To,

Registrar

V.B.S. Purvanchal University, Jaunpur (U.P.)

Subject: Syllabus of UG and PG, & Pre Ph.D in Zoology developed as per the provision under National Education Policy 2020 and duly modified by the Board of Studies

Dear Sir,

In compliance with direction of Honorable Vice-Chancellor's V.B.S. Purvanchal University, Jaunpur on dated 05-06-2024 (through Deputy Registrar, Academic) the Convener BOS has modified the syllabus of both UG and PG & Pre Ph.D in Zoology as per the syllabus development guidelines under the NEP 2020.The course code & Research Project Cum Dissertation slight modification in credit distribution in PG course according to Members of the Supervisory committee Prof.Amit Kumar Srivastav ,T.D. College, Jaunpur nominated by HON. Vice Chancellor dated 29 May 2024

I hereby submit the modified syllabus for further action.

With regards

04.07.2024

Yours faithfully

04.07.2024

Dr. (Dev Brat Mishra)
Convener BOS
Department of Zoology
T.D. P.G. College, Jaunpur (UP)

Dr. Dev Brat Mishra
Asstt. Professor
P.G. Deptt. of Zoology
T.D. College, Jaunpur

Minutes of Board of Studies Zoology

A BOS meeting was held today 04.07.2024 in the Academic Hall, V.B.S. Purvanchal University, Jaunpur (UP).

1. Dr. Dev Brat Mishra
   Convener BOS Zoology

Dr. Dev Brat Mishra
Asstt. Professor
P.G. Deptt. of Zoology
T.D. College, Jaunpur

2. Prof. S.P. Singh
   External Expert. AND Univ. of Agri. and Tech., Faizabad.

PROF. SHRIPRAKSH SINGH
Retd. Prof. Dept. of Fisheries
A.N.D. University of Agriculture
& Technology, Faizabad

3. Prof. S.Z. Ali
   External Expert. Shibli National P.G. College, Azamgarh.
4. Dr. Shailendra Kumar Singh, Member (PG), T. D. P.G. College, Jaunpur
5. Dr. Ashutosh Mishra, Member (PG), T. D. P.G. College, Jaunpur
6. Smt. Asha Rani, Member (PG), T. D. P.G. College, Jaunpur
7. Prof. Moti Chand Yadav, Member (UG), Rajkiya Mahila Mahavidyalaya, Shahganj, Jaunpur
8. Dr. Diwakar Mishra, Member (UG), Rajkiya Mahila Snatkottar Mahavidyalaya, Ghazipur
9. Dr. Manish Kumar Sonekar, Member (UG), Rajkiya Mahila Snatkottar Mahavidyalaya, Ghazipur

In the aforesaid meeting, consideration was given to approve the modification in every semester of UG and PG Zoology syllabus. The modification made in the syllabus in accordance with the National Education Policy 2020 was unanimously approved.

VeerBahadurSinghPurvanchal University, Jaunpur

SyllabusofZoologyforTwoYearsP.G. Programme

TobeimplementedfromtheAcademicyear 2024-25

SubmittedBy:

Convener/MemberofBoardofStudies

Name	Designation	Affiliation
Board of Studies		
Dr. Dev Brat Mishra	Convener	T. D. P.G. College, Jaunpur (UP)
Dr. Shailendra Kumar Singh	Member (PG)	T. D. P.G. College, Jaunpur (UP)
Dr. Ashutosh Mishra	Member (PG)	T. D. P.G. College, Jaunpur (UP)
Smt. Asha Rani	Member (PG)	T. D. P.G. College, Jaunpur (UP)
Prof. Moti Chand Yadav	Member (UG)	RajkiyaMahilaMahavidyalaya, Shahganj, Jaunpur (UP)
Dr. Diwakar Mishra	Member (UG)	RajkiyaMahilaSnatkottarMahavidyalaya, Ghazipur (UP)
Dr. Manish Kumar Sonekar	Member (UG)	RajkiyaMahilaSnatkottarMahavidyalaya, Ghazipur (UP)

PREAMBLE

Introduction

The existingsyllabus is re-constructed onthe directionofHon. V.C. V.B.S.P.U. Jaunpur, Prof. Vandana Singh, dated 05 June 2024. The reconstructed syllabusfollowingintheintentandobjectivesofNationaleducationpolicy2020 and National Credit Framework (NCrF). The syllabus has total 100 credits includingResearch Projects Cum Dissertation & Minor Elective Other than Faculty.52creditsinM.Sc.Previous(24creditsSemesterVII and28 creditsinSemesterVIII)and48creditsM.Sc.Final(20creditsinSemester IX and 28 credits in Semester X).The students will submit Research Projects Cum Dissertation in end of MSc.Pre. and MSc.Final year.

InM.Sc.previous,SemesterVIIonlyoneminerelectivepaperwillopt other than faculty. This miner elective paper is 4 credits.

AimsandObjectives:

The primary aim of present syllabus is to equip with learners with recent advances in field of Zoology and related branches. It also aims to encourage and empower the learners to understand the challenge of society and country that falls into realms of Zoology. The contents incorporated in present syllabus are enoughto include withresearchaptitude andskills thatare required to carry out research project/dissertation in the field of Zoology and interdisciplinary related branches also. The research project will full fill the gap between academia and industry. Besides above the present syllabus is enough to ignite the inquisitive minds of learners about the learning.

SemesterCoursesofM.Sc.ZoologyBased onCBCS

The course of M.Sc. Zoology will be spread in two years previous and final. Each of whichwill havetwosemesterexaminationsandthereforewillbefoursemester examinations.

MSc. Previous Year Semester-VII:20 +4 =24Credits		
CourseCode	**CourseTitle**	**Credits**
B050701T	NonChordata	4
B050702T	Tool&TechniquesinBiologicalScience	4
B050 703T	ComparativeAnimalPhysiology	4
B050 704T	BiologicalChemistry	4
B050705P	**Practical**	4
	Minor Elective Other than Faculty	4

Semester-VIII:28Credits		
CourseCode	**CourseTitle**	**Credits**
B050 801T	Chordata	4
B050 802T	Systematics,BiodiversityandEvolution	4
B050 803T	GeneticsandCytogenetic	4
B050 804T	DevelopmentalBiology	4
B050 805P	**Practical**	4
B050806R	**ResearchProject Cum Dissertation**	8

Semester-IX:20Credits		
CourseCode	**CourseTitle**	**Credits**
B050 901T	BiostatisticsandComputationalBiology	4 **CompulsoryPaper**
B050 902T	AnimalBehavior	4 **CompulsoryPaper**
	Optional for one Paper to be choosen	
B050 903T	PrinciplesofEcologyTheory	4 ElectivePaper
B050 904T	BiologyofParasitism	4 ElectivePaper
B050 905T	AppliedZoology	4 ElectivePaper
	Optional for one Paper to be choosen	
B050 906T	Epigenetic&ChromatinBiologyTheory	4 ElectivePaper
B050 907T	Structure&FunctionofGenes	4 ElectivePaper
B050 908T	MolecularEndocrinology	4 ElectivePaper
B050909P	**Practical**	4

Semester-X:28 Credits **Choose Only one Stream** **Stream-1 Entomology**		
CourseCode	**CourseTitle**	**Credits**
B051001T	InsectMorphologyPhysiology&Development	4
B051002T	Ecology,Evolution&Taxonomy	4
B051003T	EconomicEntomology	4
B051004T	Insect Toxicology	4
B051005P	**Practical**	4
B051006R	**ResearchProject CumDissertation**	8

Stream-2Fish Biology		
CourseCode	**CourseTitle**	**Credits**
B05 1007T	Morphology,Physiology&Developmentof Fishes	4
B051008T	Taxonomy&EcologyofPisces(Theory)	4
B051009T	AppliedIchthyology	4
B051010T	FishandFisheries	4
B051011P	**Practical**	4
B051012R	**ResearchProject Cum Dissertation**	8

Stream- 3CellBiology		
CourseCode	**CourseTitle**	**Credits**
B051013T	CytologicalTechniques	4
B051014T	CellularOrganization&Fundamental Processes:CellStructure	4
B051015T	CellRegulation-CellCommunication& Differentiation	4
B051016T	TrendsinCellBiology	4
B051017P	Practical	4
B051018R	ResearchProject Cum Dissertation	8

Stream- 4EnvironmentalBiologyandToxicology		
CourseCode	**CourseTitle**	**Credits**
B051019T	WildLife Biology	4
B051020T	EnvironmentalChemistry	4
B051021T	EnvironmentalMonitoring	4
B051022T	EnvironmentalToxicology	4
B051023P	**Practical**	4
B051024R	**ResearchProject Cum Dissertation**	8

Total100Credits

ProgrammeSpecificOutcomesofZoology

1. Developingdeeper understandingofkeyconceptsofbiologyat biochemical, molecular andcellular level, physiologyandreproductionat organismlevel, andecologicalimpact on animal Behavior.
2. Developing the concept of animal adaptation by exploring the diversity of functional characteristics of various kinds of organisms which is closely related to evolutionary processes and environmental changes.
3. Understanding of Mendel's principle, its extension and chromosomal basis; chromosomalanomaliesand associated diseases;developing conceptsofregulationof gene activity in prokaryotes and eukaryotes of transcriptional and post transcriptional level.
4. Development ofanunderstanding ofanimalscience for itsapplication inentomology, apiculture, aquaculture, agriculture and modern medicine.
5. Developaninformationabout andbasicconcept ofdevelopmentalbiologyelucidation of early embryonic development and organogenesis of invertebrates and vertebrates, explanation of embryonic stem cells and their application.
6. To understand the basic components of computers, software (operating system) and application of software used in biological and statistical studies.
7. Developmentoftheoreticalandpracticalknowledgeinhandlingtheanimalsandusing them as model organism.
8. By the theoretical project work is aimed to in calculate ability to develop a research question, organize relevant available literature and development of technical writing skill.
9. Tounderstandtheimpactofchemicalsonbiodiversityofmicrobes,animalsandplants; Bio-indicators and bio-markers of environmental health. Biodegradation and bioremediationofchemicals;competitionandexistence;intraspecificandinterspecific interactions.
10. Maintenanceofhighstandardsoflearninginanimalsciences.

M.Sc. (Zoology)

TheM.Sc. Zoologyexaminationwillconsist ofIVsemesters(M.Sc. Pre. VII andVIII semesters and (M.Sc. FinalIX and X Semester). Ineachsemester examinations, there willbe four papers and one practical. There will be oneResearch Project Cum Dissertation in VIII and X semester. Each theory paper willbeofthreehours durationand4 credit,andsixhoursdurationpracticalwith4credits and Research Projects cum Dissertation with 8 credits in VIII & X semester (Total 96 credits) (maximum marks75) except wherestatedotherwise. Therewill be 25% internalevaluationineachtheory paper and practical based on:

1. Attendance 10Marks
2. ClassTest/Assignment 05Marks
3. Seminar 10Marks

FormatoftheQuestion Paper:MM-75

Section–A
(Veryshortanswertypeofquestions)

Attempt all parts of this question Give answer of each part in about 50 words. 10x2=20

1.
(i)
(ii)
(iii)
(iv)
(v)
(vi)
(vii)
(viii)
(ix)
(x)

Section–B
(Short answertypeofquestions)

Attempt anyfiveofthisquestionGiveanswer ofeachquestioninabout 200words.5x7=35 2.
3.
4.
5.
6.
7.
8.
9.

Section–C
(Long answertype of questions)

Attempt anytwoofthisquestionGiveanswer ofeachquestioninabout 500words.2x10=20 10.
11.
12.
13.

M.Sc. ZOOLOGY

TWO-YEARFULL-TIMEPROGRAMME

AFFILIATION

Theproposedprogrammeshallbegovernedbytheordinance of V.B.S.P.U.Jaunpur.

PROGRAMMESTRUCTURE

TheM.Sc.Programme isdivided intotwopartsasunder.Eachpart willconsist oftwo semesters as given below

Semester-odd,Semester-Even

Part-IFirst YearSemester-VIISemester-VIII

Part-IISecondYearSemester-IXSemester-X

ResearchProject Cum Dissertation:

The research project cum Dissertation is in 8th& 10th semester. Students will submit the final report (Research Project Cum Dissertation) of the research project carried out in semestersat theend ofyear, whichwill beassessed jointlybytheSupervisor and theExternal Examiner nominatedbytheBOS,at theendofthe yearoutof100marks. Thustheirwill be16creditsoftheexam(8 Credits in SemesterVIIIand 8 Credits in semesterX).Thestudent haveto submit aResearch Project Cumdissertation. Research Project Cum Dissertation inspiralbinding formdullycertified bytheSupervisor.If thestudentspublishesanyofhis \ herresearchpapers intheUGCCARElisted journal and published during program, then he \she can be given additional marks up to 25 in out of 100 marks.

ThisResearchProject Cum DissertationcanalsobeInterdisciplinary/Multidisciplinary. This research project cum dissertation can also be in the form of field visit: Students should undertake field work, Industrial Training/ Internship/Survey Work/Topic assigned by Supervisor.

