs,breedingtechniques. Differentbreedsofduck,farmingofducksin India. BriefideaofQuailfarmingin India.	8
3.	ANIMALBREEDING:Inbreeding:homozygosity,inbreedingdepression.Out-breeding: outcrossing,crossbreeding,Interspecifichybridization. Controlledbreedingexperiments,MultipleOvulationEmbryoTransferTechnology (MOET).	7
4.	ANIMALNUTRITION:DifferenttypesofAnimalfeedsofcattle,goat,sheep,pig,chicken, duck.Compositionandnutritivevalue.	6
5.	VETERINARYSCIENCE:Definition:Infectiousandcontagiousdiseases.Symptoms and causativeagentsofdifferentparasitic,bacterial,andviraldiseasesofcattle,sheep,pig,goat. Diagnosis,immunization,andvaccinationtocontroldifferentdiseasesofcattle. Measurestobeadoptedduringoutbreakof Diarrhoea,Anthrax,Foot,andMouthdiseases.	8
6.	POULTRYDISEASES:Diseases–types,symptoms,prevention.Vaccination Diagnosis,immunization,andvaccinationprogrammetocontroldifferentdiseasesof chicken.	7

1. G.C.Banerjee.2019.TextbookofAnimalHusbandry.Eight Edition.Oxford&IBHPublishing Co Pvt.Ltd
2. DrJainendraSuryavanshi.2022.AnimalHusbandry:HandbookofDairy,Poultry,sheep,Goat,

Pig.Shashwat Publication.
3. NSRSastryandCKThomas.2016.LivestockProductionManagement.Paperback.Kalyani Publisher.
4. G.C.Banerjee2019.PrinciplesOfAnimalNutritionandFeedsRevisedEdition,Oxford& IBH Publishing.
5. DebiprasannaDas,BhabeshChandraDas,NibeditaNayak,BasantiJena,AmiyaRanju Sahu. Textbook on Poultry Management. Narendra Ppublishing House.
6. Chuhan,H.V.S.andRoy,S.2018.PoultryDiseases,DiagnosisandTreatment.NewAge International Publishers.
7. VijayKumar.2023.PigProductionandManagement. NewIndiaPublishingAgency.
8. PavanKumarYadavDineshKumar,RashmiKumar,MSMahesh.2024.HandbookofLivestock & Poultry Production and Management. Narendra Publishing House.
9. KarenJuneP.2018.QuailFarmingforBeginners:TheUltimateComprehensiveGuide.CreateSpace Publishing.

****PracticalComponents:**(InternalAssessmentof10marksincaseofSECwillbebasedonPractical Portion of the course concerned.)
PracticalmustincludeavisittoanyPoultryfarmorAnimalHusbandrylabbystudents. Submit report and viva voce (7 + 3 = 10)

OUTCOMEOFTHECOURSE

1. This paper is designed to understand the objectives of studying Husbandry and its management techniques.Studentswillcopewiththetopicandupdatethemselveswiththeemergingconceptofthistopic.
2. Studentswillgetknowledgeaboutthetechniqueoffarmingdifferenteconomicallyimportantanimals.
3. Studentswillgetencouragementaboutentrepreneurshipin Husbandry.

ZOOL3051:MEDICALDIAGONOSTICS

Objectives of the study: This Skill Enhancement Course aims to enlighten students on the health status of patientswithsimplediagnostictestsandevaluations.Thiscoursewillhelptomakestudentsself-sufficient in future. They are expected to be adept in laboratory techniques.

