B.SC.,ZOOLOGY

SYLLABUS

FROM THE ACADEMIC YEAR
2023-2024

TAMILNADUSTATECOUNCIL FORHIGHEREDUCATION,CHENNAI–600 005

CONTENTS

TANSCHEREGULATIONSONLEARNINGOUTCOMES-BASEDCURRICULUMFRAMEWORKGUIDELINESBASEDREGULATIONS FORUNDERGRADUATE PROGRAMME	
Programme:	**B.Sc.,Zoology**
Programme Code:	
Duration:	**UG-3Years**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensiveknowledgeandunderstandingof one or more disciplinesthatformapartofanundergraduateProgrammeofstudy **PO2: Communication Skills:** Ability to express thoughts and ideaseffectivelyinwritingandorally;Communicatewithothersusingappropriatemedia;confidentlyshareone'sviewsandexpressherself/himself; demonstrate the ability to listen carefully, read andwrite analytically, andpresent complex information ina clear andconcisemannertodifferentgroups. **PO3: Critical thinking:** Capability to apply analytic thought to a bodyofknowledge; analyseand evaluate evidence, arguments, claims,beliefsonthebasisofempiricalevidence;identifyrelevantassumptions or implications; formulate coherent arguments; criticallyevaluatepractices,policiesandtheoriesbyfollowingscientificapproachtoknowledgedevelopment. **PO4: Problem solving: Capacity** to extrapolate from what one haslearned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge;andapplyone'slearningtoreallifesituations. **PO5:Analyticalreasoning**:Abilitytoevaluatethereliabilityandrelevanceof evidence;identifylogicalflawsandholesintheargumentsof others; analyze and synthesize data from a variety ofsources; draw valid conclusions and support them with evidence andexamples,and addressingopposingviewpoints. **PO6:Research-relatedskills**:Asenseofinquiryandcapabilityfor asking relevant/appropriate questions, problem arising, synthesisingand articulating; Ability to recognise cause-and-effect relationships,defineproblems,formulatehypotheses,testhypotheses,analyse,interpretanddrawconclusionsfromdata,establishhypotheses,predict cause-and-effectrelationships;abilitytoplan,executeandreporttheresultsofanexperimentor investigation **PO7:Cooperation/Teamwork:**Abilitytoworkeffectivelyandrespectfully with diverse teams; facilitate cooperative or coordinatedeffort on the part of a group, and act together as a group or a team intheinterestsofacommoncauseandworkefficientlyasamemberofateam **PO8: Scientific reasoning**: Ability to analyse, interpret and drawconclusions from quantitative/qualitative data; and critically evaluateideas,evidenceandexperiencesfromanopen-mindedandreasonedperspective. **PO9:Reflectivethinking**:Criticalsensibilitytolivedexperiences,withself awareness andreflexivityofbothselfandsociety. **PO10 Information/digital literacy:** Capability to use ICT in a varietyoflearningsituations,demonstrateabilitytoaccess,evaluate,anduseavarietyofrelevantinformationsources;anduseappropriatesoftwareforanalysisofdata. **PO11Self-directed learning**: Abilitytoworkindependently,identifyappropriate resources required for a project, and manage a projectthroughto completion.

	PO 12 Multicultural competence: Possess knowledge of the valuesandbeliefsofmultipleculturesandaglobalperspective;andcapabilitytoeffectivelyengageinamulticulturalsocietyandinteractrespectfullywithdiverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembracemoral/ethical values in conducting one's life, formulate aposition/argument about an ethical issue from multiple perspectives,and use ethical practices in all work. Capable of demonstratingtheability to identify ethical issues related to one"s work, avoid unethicalbehavioursuchasfabrication,falsificationormisrepresentationofdataor committing plagiarism, not adhering to intellectual property rights;appreciating environmental and sustainability issues; and adoptingobjective,unbiasedandtruthfulactions inallaspects of work. **PO14:Leadershipreadiness/qualities:**Capabilityformappingout
	the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
Programme Specific Outcomes:	**PSO1 – Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations **PSO3 – Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

Consolidated Semester wiseandComponentwiseCreditdistribution

Parts	SemI	SemII	SemIII	SemIV	SemV	SemVI	Total Credits
PartI	3	3	3	3	-	-	12
PartII	3	3	3	3	-	-	12
PartIII	13	13	13	13	22	18	92
PartIV	4	4	3	6	4	1	22
PartV	-	-	-	-	-	2	2
Total	23	23	22	25	26	21	**140**

***PartI.II,andPartIIIcomponentswillbeseparatelytakenintoaccountforCGPAcalculation andclassificationfortheundergraduateprogrammeandtheothercomponents. IV, V have to be completed during the duration of the programme as per thenorms,tobeeligibleforobtainingtheUGdegree.**

METHODSOFEVALUATION		
InternalEvaluation	ContinuousInternalAssessmentTest	**25Marks**
	Assignments/SnapTest/Quiz	
	Seminars	
	AttendanceandClassParticipation	
ExternalEvaluation	EndSemesterExamination	**75Marks**
Total		**100Marks**

METHODSOFASSESSMENT	
Remembering(K1)	• Thelowestlevelofquestionsrequirestudentstorecallinformationfromthecourse content • Knowledgequestionsusuallyrequirestudentstoidentifyinformationinthetextbook.
Understanding(K2)	• Understandingoffactsandideasbycomprehendingorganizing,comparing, translating, interpolatingandinterpretingintheirownwords. • Thequestionsgobeyondsimplerecallandrequirestudentstocombinedatatogether
Application(K3)	• Studentshavetosolveproblemsbyusing/applyingaconceptlearnedintheclassroom. • Studentsmustusetheirknowledgetodetermineaexactresponse.
Analyze(K4)	• Analyzingthequestionisonethatasksthestudentstobreakdownsomethingintoitscomponentparts. • Analyzingrequiresstudentstoidentifyreasonscausesormotivesandreachconclusionsorgeneralizations.
Evaluate(K5)	• Evaluationrequiresanindividualtomakejudgmentonsomething. • Questionstobeaskedtojudgethevalueofanidea,acharacter,aworkofart,orasolution toaproblem. • Studentsareengagedindecision-makingandproblem–solving. • Evaluationquestionsdonothavesinglerightanswers.
Create(K6)	• Thequestionsofthiscategorychallengestudentstogetengagedincreativeandoriginalthinking. • Developingoriginalideasandproblemsolvingskills

HighlightsoftheRevampedCurriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrialcomponents, hands-on training, skill enhancement modules, industrial project, projectwithviva-voce,exposuretoentrepreneurialskills,trainingforcompetitiveexaminations,sustaining thequalityofthecorecomponentsandincorporatingapplication orientedcontentwhereverrequired.
- The Core subjects include latest developments in the education and scientific front,advanced programming packages allied with the discipline topics, practical training,devisingstatisticalmodelsandalgorithmsforprovidingsolutionstoindustry/real life situations. The curriculum also facilitates peer learning with advanced statisticaltopicsinthefinalsemester,cateringtotheneedsofstakeholderswithresearchaptitude.
- TheGeneralStudiesandStatisticsbasedproblemsolvingskillsareincludedasmandatory components in the 'Training for Competitive Examinations' course at thefinalsemester,afirstofitskind.
- The curriculum is designed so as to strengthen the Industry-Academia interface andprovidemorejob opportunitiesforthestudents.
- The Statistical Quality Control course is included to expose the students to real lifeproblemsandtrainthestudentsondesigningamathematicalmodeltoprovidesolutions totheindustrialproblems.
- The Internship during the second year vacation will help the students gain valuablework experience, that connects classroom knowledge to real world experience and tonarrowdownand focusonthecareerpath.
- Projectwithviva-vocecomponentinthefifthsemesterenablesthestudent,applicationofconceptualknowle

dgetopracticalsituations.ThestateofarttechnologiesinconductingaExplaininascientifi candsystematicwayandarrivingat a precise solution is ensured. Such innovative provisions of the industrial training,project and internships will give students an edge over the counterparts in the jobmarket.

- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary andinter disciplinary nature are incorporated as Elective courses, covering conventionaltopicstothelatestDBMSandComputersoftwareforAnalytics.