Thescheduleofpapersprescribedforvarioussemestersshallbeasfollows.

M.Sc. Previous
SemesterVII

1. B050701TNon-Chordata
2. B050702TTooland TechniquesinBiologicalScience
3. B050703TComparativeAnimalPhysiology
4. B050704TBiologicalChemistry
5. B050705P Practical

Semester-VIII

1. B050801TChordates-Originand Evolution
2. B050802TSystematics, BiodiversityandEvolution
3. B050803TGeneticsandCytogenetic
4. B050804T DevelopmentalBiology
5. B050805P Practical
6. B050806RResearchProject Cum Dissertation

M.Sc.Final YearSemesterIX

- **TwopapersB050 901TandB050902T(Interdisciplinary) arecompulsory.**
- **Twooptionalpapersaretobeoptbyeachstudent**
- **OnepaperfromB050903T, B050904T,B050905T**
- **OnepaperfromB050906T, B050907T,B050908T.**

1. B050901TBiostatisticsandComputationalBiology
2. B050902TAnimalBehavior
3. B050 903TPrinciplesofEcology Theory OpenElective
4. B050904TBiologyofParasitismElective Course
5. B050905TApplied Zoology
6. B050906TEpigeneticandChromatinBiology
7. B050907TStructureandFunctionofGenesElectiveCourse
8. B050908TMolecular Endocrinology
9. B050909P Practical

Semester-X

Studentwillopt 0nlyOneStream.

Stream 1: Entomology

1. B051001TInsectMorphology,Physiology&Development
2. B051002TEcology,Evolution&Taxonomy
3. B051003TEconomic Entomology
4. B05 1004TInsect Toxicology
5. B051005PPractical
6. B051006RResearchProject Cum Dissertation

Stream2:FishBiology

1. B051007TMorphology, Physiology&DevelopmentofFishes
2. B051008TTaxonomy&EcologyofPisces
3. B051009TApplied Ichthyology
4. B051010TFishandFisheries
5. B051011PPractical
6. B051012RResearchProject Cum Dissertation

Stream3: CellBiology

1. B051013TCytologicalTechniques
2. B051014T Cellularorganization&FundamentalProcesses
3. B051015TCellRegulation-Cellcommunication
4. B051016TTrendsinCellBiology
5. B051017PPractical
6. B05 1018RResearchProject Cum Dissertation

Stream4: **EnvironmentalBiology &Toxicology**

1. B051019TWildLifeBiology
2. B05 1020TEnvironmentalChemistry
3. B05 1021TEnvironmentalMonitoring
4. B05 1022TEnvironmentalToxicology
5. B051023PPractical
6. B051024RResearchProject Cum Dissertation

SemesterVII(M.Sc.Previous)

CourseCode	CourseTitle	Credits
B050701T	NonChordata	4

Unit-1:OrganizationofCoelom and itstypes,ProtostomiaandDeuterostomia,Nutrition and reproduction in Protozoa: Origin of Metazoa: Organization and affinities of Porifera; Polymorphism and Coral reefs.

Unit-2: Patterns of life cycle and different larval forms of helminthes parasities:metameric segmentation in Annelida; Adaptive radiation in Annelida.

Unit-3: Organization and affinities of Onychophora; Larval forms in Crustacea; Torsion in gastropods, its effect and significance.

Unit-4:LarvalformsinEchinodermata;AffinitiesofEchinodermataandHemichordata;Brief outlines of the structure and affinities of minor phyla with special reference to Ctenophore, Rotifera.

Suggested Literature:

1. A life of invertebrates by W.D. Russel-Hunter, MacMillan Publishing Co. inc.,NewYork.
2. AdvancesinInvertebrates'ReproductionbyK.G.AdiyodiandR.G.Adiyodi,Peralam, Kerala.
3. BiologyoftheinvertebratesbyJanPechenik,WilliamC.BrownPublishers,Dubuque, lowa.
4. InvertebrateszoologybyA.Kaestner,InterscicencePublishers.
5. InvertebrateszoologybyAlfred Kaestner, H.W.Levi&L.R. Levi, JohnWiley&Sons Inc.
6. Invertebrates(ProtozoatoEchinodermata)byAshokVerma,NarosaPublishinghouse, New Delhi.
7. InvertebratesLearningbyW.C. CorningandJ.A.Dayal.
8. Invertebrates Structure and Function byE.J.W. Barrington, The Camolet Press, Great Britain.
9. InvertebratesZoologybyP.A.Meglitsch&F.R.Schram;OxfordUniversityPress.
10. InvertebratesZoologybyR.D.Barnes, VEdition. HoltSaundersInternationaledition.
11. PrinciplesofComparativeAnatomyofInvertebratesbyW.N.Bekiemishev,University of Chicago Press.

12. PrinciplesofComparativeAnatomyofInvertebratesbyDrJ.M.MacLennon;Z. Kabata, Oliver and Boyd Edinburgh.
13. TextbookofInvertebrateZoologybyG.S.Sandher;H.Bhaskar,Campusbook International.
14. TheInvertebratesbyL.H.Hymen,McGraw-HillBookCompany.
15. The Invertebrates: A New Synthesis by R.S.K Barnes, P. Calow, P.J.W. Olive, D.W. Golding, and Spicer,J.I, III Edition, Blackwell Science.
16. InvertebrateZoologybyJordonand Verma.

Course Outcomes-After the course the students will be able to understand the basics of this course. Larvalforms inEchinodermata;AffinitiesofEchinodermataandHemichordata;Brief outlines of the structure and affinities of minor phyla. Get benefit of this course in various competitive examinations.

CourseCode	CourseTitle	Credits
B050 702T	Tool&TechniquesinBiologicalScience	4

UNIT-1: PrinciplesandusesofanalyticalInstruments;FlamePhotometry,Spectrophotometer.

UNIT-2: Microbial techniques: Media preparation, sterilization, Inoculation, growth monitoring, use of fermentation and Microbial Assays.

UNIT-3: Separation and identification of biomolecules by Paper and thin layer Chromatography.

UNIT-4: SeparationofBiomoleculebyelectrophoresis: Agarose GELand SDS PAGE.

Suggested Literature:

1. EssentialLaboratoryTechniquesbyS.R.Gallagher,E.A.Wiley.
2. AnintroductiontoPracticalBiochemistrybyD.T. Plummer.
3. TechniquesinLiveSciences byD.B. Tembhare.
4. PrinciplesandTechniquesof Biochemistry andMolecularBiology,6thEditionby Keith Wilson and John Walker, Cambridge University Press.
5. Light Microscopy in Biology: A practical Approach, 2nd Edition by Alan J. Lacey,Oxford University Press.
6. ElectronMicroscopy:PrinciplesandTechniquesofBiologistbyJohnJ.Bozzola, Lonnie D. Russell, Jones &Bartiett Publ.
7. Toolsand TechniquesofBiotechnologybyMousumiDebnath,PointerPublishers.
8. ToolsandtechniquesinBiologicalSciencebyDr.Dev,Vatsand Vijeta, Xoffencer Pub, Gwalior.

Courseoutcomes-Togettheideasofthemediapreparationsandsterilization,Inoculationand growthmonitoring,useoffermentation,microbialAssaysand separationand identificationof bimolecules by Chromatography: Paper and thin layer Chromatography and SDS PAGE. This course is useful in various competitive exams like CSIR-NET etc.

CourseCode	CourseTitle	Credits
B050 703T	ComparativeAnimalPhysiology	4

UNIT-1: Modesofnutrition,typesofdigestionandabsorptionoffood;Neurons, Mechanism ofconduction and transmission of nerve impulses; types of synapse and synaptic transmission.

UNIT-2: Osmotic conformityand regulation: Stenohaline, Euryhaline animals, Hypo, Hyper environment and terrestrial life; General characteristics of stimulus and response reaction: Chemoreceptors, photoreceptors, phono receptors, mechanoreceptors, equilibrium reception;

UNIT-3:Thermoregulationinanimals:Temperaturerelationshipinpoiklotherms,endotherms, thermal acclimatization; Circulation: Types of circulation, physiological categories of heart, conduction system, cardiac cycle, electrocardiogram; Types of muscles, its composition, and muscle contraction.

UNIT-4: Pattern of nitrogen excretion in different animals: Types of excretory products, Biosynthesis of urea. Comparative study of endocrines organs and their hormonal secretion in non chordates and chordates.

Suggested Literature:

1. AnimalPhysiologybyM.Brown,AppleAcademic Press.
2. AnimalPhysiologybyR.C.Sobte,NarosaPublishing House.
3. AnimalPhysiologybyF.R.Haninsworth
4. ComparativeAnimalPhysiologybyC.L.Prosser,W.B. SaundersCompany.
5. ComparativePhysiologyofAnimalbyR.W.Hill;P.D.Sturke.
6. EnvironmentalPhysiologyofAnimals byP. Willmer;G. Stone, BlackwellScience Ltd.
7. GeneralandComparativePhysiology byW.S.Hoar,PrenticeHallofIndiaPvt.Ltd.
8. Marshall'sPhysiologyofReproductionbyG.E.Lamming,Churchill Liungstone.
9. NeuralandIntegrativeAnimalPhysiologybyC.L.Prosser,WileyIndiaPvt.Ltd.
10. PrinciplesofAnimalPhysiology byJ.A.Wilson.

Course outcomes- To study the osmotic conformity and role of membranes in ionic regulation: Stenohaline,Euryhaline animals, Hypo and Hyper environment and terrestrial lifeandpatternofexcretionindifferent animals. Afterthecoursethestudentsget abletoget benefit of this course in various national and international competitive examinations.

CourseCode	CourseTitle	Credits
B050 704T	BiologicalChemistry	4

UnitI: Elementarythermodynamicsystem;Acidbasebufforamphoteric, Zwitterions.

Unit II: Kinetics ofenzyme reaction; orderofenzyme reaction, rate equations, two substrate reactions;EnzymeInhibition,Competitiveandnoncompetitiveinhibitorsinbiologicalsystem, Applications of enzyme inhibition techniques in pest control, Allosteric Enzyme.

UnitIII: Structureandfunctionofvitaminsandcoenzymes;metabolic pathway.

UnitIV: Biosynthesisofaminoacids, Nucleotides,glycogenandurea.

Suggested Literature

1. BiochemistrybyJ.MbergJ.L.Tymoczko,W.H.FreedmanPlagraueMacmillon
2. BiochemistrybyZubey;Styrer
3. SelfphysiologyandBiochemistrybyW.D.McElory,PrenticeHallofINDIAPvt.LTD
4. Comparative biochemistrybyK.AMunday,PergmonPressOxfordLondon
5. EssentialsofBiochemistrybySrivastva;Lal;N.Singh,RekhaPublications
6. EssentialsofBiologicalchemistrybyFairleyKilgour, Affiliatedeast-westPress
7. Harper'sBiochemistrybyR.K. Murray, D.KGranner, Alongmedicalbook.
8. IntroductiontobiochemistrybyJ.Awapra,PrinticeHallofINDIAPvt.LTD
9. Lehninger Principles of biochemistry D.L Nelson, M.M .Cox W.H. Freedman Company

Course outcomes- To study the Kinetics of enzyme of reaction and kinetic of enzyme catalyzed reactions, order of enzyme reaction, rate equations, two substrate reactions; Temperature Coefficient, Activation Energy; Enzyme Inhibition, Competitive and non competitiveinhibitors;Applicationsofenzymeinhibitiontechniquesinpestcontrol,Allosteric Enzyme. This course is useful in various competitive exams.

CourseCode	CourseTitle	Credits
B050 705P	Practical	4

Max.Marks:75 **Time: 6hours**

DistributionofMarks:

Majordissection	10
Minordissection	05
Technique/Instrumentations	10
BiochemistryExercise	10
PhysiologyExercise	05
Spotting(10 spots)	20
Viva voce	05
Seminar/ Record file/ Model	10
TotalMark:	**75**

CourseB050701P: GeneralSurveyandclassificationofthenon- chordatesphyla(Protozoa to Echinodermata) with the help of museum specimens and slides.

Protozoa: Vital staining and staining preparation of *Paramecium;*Study of cyclosis and trichocysts in *Paramecium;* Permanent preparation of*Paramecium, Vorticella,* Study of prepared slides: *Balantidium, Opalina.Parameciu*mconjugation / binary fission,*Entamoebahistolytica ,Giardia, Trypanosoma, Leishmania.*

Porifera: Permanentpreparationofgemmules,spongingfibresanddifferentkindsofspicules, Studyof museum specimens specimens/models; *Lecuosolania ,Sycon , Grantia, Euplectella, Hyalonema,Chondrilla, Chliona, Spongilla, Spongia, Hippospongia.*

CnidariaandCtenophora: Studyofnematocycstsof*Hydra,*Permanentpreparationof*Hydra; Obelia and* other hydrozoan colonies and *Obelia*Medusa ; Study of museum specimens/ models : *Tubularia , Sertularia, Campanularia, Millepora, Stylaster, Physalia, Porpita, Valella,Aurelia,Tubipora,Alcyonium,Gorgonia,Pennatula,Metridium,Fungia,Madrepora.*

Helminths: Permanent preparation of selected soil and plant nematodes, cestode and trematode parasites of cattle and poultry and different larval stages of liver fluke, Study of museum specimens/ whole mounts : *Fasciola, Taenia, Echinococcus, Trichuris, Ascaris, Ancylostoma, Wuchereria;study of prepared slides :Scolex of tape worm ,mature and gravid proglottid of tape worm;Study of cysticercus larva, larval stage of Fasciola* .