Credits: 4(Theory:3,Practical:1)
FullMarks: 50(Theory:40+Internal10) **Numberof Lectures: 45**

Sl.No.	Topics/Contents	Classes
1	:IntroductiontoMedicalDiagnosticsandits Importance	3
2	DiagnosticsMethodsUsedforAnalysisof Blood: Bloodcomposition,PreparationofbloodsmearandDifferentialLeucocyteCount(D.L.C) usingLeishman'sstain.Plateletcountusinghemocytometer,ErythrocyteSedimentaryRate (E.S.R),PackedCellVolume(P.C.V.)	10
3	DiagnosticMethodsUsedforUrineAnalysis: UrineAnalysis:Physicalcharacteristics;Abnormalconstituents	4
4	Non-infectiousDiseases: Causes,types,symptoms,complications,diagnosisandpreventionofDiabetes(TypeIand TypeII),Hypertension(Primaryandsecondary),Testingofbloodglucoseusing Glucometer/Kit	6
5	InfectiousDiseases: Causes,types,symptoms,diagnosisandpreventionofTuberculosisandHepatitis, Malarialparasite;Microscopebased,andELISAbased)	6
6	ClinicalBiochemistry:LFT,Lipidprofiling	3
7	ClinicalMicrobiology:AntibioticSensitivityTest	3
8	Tumors:Types(Benign/Malignant),Detectionandmetastasis. Medicalimaging:X-RayofBonefracture,PET,MRI,andCTscan(usingphotographs).	6
9	VisittoPathologicalLaboratoryandSubmissionofProject (Internalassessment)*	4

SuggestedReadings:

1. Prakash,G.(2012),LabManualonBloodAnalysisandMedicalDiagnostics,S.Chand,andCo.Ltd.
2. Papadakis,M.A.,McPhee,S.J.andRabow,M.W.ed.(2016).CurrentMedicalDiagnosisand Treatment McGraw Hill.

****PracticalComponents:**(InternalAssessmentof10marksincaseofSECwillbebasedonPractical Portion of the course concerned.)

Visittopathologicallaboratoryandsubmissionofa report.

Outcomes:

Aftercompletionofcourse,studentswillbeable to:

1. Learnbasicunderstandingofthestructureofthehumanbody.
2. Learnaspectsrelatedtomedicaldiagnosis.
3. Learntoperformtestswhichhelpinthediagnosisandtreatmentofdiseases.
4. Handlelaboratoryinstruments.
5. Studentsareexpectedtobeeconomicallyself-sufficient.

SEMESTER-IV

MAJOR/DSCOURSES(CORE)

ZOOL4011:ANIMALPHYSIOLOGY

Objectivesofthestudy:Tounderstandvariousfunctionalcomponentsofanorganism.Toexplorethe complex network of these functional components. To comprehend the regulatory mechanisms for maintenance of function of the body.

Credits 5(Theory:4,Practical:1)

FullMarks 75(Theory:40+Internal15;Practical:20) **Numberof Lectures:** 60

Sl. No.	Topics/Contents	Classes
1.	**Digestion:** StructuralorganizationandfunctionsofGastrointestinaltractandAssociatedglands;Importance ofGItracthormones.DigestionandabsorptionofCarbohydrates,Lipids,Proteins.	10
2.	**Respiration:** MechanismofRespiration;Respiratoryvolumesandcapacities;TransportofOxygenand Carbon-dioxideinblood;Dissociationcurvesandthefactorsinfluencingit; Respiratory pigments;Carbonmonoxidepoisoning.	8
3.	**Circulation:** Structureofmammalianheart;CardiacCycleandcardiacoutput. ComponentsofBlood;Structureandfunctionsofhemoglobin;Homeostasis;Bloodclotting system;Hemopoiesisanditsregulation.	8
4.	**ThermoregulationandOsmoregulation:** Physiologicalclassificationbasedonthermalbiology;Osmoregulationinaquaticvertebrates; Externalosmoregulatoryorgansinvertebrates.	5
5.	**Renalsystem:** Structureofnephron;Juxta-glomerularapparatus,Mechanismofcountercurrent exchangeand urineformation.Regulationofacid-basebalance	5
6.	**NervousSystem:** Structureofneuron;Restingmembranepotential;Originofactionpotentialanditspropagation acrossthemyelinatedandunmyelinatednervefibers;Typesofsynapses,Synaptic transmissionandNeuro-muscularjunction;Reflexactionanditstypes.	6
7.	**MuscularSystem:** Differenttypesofmuscle;Ultrastructureofskeletalmuscle;Molecularandchemicalbasisof musclecontraction.Originandconductionofcardiacimpulses.	6
8.	**ReproductiveSystem:** Basicstructureoftestisandovary.Hormonesoftestisandovary;Physiologyof Reproduction (EstrusandMenstrualcycle).	5
9.	**Sensory system:** Eye:Physiologicalanatomy,Photoreceptors,Visualpathway,visualreflexes,Defects of imageformation. Ear:Physiologicalanatomy,Auditorypathway,Mechanismofhearing.	7