ValueadditionsintheRevampedCurriculum:

Semester	Newly introduced Components	Outcome/Benefits
I	**FoundationCourse** To ease thetransition oflearningfromhighersecondarytohighereducation,providinganoverviewofthepedagogyoflearningabstractStatisticsandsimulatingmathematical conceptstorealworld.	• Instilconfidenceamongstudents • Createinterestforthesubject
I,II,III,IV	**SkillEnhancementpapers** (Disciplinecentric/ Generic/Entrepreneurial)	• Industryreadygraduates • Skilledhumanresource • Studentsareequippedwithessentialskillstomaketheemployable
		• TrainingonComputing/Computationalskillsenablethestudentsgainknowledgeandexposure onlatestcomputationalaspects
		• Dataanalyticalskillswillenablestudentsgaininternships,apprenticeships,fieldworkinvolving datacollection,compilation,analysisetc.
		• Entrepreneurialskilltrainingwillprovideanopportunity forindependentlivelihood • Generatesself–employment • Createsmallscaleentrepreneurs • Trainingtogirlsleadstowomenempowerment
		• DisciplinecentricskillwillimprovetheTechnicalknowhowofsolvingreallifeproblemsusingICT tools
III,IV,V &VI	Electivepapers- An open choice of topicscategorized underGenericandDisciplineCentric	• Strengtheningthedomainknowledge • IntroducingthestakeholderstotheState-ofArttechniquesfromthestreamsofmulti-disciplinary,crossdisciplinaryandinterdisciplinarynature • Students are exposed to Latest topics on ComputerScience/IT,thatrequirestrongstatisticalbackground • Emergingtopicsinhighereducation/industry/communicationnetwork/healthsectoretc.areintroducedwithhands-on-training,facilitatesdesigningofstatisticalmodelsinthere spective sectors
IV	DBMSandProgramming skill, Biostatistics,	• Exposuretoindustrymouldsstudentsintosolution

	Statistical Quality Control, Official Statistics, OperationsResearch	Providers • GeneratesIndustryreadygraduates • Employmentopportunitiesenhanced
II yea rVacation activity	Internship /IndustrialTraining	• Practical training at the Industry/ Banking Sector /Private/Publicsectororganizations/Educationalinstitutions,enablethestudentsgainprofessional experienceandalsobecomeresponsiblecitizens.
V Semester	ProjectwithViva–voce	• Self-learningisenhanced • Applicationoftheconcepttorealsituationisconceivedresultingintangibleoutcome
VI Semester	Introductionof ProfessionalCompetencycomponent	• Curriculumdesignaccommodatesallcategoryoflearners;'StatisticsforAdvancedExplain'componentwillcompriseofadvancedtopicsinStatisticsandalliedfields,forthoseinthepeergroup/aspiring researchers; • 'Training for Competitive Examinations' –caters totheneedsoftheaspirantstowardsmostsought-after services ofthe nation viz, UPSC, ISS,CDS,NDA,BankingServices,CAT,TNPSCgroup services,etc.
ExtraCredits: **ForAdvancedLearners/Honorsdegree**		• Tocatertotheneedsofpeerlearners/researchaspirants

Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN (w.e.f.2023-24)
B.Sc., Zoology– PROGRAMME STRUCTURE

Sem.	Part	Course Code	Courses	Title of the Paper	T/P	Cr.	Hrs./ Week	Max. Marks		
								Int.	Ext.	Total
I	I	2311T	T/OL	**தமிழ் இலக்கிய வரலாறு-I** /Other Languages	T	3	6	25	75	100
	II	2312E	E	General English - I	T	3	6	25	75	100
	III	23BZO1C1	CC-I	Invertebrata	T	5	5	25	75	100
		23BZO1P1	CC-II	Invertebrata-Lab course	P	3	4	25	75	100
		-	Generic Elective (Allied)	Botany/Chemistry/Biochemistry/ Microbiology	T	3	3	25	75	100
		-		Allied IA Practical	P	2	2	25	75	100
	IV	23BZO1S1	SEC –I	Ornamental Fish Farming and Management	T	2	2	25	75	100
		23BZO1FC	FC	Foundation Course for Zoology	T	2	2	25	75	100
				Total		**23**	**30**	**200**	**600**	**800**
II	I	2321T	T/OL	தமிழ் இலக்கிய வரலாறு-2 / Other Languages -II	T	3	6	25	75	100
	II	2322E	E	General English - II	T	3	6	25	75	100
	III	23BZO2C1	CC-III	Chordata	T	5	5	25	75	100
		23BZO2P1	CC-IV	Chordata Practical	P	4	4	25	75	100
		--	Generic Elective (Allied)	Allied IB Botany/Chemistry/Biochemistry/ Microbiology	T	2	3	25	75	100
		--		Allied IB Practical	P	2	2	25	75	100
	IV	23BZO2S1	SEC –II	Aquarium Keeping	T	2	2	25	75	100
		23BZO2S2	DSC-I	Animal Behaviour	T	2	2	25	75	100
				Total		**23**	**30**	**200**	**600**	**800**
III	I	2331T	T/OL	**தமிழக வரலாறும் பண்பாடும்**/ Other Languages -III	T	3	6	25	75	100
	II	2332E	E	General English – III	T	3	6	25	75	100
	III	23BZO3C1	CC-V	Cytogenetics	T	6	6	25	75	100
		23BZO3P1	CC-VI	Cytogenetics Practical	P	3	3	25	75	100
		--	Generic Elective (Allied)	Allied IB Botany/Chemistry/Biochemistry/ Microbiology	T	3	3	25	75	100
		--		Allied IB Practical	P	2	2	25	75	100
	IV	23BZO3S1	SEC-III	Biocomposting for Entrepreneurship	T	2	2	25	75	100
	IV	233AT/ 23BZO3S2	DSC-II	Adipadai Tamil/Nanobiology	T	2	2	25	75	100
				Total		**24**	**30**	**200**	**600**	**800**
IV	I	2341T	T/OL	**தமிழும் அறிவியலும்** / Other Languages -IV	T	3	6	25	75	100
	II	2342E	E	General English – IV	T	3	6	25	75	100
	III	23BZO4C1	CC-VII	Developmental Biology	T	4	4	25	75	100
		23BZO4P1	CC-VIII	Developmental Biology Practical	P	3	3	25	75	100
		--	Generic Elective (Allied)	Allied IB Botany/Chemistry/Biochemistry/ Microbiology	T	3	3	25	75	100
		--		Allied IB Practical	P	2	2	25	75	100

	IV	23BZO4S1	DSC-III	Human Reproductive Biology	T	2	2	25	75	100
		234AT/ 23BZO4S2	DSC-IV	Adipadai Tamil/Wildlife Conservation and Management	T	2	2	25	75	100
		23BES4		E.V.S	T	2	2	25	75	100
				Total		**24**	**30**	**225**	**675**	**900**
V	III	23BZO5C1	CC-IX	Evolutionary Biology	T	4	5	25	75	100
		23BZO5C2	CC-X	Animal Physiology	T	4	5	25	75	100
		23BZO5C3	CC-XI	Environmental Biology	T	4	5	25	75	100
		23BZO5E1	DSE-I	Food, Nutrition and Health	**T**	**4**	**5**	**25**	**75**	**100**
		23BZO5P1	CC-XII	Eco-Physiology Practical	P	2	4	25	75	100
		23BZO5P2	CC-XIII	Evolution and Environmental Toxicology Practical	P	2	4	25	75	100
		23BVE5		Value Education	T	2	2	25	75	100
		23BZO5IV		Internship/Industrial Visit/ Field Visit		2	-	25	75	100
				Total		**24**	**30**	**200**	**600**	**800**
VI		23BZO6C1	CC-XIV	Animal biotecnology	T	4	6	25	75	100
		23BZO6C2	CC-XV	Microbiology and Immunology	T	4	6	25	75	100
		23BZO6E1	DSE-II	Agricultural Entomology	**T**	**4**	**6**	**25**	**75**	**100**
		23BZO6PR	CC-XVI	Project		5	7	25	75	100
		23BZO6P1		Animal Biotechnology, Microbiology and Immunology Practical	P	2	3	25	75	100
		--		Extension Activity		1		-	-	100
		23BZO6S1		Essential Reasoning and Quantitative Aptitude	T	2	2	25	75	100
				Total		**22**	**30**	**150**	**450**	**700**
				Grand Total		**140**	**--**	**--**	**--**	**4800**

TOL-Tamil/Other Languages,
 E –English
 CC-Core course –Core competency, critical thinking, analytical reasoning, research skill & teamwork
 Generic Elective AL - Allied -Exposure beyond the discipline
  SEC - Skill Enhancement Course - Exposure beyond the discipline (Value Education, Entrepreneurship Course,
Computer application for Science, etc.,)
DSE-Disclipline Specific Elective Courses
FC-Foundation Course
* T- Theory, P-Practical
Intenship/Industrial visit/Field Visit:Marks-Internal =25(15+10)Report and Viva Voce
External =75 Report=50 Viva Voce=25
Project=Marks-Internal =25(15+10)Report and Viva Voce
External =75 Report=50 Viva Voce=25