Annelida: Studyofmuseumspecimens*/models:Aphrodite,Glycera,Chaetopterus,Arenicola ,Sabella, Serpula, Tubifex, :Study of prepared slides:T.S*. of body of leech passing through various places.

Arthropoda: Study of museum specimen: *Limulus, Palamnaeus, Apus, Argulus,Balanus, Sacculina, Mysis, Squilla,* Prawn, Lobster, true crab, hermit crab, *Julus, Scolopendra,, Lepisma,* stick insect, grass hopper, *termites, Pediculus*, butterfly, wasp, *Xenopsylla,* life history of honey bee, lac insect andsilk moth; Study of prepared slides: Mouth parts of mosquitoes, house fly, honey bee, butterfly, *Cimex, Daphnia, Cypris, Cyclops, Pediculus.* **Mollusca**: Study of museum specimen/models :*Chiton, Dentaliun, Pila, Aplysia, Doris, Lymnaea, Mytilus, Patella, Limax,* pearl oyster, *Teredo, Nautilus, Loligo, Sepia, Octopus.* Studyofprepared slide: Radula, T.S ofshellof *Unio*, T.Sofgill lamina *of Unio,* T.S ofbody of *Unio*passing through middle region; Larvae of mollusca.

Echinodermata: Study of museums specimen/ models: *Asterias, Ophio*thrix, *Echinus, Thyone, Holothuria, Antedon*; Study of prepared slides: Larvae of echinoderms: Aristotle's lantern.

Hemichordata: Studyofmuseumspecimens:*Balanoglossus,Tornaria*larva,

Minor phyla: Representative specimens of Onychophora (*Peripatus*), Sipunculida *(Sipunculus*),Echiurida(*Bonelia)*

Study/DissectionofPrawn, Sepia, Loligo, Pila and Earthworm(Nervous system, Masticating organ)

Course B050 702 P: Basic principles and functioning of Spectrophotometry, Paper and thin layer chromatography.

Course B050 703 P: Comparative study of total count of erythrocyte and leukocytes of fish and mammals. estimationof heamoglobincontent ofthe blood,Determinationof haematocrit in fish, bird and rat. Determination of respiratoryrate of rat in relations to size and sex.

CourseB050704P: Quantitativeestimationoftotalfreeaminoacidbypaperchromatography in tissues of cockroach. paration of these amino acids; Kinetic assay of salivary amylase and study of effects of time, temperature and pH.

SEMESTER-VIII

CourseCode	CourseTitle	Credits
B050 801T	Chordates-originandEvolution	4

Unit–1: StudythefamousBiologistandtheircontribution:CharlesDarvin,C.R.Narayan Rao,R.Mishra, Dr.Lalji Singh and Salim Ali.

Originofchordates:InterrelationshipofOstractodermsand placodermi.

Unit–2: Generalorganizationofdipnoiandcrossopterygii;originofpairedfinsinteleosts.

Unit–3: Originand evolutionofreptiles,birdsandmammals.

Unit–4: Comparative study of heart in different classes of vertebrates, e.g., fish, amphibians reptiles, birdsand mammals, comparativestudyofurinogenitalsystemindifferent group, e.g., amphibians, reptiles, birds and mammals.

Suggested Literature:

1. ComparativeAnatomyofvertebratesbyHerbert W.Rand ,Harverd UniversityPress
2. ComparativeAnatomyofVertebratesbyM.D.L.Srivastava
3. Evolutionofthevertebrates,E.H.Colbert.
4. IntroductiontovertebratesbyT.C.Majupuria,s. NaginCompany
5. TextbookofComparativeAnatomyofVertebratebySauravSingh,CentrumPress
6. TextbookofZoology:VertebratesbyT.J.Parker&W.Haswell,modifiedbyA.J.Marshal.
7. Thelifeofvertebrates: J.Z.Young.
8. TheoriginofvertebratesbyN.J.Berrill,Oxfordat The clarendonPress
9. ThevertebratesBody,A.S.Romer.
10. VertebratelifebyMcFaland;Pough;code;Heiser,MacmillianandCollierPublisher
11. VertebratePalenotology.A.S.Romer.

Course outcomes- After the course the students will be able to understand the basics of this course. To understand the applications of this course in different field of Science and Technology. Think and develop new ideas in this subject, benefit of this course in various national and international competitive examinations

CourseCode	CourseTitle	Credits
B050 802T	Systematics,BiodiversityandEvolution	4

Unit-1: Definition and basics concept of biosystematics & Taxonomy: Historical resume of systematics and its importance and application in biology; trends in biosystematics. Concepts of different conventional and newer aspects – chemotaxonomy, cytotaxonomy, molecular taxonomy.

Unit-2: Dimensionsofspeciationandtaxonomiccharacters:typeofspeciesconcepts–species category, different species concepts, subspecies and intraspecific categories, theories of biological classification hierarchy of categories taxonomic and non-taxonomic character.

Unit-3: Internationalcodeofzoologicalnomenclature(ICZN) –its operative principles, interpretation and application of important rules, zoological nomenclature, formation of scientific names of various taxa.

Unit-4: Darwinian and Pre-Darwinian concepts of evolution: Birth of concept of organic evolution; Lamarckian theories, Darwin's theory of natural selection: merits and demerits, Neo-Darwinianconceptsandsourcesofvariation:Post-Darwinianconceptsofevolution:Neo-Lamarckism,Neo-Darwinism'ssynthetictheoryofevolution.Isolationandspeciation;Genes inpopulation;HardyWeinbergLawandSewellwrighteffect,microevolution,macroevolution and mega evolution, Evolution in action.

Suggested Literature:

1. BiologySystematics byA.Mielli,ChapmanandHall
2. EvolutionbyHallandHallgrimsson,johnsnand Bartlettpublisher
3. EvolutionbyMarkRidley.Blackwellscience
4. Evolution by Bartonn. Hbriggs, D.E.G., Eisen J.A., Goldstein, A.E. Ptel, N.H., cold spring Harbor Laboratory press New York, U.S.A.
5. EvolutionbyFutuyma,D.J.,Sinauerassociatesinc., sunderland, USA
6. Evolution byHall, B.K. and Hallgrimsson, B.Jonesand Bartlett publisher, Sudbury, USA
7. Evolutionanalysis byFreemanandHerron, Person/prenticehall

8. MethodsandprincipleofsystematicZoologybyE.Mayer,E.G.Linsley,R.L. Usinger, McGraw – Hill Book Company , ICN
9. NumericalTaxonomybyjosephfelsentein, Springer –Verlag BerlinHeidelbergNew York
10. Procedure in Taxonomy by E.T. Schenk and J.H.Mc. Masters ,Standford University Press

1.Standford,California

11. Taxonomy; Atextand referencebookbyR E,blackwelder ,JohnWileyand sons,INC
12. Whatevolution isbyMayr E.BasicBooks,newYork,USA

Course outcomes- The study of the DNA fingerprinting & Molecular markers for detection evaluationofpolymorphism,RFLP,RAPDandnumericaltaxonomy,forusefultostudentforresearchmethodologyand furtherstudyofresearchworkindifferenttopics.Thiscourseis useful in various competitive exams like CSIR-NET etc.

CourseCode	CourseTitle	Credits
B050 803T	GeneticsandCytogenetics	4

Unit-1: Mendel'sLawandtheirchromosomalbasis;extensionofMendel'sprinciples;Allelic variation and gene function incomplete dominances and co-dominances, gene mutation for allelism; gene action at genotype and phenotype.

Unit-2: Cytoplasmic inheritance; environment and heredity: lethal genes; sex – linked inheritance; chromosomal Mapping

Unit-3: Sex chromosome; Sex determination; multiplealleles; numerical and structural chromosome aberrations and their significance; DNA replication.

Unit-4: Microbialgenetics: Bacterialtransformation, transduction, conjugation, Bacterial chromosome,Bacteriophages;Molecularcytogeneticstechniques(FISH,GISH,DNAFingerprinting , Flow cytometry and chromosome painting)

Suggested literature:

1. Development geneticsofhigherorganismsbyGeorgeM.Malacinski,Maxmillan
2. EmbryologybyM.P.Arora,Himalayapublishinghouse
3. FundamantalofhumangeneticsbySanjaymadsal,newcentralbookagency,Landon
4. FundamentsofgeneticsbyG.S.Migalani,Norsapublishinghouse
5. Genetics byP.Kgupta,Rastogipublication
6. GeneticsbyE.Conrad,appleacademicspress
7. GreneticsbyUrsilagoodenough,Hotl-Saumdersinternationaledition

8. Genetics by J..Russwell , Benjamin- cummings publishing company , San Francisco
9. Moderngeneticsanalysis:intergratinggenesandgenome,byGriffithsJ.F.,Gelbart ,M.,
10. Lewontin,C,and Miller,W.HFreemanand company,NewYork,USA
11. MoleculargeneticsbyGuthers.StentRichardcolendar.cbspublicationanddistributors
10. PrinciplesofgeneticsbySnustad andSimmons(4thED.2005),JohnWilley&sons.USA
11. Cellbiologyand GeneticsDr.Dev Brat Mishra, Ayushman Pub. New Delhi

Course outcomes- To study the students get ideas of this course including sex chromosome, sex determination, multiple alleles, Numerical and structure chromosome aberrations and their significance, DNA replication, Transposable elements in prokaryotes and eukaryotes ; Role of transposable elements in genetic regulation Microbial genetics Imprinting of genes , chromosomesand gene, genetherapyforhelp intotheresearchwork.Students getbenefit to this course in various competitive examinations.

CourseCode	CourseTitle	Credits
B050 804T	DevelopmentalBiology	4

Unit-1: Basic concepts of developmental biology – cellular differentiation, signalling, patterning; Determination of polarity and symmetry.

Unit-II: Early embryonic development of vertebrates and invertebrates; Gametogenesis, structureofthegametes–thespermandeggs,itstypes;functionofvitellogenesis,yolkandegg membranes;Hormonalcontrolofovulation;fertilization,mechanismandtypes,capacitation, acrosome formation, fertilizinandantifertilizinreactions, amphimixis, patternsofcleavages in different types of animals eggs. Role of Yolk in egg organization planes of cleavage..

Unit-III: Fate maps and cell lineages; gastrulation; cleavages and formation of blastula, gastrulation, neural tube formation, fate of germinal layers, ontogenesis.

Unit-IV: Introduction and organizer concept; stems cell types its biomedical application, transplantation;ageingandcellulardeath;transgenicanimalmethodsofformation,production and biomedical application of transgenic animals.

Suggested Literature:

1. AsurveryofembryologybyF.G.Gilchirst,McGraw–HillBokkcompany
2. AninteroductiontoembryologybyB.L.Balensky,CBScollege publishing

3. AnintroductiontoembryologybyB.L.Balinsky;Dr.Biol.Sci,Sunderscollege publishing.
4. Analysisofbiologydevelopmentbykathoff,McGraw –hillscience,NewDelhi,India.
5. Atlas ofdevelopmentembryologybyEmil.S.Szebenyi,FaireighDickinsonUniversity press
6. DevelopmentalbiologybyN.J.Berrill,TataMcGraw– Hillpublication
7. DevelopmentalbiologybyScottF.Gillbert,SiauerAssociatedINCpublication
8. DevelopmentalbiologybyGillbert,SinauerAssociatesInc, Massachusetts,USA
9. Experiment embryologybyRobertRogh,burgesspublishing company
10. Foundation of embryology by Bradley M.Bopdwmer ,HoltRinerhartand Winston , INC
11. ModernembryologybyCharlesw.Bopdwner, holtRinehartandWinston,INC
12. PrincipleofdevelopmentbiologybyWolpert,Beddington,Brockes,Jessell, Lawrence,Meyerowitz.(3rdED., 2006),OxfordUniversitypress.
13. Regenerationinvertebrate byC.SThornton,theuniversityofChicagopress.

Course outcomes-After studying this course the student will be able to understand the basic of this course and think and develop new ideas in this course to know introduction and organizer concept; stems cells types its biomedical application, EMB transformation, teratogenesis, neoplasia ,allometric growth ; nucleocytoplasmic interaction.

CourseCode	CourseTitle	Credits
B050 805P	Practical	4

Max.Marks:75 **Time:6 Hour**

Distributionofmarks:

Exercise

MajorDissection	10
MinorDissection	05
Cytologicalexercise	05
GeneticBasedexercise	10
Embryologyexercise	10
Spotting (1 -10spots)	20
Viva-Voce	05
Seminar/Record file/ Model	10
Totalmarks	**75**

Courses B050 801- B050 802 P: General character and classification of chordate phyla.