SuggestedReadings:

1. Guyton,A.C&Hall,J.E.TextbookofMedicalPhysiology,XlEd.W.B.SaundersCo. (2006).
2. Tortora,G.J.&Grabowski,S.PrinciplesofAnatomy&Physiology.XIEd.JohnWiley&sons(2006).
3. ChristopherD.Moyes,PatriciaM.Schulte.PrinciplesofAnimalPhysiology.3rdEd.PearsonEducation

(2016).
4. Hill,RichardW.,etal.Animalphysiology.Vol.2.Sunderland,MA:SinauerAssociates,(2004).
5. ChatterjeeCCHumanPhysiologyVolumel&2,11thedition,CBSPublishers(20I6).
6. Ganong'sReviewofMedicalPhysiology(2019).
7. Eckert.ANIMALPHYSIOLOGY.

AnimalPhysiology:Practical

1. EstimationofHemoglobininhumanbloodusingSahli'shemoglobinmeter
2. DifferentialstainingofhumanbloodcorpusclesusingLeishmanstain
3. DeterminationofBleedingTime&ClottingTimeusingsuitablemethod.
4. DeterminationofBloodGroup.
5. DeterminationofErythrocyteSedimentationrate.
6. Experimentofkneejerkbysuitablemethod.

Examinationpattern: FullMarks: 20

1. Onequestionfromitemno.1&4	05
2. Onequestionfromitemno. 2&5	05
3. Onequestionfromitem no. 3	04
4. Onequestionfromitem no. 6	04
5. Laboratorynotebook	02

Suggestedreadings:

1. ChatterjeeandChatterjeePracticalZoology
2. Ghosh,K.C.andManna,B.(2015):PracticalZoology,NewCentralBookAgency,Kolkata
3. Sinha,J.K.,Chatterjee,A.K.andP.ChattopadhyayAdvancedPractical Zoology
4..ChatterjeeCCHumanPhysiologyVolumel&2,11thedition,CBSPublishers(20I6).

Virtual Labs (Suggestive sites)

https://www.vlab.co.in
https://sites.dartmouth.edu

CourseOutcomes:

1. Attheendofcoursethestudentshouldbeabletounderstand:
2. Developtheskillstoidentifydifferenttypesofbloodcells.
3. Enhancebasiclaboratoryskillslikekeenobservation,analysisanddiscussion.
4. Learnthefunctionalattributesofdifferentorgansystemsofthebody.

ZOOL4012:DISEASEBIOLOGY

Objectives of the study:The specificlearninggoals fordisease biologyare to explore the causes of diseases of the animal world and to provide students with a working knowledge of fundamental concepts and molecular mechanisms leading to diseases. This will help in further understanding of the immune responses facilitating recovery and protection, also examine the mechanism of action of disease therapies and investigate the physiological and ecological factors that influence the frequency of disease occurrence.

Credits 5(Theory:4,Practical:1)
FullMarks 75(Theory:40+Internal15;Practical:20) **Numberof Lectures:** 60