Chairperson details: Mr.R.Navukkarasu, Sree Sevugan Annamalai College, Devakottai.
Mobile No: 7373741881

SEMESTER – I

Course Code:	Course Name	Category	L	T	P	S	C	Inst Hours	Marks		
									Int.	Ext.	Total
23BZO1C1	**INVERTEBRATA**	Core	Y	-	-	-	5	5	25	75	100

Learning Objectives	
CO1	To understand the basic concepts of lower animals and observe thestructure andfunctions.
CO2	To illustrate and examine the systemic and functional morphology ofvariousgroup of invertebrates.
CO3	To differentiate and classify the various groups of animal modes of lifeand toestimate the biodiversity.
CO4	To compare and distinguish the general and specific characteristics ofreproduction in lower animals.
CO5	To infer and integrate the parasitic and economic importance ofinvertebrate animals

	Details	**Course Objectives**
UNIT I	**Protozoa:** Introduction to Classification, taxonomy and nomenclature. General characters and classification of Phylum Protozoa up to classes. Type study - *Paramecium* - Parasitic protozoans (*Entamoeba*, *Trypanasoma* &*Leishmania*) - Economic importance Nutrition in protozoa - Host-parasitic interactions in *Entamoeba Lo*comotion in protozoa **Porifera:** General characters and classification up to Classes. Type study Ascon Sponge (Leucosolenia) - Skeleton in sponges, Economic importance in Sponges Canal system in sponges - Reproduction in sponges	CO1
UNIT II	**Coelenterata :** General characters and classification up to classes – Type study - *Obelia* - Mesenteries in Anthozoa - Economic importance of corals and coral reefs - Polymorphism in Coelenterates. **Platyhelminthes:** General characters and classification of up to classes. Type study – *Fasciola hepatica*. Parasitic adaptations. Host- parasitic interactions of Helminth parasites.	CO2
UNIT III	**Aschelminthes** : General characters and classification of up to classes - Type study - *Ascaris lumbricoides.* Nematode Parasites and diseases - *Wuchereria bancrofti*,Enterobius vermicularis. **Annelida:** General characters and classification up to Classes. Type study –*Nereis* Metamerism in Annelida.Nephridium in Annelids.Coelom in Annelids ,,Reproduction in polychaetes.	CO3
UNIT IV	**Arthropoda:** General characters and classification of Phylum Arthropoda up to Classes. Detailed study: *Penaeus indicus*. Affinities of *Peripatus* – Larval forms in Crustacea – Organization of Centipede and Millipede **Insects associated with human diseases:** Mosquitoes, housefly, bed bug, human head louse.Insects associated with household materials: Ants, Termites, Silver fish. **Insect pests: L**ife cycle and types of damage to plants. Pest of rice: Rice stem borer (*Scirpophaga incertulas*) – Pest of Sugarcane: The shoot borer (*Chilo infuscatellus*) – Pest of coconut: The rhinocerosbeetle (*Oryctes rhinoceros*) Principles of Integrated PestManagement.	CO4

UNIT V	**Mollusca:** General characters and classification of Phylum Mollusca up to Classes. Detailed study: *Pila globosa*. Foot in Mollusca, torsion in Mollusca, Economic importance of Molluscs – Cephalopoda as the most advanced Molluscs. **Echinodermata:** General characters and classification of Phylum Echinodermata up to Classes. Detailed study: *Asterias.* Water vascular system in Echinodermata – Larval forms of Echinoderms.	CO5

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic concepts of invertebrateanimalsand recall its structure and functions.	PO 1
CO2	Illustrate and examine the systemic and functionalmorphology of various groups of invertebrata.	PO1, PO2
CO3	Differentiate and classify the animal's mode of life invarious taxa and estimate the biodiversity.	PO4, PO6
CO4	To compare and distinguish the various physiologicalprocesses and organ systems in loweranimals.	PO4, PO5, PO6
CO5	Infer and integrate the parasitic and economicimportanceof invertebrate animals.	PO3, PO8

Text Books(Latest Editions)

1.	Ekambaranatha Iyer, 2000. A Manual of Zoology, 10th edition, Viswanathan,S.,Printers & Publishers Pvt Ltd
2.	Jordan, E.L. and Verma P.S, 1995. Invertebrate Zoology, 12th edn. S.Chand& Co.
3.	Kotpal, R.L, 1992. Protozoa, Porifera, Coelenterata, Annelida,Arthropoda.

References Books
(Latest editions, and the style as given below must be strictlyadhered to)

1	Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. HoltSaunders International Edition.
2	**Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science**
3.	Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4	Hyman L.H, 1955. The invertebrates - Vol. I to Vol. VII – Mc Graw Hill BookCo.
5	Parker, J. and Haswell , 1978. A text book of Zoology Vol. I - Williams andWilliams.

Web Resources

1.	https://www.nationalgeographic.com/animals/invertebrates/
2.	https://bit.ly/3kABzKa
3.	https://www.nio.org/
4.	https://greatbarrierreef.org/

Methods of Evaluation

Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks

Methods of Assessment

Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary oroverview
Application(K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems,Observe, Explain
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

SEMESTER – I
CORE COURSE-II

Course Code	Course Name	Category	L	T	P	S		Inst Hours	Marks		
									CIA	Ext.	Tot.
23BZO1P1	**INVERTEBRATA LAB COURSE**	Core practical		-	p	-	3	4	25	75	100

Learning Objectives	
CO1	To identify the different groups of invertebrate animals by observing theirexternal characteristics.
CO2	To understand the organs, organ system and their functions in lower animals.
CO3	To get knowledge about the different modes of life and their adaptation based on the environment.
CO4	Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates.

SECTION	**DetailS**	**Course Objectives**
UNIT I	**Major Dissection :** Cockroach: Digestive system. Circulatory system, Nervous system,. Earthworm: Nervous System, Digestive system *Pila globosa*: Nervous system, Digestive system	CO1
UNIT II	**Mounting:** Earthworm: Body setae; Pineal setae. *Pilaglobosa*: Radula. Honey Bee, House fly ,Cockroach and Mosquito mouthparts. Prawn appendages.	CO2
UNIT III	**Spotters :** **(i).Protozoa:** Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax **(ii). Porifera:** Sycon, Spongilla, Euspongia, Sycon - T.S &L.S, Spicules, Gemmule **(iii). Coelenterata:** Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula **). Platyhelminthes:**Planaria, Fasciola hepatica, Fasciola larval forms-Miracidium, Redia, Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium **(v).Nemathelminthes:** Ascaris(Male & Female), Drancunculus, Ancylostoma, Wuchereria **(vi). Annelida:** Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva **(vii). Arthropoda:** Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis,Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly. **(viii). Mollusca:** Chiton, Pila, Unio, Pteredo, Murex,Sepia, Loligo,Octopus, Nautilus, Glochidium larva **(ix). Echinodermata:** Asterias, Ophiothrix, Echinus,Clypeaster, Cucumaria, Antedon, Bipinnaria larva	CO3
UNIT IV	**Preserve any Two insect pests** and prepare a report on its name,life cycle, damaging crops and management of the pests using different methods.	CO4
UNIT V	Observation note/Record	CO5

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Identify and label the external features of different groups of invertebrate animals.	PO1
CO2	Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals.	PO1, PO2
CO3	Differentiate and compare the structure, function and	PO4, PO6

	mode of life of various groups of animals.	
CO4	To compare and distinguish the dissected internal organs of lower animals.	PO4, PO5, PO6
CO5	Prepare and develop the mounting procedure of economically important invertebrates.	PO3, PO8

Text Books (Latest Editions)	
1.	Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai
2.	Ganguly, Sinha an d A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
3.	Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced PracticalZoology, Books & Allied Ltd; 3rd Revised edition, 1 07 0 pp.
4.	Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.
5.	Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 4 97pp.