Urochordata:studyofmuseumspecimens/wholemount *:Oikopleura*, *Herdmania*, *Ascidia*, *Pyrosoma*, *Doliolum*, *Salpa*.

Cephalochordate:studyofmuseumspecimen:*Branchiostoma*.

Cyclostomata: Study of museum specimens/models: *Petromyzon*, *Myxine*; Ammocoetelarva.

Pisces: Study of museum Specimens/ models: *Sphyrna* (hammer– headed shark), *Trygon*, (sting –rays), *Pristis*, *Raja* (skate), *Torpedo*(electric –rays), *Chimaera*, *Polypterus*, *Acipener*, *Amia*, *Lepidosteus*, *Harpodon*, *Notopterus*, *Labeo*, *Catla*, *Cyprinus*, *Cirrhina*, *Arius*, *Heteropneustes*, *Clarias*, *Wallago*, *Mystus*, *Anguilla*, *Exocoteus*, *Hippocampus*, *Channa*, *Amphipinous*,*Anabas*,*Synaptura*,*Echeneis*,*Protopterus*;Studyofdisarticulatedboneofcarp.

Amphibia: Study of museum specimen/models: *Ichthyophis*, *Ambystoma*, Axolotl, *Amphiuma*, *Triturus*, *Proteus*, *Necturus*, *Siren*, *Alytes*, *Bufo*, *Hyla*, *Rhacophorus*, study of disarticulated bone to frog.

Reptilia: Studyof museum specimen/models *Chelone*, *Kachuga*, *Sphenodon*, *Hemidactylus*, *Calotes*,*Draco*,*Heloderma*,*Varanus*,*Typhlops*,*Python*,*Natrix*,*Dendrophis*,*Bungarus*,*Naja*, Russlle's viper, pit viper, *Hydrophis*, *Crocodilus*, *Alligator*, *Gavialis*,study of disarticulated bones of varanus

Aves: Study of museum specimens/ models: *Arhaeopteryx*, *Milvus* (kite), *Pavo*(peacock), *Columba* (pigeon), *Eudynamys*(koel), *Psittacula*(parrot), *Bubo* (owl), house sparrow, *Corvus* (crow); study of disarticulated bones of fowl.

Mammalians: Study of museum specimens / models: *Echidna*, *Ornithorhynchus*, *Macropus*, Bat, *Manis*, *Hystrix*, *Rattus*, *Lepus*, study of disarticulated bones of rabbit.

Study/dissection of *Scoliodon* (cranial nerve, afferent and efferent blood vessels, internal ear and placoid preparation)and *Herdmania* (General Anatomy)

Course B050 803T: Studyof mitosis inonionroottip and meiosis intestis ofgrasshopper or withtheacetocarminesquashmethod;studyofthesalivaryglandchromosomesof*Drosophila* and *Chironomus larva.*

Course B050 804T: Prepared slides of the embryology of frog, chick and mammals and mammalian placentation microtomy of embryonic stages of chick embryonic; application of window techniques for in –situ study of chick embryo.

CourseCode	CourseTitle	Credits
B050 806R	ResearchProject Cum Dissertation	8

SEMESTER – IX

CourseCode	CourseTitle	Credits
B050 901T	BiostatisticsandComputationalBiology	4

UNIT-1: Basic components of computer- hardware (CPU, input, output, storage devices), software (operating systems). Application of software: introduction to M S EXCEL use of worksheet to enter data, edit data, copydata, move data. T-Graphicaltools in excel for presentation ofdata; image and data handling.

UNIT-2: Sampling technique: methods of sampling, choices of sampling methods, sampling and non- sampling errors. Tabulation and graphic representation of data. Frequency distribution, bar diagram, histogram, pie-chart andtheir significance and limitations. Measures ofdispersion:varianceandstandardvariation,coefficientofvariation.

UNIT-3: Correlation analysis, correlation ofcoefficient. Regression; regression analysis, regression coefficient and its properties. Properties and application of t-distribution.

UNIT-4: Thesquaretest:degreeoffreedom. Propertiesand usesofchi-square, conditions forusingthe chi-square. Analysis of Variance (ANOVA); one way and two way of classification.

Suggested literature:

1. BiostatisticsbyPNAroraandP.KMalhan, Himalayapublishinghouse
2. PrinciplesofBiostatisticsbyPaganoM. Gauvreau,K(2000),Duxburypress,USA
3. FundamentalofBiostatisticsbyIAKhanand AKhanam,Ukaazpublication,Hyderabad
4. ResearchMethodologyby Dr. Dev BratMishra, Xoffencer Pub. Gwalior

CourseOutcomes-Introductiontobasiccomponentsofcomputers,Software(operating systems)andapplicationsoftwareusedinbiologicalandstatisticalstudies.Anoverviewofdatabanks earchdatamining,datamanagementandinterpretation.Anintroductionandlearning of Probit Log Analysis for interpretation of toxicity data.

CourseCode	CourseTitle	Credits
B050 902T	AnimalBehavior	4

UNIT-1: Animal behavior; definition, historical out line, patterns of Behavior, Objectives of behavior, mechanism of behavior. Reflexes; reflex action, types of reflexes, reflex arch, characteristics of reflexes and complex behavior. Orientation; primary and secondary orientation; kinesis.

UNIT-2: Production of new queen and hive, swarming, honey bee as super organism; fixed

action pattern mechanism, learning and instincts, conditioning, sensitization.

UNIT-3: Physiologicalbasisofmotivation;roleofhormone, motivationalcontrolanddecision making, displacement activity, models of motivation, measuring motivation. Hormones and pheromones influencing animal behavior.

UNIT-4: Pattern of communication (chemical, visual, light, audio, species specificity of songs, evolution of language with respect to primates). Sexualbehavior, courtship, sexual selection, mating patterns, parental care, migratory behavior of fishes and birds, territorial behavior.

Course outcome-

Exhibit criticaland integrative thinking skills. Demonstrate ability to communicate scientific informationinbothoralandwrittenformats.Demonstrateknowledgeofkeyconceptsin animal Behavior. Exhibit quantitative research skills (or demonstrate ability to perform all parts of the scientific method).Demonstrate ability to think flexibly and apply knowledge to new problems.

Suggested literature:

1. AnintroductiontoAnimalBehaviourbyA.ManningandM.S.DawskinsCambridge University Press, UK.

2. AnimalBehaviouranEvolutionaryApproachbyV.S.Lamourens,AcademicPress.

3. AnimalBehaviour.ReenaMathur, Rastogipublication.

4. PrinciplesofAnimalBehaviourbyJ.R.Millenson. TheMacMillanCompany.

5. ReadinginAnimalBehaviourbyT.F. MacGrill.

6. AnimalbehaviorbyDr. DevBratMishra& Ajay Chaubey, MahalakshmiPub. New Delhi..

CourseCode	CourseTitle	Credits
B050 903T	PrinciplesofEcologyTheory	4

UNIT-1: Environment: meaning, definition and environmental perception. Environmental factors(Abiotic)medium,substrate,solid,waterandhumidity,light,temperature,atmospheric gases (O_2, CO_2, and N_2), ph.

UNIT-2: Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere; Terrestrial and aquatic (freshwater and marine) habitat; Environmental (biotic factors; population and community ecology, parasitism and prey-predator relationship; Ecosystem definition, type, structural components of ecosystem (pond ecosystem) - autotrophs and heterotrophs (producer consumers, decomposers and transformers); Ecological pyramids on numbers biome and energy.

UNIT-3: Bio-geochemical cycle, Acclimation & acclimatization, adaptation, ecological

habitats and niche, concept of limiting factors, Liebig's law ofthe minimum; Shelford law of tolerance; ecological succession.

UNIT-4: Ecological succession, Energy flow; First and second law of thermodynamics; population size and density, dispersion, age structure, population growth, natality, mortality, biotic potential, population interaction, Concept of r and k selection.

Suggested Literature:

1. BasicconceptsofEcologybyCliffordB.Knight,TheMacmillanCompany,NewYork
2. BasicEcologybyE.P.Odum,Oxford and IBNPublishing Co.,New Delhi
3. EcologicalModelingbyGrant,W.E.andSwannack,T.M.,(2008),Blackwell.
4. EcologyandAppliedEnvironmentalSciencebyKimonHadjibros,CroPress.
5. EcologyandMargaretBrown,AppleAcademic
6. EnvironmentalLawbyGurkiratkaur,ShreePublishersand Distributors,NewDelhi
7. FieldBiologyandEcologybyBentonandWerner,McGraw-HillBookCompany
8. Field Sampling: Principles and Practices in Environmental Analysis by Conklin A.R. Jr (2004), CRC Press
9. FundamentalprocessesinEcology:AnEarthsystemApproachbyWilkinson, D.M.;(2007), Oxford University PRESS, UK,
10. Fundamentals ofEcologybyE.P.Odum,
11. PrinciplesandstandardsforMeasuringPrimaryProductionbyFahey,T.J.andKnapp, A.K., (2007),Oxford University press, UK.

Courseoutcomes-Demonstratedanunderstoodofecologicalrelationshipsbetweenorganisms and their environment. A Presented an overview of diversity of life forms in an ecosystem. Explained and identified the role of the organism in energy transfers, Described the habitat ecology and resource ecology. To understood the Environmental Pollution and their management.

CourseCode	CourseTitle	Credits
B050 904T	BiologyofParasitism	4

UNIT-1: Introductiontoparasitology:Animalassociationsandhost –parasiterelationship:Distribution ofdiseasesandzoonosiscausedbyanimalparasites,morphology,lifecycle,modeofinfection of *Plasmodium*, molecular biology of *Plasmodium*

UNIT-2: Morphology, lifecycle and mode of infection of *Leishmania*: morphology, lifecycle, mode of infectionof*EntamoebaandGiardia*,morphology,biology,lifecycleandmodeofinfectionof gastrointestinal, nematodes(*Ascarislumbricoides, Ancylostomaduodenale,*)*andWuchereriabancrofti*

UNIT-3: Morphologybiology,lifecycleandmodeofentryof*Fasciola,Taenia*

UNIT-4: Pathologyofhelminth infections; immune response and self defense mechanisms, immune invasion and biochemical adaptation parasites

Suggested Literature

1. EcologyofParasitesby A.PDiwan,A.KArora,AnmolPublications,New Delhi
2. Foundations of Parasitology by Roberts L.S. and Janovy J; M.C. Graw – Hill Publishers, New York U.S.A
3. Mordern Parasitology: A TextbookofParasitologyby F.E.G.Cox, Wiley- Blckwell, U.K.

Course outcome- A studyof the immune response to parasite and self-defense mechanisms, immuneinvasionandbiochemicaladaptationsofparasitesanddescriptionofparasitesof insects and their significance, nematode parasites of plants and host parasite interaction.This course is useful in various competitive exams.

CourseCode	CourseTitle	Credits
B050 905T	AppliedZoology	4

UNIT-1: Aquaculture;marine,reverineandeusturinefishes;SomefoodfishesofIndia:*Wallago, Anguilla,Harpodon,Notopterus,Channa,Clarias,Labeo,Catla,Cirrhinus,Barbus*:FishcultureinIndia:IndianAquaculture:CultureofCarps,Culturemethods,Prawnculture,exotic fishes;Importanceofpearlculture;methodsofpearlculture,;statusofpearlindustryinIndia.

UNIT-2: Domestic animals, Animal husbandry and Poultry: cattle breeding, artificial insemination, feedingandmanagementofdairystock,dairyproduct andchemistryofmilk.:Positionofgoat/ PigproductionindustryinIndia,breedsofgoat/pig;commoncattlediseases;poultryindustry in India, important poultry breeds, poultry farming, disease of fowl.

UNIT-3: Apiculture:importanceofBeekeeping,Apiculture,*Apis*species,beehive,sociallifeofhoney bee, properties of honey: Lac culture, Lac insect and its biology, rearing of Lac insects, collectionand processingofLac:Sericulture:Mulberryandnonmulberry Sericulture(tasar, munga and eri sericulture) ; lifecycle of silk moth; physical and chemical properties of silk.

UNIT-4: Vermiculture: Introduction, ecology and distribution of earthworms;Vermiculture and vermicomposting methods; chemical composition ofwaste based vermicompost; Economics ofvermiculture and vermicomposting; species ofearthworms for vermin composting;Insitu applicationofvermicultureandcropproductivity;useofearthwormin land improvement and reclamation.

Suggested literature:

1 BeekeepinginIndiabyA.M. Wadhwani

2 PoultryHusbandrybyMorleyA.Jull.

3 DomesticWaterBuffalobyM.Fahimuddin

4 LifestockandPoultryProductionbyHarbansSinghandE.N.MOORE

5 TextbookofdairychemistrybyM.P.Mathur,D.DRoy,P.Dinaker

Course outcome- To understand concept of fisheries, fishing tools and site selection and introduction to basic concepts of Aqua culture systems, induced breeding techniques, post harvesting techniques. To understand the variousconceptsin lac Cultivationandalso to know theeconomicalimportanceoflac cultivation,sericultureandapiculture.Tostudythe methods of Vermiculture and Vermi-composting and economic value of vermiculture and vermi-composting. Uses of earthworm in land improvement and reclamation.