Sl. No.	Topics/Contents	Classes
1.	**Basicconceptsof disease:** Endemic,epidemic,pandemic;acuteandchronic,communicable,andnon-communicable; infectiousandcontagious;zoonotic,waterborneandnosocomial diseases.	3
2.	**CommunicableDiseases:Modeoftransmission,pathogenesis,andmanagement of:** Bacterial;Cholera,Tuberculosis. Viral;(RNA(AIDS,SARS),DNA(Pox)&Naked(rhinovirus). Protozoan;Malaria,Amoebiasis Helminth:LymphaticFilariasis,Taeniasis	20
3.	**Non-CommunicableDiseases:RiskFactors,Pathophysiology&management of:** Gastro-intestinaldiseases:Diarrhea,IrritableBowelSyndrome,Cirrhosisofliver. Cardio-vasculardiseases:Atherosclerosis,Ischemicheart,andMyocardialinfarction. Diabetes:Types1&2,Gestational diabetes. KidneydiseaseslikeGlomerularNephritis,Nephrolithiasis. Respiratory;COPD	18
4.	AsthmaandAllergy;Basicconceptandtypes.Mechanismofallergicreaction,Diagnostic test,andprophylacticmeasure.	4
5.	**Epidemiology,Prevalence,ClinicalFeaturesandPreventiveStrategiesof:** ProteinEnergy metabolism (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Disorders (IDD).	

SuggestedReadings:

1. KathrynL.,McCance&SueE.Huether,Pathophysiology:TheBiologicBasisforDiseasesinAdults and Children. Publisher: Elsevier
2. K.D.Tripathi,EssentialsofMedicalPharmacology.6th Edition;Publisher:Jaypee
3. N.J.DimmockandS.B.Primrose;IntroductiontoModernVirology;4th Edition;Blackwell Scientific Publications, London.
4. L.M.Prescott;L.M.Harleyet.al.Microbiology;3rd Edition;McGrawHill,NewYork.
5. ModernNutritioninHealthandDisease;10th Edition;Lippincott,William,andWilkins.
6. TheNutritionSocietyTextbookSeries;BlackwellPublishingCompany.

DiseaseBiology:Practical

1. Identificationof*Ascarissp.*MaleandFemale,*Taeniasp.,Entamoebahistolytica,Plasmodium vivax*
2. QuantitativeestimationofglucosebyGOD-POD.
3. DemonstrationofestimationoftotalIgE(EIAmethod)

4. TCandDCof blood.
5. AsurveyreportofDiabetesmellitusdistributionamongdifferentagegroupsandincomegroups.
6. Identification of patients with reasons (photographs): Rickets, Marasmus, Kwashiorkor.IdentificationofSalmonellaantigeninserum(UsingWidalTestteachingkit)

ExaminationPattern **FullMarks:20**

OnequestionfromItemNo.2---------- 05
OnequestionfromItemNo.4---------- 05
IdentificationanyfourfromItemNo.1and4---$1^{1/2}$x4=06
LaboratoryNotebook---------- 04

Outcomeofthe Study:

1. Demonstrateaknowledgeofinnateandadaptiveimmunity,includingtheprocessofinflammation;
2. Demonstrateaknowledgeofhowmicrobialpathogens(viruses,bacteria,andparasites)evadehost defences and cause disease;
3. Demonstrateaknowledgeofhowderegulationofcellulargrowthanddifferentiationcausedisease;
4. Demonstrateaknowledgeofthepathobiologyofthecirculation,includingtheprocessofthrombosisand infarction.
5. Demonstrateaknowledgeofinteractionsbetweeninfectiousorganismsandtheirhosts,withparticular reference to emerging infections;
6. Recognizeandidentifyanumberofcommonbacterialspeciesthatmaybeassociatedwithhumanand animal diseases.

ZOOL4013:COMPARATIVEENDOCRINOLOGY

Objectives of the study: To introduce basic terms of Endocrinology. To develop conceptual clarity of Endocrinology. To familiarize the learners with the structure, types, and classification of chromosomes. To introduce the concept of sex determination and its types, sex-linked, sex-influenced, and sex-Limited Genes. To develop an understanding of genetic variability within a population and learn as to how the changes take place.