References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science.
2.	Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt SaundersInternational Edition.
3.	Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. IIEdition,E.L.B.S. and Nelson
4.	Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the useof Students*. Asia Publishing Home.
5.	Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut

Web Resources	
1.	https://nbb.gov.in/
2.	http://www.agshoney.com/training.htm
3.	https://icar.org.in/
4.	http://www.csrtimys.res.in/
5.	http://csb.gov.in/
	https://iinrg.icar.gov.in/
	https://www.nationalgeographic.com/animals/invertebrates/

SCHEME OF EVALUATION	
Dissect and display the digestive system of Pila/Dissect and display the digestive system and nervous system of Earthworm	15 Marks
Mounting Housefly mouth parts/Earthworm body setae and penial setae	10 Marks
Identify Sketch and comment on A,B,C,D &E	15 Marks
Preserve any two insect pest and submit a descriptive report about the pest ,infested plants ,types of damage and natural way of control	10 Marks
Bonafide Record of the , work done in laboratory	10 Marks
Total	60 Marks

Course Code	Course Name	Category	L	T	P	S		Inst Hours	Marks		
									CIA	Ext.	Tot.
23BZO1S1	Ornamental Fish Farming & Management	SEC	Y	-	-	-	2	2	25	75	100

Learning Objectives:

- To highlight the importance of ornamental fish culture in relation to entrepreneurship development.
- To enable the identification, culture and maintenance of commercially important ornamentalfishes.
- To provide the knowledge on the techniques of ornamental fish breeding, rearing, disease controland economics of ornamental fish farming.

Unit I	Introduction to ornamental fish keeping. Scope and importance of ornamental fish culture. Domestic and global scenario of ornamental fish trade and export potential. Commercially important ornamental fishes - Indigenous and exotic varieties.
Unit II	Biology of egg layers and live bearers. Food and feeding in ornamental fishes. Formulated feed and Live feed; Live feed culture. Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg. Guppy).
Unit III	Aquarium design and construction; Accessories - aerators, filters and lighting.Aquarium plants and their propagation. Maintenance of aquarium and water quality management. Ornamental fish diseases, their prevention, control and treatment methods.
Unit IV	Conditioning, packing, transport and quarantine methods. Economics, trade regulations, domestic and export marketing strategies. **Practical** 1) Identification of locally available ornamental fishes - Egg layers and live bearers. 2) Identification of locally available live feed organisms.

References:

1. Swain SK., Sarangi N. and Ayyappan S. 2010. Ornamental fish farming. ICAR, New Delhi.
2. Living Jewels – A handbook on freshwater ornamental fish, MPEDA, Kochi.
3. Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi.
4. Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquariculture. Daya Publishing House,New Delhi.

Web links:

1. **http://ecoursesonline.iasri.res.in/course/view.php?id=297**
2. **https://www.ofish.org/**
3. **https://krishijagran.com/agripedia/income-generation-by-ornamental-fish-culture/**
4. https://99businessideas.com/ornamental-fish-farming/

Course Outcome:

- The students will be able to identify, culture, maintain and market the commercially importantornamental fishes.
- The knowledge and skills gained on the different aspects of ornamental fish keeping will enablethe students to develop entrepreneurship potential and help in self employment.

Course Code	Course Name	Category	L	T	P	S		Inst Hours	Marks		
									CIA	Ext.	Tot.
23BZO1FC	**Foundation course for Zoology**	FC	Y	-	-	-	2	2	25	75	100

Learning Objectives:

- To highlight the importance of ornamental fish culture in relation to entrepreneurship development.
- To enable the identification, culture and maintenance of commercially important ornamentalfishes.
- To provide the knowledge on the techniques of ornamental fish breeding, rearing, disease controland economics of ornamental fish farming.

Unit I	**Life and its manifertation** ,History of Biology-Evolution of Biology, Branches of zoology, Biodiversity -Outline Classification of Invertebrates and Vertebrates up to class level.
Unit II	**Interaction of living organisms with environment**: Types of Ecosystem-Pond, Terrestrial, Forest and Land, Components of Ecosystem-Abiotic and Biotic factors, Food web,Food chain, Environment issues Conservation and Management stratergies-Zoological Parks and Santuries.
Unit III	**Cytology and Genome biology**:Prokaryotic cells-Eukaryotic cells-Importance of cell organelles-Cancer cells-Immune cells-Stem cells- Principle resolving power & use of compoundmicroscopie,confocal microscope and electron microscope-Characteristics features-Mendels Principles-DNA-RNA modern concept of gene-central dogma of molecular biology.
Unit IV	**Embroyology and Development of Biology**:Gametes (Sex cells)-Egg-Sperm-Fertilization-Cleavage-Developmental stages-Zygote-Clevage-Morula-Blastula and Gastrula.Origin of life,Spontaneous generation theoryof life,Origin of cells-Oparin coacervate theory.
Unit V	**Biochemistry and Physiology** :Introduction to role of essential biological Compounds –Proteins ,Carbohydrates, Lipids, Water and Vitamins. **Scope of Zoology**-General introduction and Application of Apiculture, Aquaculture, Sericulture, Lac culture, Vermiculture, Poultry Keeping, Dairy farming-Zoological survey of India, Central Marine Fishries Research Institute.

SEMESTER II

CourseCode	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO2C1	**CHORDATA**	Core	Y	-	-	-	5	5	25	75	100

LearningObjectives	
CO1	TounderstandthestructuresanddistinctfeaturesofPhylumChordata.
CO2	Tounderstandandabletodistinguishthecharacteristicfeaturesofeach subphylumandclass.
CO3	Tounderstandtheeconomicimportanceofvertebrates
CO4	Toknowabouttheadaptationsofvertebrates
CO5	Tounderstandtheevolutionarypositionofdifferentgroupsofvertebrates

	Details	**No.of Hours**	**Course Objectives**
UNIT I	**GeneralCharactersandClassificationofPhylumChordata**:Origin of Chordata, Differences between non-chordates and chordates, General characters, Affinities and Systematic position of Hemichordata (*Balanoglossus*), Urochordata (*Ascidia*), Cephalochordata(*Amphioxus*).	12	CO1,CO2
UNIT II	**Prochordates and Agnatha**: Characteristics of sub phylum vertebrata, Classification of Vertebrata upto Class level,Agnatha(*Petromyzon*),-isces (*Scoliodonsorrakowah*) General characters and classification, Origin of fishes, Affinities of Dipnoi -Typesofscalesandfins-Accessoryrespiratoryorgans-Airbladder-Parentalcare-Migration-Economic importance.	12	CO1,CO2,CO4,CO5
UNIT III	**Amphibia**:General characters andclassification-Origin of Amphibia-Type study-*Ranahexadactyla*-Adaptive features of Anura,Urodela and Apoda-Neoteny in Urodela-Parental care in Amphibia.	12	CO1,CO2, CO3,CO4, CO5
UNIT IV	**Reptilia**:General characters and classification-Type study–(*Calotesversicolor (endoskeleton of Varanus*) - Origin of reptiles and effects of terrestrialisation, Extinctreptiles. Snakes of India.Poison apparatus and biting mechanism of poisonous snakes - Skullin reptiles as basis of classification	12	CO1,CO2,CO4,CO5
UNIT V	**AvesandMammalia:**Ayes: General characters and classification – Type study - *Columba livia* - Origin of birds, Flight adaptations, Migration. Mammalia: General characters and classification-Type study-Rabbit-Adaptiveradiationinmammals- Egglayingmammals, Marsupials, Flying mammals, Aquatic mammals, Dentition in mammals.	12	CO1,CO2,CO4,CO5
	Total	**60**	

CourseOutcomes		
Course Outcomes	Oncompletionofthiscourse,studentswill;	
CO1	Classify,Identifyandrecallthenameanddistinctfeaturesofdifferentsubphylumbelongingtophylum Chordata.	PO1
CO2	Explain,andrelatetheorigin,structuralorganizationand evolutionaryaspectsofvertebrates.	PO1,PO2
CO3	Analyze,compare and distinguishthe developmentalstagesanddescribetheimportantbiologicalprocess.	PO3,PO4,PO5
CO4	Correlatethedifferentmodesoflifeandparentalcare amongdifferentvertebrates.	PO3,PO5,PO6
	Summarisethemorphologyandecologicaladaptationsinve	

CO5	rtebratesandlistouttheeconomicimportance.	PO2,PO3,PO5,PO8

TextBooks(LatestEditions)	
1.	Ayyar,E.K.andT.N.Ananthakrishnan,1992.ManualofZoologyVol.II (Chordata),S.Viswanathan(PrintersandPublishers)PvtLtd.,Madras,891p.
2.	Jordan,E.K.andP.S.Verma,1995.ChordateZoologyandElementsofAnimal Physiology,10thedition,S.Chand&CoLtd.,RamNagar,NewDelhi,1151pp.
3.	Nigam,H.C.,1983.ZoologyofChordates,VishalPublications,Jalandhar-144008,942.
4.	Ganguly,Sinha,.BharatiGoswamiandAdhikari,2004.BiologyofanimalsVol.II -NewcentralbookAgency(p)Ltd.
5.	Kotpal.R.L.A,ModerntextbookofZoologyVertebrates-Rastogipublications.2009
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)	
1.	DarlingtonP.J.TheGeographicalDistributionofAnimals,R.E.KriegerPub.Co.
2.	HallB.K.andHallgrimssonB.(2008).Strickberger'sEvolution.IVEdition. JonesandBartlettPublishersInc.
3.	Hickman,C.P.Jr.,F.M.HickmanandL.S.Roberts,1984.IntegratedPrinciplesofZoology,7thEditio n,TimesMerror/MosbyCollegePublication.St.Louis.1065 pp.
4.	Newman,H.H.,1981.ThePhylumChordata,SatishBookEnterprise,Agra–282 003,477pp.
5.	ParkerandHaswell,1964.TextBookofZoology,VolII(Chordata),A.Z.T,B.S. PublishersandDistributors,NewDelhi-110051,952pp.
6.	PoughH.Vertebratelife,VIIIEdition,PearsonInternational.
7.	Waterman,AllynJ.etal.,1971.ChordateStructureandFunction,MacMillan&Co.,NewYork,587pp
8.	Young,J.Z.(2004).TheLifeofVertebrates.IIIEdition.Oxforduniversitypress.