CourseCode	CourseTitle	Credits
B050 906T	Epigenetic&ChromatinBiologyTheory	4

UNIT-1: Chromatin structure- basic organization of a eukaryotic genome; histone- structure and function; nucleosome as fundamental particle; intra nuclear spatial organization of chromatin: MARs and SARs and their importance.

UNIT-2: Epigenetics- from phenomenon to field, a brief history of epigenetics- overview and concepts:chromatinmodificationsandtheir mechanismofaction, conceptof'Histone- code' hypothesis, position effect variegations heterochromatin formation, and gene silencing in D*rosophila* , role of non-coding RNAs;

UNIT-3: Chromatin structure and epigenetic marks – transcriptional silencing by polycomb group proteins, histone variants and epigenetics, epigenetic regulation of chromosome inheritance, epigenetic regulation of the X chromosomes.

UNIT-4: Epigenetics and genome imprinting – DNA methylation in mammals, genomic imprinting in mammals, germ line stemcells, nuclear transplantation and the reprogramming of the genome, epigenetic and human disease, epigenetic determinants of cancer.

Suggested Literature:

1. Epigenetics byC.David Allisand ThomasJenuwein, (2007) Cold spring Harbor Laboratory PRESS, New York. USA

2. Molecular biology of gene by Watson at.al(5th.E.d 2004), Pearson Education Delhi India

Courseoutcome-Detailedunderstandsofchromatinstructureanddifferentlevelsofits organization. Awarenessofbriefhistoryofepigeneticsandkeyconcepts. Detailedknowledge chromatin modifications and their mechanismofaction, concept of'histone code' hypothesis inthephenomenonofepigenetics.Developingskillindescribingchromatinstructureand epigenetics marks, dosage compensation and mechanism of chromatin remodeling. Learning of epigenetics and genome imprinting and the reprogramming of the genome.

CourseCode	CourseTitle	Credits
B050 907T	Structure &FunctionofGenes	4

UNIT-1: Structureofnucleicacid,denaturation,renaturation,super-coilingofDNA,packaging ofDNAinthenucleus,structureofchromatin.Geneticmaterialanditsevolutionstructureand function relationships, evolution of genetic material, genes and genomes.

UNIT-2:DNAreplication,recombinationDNApolymerasesproof-readingactivity,mechanism of DNA repair; genome instability, transcriptional control of gene expression – positive and negative regulations, RNA polymerase, promoters and regulatory sequences, activators and repressors of transcription, regulation of transcription factor activity, elongation and termination of transcription.

UNIT-3: Post-transcriptional gene control and nuclear transport- types of introns and their splicing, catalyticRNA, regulationofPre-mRNAProcessing, micro RNAandothernon-codingRNAs, degradation of RNA.

UNIT-4: Transport across the nuclear envelope and stability of RNA- structure of nuclear membrane and nuclear pore complexes, processes of nuclear import and export and their regulation, degradation of RNA, Translation machinery, t-RNAs and their modifications, aminoacyl t-RNA synthetases, inhibitors of translation.

Suggested Literature

1. GenesbyLewin,(9thEdition2008),JonesandBartlenPublishers,Boston,USA

2. Genetics(AnalysisofgenesandGenomes)byDenialL.Hartl,JonesandBartlettpublishers.

3. MolecularBiologyofTheCellbyBruceAlberts,GarlandScienceTaylorandFrancisGroup

4. Molecular Biology of the Gene by Watson et.al. (5th Ed. 2004), Pearson Education, Delhi India

5. TheCell*AMolecularApproach* byGeoffreyM.Cooper,Sinauer Associates,INC.

Course outcome- An introduction to structureofnucleic acids, folding motifs, conformation flexibilities,denaturation,renaturation,kineticsofhybridization,super-coilingofDNA,packaging of DNA in the nucleus, structure of chromatin, chromatin territories used for thestudents for further study.Regulation of Pre-mRNA Processing,micro RNA and other non- coding RNAs, degradation of RNA. Description of transport across the nuclear envelope and stability ofRNA, processes of nuclear import and export and their regulation, degradation of RNA. This courses useful in various competitive exams like CSIR-NET etc.

CourseCode	CourseTitle	Credits
B050 908T	MolecularEndocrinology	4

UNIT-1: Discoveryofhormonesaschemicalsignalsforcontrolandregulationofphysiological processes: Nature of hormonal actions;

UNIT-2: Structureofpeptide and protein hormones; Structure-Functionrelationships indifferent hormones; Phylogenic analysis of hormonal structure and functions; Biosynthesis of protein hormones; Storage and secretion of hormones;

UNIT-3: Nature of hormonal effects and actions; Discovery of receptors in target tissues; Mechanisms of hormone action and signal attenuation; Signal discrimination, Signal transduction and signal amplification in hormone regulated physiological processes; Metabolism of hormones by target and non-target tissues;Hormones behavior –

UNIT-4: Hormones as therapeutic agents; Recombinant protein hormones-production and application in regulation of fertility in farm animals and humans;

Suggested Literature:

1. MolecularBiologyofSteriodandNuclearHormoneReceptorsbyL.P.Freedom,Bickhauser, Boston. USA

2. BiochemicalactionsofHormones*byed.*G.Litwack,Academicpress, NewYork,USA

3. ComparativeVertebrateEndocrinologybyP.J.Bentlay

Course outcome- Understanding the natureofhormonalactionand its experimentalmethods of evaluation elucidation of biosynthesis of protein hormones and molecular mechanisms of regulation.Knowledgeofsignaldiscrimination,signaltransductionandsignalamplificationin hormone regulated physiologicalprocesses. To Developing knowhowofpharmacokinetics of hormones and Behavior.

CourseCode	CourseTitle	Credits
B050 909P	Practical	4

Max. Marks: 75 **Time:6hours**

Distribution of marks:

StatisticalExercise	05
Exercise foranimalBehavior(2)	10
Ecologyexercise (2)	10
Exerciseforparasitism(2)	10
Exercise forappliedzoology(2)	10
Exerciseforepigeneticsandchromatinbiology(2)	05
Exercisefor structureandfunctionofgene(2)	05
ExerciseforMolecularendocrinology(2)	05
Viva-Voce	05
Seminar/Record file/Model	10
Total	**75**

Course B050 901: Use of excel sheet for data processing. Designing simple experiment for testing mean differences, test of significance (Chi-square test), extra.

Course B050 902: Study of Taxis; Kinesis; Habituation; Trial and error learning; Visual discrimination; Feeding Behavior, Pheromonal communication with reference to sexual/special Behavior. To study the responses of woodlice to hygrostimuli. To study the geotaxis Behavior of earthworm; to study the orientation responses of first instar noctuid larvae to photo stimuli. To study the median threshold concentration of sucrose solution in elicitingfeedingresponsesofhousefly;Tostudytheorientationresponsesoflarvaetovolatile and visual stimuli.

CourseB050903: Studyofdifferentstructuraladaptationofanimals toecologicalconditions;Studyofmicro and macro faunaofsoilby frothfloatation method;Comparativeestimateof physicochemical eco factor of in different localities; Temperature, pH, Carbonate, sulphate, nitrate,andturbidity,infreshwatersample;moisturecontentingsoilsample;Studyofseasonal variation in plankton population demonstration of parallax vision and height perception; Analysis of plant community and biodiversity and biomass; Study of seasonal plankton population both qualitative and quantitative

Course B050 904: Study prepared slides and museum specimen of selected parasites of representativegroupsofprotozoans,helminthes,andarthropods;demonstrationofinvitroand invivo,infectionof*Fasciola*insnailsandmammalsbyhistopathologyand immunereactions. Culturing insect parasitic nematodes and their life-cycle. Culturing an insect parasitoid and studyingtheir infectiononaninsecthost;surveyofvectorborndiseasesinlocalandadjoining areas.

Course B050 905: Field study at different Government/ Non Government farm houses/ apiaries/ dairies/ poultries/ seri culture in localareas and project has to be submitted.

CourseB050906: Isolationofnuclei(asasourceforstudiesonstructureofchromatin)from rat/mouse liver by discontinuous sucrose density gradient centrifugation; Isolation of total histones and resolution on SDS-PAGE, Studies on modifications of histones (such as acetylation, methylation etc) by western blotting using modification specific- anti bodies; Expressionandpurificationofrecombinanthistones;isolationandcharacterizationoftotalnuclearpr oteins.DigestionofnucleibyMNaseandcalculationof‘repeat-length’of nucleosomes. Digestion of nuclei by DNase-I, and studies of DNA super helicity in the nucleosomes;Preparationand characterizationofsoluble chromatin(10 and 30 nmchromatin fibres);Purificationandcharacterizationofmononucleosomes;reconstitutionofnucleosome- core PCR Amplified synthetic DNA ; chromatin immuno precipitation (Chip)

CourseB050907: Familiarizationwithsterilehandlingtechniquesforgrowthofbacteria,such as sterilization, growth media types of culture etc. Isolation of genomic DNA from bacteria and mouse/rat liver, measurement of absorption spectrum of DNA, RNA and nucleotides ; studyofdenaturationofDNAanddeterminationofTmandcalculationofG:Ccontent;Studies on stability of DNA and RNA towards alkali; Study on growth curves of *E.coli* in synthetic medium and calculation of log phase for metabolic experiments ; Studies on induction of *lac* operon : Studies on catabolite repression of *lac* operon and role of cAMP ; Generation and selection of mutants for *lac* operon, calculation of mutation frequency.

Course B050 908: Isolation ofprotein of bio-activity in an in vivo bio-assay (e;g: FSH); and chemicallocalizationofapituitaryhormoneusinglightorelectronmicroscopy(e.g;Prolactin), Invivobio-assayforestrogen;InvivoBio-assayfortestosterone;vivobio-assayforluteinizing hormone;Invitrobiochemicalassayforahormone(LHorPRL);EffectofhCGonpolyArich RNAcontent inovary;Quantificationofspecifictranscript (mRNA) after ovarianstimulation by hCG or FSH.purification of bovine/bubaline pituitary TSH; Preparation and characterization of hormone- enzymeconjugate, ELISAfor anyone hormoneandestimationofplasma level;Estimationof cAMPinarattissue(exampleadipose)withandwithouthormonestimulation;Streptozotocin administered rat model for diabetes; Demonstration of phosphlipase C action; Molecular cloning of a protein hormone (eg., buffalo prolactin); Expression of recombinant buffalo prolaclin in *E.coli*.

Semester:X

ELECTIVE COURSES
STREAM1:ENTOMOL
OGY

CourseCode	CourseTitle	Credits
B051001T	InsectMorphologyPhysiology&Development	4

UNIT-1: The integumentary system: histology of the integument, physical property and chemical composition of cuticle, coloration and molting.

UNIT-2: Nervoussystem:theneurons,centralvisceralandperipheralnervoussystem.Sensory mechanisms; mechanoreceptors (tango reception, proprioception, sound perception), chemoreception,thermoreception,hygroreceptionandphotoreception(compoundeyes,image formation, stemmata, ocelli); Bioluminescence and sound production.

UNIT-3: Alimentary system : nutrition, feeding Behavior, morphology of the gut and physiologyofdigestionandabsorption, Circulatorysystem:dorsalvessel, accessorypulsating structures, sinuses and diaphragms mechanism of circulation, composition and function of haemolymph : respiratory system structure of trachea, tracheales, air sacs , spiracles, physiology of respiration, respiratory adaptation of aquatic and parasitic insects; Excretory system : Malpighian tubules and its arrangements, physiology of excretion (nitrogenous excretion, salt and water balance)

UNIT-4: Reproductivesystem: maleand female: development, post embryonicdevelopment, metamorphosis, types of larvae and pupae. Exocrine glands: structure and function, pheromones, Endocrine glands: structure and function of non-neural, neural and peptide hormones, regulation of general body function and metabolic activities, molting, polymorphism and diapauses.