Credits 5(Theory:4,Practical:1)
FullMarks 75(Theory:40+Internal15;Practical:20) **Numberof Lectures:** 60

Sl. No.	Topics/Contents	Classes
1:	**IntroductiontoEndocrinology:** Endocrinesystem,ClassificationofHormones.Modesofhormonesecretionandtransport, feedback mechanism.	7
2:	**InvertebrateEndocrineSystemandPhysiology:** Insecthormones:typesandtheirreleasesites Endocrineregulationofinsectgrowthandmetamorphosis,moulting,diapauses Vertebrate-type hormones in Crustaceans: X-organ, Y-organ and associated neurochemical organs.	8
3:	**VertebrateEndocrineSystem:** Hypothalamus-hypophysialAxis;Pituitarygland(celltypes),hormonesandtheir functions. Pineal gland, biosynthesis of melatonin and its functions Cellularcharacteristics,Secretion,andfunctionsofhormonesfrom(a)Thyroid,(b)Pancreas, (c)Adrenal,(d)Testisand(e) Ovary MetamorphosisinAmphibians;NeotenyandProgenesis/Pedogenesis Role of hormones in homeostasis: Glucose and Calcium. HormonalcontrolofOsmoregulatoryFunctions EndocrinologyofMammalianreproduction:Regulationofspermatogenesis;Oogenesis; Endocrine control of gestation, parturition, and lactation.	25
4	**Molecularmechanismofhormoneactionsatcellularlevel**:endocrinereceptors, mechanismofactionsofsteroidandpeptidehormones(emphasizingtheroleofsecond messengers)	10
5:	**Specialtopicsin Endocrinology:** EndocrinedisordersinHuman,Endocrinedisruptingchemicals(EDCs) Hormonemimicsandtheirappliedvalues(withspecialreferencetoInsectpestmanagement. Bioassays of hormones using RIA & ELISA.	10

Suggestedreadings:

1. EndocrinePhysiologybyPatriciaE.Molina,5th ed(2018),McGrawHill.
2. VertebrateEndocrinologybyDavidO.Norris,4th ed.(2006),Academicpress.
3. ComparativeVertebrateEndocrinologybyP.J.Bentley,3rd ed.(1998),CambridgeUniversityPress.
4. TheInsects:StructureandFunctionbyR.F.Chapman, 4th ed.(1998),CambridgeUniversityPress.
5. BasicMedicalEndocrinologybyH.M.Goodman,4th ed.(2009),AcademicPress.
6. DevelopmentalBiologybyMichaelJ.F.Barresi,ScottF.Gilbert,12th ed.(2019),Sinauer Associates.

7.InvertebrateendocrinologybyDBTembhare(2012)HimalayaPublishingHouse.

ComparativeEndocrinologyPractical:

1. DissectanddisplayofEndocrineglandsinlaboratorybredRat.
2. Studyofpermanentslidesofalltheendocrineglands(Thyroid,Adrenal,Pancreas,Testis,and Ovary).
3. Tissuefixation,embeddinginparaffin,microtomyandslidepreparationofmammalianTestis.
4. Studyofvaginalsmearofratsforidentificationofdifferentstagesofestrouscycle.
5. Effectofhormonemimiconthemetamorphosis ofLepidopteraninsect.
6. DemonstrationofhormoneassaythroughELISAfromavailableteachingkit.

ExaminationPattern:FullMarks: 20

OnequestionfromItemNo.1---------- 04
OnequestionfromItemNo.3---------- 04
OnequestionfromItemNo.4---------- 04
IdentificationanyfourfromItemNo.2and6---------$1^{1/2}$x4 =06
LaboratoryNotebook---------- 02

Course outcome:

1. Studentsunderstandhowtheendocrinesystemis functioning.
2. Theyknowthestructuresandmolecularmodesofactionofalargevarietyofvertebrateandinvertebrate hormones and understand how metazoan hormones and their functional mechanisms have evolved.
3. Hormonesasmediatorsofgrowth,development,phenotype, behavior,reproduction,andepigeneticeffects are covered and connected to relevant current events.

MINORCOURSE

ZOOL4021: WILDLIFE CONSERVATION

Objectives of the study: To provide a knowhow of the (a) various aspects of wildlife, including theirvalues, depletion, conflicts with human beings and principles of conservation and various ecological attributes, (b) management and legal protection of different natural habitats and threatened species, and (c) different tools and techniques related to wildlife study.