WebResources	
1.	http://tolweb.org/Chordata/2499
2.	https://www.nhm.ac.uk/
3.	https://bit.ly/3Av1Ejg
4.	https://bit.ly/3kqTfYz
5.	https://biologyeducare.com/aves/
6.	https://www.vedantu.com/biology/mammalia

MethodsofEvaluation		
Internal Evaluation	ContinuousInternalAssessmentTest	25Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
External Evaluation	EndSemesterExamination	75Marks
	Total	100Marks

MethodsofAssessment	
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/ Comprehend(K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview
Application (K3)	Suggestidea/conceptwith examples, Suggestformulae, Solveproblems,Observe,Explain
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas, Map knowledge
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion,Debatingor Presentations

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	S							
CO2	M	S						
CO3		S	S	S	S	S		S
CO4			S	S	S	M		
CO5			S		S			S

Course Code	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO2P1	**CHORDATA - PRACTICAL**	Core	-	-	P	-	4	4	25	75	100

LearningObjectives			
CO1	Tounderstandthestructuresanddistinctfeaturesofphylumchordata.		
CO2	Tounderstandandabletodistinguishthecharacteristicfeaturesofeach Sub phylum andclass.		
CO3	Tounderstandandcomparethestructureofvariousinternalorgansindifferent classesofvertebrates.		
CO4	Toknowabouttheclassification,adaptationsandaffinitiesofchordateanimals.		
	Details	**No.of Hours**	**Course Objectives**
UNIT I	**Dissections**:Frog(Demo)/Fish:Externalfeatures,Digestivesystem,Arterialsystem,Venoussystem,5thCranialnerve,9th and10th cranialnerves, Male and female rinogenitalsystem.	12	CO1
UNIT II	**Mounting**:Fish:PlacoidandCtenoidscales,Frog: HyoidapparatusandBrain(Demo).	12	CO2
UNIT III	**Osteology**:Frog:Skull and lowerjaw,Vertebralcolumn,Pectoral girdle,Pelvicgirdle,Forelimb,Hindlimb.Chelonia-Anapsid skull,Pigeon-skullandlowerjaw,synsacrum.	12	CO3
UNIT IV	**SpecimenandSlides**:**(i)Hemichordata:**Balanoglossus,Tornarialarva**(ii).Protochordata:**Amphioxus,AmphioxusT.S.throughpharynx**(iii).Cyclostomata:**Petromyzon,Myxine,Ammocoetuslarva**(iv).Pisces:**SphyrnaPristis,Torpedo,Channa,Pleuronectes,Hippocampus,Exocoetus,Echieneis,Labeo,Catla, Clarius, Auguilla, Protopterus, Scales: Placoid, Cycloid,Ctenoid**(v).Amphibia:**Ichthyophis,Amblystoma,Siren,Hyla,Rachophous,Bufo,Rana,Axolotallarva**(vi). Reptilia :** Draco, Chemaeleon, Gecko, Uromastix,Viperarusselli,Naja,Bungarus,Enhydrina,Typhlops,Testudo,Trionyx,Crocodilus,Ptyas.**(vii).Aves:**Archaeopteryx,Passer,Psittacula,Bubo,Alcedo,Columba, Corvus, Pavo; Collection and study of differenttypesoffeathers:Quill,Contour,Filoplume, Down **(viii). Mammalia:** Ornithorhynchus,Tachyglossus,Pteropus,Funambulus,Manis,Loris, Hedgehog	12	CO4
UNIT V	Choose any commercdial fish/amphibian/reptiles/bird/mammal and do a project work on the generic identification description and illustration with a note on its importance	12	CO5
	Total	**60**	

CourseOutcomes		
Course Outcomes	Oncompletionofthiscourse,studentswill;	
CO1	Identifyandrecallthenameanddistinctexternalandinternalfeaturesofanimalsbelongingtophylum Chordata.	PO1
CO2	Explainthestructuralorganizationofvariousorgans andsystemsindifferentclassesofvertebrates.	PO1,PO2
CO3	Analyse,compareanddistinguishthemorphological featuresanddevelopmentalstagesofchordates	PO4,PO6
CO4	Dissectandexplainvariousorgansandinternalsystems indifferentvertebratesandcorrelateitsfunction.	PO4,PO5,PO6
CO5	Summarisethe morphologyandecologicaladaptations invertebratesandlistouttheeconomicimportance.	PO3,PO8

TextBooks (LatestEditions)		
1.	LalSS,2009.PracticalZoologyVertebrate,RajpalandSonsPublishing,484pp.	
2.	VermaP.S,2000.AManualofPracticalZoology:Chordates,S.ChandLimited,627pp.	
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)		
1.	RobertWilliamHegner,2015.PracticalZoology,BiblioLife,522pp.	
2.	Young,J,Z.,1972.Thelifeofvertebrates.OxfordUni.London.	
WebResources		
1.	https://www.youtube.com/watch?v=b04hc_kOY10	
2.	https://bit.ly/3CzTEy8	
3.	http://tolweb.org/Chordata/2499	
4.	https://www.nhm.ac.uk/	
5.	https://bit.ly/3Av1Ejg	
MethodsofEvaluation		
InternalEvaluation	ContinuousInternalAssessmentTest	25Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
ExternalEvaluation	EndSemesterExamination	75Marks
	Total	100Marks
MethodsofAssessment		
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions	

S-Strong(3) M-Medium(2) L-Low(1

SCHEME OFEVALUATION	
I.Dissect and display the digestive system of given bony fish	20Marks
II.Mounting -placoid/Ctenoid scales(Sketch and lable the parts)	5Marks
III.Comment on the given Osteology Specimen	5Marks
IV.IdentifyCommentontheSpotters A,B,C,D &E	15Marks
V.Choose any commercdial fish/amphibian/reptiles/bird/mammal and do a project work on the generic identification description and illustration with a note on its importance	10 Marks
ObservationNote/Record	20Marks
Total	75Marks

Course Code	Course Name	Category	L	T	P	S		Inst Hours	Marks		
									CIA	Ext.	Tot.
23BZO2S1	**AQUARIUM KEEPING**	SEC-II	Y	-	-	-	2	2	25	75	100

- Tocreateknowledgeonselfemploymentopportunityofornamental fishes
- Toprovidetheknowledgeofornamentalfishes andtheirequipment
- Tounderstandthedifferentbreedingtechniquesofornamentalfishes

UNIT I	Introduction and scope - Aquarium fish keeping as hobby and cottage industry. Commercial aspects likenational and international market- Self employmentopportunity.
UNIT II	Externalmorphologyof atypicalfish.Exoticandendemicvarietiesofornamental fishes.
UNIT III	Aquarium preparation and maintenance - Kinds of tanks, tank setting, biological filter andaeration,water management, planting, lighting and feeds.Budget for setting up an Aquarium Fish Farm as a Cottage Industry
UNIT IV	Livefishtransport-handling, feeding andforwardingtechniquesoffish.FishDiseases and their control.
UNIT V	Breeding – Common characters and sexual dimorphism of Fresh water and Marine aquariumornamentalfishvarietiessuchasGuppies,Mollies,Swordtails,Platy,Siamesefighter s and Gold fish, Butterfly fish, Blue morph and Anemone fish.