Suggested Literature:

1. AtextBookofEntomologybyR.Mathur,Campusbooks
2. AtextbookEntomologybyPatnaik,D.D(2013),DominantPbl.
3. BiochemistryofinsectsRockestein, M (1978), AcademicPress, NewYork
4. CollegeEntomologybyEssig,E.O.(1942)Macmillan,NewYork
5. ComprehensiveinsectPhysiology,BiochemistryandPharmacologybykerkut,GAand B.IGilbert(1985)volume1-13,PergamonpressOxfordNewYork
6. ElementsofEntomologybySingh,R(2015)RastogiPublication.
7. EntomologyEcologyandBiodiversitybyTyagiB.K.(2011),ScientificPublishers(India)
8. FundamentalsofinsectphysiologybyBlum,M.S(1985) ,Wileandsons, NewYork

9. GeneralEntomologybyMani,M.S(1982)OxfordandIBHpublishingCo.Pvt.LTD.New Delhi
10. InsectBiologyAtextBookofEntomologybyEvans.H.E,.(1984)AddisonWisley publishing company, Reading EGKFOKY
11. Insectphysiologyand AnatomybyPant,N.CandS.Ghai(1981),ICAR,NewDelhi
12. Pest control by Van Emden , H.F.(1992) 2nd Edition Cambridge University Press, New York
13. PrinciplesofinsectMorphologybySnodGrass, R.E(1935),McGraw,Hill, NewYork
14. TheInsects:AnOutline ofEntomologybyP.J.Gullan,Wiley-Blackwell
15. TheInsectsStructureandFunctionbyChapman.R.F.(1998),4thEdition,Cambridge University Press.
16. ThePrinciplesofInsectphysiologybyWigglesworth.V.V(1982),Chapman&Hall, London
17. TheScienceofEntomologybyRomoser,.W.S.andJ.G.Stoffolano(1994),3rdEdition,
18. Wm.C. BrownPublisher, USA.

Courseoutcome-Tothevalueofwildlife,fieldobservationssignandfoot prints,locomotory pattern in tetrapods. Understand the management practices required to achieve a healthy ecosystem for wildlife population along with emphasis on conservation and restoration. Sociobiology of wild animals, migratory and breeding Behaviour and their sociobiological importance.Descriptionofreasonforwild lifedepletionandwildlifeecotourismmanagement measures for wild life conservation.

CourseCode	CourseTitle	Credits
B051002T	Ecology,Evolution&Taxonomy	4

UNIT-1: Abiotic environment: effect of temperature, moisture and light on insect population; insect plant interaction; plant and insect herbivore relationship; primary and secondary metabolic plant products. Host selection by insects; chemical defence in plants; allocation of protective chemicals, primaryrole oftoxic chemicals;response ofinsects to chemicaldefence;temporal avoidance of chemical semi chemicals.

UNIT-2: Insect origin and evolution: Ancestry of insect origin and evolution of insects, relationship

betweenentogonathousandectogonathusapeterygotes.Outlineclassificationofinsects:

classification, characters, economic importance and examples of following: Entognatha (proturan, collembola, dipluran); Thysanura (Lepismatidae); Palaeoptera (Ephemeroptera, odonata) Orthoptera

UNIT-3: Classification, characters, economic importance, and examples of following: Hemiptera (Fulgoridae, Lophopidae, Cicadidae, Membracidae, Cicadellidae, Psyllidae, Aleyrodidate, Aphidadae, Margarodidae, Kerridae, Pseudococcidae, Coccidae, Diaspididae,

UNIT-4:Siphonophera: (Pulicidae, Ceratophyllidae); Diptera (pschodidae, Culicidae, Simulidae,
Chironomidae,Bibionidae,Myctophilidae,Cecidomyidae,Tabanidae,Asilidae,Bombyliida e, Syrphidae, Agromyzidae, Drosophilidae, Gasterophilidae, Muscidae, Calliphoridae, Hippoboscidae); Lepidoptera

Suggested literature:

1. ElementsofEntomologybySingh.R,(2015),RastogiPubl,Meerut.
2. Dynamics ofInsect-Plant Interactionby Ananthkrishnana, T N & ARaman(1988). Oxford & IBH Publishing Co Pvt. Ltd., New Dehli.36
3. Navel aspects of insectplantinteraction by Barbosa.P.& D.K.Letoumeau (1988).John Wiley & Sons New York.
4. ArthropodaPhylogeny byBoudreaux, B.H (1997), withspecialreference to insects, Wiley and Sons, New York, pp. 320.
5. Evolution of the insects by Grimaldi. D &Engel .M.(2005), Cambridge University Press, New York and Cambridge, pp. 755.
6. ArthropodaPhylogenybyGupta,A.P.(1979),VanNostrandreinhold,NewYork.
7. InsectEcologybyPrice,P.W1984, 2ndedition,JohnWiley&Sons,New York.

Courseoutcome-Bybiologicalevolutionwecouldunderstandthatmanyoftheorganismsthat inhabit the Earth today are different from those that inhabited it in the past Explained adaptation, providing examples from several different fields of biology explained how the molecularrecordprovidesevidence forevolutionUnderstoodtheHumanoriginandevolution.

CourseCode	CourseTitle	Credits
B051003T	EconomicEntomology	4

UNIT-1: Beneficial insects: biologyofbeneficialinsects (Apis, Bombyx,Kerria), Insect products,use

ofinsectsinmedicines,insectsinbiologicalResearch,Pollinationbyinsects,insectsasconsumers,Scavengersandasfood,forensicentomology.Harmfulinsect:lifehistory,damage caused and control measuresof following insects pests: household insects: insect injurious to man (Aedes, Anopheles, Culex. Cimex, Xenopsylla, Pediculus)

UNIT-2: Lifehistory,damagecausedandcontrolmeasuresoffollowinginsectpests,pestofcerealcrops (Leptocorsiaacma, Scirpophagaincertulus, ChlioSuppressalis, Hieroglyphusbanian, Dicladispaarmigera, Nephotettixspp,Sesamiainferens); pest of pulses (Hehcoverpaarmigera), pests of vegetables (Aulacophoraindica, Leucinodesorbanalis, Bactroceracucurbitae, Henosepilachna spp., Phthorimaeaoperculella, Pierisbrasiccae);

UNIT-3: Methods of pest management: physical control measures (temperature, electromagnetic fields and ionizing radiations,); mechanical control measures (handpicking of infested plants and theirdestruction,netting,bagginganddislodginginsectpests,trenching,insect barriers,insect traps, destruction of crops residues, weeds and trash); cultural control measures.

UNIT-4: Chemical control measures: insecticides: classification, properties, synergistic, repellants, attractions: feeding deterrents: formulations Biopesticides; benefits and risks ofchemical control;application; modes ofactionofinsecticides. Developments ofinsect resistanceagainstinsecticides;biocontrolmeasures(organismsusedinbiocontrol, inoculation, augumentation and conservation of natural enemies – pathogens, predators and parasitoids; selected criteria of a promisingnatural enemy).

Suggested literature:

1. IntegratedpestmanagementbyAbroi,D.P.(2014).Academicpress,USA.
2. AtextbookofAgriculturalentomologybyAlford,D.V.(1990),Wiley–Blackwell.
3. AgriculturepestsofSouthasiaandtheirManagementbyAtwal,A.S.&Dhalwal,G.S(1997), Kalyani Publishers, New Delhi.
4. AgriculturalpestsandtheircontrolbyAwasthi,V.B(2001),ScientificPublishers,NewDeli
5. Elements of economic entomology byDavid, B.V (2000), Popular Book Depot, Chennnai

Courseoutcome-

Tostudythemethodsofpestmanagementphysicalcontrolmeasuresmechanicalcontrolmeasureselectedofqualityseeds, cleancultivation,destructionof alternative/trapplants,croprotations,tillageoperations,timingofplanting/harvesting, nutrient/water management.

CourseCode	CourseTitle	Credits
B051004T	Insect Toxicology	4

Unit-1: Studyofdifferenttypesofinsecticides-organophosphates,carbamates.Methodsofapplication of insecticides.

Unit-2: Hazardsofinsecticides, precautions,antidotesand fumigants.

Unit-3: Principles of biological control,parasites,predators, and pathogen affectinginsectpest and efficacy.

Unit-4: Principleandcomponentofintegratedpestmanagement(IPM)Chemosterilants.

Suggested literature:

1. Integratedpestmanagement byAbroi,D.P.(2014).Academicpress,USA.

2. AtextbookofAgriculturalentomologybyAlford,D.V.(1990),Wiley–Blackwell.

3. AgriculturepestsofSouthAsiaandtheirManagementbyAtwal,A.S.&Dhalwal,G.S(1997), Kalyani Publishers, New Delhi.

4. AtextbookofInsectToxicology:R.P. Srivastava, R.P.Saxena

5. ElementsofeconomicentomologybyDavid,B.V(2000),PopularBookDepot,Chennai.

6. ToxicologyofInsecticides:S.B.Singh, A.K.Vaidya, S.N.Upadhayay.

Course outcome-To study the methods of pest management physical control measures mechanical control measure selected of quality seeds, clean cultivation, destruction of alternative/trap plants, crop rotations, tillage operations, timing of planting/harvesting, nutrient/water management.

CourseCode	CourseTitle	Credits
B051005P	Practical	4

PRACTICAL

MaxMarks:75 Time:6 hours

Distributionofmarks:

MajorDissection	10
MinorDissection	05
Taxonomy(identificationoftwoinsects)	10

PhysiologyExercise	15
Spotting(1-10spots)	20
Viva-Voce	05
Seminar/Record file/Model	10
Total	**75**

1. Detailedstudyoftheexternalfeatures ofgrasshopper
2. DissectionofdifferentsystemsofGryllotalpa,Dysdercus,Housefly/Calliphora, Moth/butterfly/Catterpillars/ Wasp, honey bee, Dung beetle, Water beetle.
3. PermanentpreparationoftestisofCockroach,salivaryglandofdysdercus,ovary, spermatheca and accessory gland of house fly.
4. Sting apparatusofwasp/ honeybee.
5. Spiraclesofthecaterpillar andwingscalesofalepidopteraninsect.
6. Legsofterrestrialandaquatic insectsshowingsimpleadaptationconcerninglocomotion.
7. StudyofpreparedslidesofT.S/L.S.ofintegumentandthevariousregionofgut,ovary, testis and brain.
8. Whole mounts of thoracic/ abdominal spiracles, different types of antennae, legs, moth parts, wings and sting apparatus of honey bee/ wasp.
9. DeterminationofpHofinsectsgutsand haemolymph.
10. Qualitativeassayoffreeaminoacidsandhaemolymphandfatbody.
11. Quantitativeestimationofglycogen,proteinandlipid.
12. Qualitativedeterminationofuricacidfromfatbody/Malpighiantubules.
13. Determinationoftherateofpassageoffoodthroughgut.
14. Collectionofdifferentkindsoflarvaeandpupaeofinsects.
15. Collection,preservationandidentificationoflocallyavailableinsects.
16. Permanentpreparation of mouth parts,antennae,wings,legs,Spiraclesandexternal genitalia of insects from different groups.
17. Identificationofvariousinsect'spests,theirlife-historyandmaterialsdamagedbythem.
18. Studyofvariousgroupsofinsecticidesandequipment'susedforinsecticideapplication.
19. To studyhistologyandto demonstratethepresenceoflipidandglycogeninmicrotomy sections of suitable material.
20. Studyoflife-historyofbeneficialinsectsand theirproducts.

CourseCode	**CourseTitle**	**Credits**
B051006R	ResearchProject Cum Dissertation	8

ELECTIVE COURSES STREAM2:FISHBIO LOGY

CourseCode	CourseTitle	Credits
B051007T	Morphology,Physiology&Developmentof Fishes	4

UNIT-1: Structure and function of internal ear-air bladder; connection with Weberian apparatus; different types of caudal fins; specialized organs in fishes (electric organ, sound producing organs, light producing organs, poison glands); sense organs and nervous system in fishes.

UNIT-2: Differenttypesoffeedinghabitsinfishesandtheiradaptation.osmoregulation(freshwaterand marinefishes);structureofkidneyoffreshwaterandmarinefishesandphysiologyofexcretion.

UNIT-3: Structure of reproductive organs and physiology of reproduction; embryogenesis; process of gastrulation,neurulation,organformation,larvaldevelopmentandmetamorphosisinfreshwater fish.

UNIT-4: Structure of pituitary gland, thyroid, adrenal glands, corpuscles of stannous and urophysis in fishes: hormones, secreted by these glands and their physiological significance.

Suggestedliterature:

1. BehaviorofteleostfishesbyTonyJ.Pitcher, Chapmanandhall.
2. EcologyoffreshwaterbyBriaMass, WilleyBlackwell
3. FishandfisheriesbyS.SKhanna.
4. Fishes of U.P. and Bihar byC.B.L.Srivastava
5. FishlifeEnvironmentanddiversitybyN.B.Marshal,agrobios(India)
6. Fish physiology edited by W.S Hoar & D J Randall VolI and II academic press INC.

Course outcomes-Study of the physiology of fish structure and function of ear-air bladder; connection with Weberian apparatus; different types of caudal fins; specialized organs in fishes (electric organ, sound producing organs, light producing organs, poison glands); sense organs and nervoussystemin fishes. Understand the basic ofthiscourse andthink &develop new ideas in this course.

CourseCode	CourseTitle	Credits
B051008T	Taxonomy&EcologyofPisces	4

UNIT-1: Characteristics of fishes: classification by L.S berg, detail taxonomicstudiesoffollowingordersoffishesofU.P.andBihar uptofamilies:clupeiformes, cypriniformes, beloniformes, cyprinidontiformes, mugiliformes, ophiocephaliformes, symbranchiformes, perciformes, mastacembaliformes.