Credits 4(Theory:3,Practical:1)
FullMarks 75(Theory:40+internal15;Practical: 20) **Numberof Lectures:** 60

Sl. No.	Topics/Contents	Classes
1.	IntroductiontowildlifeConservation:DefinitionandimportanceofwildlifeThreatened wildlifeandIUCNstatus─ConceptofExtinct,CriticallyEndangered,Endangered, Vulnerableandnearthreatenedspecieswithexamples;Reddatabook Conceptofconservation:*insitu*(Nationalparks,Sanctuaries,Communityreserve, ConservationReserves)&*ex-situ*methodsofconservation. BiosphereReserves:ConceptofMAB,characteristics,examplesfromIndia.	15
2.	BasicConceptsinWildlifeEcologyBasicConceptsinWildlifeEcology Energyflowsthroughecosystems:linearandY-shapedfoodchains,foodwebsand ecological pyramids. Populationattributes:density,natalityrate,mortalityrate,sexratioandage;survivorship curves.Populationgrowth:exponentialandlogisticgrowth Communitycharacteristics:speciesdiversity(richnessandabundance),keystonespecies, ecotone,andedgeeffect;conceptofniche.	20
3.	Species-specificConservation.Conservationstatus,habit&habitat,threats,andconservation managementofthefollowinganimalsinIndia:Tiger/Oliveridleyturtles/GreatIndian bustard/Himalayanmuskdeer/Greaterone-hornedrhinoceros/GangesRiverdolphin.	10
4.	Man,andWildlife:Causes,consequencesofhuman-wildlifeconflictsandmitigation of conflictwithspecialreferencetoprojectelephantinIndia	5
5.	ManagementPlanningofProtectedAreas:Designandmanagementofnaturereserve;concept ofwildlifecorridor;jointforestmanagement. Ecotourism/WildlifeTourisminforests:PositiveandNegativeimpacts Wildlife(Protection)Act,1972[withamendments],problemsinwildlifeprotection,role of WWF,WCU,CITES, TRAFFIC	10

SuggestedReadings:

1. Bookhout,T.A.(1996).ResearchandManagementTechniquesforWildlifeandHabitats,5th edition. TheWildlifeSociety,AllenPress.
2. Caughley,G.,andSinclair,A.R.E.(1994).WildlifeEcologyandManagement.BlackwellScience.
3. Krebs,C.J.(2001).Ecology.Benjamin Cummings.
4. Molles,Jr.M.C.(2005).Ecology:ConceptsandApplications.3rdEd.McGraw-Hill.
5. Pullin,A.S.(2002).ConservationBiology.CambridgeUniversityPress.
6. Smith,R.L.&Smith,T.M.(2001).EcologyandFieldBiology.Benjamin Cummings.
7. Smith,T.M&Smith,R.L.(2006).ElementsofEcology.6thEd.Pearson Education.

PracticalComponents:

1. Calculationofdensityanddiversityindices(usingShannon-Weinerindex)from natural/hypothetical community by quadrat method.
2. Studyofanimalevidence(pawmarksandhoofmarks,hornsandantlers,scatsandpellets,nests,etc. by photographs) and equipment in the field (GPS, binocular, camera trap, compass, radio tracker).
3. Pugmarkanalysisandcensus method.
4. Visittoanyhabitatofwildlifeimportance(ProtectedAreas,BiosphereReserves,Wetlandsand Ramsar Sites, Zoological and Botanical Gardens) and submission of field report.

ExaminationPattern: **FullMarks20**

OnequestionfromItemno. 1----------(7 X1) = 07
IdentificationfromItemNo.2(anythree)---------- (3X2)= 06
OnequestionfromItemNo.3 ---------- = 02
FieldVisit Report ---------- 03
Lab Notebook ---------- 02

Course outcome:

At the end of the course, students should learn about the importance of wildlife and conservation in and aroundour surroundings aswell as wildhabitatsandtheirrelationtodifferentecological principles, emerging cases of man – animal conflict and impact of ecotourism on wild animals, with a general knowledge on the different legal structures associated with wildlife fauna.