ReferenceBooks:

1. Santhanam,P.,Sukumaran,N.&P.Natarajan,A manualoffreshwateraquaculture(1987), Reprint 1999, Oxford & IBH Publishing Company Pvt., Ltd., New Delhi.
2. CliffHarrison,AcolourguidetoTropicalFish(1980),ChartwellBooks,INC,Cerkshire, printed in Hon Kong.
3. O"Connell,R.F.,Thefreshwateraquarium(1977),ArcoPublishingCompany,INCNew York.
4. JingranV.G.,1991:FishandFisheriesinIndia –HindustanPubl.co.NewDelhi
5. MillDick,1993:AquariumFish,DayaPub.co.,New Delhi.

CourseOutcome:

1. Studentstolearnaboutdifferentornamentalfishesandidentifythediseasesofthem
2. Todevelopentrepreneurpotentialinthefieldofaquariumandgetselfemployment.

DSC-I

Course Code	Course Name	Category	L	T	P	S		Inst Hours	Marks		
									CIA	Ext.	Tot.
23BZO2S2	**ANIMAL BEHAVIOUR**	DSC-I	Y	-	-	-	2	2	25	75	100

LearningObjectives

1. Tolearn theoriginanddevelopmentofanimalbehaviourandtounderstandthe influence of genetics, environment on animal behaviours.
2. Tounderstandthebiologicalpropertiesofanimalbehavior,withanevolutionaryand ecological emphasis.
3. ToCompareinnateandlearnedbehavioranddifferentiatebetweenvarious mating system.
4. To impart the knowledge about visual and auditory communication; courtship, mate choice,andmatingsystems;socialbehaviorandsocialsystems;andanimalpersonality.
5. To discuss how movement and migration behaviors are a result of natural selection.

UNIT I	**Genetics and Behaviour** : Genetic material, Genes and chromosomes, Genetic variation, Single and Polygenic inheritance of behaviour, Heritability of behaviour,Natural Selection and behaviour, Frequency distribution of phenotypes,Darwinian fitness,Evolution of adaptive strategies.
UNIT II	**EvolutionandSocialBehaviour:**Sexualselection,Altruism,Sexualstrategyand social organisation, Animalperception, Neural controlofbehaviour,Sensoryprocesses and perception, Visual adaptations to unfavourable environments.
UNIT III	**AnimalandtheEnvironment:**CoordinationandOrientation,Homeostasisand Behaviour, Physiology and Behaviour in changing environments, Animal Learning, Conditioning and Learning, Biological aspects of learning, Cognitive aspects of learning.
UNIT IV	**UnderstandingComplex Behaviour :**Instinct and learning, Displacement activities, RitualizationandCommunication,DecisionmakingbehaviourinAnimals,Complexbehaviour of hobey bees, Evolutionary optimality, Mechanism of Decision making. The mentality of Animals : Languages and mental representation, non-verbal communication in human, mental images,Intelligence, tool use and culture, Animal awareness and Emotion.
UNIT V	**Chronobiology** :Organization of circadian system in multicellular animals; Concept of central andperipheralclocksystem;Circadianpacemakersysteminvertebrates with particular reference to Drosophila; Photoreception and photo- transduction; The physiological clock and measurement of day length; Molecular bases of seasonality; The relevance of biological clocks for human welfare - Clock function (dysfunction); Human health and diseases - Chronopharmacology, chronomedicine, chronotherapy.22

Text Books

1. DavidMcFarland,1985.AnimalBehaviour,LongmanScientific&Technical, UK.576pp.
2. HarjindraSingh,1990.AText Book of Animal Behaviour, Anomol Publication,293pp.
3. HoshangS.GundeviaandHareGovingSingh,1996.AnimalBehaviour,S.Chand &Co, 280pp.
4. Shukla,J.P2010,FundamentalsofAnimalBehaviour,Atlantic, 587pp.
5. VinodKumar,2002.BiologicalRhythms.NarosaPublishingHouse,Delhi.

Suggested Readings

1. MichaelD.BreedandJaniceMoore,2012.AnimalBehaviour,AcademicPress,USA, 359pp.
2. AubreyManningandMartinStampDawkins,2012.AnIntroductiontoAnimal Behaviour, 6th Edition, Cambridge University Press, UK. 458pp.
3. DavisE.Davis,1970.IntegralAnimalBehaviour,MacMillanCompany,London , 118pp.
4. Jay,C.Dunlap,Jennifer,J.Loros,PatriciaJ.DeCoursey(ed).2004.Chronobiology Biological time Keeping, Sinauer Associates Inc, Publishers, Sunderland, MA.

WebResources

1. https://www.ncbs.res.in/content/animal-behaviour
2. https://bit.ly/3i6wUxR
3. https://www.behaviour.univie.ac.at/

4. https://www.ru.nl/bsi/

CourseOutcomes(COs)

1. Recallandrecordgeneticbasisandevolutionaryhistoryofbehaviour.
2. Classifymovementandmigrationbehaviorsandexplainenvironmentalinfluenceupon behaviour.
3. Analyzeandidentifyinnate,learnedandcognitivebehavioranddifferentiatebetween various mating systems.
4. Assesscomplexityinvolvedinbehaviouraltraitsandevaluatehormonesandtheirrole in aggression and reproduction.
5. Discusstherhythmicityofbehaviouralexpressionsandthescientificconcepts in behaviorandbehavioralecology.23

SEMESTER III

Course Code	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO3C1	**CYTOGENETICS**	Core	Y	-	-	-	6	6	25	75	100

LearningObjectives	
CO1	Tounderstandthestructuresandpurposesofbasiccomponentsofprokaryoticand eukaryoticcells,especiallymacromolecules,membranesandorganelles.
CO2	Tounderstandhowthesecellularcomponentsareusedtogenerateandutilize energyincells.
CO3	Tounderstandthecellularcomponentsunderlyingmitoticcelldivision.
CO4	To understand the structure and functions of nuclic acid in the cell. To comprehent the important of genetic variation in evolution,and their cumulative effect in human population and the molecular basis of variations.

	Details	**No.of Hours**	**Course Objectives**
UNIT I	**History of Cell Biology**, Tools and Techniques of Cell Biology Cell Fractionation, Homogenization, Centrifugation, Isolation of subcellular Components.Histological techniques – Staining – Vital Stains.–Cytoplasmic and Nuclear Stains.MicroTechnique Methods, Microscopes - Types - Light, Phasecontrast,SEM,TEM-Units of measurement.	12	CO1,CO2
UNIT II	**Cell components**- Plasma Membrane Ultra Structure – Different Models- Functions-Ultrastructure, Composition and Function of Endoplasmic reticulam, Ribosomes, GolgiComplex, Lysosomes, Centrioles, Microtubules Microfilaments, Mitochondria and Microsomes.**Nucleus** - Ultrastructure, Composition andFunctions-NuclearMembrane-Nucleoplasm-Nucleolus-NucleolusCycle-DNAandRNAs .Protein synthesis and regulation	12	CO1,CO2,CO4,CO5
UNIT III	**Cell Divisions and Cell Cycle** - Amitosis, Mitosis andMeiosisandtheirSignificance-Cancer,Biology–Characteristicsofcancercells,types,theoriesonCarcinogenesis,Ageingof Cells – Apoptosis and Stemcellstudies.	12	CO1,CO2,CO3,CO4,CO5
UNIT IV	**Mendelian Genetics and Inheritance:** Mendeliangenetics:Mendelian experiments, laws of Mendel,Monohybrid,Dihybrid,backandtestcross;Interactiono f genes: Incompletedominance,codominance,complementarygenes,supplementarygenes,inhibitinggenes,lethalgenesandatavism.Inheritance:Polygenicinheritance-skincolour;multiplealleles-ABObloodgroupssexlinkedinheritance–eyecolourinDrosophila,colourblindnessandhemophiliainman.	12	CO1,CO2,CO4,CO5
UNIT V	**LinkageandCrossingOver**:Linkage:Linkedgenes,completeandincompletelinkage.Crossingover:molecularmechanismsofcrossingover,kindsofcrossingover,**HumanandPopulationGenetics:**Humangenetics: sex determination - Barr bodytechnique,drumstickmethod;chromosomalabnormalitiesinhumans,Pedigreeanalysis;Eugenics, Euphenics, and	12	CO1,CO2,CO4,CO5

	Euthenics. gene pool,genefrequencyandgenotypefrequency.		
	Total	**60**	

CourseOutcomes		
Course Outcomes	Oncompletionofthiscourse,studentswill;	
CO1	Tounderstandandrecallthebasicstructure,originand developmentofcellorganelles.	PO1
CO2	Tointegrateandassessthebiochemical,cytologicaland histologicaltoolstoinfercellularbasisoforganization.	PO1,PO2,PO3
CO3	Toanalyzeanddifferentiateorganismsbasedonstructure,c ompositionandinterandintracellular interactions.	PO3,PO4,PO5
CO4	Toexplaintheroleofcellsandcellorganellesinvarious biologicalprocesses.	PO2,PO3,PO5,PO6,PO8
CO5	Toconstructandsimulatetheroleofdifferentcytologicaltools to explainthestructureandcomplexity of cells andcellorganelles.	PO3,PO4,PO5,PO6,PO7, PO8

TextBooks(LatestEditions)

1.	Ambrose,E.J.andDorothy,M.Easty,1970.CellBiology,ThomasNelson&SonsLtd.,500pp.
2.	KumarP.andMinaU.(2018)LifeSciences:FundamentalsandPractice,Part-I, 6thEdn.,PathfinderPublication.p.608.
3.	VeerBalaRastogi,Introductorycytology.KedarNathRamNath.Meerut250001.
4.	Verma,P.S.andV.K.Agarwal,1995.CellandMolecularBiology,8thEdition, S.Chand&co.,NewDelhi-110055,567pp.
5.	VermaP.S.andAgarwalV.K.(2016)CellBiology(Cytology, Biomolecules,MolecularBiology),Paperback,S.ChandandCompanyLtd.

ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)

1.	AlbertB.,HopkinK.,JohnsonA.D.,MorganD.,RaffM.,RobertsK.andWalter P.(2018)EssentialCellBiology5thEdn.,(paperback)W.W.Norton&Companyp.864.
2.	Burke,Jack.D.,1970.CellBiology,ScientificBookAgency,Calcutta.
3.	ChallonerJ.(2015)TheCell:AvisualtourofthebuildingblockoflifeThe UniversityofChicagoPressandIvyPressLtd.,p.193.
4.	Cohn,N.S.,1979,ElementsofCytology,FreemanBookCo.,NewDelhi– 110007,495pp
5.	CooperG.M.(2019)TheCell–AMolecularApproach,8thEdn.,Sinauer

MappingwithProgrammeOutcomes:

	AssociatesInc.,OxfordUniversityPressp.813.
6.	DeRobertis,E.D.P.andE.M.F.DeRobertis,1988.CellandMolecularBiology, 8thEdition,InternationalEdition,Infomed,HongKong,734pp.
7.	Dowben,R.,1971.CellBiology,HarperInternationalEdition.HarperandRow Publisher,NewYork,565pp.
8.	Giese,A.C.,1979.CellPhysiology,SaundersCo.,Philadelphia,London,Toronto, 609pp.
9.	HardinJ.andBertoniG.(2017)Becker'sWorldoftheCell.9thEdn(Global Edition).PearsonEducationLtd.,p.923

10.	KarpG.,IwasaJ.andMasallW.(2015)Karp'sCellandMolecularBiology ConceptsandExperiments.8thEdn.JohnWileyandSons.p.832.
11.	Loewy,A.G.andP.Sickevitz,1969.CellStructureandFunction,Amerind PublishingCo.,NewDeihi-110020,516pp.
12.	MasonK.A.,LososJ.B.andSingerS.R.(2011)RavenandJohnson'sBiology.9th Edn.McGrawHillpublications.p.1406.
13.	Powar,C.B.,1989.EssentialofCytology,HimalayaPublishingHouse,Bombay-400004,368pp.
14.	Swansen,C.P.andP.L.Webster,1989.TheCell,PrenticeHallofIndiaPvt.Ltd., NewDelhi-110001,373pp.
15.	UrryL.A.CainM.L.,WassermanS.A.,MinorskyP.V.,JacksonR.B.andReece J.B.(2014)CampbellBiologyinFocus.PearsonEducation.p.1080.

WebResources	
1.	http://www.microscopemaster.com/organelles.html
2.	https://bit.ly/3tXwDSB
3.	https://bit.ly/3tWNpRX
4.	https://bit.ly/3AuYR9M
5.	https://rsscience.com/cell-organelles-and-their-functions/

MethodsofEvaluation		
Internal Evaluation	Continuous Internal Assessment Test	25Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
External Evaluation	End Semester Examination	75Marks
	Total	100Marks

Methods of Assessment	
Recall(K1)	Simple definitions,MCQ,Recall steps,Concept definitions
Understand/ Comprehend (K2)	MCQ,True/False, Shortessays,Concept explanations,Short summary or overview
Application (K3)	Suggestidea/concept with examples, Suggest formulae, Solve problems, Observe,Explain
Analyze(K4)	Problem-solving questions,Finish a procedure in many steps,Differentiate betweenvariousideas,Mapknowledge
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion,Debatingor Presentations

S-Strong(3) M-Medium(2) L-Low(1)

SEMESTER-III

Course Code	Course Name	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO3P1	**CYTOGENETICS PRACTICAL**	Core		-	P	-	3	3	25	75	100

LearningObjectives			
CO1	Toencouragestudentstointerprettheorganizationofgenomicmaterialandtoresearchtheoriesofgeneticinheritance.		
CO2	Toimparttheskillsrequiredtopreparesamplesofgeneticmoleculesandtodeterminetheirpurity,structureandcharacteristicsandtoanalyzegenomic preparations.		
CO3	Tostudythechangesingeneticmaterialandtopredictandconsiderthe consequencesofthosechanges.		
CO4	Toencouragestudentstoreportandjustifytheresultsofmolecularandgenetic experimentsinanaccurateandmeaningfulmanner.		
	Details	**No.of Hours**	**CourseObjectives**
UNIT I	PreparationandIdentificationofslidesofMitoticdivisionswithonionroottips.PreparationandIdentificationofdifferentstagesofMeiosisinGrasshopper Testes. Identification and study of different stages of Mitosis and Meiosis. Buccalepithelium(Barr body) preparation.	12	CO1
UNIT II	Stain in gand observation of poly tene chromosome sinsalivaryglandsofchironomouslarva.Karyotyping(withthehelpofphotographs)–normal male and female karyotypes and study of karyotypes of different genetic syndromes.Verification of the Mendelian laws of inheritance using coloured beads.Observation on genetic traits.	12	CO2
UNIT III	Histochemistry and Microtechnique-Fixation and Fixatives:Types of fixatives,Chemistry of fixation,Choice of Fixatives Tissue processing: Dehydration, Clearing and Embedding Microtomy:Types of microtomes,Sectioning of Paraffin blocks Staining of paraffin sections: Principle and methods of staining. Histological stains:Haematoxylin and Eosin.	12	CO3
UNIT IV	(1)Culturing and Handling of Drosophila: a)Media Preparation b)Cleaning and Sterilization of bottles c)Handling of Drosophila(2)Morphology and Sexual dimorphism, Study of at least five types of Drosophila,Bodycolormutant-Ebony body and Yellow body.Wing mutant- Curly wing and Vestigial wing. Eye colormutant-Bareye,Whiteeye,Sepiaeye.Mounting of Sex Combof Drosophilamelanogaster.	12	CO4
UNIT V	Study offlower colour in Antirrhinum/ Mirabilis. Coatcolour in Mice. Comb pattern in Poultry. Blood Typing.Biometrical Computation of: Mean, Median and Mode,Variance,StandardDeviation.Problemson:Student's't'testandChisquaretest.GeneticproblemsonMultiplealleles,GeneInteractions(Complemetary/Supplementary/DominantEpistasisgeneinteractions).GeneticProblemsonLinkageandCrossingover: 03 Prs.a)Drosophila.b)Maize.c)Human(SexLinkage).	12	CO5
	Total	**60**	
CourseOutcomes			