UNIT-2: Adaption to different modes of life with special reference in hill stream and deep sea fishes: relationbetweenfishesandtheirabioticandbioticenvironment;influenceoffollowingabiotic factors on life of fishes, e.g. density and pressure, temperature, salt content in water, light, sound, electric current, bottom deposits and particle suspended in water.

UNIT-3: Influence of biotic factors on life of fishes; interspecific and intraspecific interrelationship among fishes with different other organisms- paratisims, commensalisms, mutualisms, predatorisms and cannibalisms.

UNIT-4: Plankton in relation to fish production: sewage fed fisheries and its importance; pollution affecting fisherywater withspecialreference tooilspills, domestic pollution, industrialwater pollution, and radioactive waste.

Suggested Literature:

1. Behaviorofteleostfishes byTonyJ. Picher, Champmanand Hall.
2. ComparativeVertebrateEndocrinologybyP.J. Bentlay
3. EcologyoffishesbyG.V.Nikolsky,Academypress,London.
4. EcologyoffreshwatersbyBria Mass,WilleyBlackwell
5. FishandfisheriesbyS.SKhanna
6. Fishes of U.P. and Bihar byC.B.LSrivastava.

Courseoutcomes-Studentstoknowthestudyoftheinfluenceofbioticfactorsonlifeoffishes; interspecific and intraspecific interrelationship among fishes with different other organisms- parasitism, commensalisms, mutualisms, predations and cannibalisms for help to prepare competitive examinations.

CourseCode	CourseTitle	Credits
B051009T	AppliedIchthyology	04

UNIT-1: Fishculture- nutritional requirements ofcarp, siluroids and murrels, carp cultivation in India; spawning, collection, hatcheries, rearing, stocking, transport and mortality of fish fry.

UNIT-2:

Fertilizationandmanagementoffisherypond.Compositefishculture,cageculture and culture ofexotic fishes; induced breeding. Preservation, processing, transport and Marketing of fish. Food value and flavor's of different fishes.

UNIT-3: Larvivorus fishes and public health, common enemies and symptoms, fish culture in paddy fields and reservoir.

UNIT-4: DevelopmentoffisheriesinIndia;fish-basedindustryandtheirbyproducts;cultureofasexual orsterile fish;homosexculture;hybridization, gynogenesisandandrogenesis;transgenic fish; fish conservation of threatened fresh water fishes (in situ, ex situ), techniques of Cryopreservation.

Suggested Literature:

1. AquacultureandfisheriesbiotechnologyGeneticApproaches,Dunha,R.A,CABI publishing USA.

2. HandbookoffisherytechnologybyV.M.Novikov,A.MErindublishngcompany.

3. FishandfisheriesofIndiabyV.G.JhingranHindustanpublicationcorporation.

4. Fisheries Scienceby Rounsefell and Evarhart,international books and periodical supply service.

5. Aquaculturepr inciplesandpractices,PillayT.V.R..Blackwellpub.,USA

Course outcomes-Learnt the general classification of fishes, economically important marine and freshwater fishes, migrationsand fisheryproducts. Described recent concepts in fisheries management, endangered species management and Came to know the various aquaculture systems. Understood the type of hatchery, brood stock, larval production, feed management water quality and disease management in cultivable species, live feed production.

CourseCode	CourseTitle	Credits
B051010T	Fishand Fisheries	04

UNIT-1: Aquaculture: Definitiontypesand cultivable fish, current and future aspectsofaquaculture in India. Marine, fresh water eustrine, reservoir and cold water fisheries of India.

UNIT-2: MethodoffishinginIndiawithparticularreferencetoU.P.Inlandcapturefisheryresourcesof India, riverine, pollution and fish landing.

UNIT-3: Integrated fish framing with Prawn, pig, duck andpoultryand pearlculture.Principle method used in fish culture.

UNIT-4: Management Pond: Pond preparation, use of fertilizers, supplementary feeding, physico – chemicalandbiologicalfactor.Importanttraditionalandmoderncraftsandgearsusedforfish catch in inland and marine water.

Suggested Literature:

1. AquacultureandfisheriesbiotechnologyGeneticApproaches,Dunha,R.A,CABI publishing USA.
2. HandbookoffisherytechnologybyV.M.Novikov,A.MErindublishngcompany.
3. FishandfisheriesofIndiabyV.G.JhingranHindustanpublicationcorporation.
4. Fisheries Scienceby Rounsefell and Evarhart,international books and periodical supply service.
5. FishandfisheriesofIndia:JhingranV.G.
6. Aquaculture:Bardach
7. Aquacultureprinciplesandpractices,PillayT.V.R..Blackwellpublishing,USA

Course outcomes-Learnt the general classification of fishes, economically important marine and freshwater fishes, migrationsand fisheryproducts. Described recent conceptsin fisheries management, endangered species management and Came to know the various aquaculture systems. Understood the type of hatchery, brood stock, larval production, feed management water quality and disease management in cultivable species, live feed production.

CourseCode	CourseTitle	Credits
B051011P	Practical	4

PRACTICAL

Max Marks: 75 Time:6hours

Distribution of marks:

MajorDissectionofedible/culturablefish	15
Taxonomy(identificationoftwofishes)	10
PhysiologyExercise	10
Ecologyexercise	05
Spotting(1-10spots)	20
Viva-Voce	05
Seminar/Record file/Model	10
Total:	**75**

1. Study/Dissectionof organ system of Sc*oliodon, Labeo*and W*allago*; study of accessory respiratory organs and their blood supply in H*eteropneustes*. *Clarias, Channa*and Amphipnous: Study of air bladder and ear connection in Notopterus and Gudusia Morphologyofolfactoryorgansandtheirinnervationsonteleost's:preparationofaskeleton and an alizarin mount of fish, Study of prepared micro slides: Osteology of *Wallago*.
2. Quantitativeestimationofliverglycogenandblood sugar;demonstrationofcolorchange.
3. Systematicsofmarineandfreshwaterfisheswithspecialreferencetoidentificationoflocal forms; structural adaptations in fishes.
4. Qualitativeandquantitativestudyoffreshwaterplankton;estimationofDissolvedoxygen, free carbon dioxide, alkalinity in a local fish pond; oxygen consumption in local fish sin different habitats.
5. Study of food and structural modifications due to feeding habits, gills and gill-rackers, mouth eyealimentarycanal,olfactoryorgansetc:Studyofageandgrowthinfishes;Study of amphibians, exotic poisonous, venomous larvivorous and sound producing fishes.
6. Study of common aquatic vegetation and aquatic insects: study of fishing gears, with particular reference to UttarPradesh: soil factors; estimation of hydrobiogical parameters temperature,pH,conductivity,salinity,dissolvedoxygen,primaryproductivity,ammonia, nitrite, nitrate, phosphate,biologicaloxygendemand,chemicaloxygendemand, ofnursery rearing, stocking and breeding ponds.

7. Estimation of ovarian egg counts: culture of live food organisms and assay of nutritional quality of live food; estimation of popular density of live food organisms; decapsulation and hatching of *Artemia*cysts for use in hatcheries; Demonstration of breeding pools and hatcheries. Induced breeding of Indian major carps and catfishes. Identification of eggs, spawn, fry and fingerlings of cultivable fishes of India.
8. Collection and identification ofaquatic weeds and aquatic insects: Studyof feeding habits of fishes by gut content analysis, isolation and estimation of fish immunoglobulins; Molecular techniques in fish health management: Aquarium design and maintenance formulation and preparation of artificial fish food for Indian major carps and Prawns; Analysis of proximate composition of fish and processed products.
9. Visittofreshwatermarinefish farm.

CourseCode	CourseTitle	Credits
B051012R	ResearchProject Cum Dissertation	8

ELECTIVE COURSES

STREAM3:CELLBIOLOGY

CourseCode	CourseTitle	Credits
B051013T	CytologicalTechniques	4

UNIT-1: Microscopy: basic principles of light microscopy, magnification, numerical aperture, resolution, stereo microscopy, principles and instrumentation ofphase contrast, interference, polarization, Fluorescence microscopy; principles and instrumentation of electron microscopy(transmission electron microscope (TEM), Scanning electron microscopy(SEM)); different fixation and staining techniques for electron microscope.

UNIT-2: Basic principles of freeze drying technique (Lyophilization) and their uses; X-raydiffraction; basic principle of X-ray diffraction methods and instrumentation uses of X-ray diffraction study in cell biology.

UNIT-3: Chemicalbasisoffixationofethanol,methanol,acetone,aceticacid,trichloroaceticacid,picric acid, mercuricchloride, formaldehyde, chemistryofcytochemicallocalizationofglycogenby periodic acid-Schiff method; protein by coupled tetrazoniumreaction method; lipid by Sudan BlackBmethod;nucleicacidbyFeulgenandmethylgreen-pyronin;acidandalkalinephosphatase by method Gomori's lead phosphate and Azo-dye coupling method;oxidases by diphenyl amine and nathoquinone.

UNIT-4: Purificationandfractionationofnucleicacid,nucleicacidhybridisation,enzymaticreplication of DNA by PCR- optimize reaction component, cycling parameters. GISH and FISH.

Suggested Literature:

1. CellandmolecularBiology,D.Roberties
2. MolecularCellbiology,AlbertBruceeetal
3. TheCelland Molecularapproach,G.MCooper
4. Cellbiology,GeraldKarp.

Course outcomes-After the course the students will be able to Purification and fractionation of nucleic acid, nucleic acid hybridisation, enzymatic replication of DNA by PCR- optimize reactioncomponent,cyclingparameters.Courseisusefulinvariouscompetitiveexaminations.

CourseCode	CourseTitle	Credits
B051014T	CellularOrganization&Fundamental Processes:CellStructure	4

UNIT-1: The nucleus (the nuclear envelop and traffic between the nucleus and cytoplasm), internal organization of the nucleus, the nucleolus; plasma membrane structure and chemical composition; movements of substances across the membrane.

UNIT-2: Proteinshorteningandtransportendoplasmicreticulum(theendoplasmicreticulumandprotein secretionthe smoothER and lipid synthesis, exportof proteinand lipids fromtheER), The Golgi apparatus (organization of the Golgi, protein glycosylation within the Golgi Lipid and polysaccharide metabolism to the Golgi, protein sortening and export from the Golgi apparatus).

UNIT-3: Lysosomes. Types, ultrasound and functions, lysosomal enzymes, endocytosis and lysosome formation, phagocytosis and autophagy; lysosomal storage disorders.

UNIT-4: Bioenergetics and metabolism (mitochondria-organization and function, mechanisms of oxidative phosphorylation, peroxisomes- functions of peroxisomes); types of ribosomes, its ultrastructure; functions and biogenesis in eukaryotes and prokaryotes.

Suggested Literature:

1. BiochemistryoflipidsandmembranesbyD.EVance;JEVance,theBenjamin/CummimgeCo.
2. Cell&Molecularbiology,DRoberti's.
3. Moleculercellbiology,AlbertBruceetal
4. Thecellandmolecularapproach, G.MCooper
5. Cellbiology,GeraldKarp.
6. CellbiologybyThomasD.Pollard, Saunders.
7. CellBiologyandGenetics,Dr.DevBratMishra. Ayushman Pub. New Delhi

Course outcomes-Understood about the transmission, distribution, arrangement, and alteration of

geneticinformation and how it functions and is maintained in populations. Bioenergetics and metabolism. Course is useful to further study of the students.

CourseCode	CourseTitle	Credits
B051015T	CellRegulation-CellCommunication& Differentiation	4

UNIT-1: CellSignalling:generalprinciplesofcellSignalling,formsofSignalling,classesofcellsurface receptors protein, Signalling of steroid and thyroid hormones through intercellular receptors, Signalling via – Gprotein linked cell surface receptors; interferon; the cell division cycle.

UNIT-2: Cellular mechanism of development: mechanisms of cell diversification in the early animal embryo, cell memory, cell determination and the concept of positional values; differentiated cells and their maintenance: maintenance of the differentiated state, tissues with permanent cells.

UNIT-3: The immune system: the cellular basis of immunity, antigen & antibody interactions. The functionalpropertiesofantibodies.Thefinestructureofantibodies,production&Synthesisof Polyclonal and monoclonal antibodies. T-cell receptors and subclasses, AIDS, MHC(major histocompabilitycells),molecularandantigenpresentationontoT-cells,Cytoxic-Tcells,Helper T Cells and T cell activation, Selection of the T cells repertoire.

UNIT-4: Cancer: cancer as a micro-evolutionary process, causes and types of cancer, properties, propertiesofcancercells,Moleculardiagnosis,preventionandtreatment,Moleculargeneticsof cancer; controlling gene expression : An overview of gene control, promoter and operator genes. Hormone regulation or gene control.

Suggested Literature:

1. Cell&MolecularBiology,D.Roberti's.
2. CellBiology,Saunders
3. Moleculercellbiology,AlbertBruceeetal
4. Thecellandmolecularapproach, G.MCooper
5. Cellbiology,GeraldKarp

Course outcomes-Outline the keycomponents ofthe innate and adaptive immune responses. Todescribeabout celltypesandorganswhichareinvolved inanimmuneresponse, described the Infectious diseases, hypersensitivity, autoimmune disorders, immunodeficiency diseases and Understood the microbial diversity, ultra structure, culture techniques of microbes.

CourseCode	CourseTitle	Credits
B051016T	TrendsinCellBiology	4

UNIT-1: Autoradiography:Useofradioisotopesastrancerincell,immunocytochemistryand immunohistochemistry.

UNIT-2: Immunoelectron microscopy: Nano- gold immuno prov and proteinofgold immune-cytochemistry.

UNIT-3: Applicationsofimmunohistochemistry,immunocytochemistry.Detectionofhistopathologyof diseases.

UNIT-4: Studyofhistogenesisandcytogenesis,detectionofapoptoticandnarcoticcell.

Suggested Literature:

1. Cell&MolecularBiology,D.Roberti's.
2. CellBiology,Saunders
3. Moleculercellbiology,AlbertBruceeetal
4. Thecellandmolecularapproach, G.MCooper
5. Cellbiology,GeraldKarp
6. Immunology:Owen,J.A.,Stranford,S.A.andUones,P.P.Kubey.
7. PrincipleofBiochemistry:Lehninger.

Course outcomes-Outline the keycomponents ofthe innate and adaptive immune responses. Todescribeabout celltypesandorganswhichareinvolved inanimmuneresponse, described the Infectious diseases, hypersensitivity, autoimmune disorders, immunodeficiency diseases and Understood the microbial diversity, ultra structure, culture techniques of microbes.

CourseCode	CourseTitle	Credits
B051017P	Practical	4

PRACTICAL

MaxMarks: 75 **Time:6 hours**

Distributionofmarks:

Cytochemicallocalization	10
Vitalstaining	10
Microtomy	10
Isolationofnucleicacid	10
Spotting(1-10spots)	20
Viva-Voce	05
Seminar/Record file/Model	10
Total	**75**

1. Handlinganduseofphasecontrastmicroscope.
2. QuantitativeestimationofDNA,RNA,alkalinephosphate.
3. Cytochemicallocalizationofphosphatases,RNA,DNA,proteins,lipidsandglycogen.
4. StudyofchromosomalBehaviorduringcelldivision,usingsquashpreparationsof animal(testesofratandgrasshopper;bonemorrowofrat)tissuesandplants(onionroottip)tissues.
5. PreparedslidesofchromosomesBehaviorduringcelldivision.
6. Studyofsalivarygland chromosomesofdrosophilaand/orChironomuslarvae.
7. Identificationand studyofmutantformsofdrosophila.
8. Druxoplnlaculturetechnique.
9. Cytochemicallocalizationofgolgicomplex,mitochondria,acidsandalkaline phosphatases and glycogen.
10. SupravitalstainingofNisslbodies,mitochondriaandCytoplasmicorganellsand inclusion.
11. Studyofprepared slidesofvariouscytoplasmicorganellsandinclusion.
12. Study of prepared slides of various stages during mitotic, and meiotic cell divisions.Bacterial culture techniques. Isolation of nucleic acids.

CourseCode	CourseTitle	Credits
B051018R	ResearchProject Cum Dissertation	8

ELECTIVECOURSES

STREAM4:ENVIRONMENTALBIOLOGYTOXICOLOGY

CourseCode	CourseTitle	Credits
B051019T	WildLife Biology	4

UNIT-1: Value of Wildlife, field observation, study of sign and symptoms, footprints; locomotory patterns in tetrapod;types of movement;tiger pug marks, footprints ofother animals, feeding sign, animal dropping, wildlife photography.

UNIT-2: Wildlife Census Method (water hole survey point count and line transect methods, pug mark count methods, king's census method); major wildlife habitat biomes, tropical and temperate habitat.

UNIT-3: Sociobiologyofwildanimals,terrestrialbehavior,migratorybehavior,breedingbehavior, visual, acoustic and olfactory communication and their socio biological importance; India wildlife (introduction, distribution of wildlife in ecological sub division of India); IUCN categories,cinctures,biosphere, reserves, nationalparks,sanctuariesandzoosinIndia;gene - pool.

UNIT-4: Reasons for wildlife depletion (habitat, distribution, commercial wildlife exploitation, overgrazing etc); wildlife ecotourism management, measures for wildlife conservation (policies and programme); special projects for endangered species (project Tiger, Gir Lion Sanctuary, project, crocodile breeding project, project Hangul).

Suggested literature:

1. Wildlifeecology,A.N.Moen.
2. Wildlifeecologyandmanagement,E.G.Balen
3. Indianwildlife,RameshBedi
4. Wildlifemanagement,RajeshGopal.
5. Fundamentalsofparasitologywildlifeandeconomiczoology.Dr.S.K.SinghVats Book Squirrel Pub. Indore

Course Outcomes-Distribution of wildlife in ecological sub division of India); IUCN categories, cinctures, biosphere, reserves, nationalparks, sanctuariesandzoosinIndia;gene-pool, habit, habitat and breeding biology of a representative wildlife and weaverbird. This course is useful in various competitive exams like CSIR-NET, Civil Services.

CourseCode	CourseTitle	Credits
B051020T	EnvironmentalChemistry	4

UNIT-1:

Fundamentalsofenvironmentalchemistry:stereochemistry,Gibbsenergy,chemicalpotential, chemical equilibrium, acid base reaction, solubility product, solubility of gases in water.

UNIT-2: Chemicalcomponentsofair:classificationofelements,chemical speciationparticlesionsand radicals in the atmosphere, chemical processes for information of inorganic and organic particulate matter, thermo chemical and photo chemical reaction in the atmosphere, oxygen and ozone chemistry of air pollutants, photochemical smog.

UNIT-3: Waterchemistry:chemistryofwaterconceptsofD.O.,BOD,COD.

UNIT-4: Toxic chemicals in the environment: pesticides inair,water and soil: biochemical aspects ofLead, Mercury, Cadmium, Arsenic, carbon monoxide, O_3 and PAN: carcinogens.

Suggested literature:

1. Environmentalchemistry,IanWilliams
2. Environmentalchemistry,ColinBaird.M.Cann
3. Environmentalchemistry,F. Helmet
4. Anintroductiontoenvironmentalchemistry,J.E. Andrews
5. Anintroductiontoenvironmentalchemistry,Andrewsetal.
6. Chemistryoftheenvironment,T.G.Spiro,W.M.Stygian

CourseOutcomes-Fundamentalsofenvironmentalchemistry:stereochemistry,Gibbsenergy, chemical potential, chemical equilibrium, acid base reaction, solubility product, solubility of gasesinwater,carbonatesystem,unsaturatedandsaturatedhydrocarbon,radio-nuclides, toxic

chemicals inthe environment. Get benefit ofthiscourse invariouscompetitive examinations.

CourseCode	CourseTitle	Credits
B051021T	EnvironmentalMonitoring	4

UNIT-1: Air pollution monitoring: air quality standards, sampling methods, instruments, duration of samplingperiod.Locationofsamplingsites,Airsampleroperation,stacksamplingtechniques, control of gases contaminants combustion. Ganga action plan.

UNIT-2: Physiochemical and bacteriological sampling and analysis ofwater quality. Waste treatment,

primary,secondary,andtertiarytreatment,criteriafortheapplicationofaerobicandanaerobic biological treatment. Types of biological treatment, treatment for various industrial effluents with reference to distillery,

UNIT-3: Pollution control in petroleum refineries and petro-chemical unit. Odours and their control. Thresholdconcentrationoxidation,watersupplymanagement:introduction,demandofwater, need of water supply.

UNIT-: Treatment of ground water, pollution, control in petroleumrefineries and petrochemicalunit, oil spills. Sources and generation of solid-waste and its control. Sewage treatment, physico- chemical and bacteriological samplings as analysis of soil quality, control of soil pollutants, remedial measures of soil pollutants, protection and control from radiation.

Suggested literature:

1. Toxicology,EarnestHodgson.
2. Environmentalpollutionandmanagement,G.R.Pathake,P.K. Goel.
3. Pollution,A.D.Stern
4. Pollutantsandtheirdetermination,Gryson
5. AssessmentandManagementofCarbon,NitrogenandSulphur,P.A.Debarry.
6. Toxicologyandriskassessment principles.MethodsandapplicationbyAnnaMFan,Louis W Chang, Marcel Dekker, inc, New York.

Course Outcomes- Study is useful to **p**hysiochemical and bacteriological sampling and analysis of water quality.Types of biological treatment, treatment for various industrial effluents with reference to distillery, paper and pulp, textile and dyeing wastes, industrial pollution abatement for useful to the student applied work.

CourseCode	CourseTitle	Credits
B051022T	EnvironmentalToxicology	4

UNIT-1: Toxicology:Introductionofbasicconceptofenvironmentaltoxicology.

UNIT-2: Heavymetalandpesticidepollution,hazardsofpesticidepollution.Biodegradationof pesticides.

UNIT-3: Toxicantsofhealthhazards. Bio concentrationandbio magnification.

UNIT-4: PollutionIndicators,Serbianindex. Recyclingof no degradablesubstances, roleofNGO's in environmental management and conservation, integrated pest management.

Suggested literature:

1. Toxicology,EarnestHodgson.
2. Environmentalpollutionand management,G.R.Pathak,,P.K.Goel.
3. Pollution,A.D.Stern
4. Pollutantsandtheirdetermination,Gryson
5. AssessmentandManagementofCarbon,NitrogenandSulphur,P.A.Debarry.
6. Toxicologyandriskassessment principles.MethodsandapplicationbyAnnaMFan,Louis W Chang, Marcel Dekker, inc, New York.
7. ElementsofEcology:Clarke.
8. EcologyandToxicology;P.D. Sharma.

Course Outcomes- Study is useful to **p**hysiochemical and bacteriological sampling and analysis of water quality. Types of biological treatment, treatment for various industrial effluents with reference to distillery, paper and pulp, textile and dyeing wastes, industrial pollution abatement for useful to the student applied work.

PRACTICAL

CourseCode	CourseTitle	Credits
B051023P	Practical	4

Max Marks: 75 **Time:6hours**

Distribution of marks:

Exercise Forwildlife biology(2)	20
Exercise(2)Forenvironmentalmonitoring	25
ExerciseEnvironmentaltoxicology	15
Viva-Voce	05
Seminar/Record file/Model	10
Total	**75**

1. Studyofwildlifeoflocalandsuburbanareas andsubmissionofthereport.
2. Studyonwildlifeinadjoiningareawithbiodiversityofwildflora&fauna.
3. Studyonwildanimalsandtheirbehavior
4. Comparisonofdissolveoxygen(D.O.)inwater samples fromdifferentsources.
5. Determinationofthechloridedemandandchloride residue.
6. Estimationofchemicaloxygendemand.
7. Estimationofbiologicaloxygendemand.
8. Estimationoffreecarbondioxide demand.
9. Estimationofchloride concentration.
10. Determinationofturbidity.
11. EstimationofpH
12. EffectofUVradiationonanimals
13. Demonstrationsofvectorsofdifferentdiseases
14. Determinationoftemperature,color,odor.
15. Determinationofconductivity.
16. Determinationoftotalsolidsinwatersamples.
17. Determinationofalkalinity
18. Determinationofgaspollutionindifferentlocalitiesofthe city.
19. Measurementofhumiditybyhair hygrometer.
20. MeasurementoftemperaturebyMax. Minthermometer
21. Studyonenvironmentalawarenessindifferentgroupofsociety
22. EstimationofLC50, LC10, LC90, measurementofselectedtoxicant forselectedorganisms. Determination of upper and lower confidant limits, slope with value of each study
23. Study of selected biological effect of selected pollutants, especially on the behaviour on animals
24. Effectoftoxicantonenzymeacetylcholinesterase(AchE)andalkalinephosphatase(ALP) in the nervous tissues of aquatic animals of different groups.

CourseCode	CourseTitle	Credits
B051024R	ResearchProject Cum Dissertation	8

04.07.2024.
Dr. Dev Brat Mishra
Convener BOS Zoology

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Prof. S.P. Singh
External Expert

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A.N.D. University of Agriculture
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Dr. Manish Kumar Sonekar, Member (UG), Rajkiya Mahila Snatkottar Mahavidyalaya, Ghazipur

In the aforesaid meeting, consideration was given to approve the modification in every semester of UG and PG Zoology syllabus. The modification made in the syllabus in accordance with the National Education Policy 2020 was unanimously approved.

Justification for M.Sc. Zoology

Necessity for the starting the course: As per provisions of NEP 2020 accepted by V.B.S. Purvanchal University, Jaunpur. It is necessary to start this course.

Whether the UGC recommended this course: Yes

Opportunities of employability: Employment available after under taking this course: lots of opportunities are available in both Government and Privet Sector.

Your's Faithfully

Dr. (Dev Brat Mishra)
Convener BOS, Zoology