Course Outcomes	Oncompletionofthiscourse,studentswill;	
CO1	Todescribe,examineandinterprettheorganizationof genomicmaterialandtoresearchtheoriesofgeneticinheritance.	PO1
CO2	Toprepare samples of genetic molecules and to determinetheirpurity,structureandcharacteristics.	PO1,PO2
CO3	Toexperimentwithgenomicpreparationsanddevise Techniquestodistinguishgeneticmaterialindifferentorganisms to surveybiodiversity.	PO4,PO6
CO4	Toassessthechangesingeneticmaterialandtopredict andconsidertheconsequencesofthosechanges.	PO4,PO5,PO6
CO5	Toreportandjustifytheresultsofmolecularandgeneticexperiments inanaccurateandmeaningful manner.	PO3,PO8
TextBooks (LatestEditions)		
1.	SuryaNandanMeena,MilindNaik,2019.AdvancesinBiologicalScience Research:APracticalApproach,AcademicPress,NewYork,USA.	
2.	MichaelPerlin,WilliamBeckerson,AdarshGopinath,2017.Cell,Genetics,and MolecularBiology:ALabManual(FirstEdition),CognellaInc.,USA.	
3.	SaxenaJ.,BaunthiyalM.,RaviI.,2015.LaboratoryManualofMicrobiology, BiochemistryandMolecularBiology,ScientificPublishers,India.	
4.	BansalM.P.,2013.MolecularBiology and Biotechnology:basicexperimental	
	protocols,TheEnergyandResourcesInstitute(TERI),NewDelhi,India.	
5.	ChaitanyaK.V., 2013. Cell and molecularbiology: A Lab Manual, Phi LearningPvt.Ltd.,NewDelhi,India.	
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)		
1.	AndreasHofmann,SamuelClokie,2018.Wilsonand Walker'sPrinciplesand TechniquesofBiochemistryandMolecularBiology,CambridgeUniversityPress,UK.	
2.	Bancroft,J.D.andGamble,M(2007)TheoryandPracticeofHistological Techniques,6thEdition,ChurchillLivingstone.	
3.	IanFreshneyR.,2010.CultureofAnimalCells:AManualofBasicTechnique andSpecializedApplications,JohnWiley&Sons,USA.	
4.	JohnKiernan(2008)HistologicalandHistochemicalMethods:Theoryand Practice,4thedition,ColdSpringHarborLaboratoryPress.	
5.	Kerr,J.(2013)FunctionalHistology,Elsevier6.Kiernan,J.A.(2008)Histological&Histo chemicalmethods:Theory&Practice(4thEd).ColdSpring HarborLaboratoryPress.	
6.	LeonardDavis,MarkDibner,JamesBattey,2012.BasicMethodsinMolecular Biology,ElsevierSciencePubilshingCo.,NY,USA.	
	LuizCarlos(2005)BasicHistology:TextandAtlas(11thEd).McGrawHill Medical.	
7.	RobertF.Schleif,PieterC.Wensink,2012.PracticalMethodsinMolecular Biology,Springer-Verlag,NY,USA.	
	Ross,M.H,,Kaye,G.I.&Pawlina,W.(2002)Histology:Atextandatlas(4th ed).LippincoatWilliams&Wilkins.	
	SarahStauffer,AaronGardner,WilkoDuprez,DewiAyuKencanaUngu,PhilipWismer,2018.LabsterVirtualLabExperiments:BasicGenetics,Springer Publishers,NY,USA.	
WebResources		
1.	https://www.jove.com/	
2.	https://vlab.amrita.edu/?sub=3&brch=77	
3.	http://cbii-au.vlabs.ac.in/	
4.	https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/index.html	

5.	https://www.ibiology.org/biology-techniques/
MethodsofAssessment	
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

MappingwithProgrammeOutcomes:

Understand/ Comprehend (K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview
Application (K3)	Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe,Explain
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons
Create(K6)	Checkknowledgein specificoroffbeatsituations,Discussion,Debatingor Presentations

SCHEME OFEVALUATION	
I. Mounting of Mitotic / Meiotic /Giant chromosome Experiment to study mendels law using beads.	20 Marks
II. Mounting of squamous epithelial cells/Blood cells sketch and lable the parts	10Marks
III.Finding out the trait type of the mendelian traits inMan any two	5 Marks
IV.Identify sketch and comment on pedigree chart	5 Marks
V.Identify sketch and comment on the given spotters(tree from Cellbiology and two from Genetics	15Marks
Observation note book	20 Marks
Total	75 Marks

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium(2) L-Low(1)

Course Code	Course Name	Category	L	T	P	S		Inst Hours	Marks		
									CIA	Ext.	Tot.
23BZO3S1	**BIOCOMPOSTING FOR ENTREPRENEURSHIP**	SEC-III	Y	-	-	-	2	2	25	75	100

LearningObjectives:

- TohighlighttheimportanceofBiocompostingforentrepreneurshipinwastemanagement.
- ToenablestudentsforsettingupBiocompostunitsandbinsforwastereduction.

UNIT I	Biocomposting–Definition,typesandecologicalimportance.
UNIT II	Types of Biocompostingtechnology–Fieldpits/groundheaps/tank/large-scale/batchand continuous methods.
UNIT III	Preparation of Biocompostpitandbedusingdifferentamendments.
UNIT IV	Applications of Biocompost in soil fertility maintenance, promotion of plant growth, valueaddedproducts,waste reduction,etc.
UNIT V	Economicsof establishmentofasmallbiocompostunit– projectreportproposal for Self Help Group(Incomeandemploymentgeneration). **Practical** ➢ PreparationproceduresforBiocompostpit. ➢ SelectionofBiocompostmaterial,separation of Compostable and Non-compostable materials. ➢ PackingandmarketingofBiocompost. ➢ FieldvisittoBiocomposting unit.

References

BikasR.Pati&SantiM.Mandal(2016).Recenttrendsincompostingtechnology.

VanderWurff,A.W.G.,Fuchs,J.G.,Raviv,M.,Termorshuizen,A.J.(Editors)2016.Handbook for Composting and Compost Use in Organic Horticulture. BioGreenhouse COSTActionFA1105,www.biogreenhouse.org.

Courseoutcomes:

- ThestudentswillgainknowledgeabouttheprocessofBiocomposting.
- StudentswillbeabletodemonstrateBiocompostingtechniquesforvariousendapplications like solid waste management, industrial waste recycling using sugarcanebagasse,etc.
- Togain knowledge about the economic cost ofestablishing small Biocompost units asacottageindustry.

Course Code	Course Name	Category	L	T	P	S		Inst Hours	Marks		
									CIA	Ext.	Tot.
23BZO3S2	**NANOBIOLOGY**	DSC-II	Y	-	-	-	2	2	25	75	100

LearningObjectives:

This course provides knowledge about the basic concepts of nanobiology.The learners will beable to acquire skills in the assembly,design and types of nanomaterials and nanoparticles,Theywillbeabletoappreciatetheapplicationsofnanobiologyindiversefields.

UNIT I	Nanobiology-Definition-conceptsandscope. History of nanotechnology and nanoscience in Nature;Structure and Properties of nanomaterials: size, surfacecharge, conductivity, optical properties and biocompatibility.
UNIT II	Synthesisandcharacterizationofnanomaterials,Fabricationofnanostructures,Metallic nano particles,semiconductor,biopolymericnano-structuresandnanoparticles.
UNIT III	Composition and functional properties of nanostructures: Protein and peptide-basednanostructures,carbohydrate andnucleic acidbased nanomaterials; Use of gold,silver andothermetallicnanoparticles.
UNIT IV	Strategiestodesignbiologicallyactivenanostructure-basedbiomaterials.Interaction of nanoparticles with biomolecules to study their conformational and functionalproperties.
UNIT V	BiologicalApplicationsofNanomaterialsandnanoparticles–therapeutics–biomaterials - Immobilized enzymes - drug delivery systems – Biosensors - Cellular imagingtoolsanddiagnostics.

References

1. Pradeep,T.(2017)TheEssentials:UnderstandingNanoscienceandNanotechnology:McGraw-HillEducation.
2. Phoenix,D.A.andAhmad,W(2014)Nanobiotechnology.OneCentralPressLtd.

Course outcomes(Cos)

Studentswillbeableto:

- UnderstandbasicsofNano-scienceandNano-biology.
- Gainknowledgeonnanomaterialsandnanoparticles.
- Knowthebiologicalapplicationsofnanomaterialsandnanoparticles.
- Applytheirknowledgeintheircareerdevelopmentinhighereducation,research and development.

SEMESTER-IV

Course Code	CourseName	Category	L	T	P	S	Inst.Hours	Marks		
								CIA	External	Total
23BZO4C1	**Developmental Biology**	Core	Y	-	-	-	4 4	25	75	100

LearningObjectives	
CO1	Tocreateanawarenesstothestudentsaboutthetheories,conceptsandbasicsof DevelopmentalBiology.
CO2	Toprovidestudentsabouttheideaofsexcells,fertilization,cleavage, differentiationanddevelopmentoforgans.
CO3	Tomakeanawarenessoftheinduction,organizersanddevelopmentofextra embryonicstructures.
CO4	Toprovideadequateexplanationtostudentsaboutthelateembryonic developmentsandpostembryonicdevelopmentandageing
CO5	Togiveanideaaboutteratogenesis,invitrofertilization,stemcellsand amniocentesistothestudents

	Details	**No.of Hours**	**Course Objectives**
UNIT I	**Gametogenesis&Fertilization** Basicconceptsofdevelopmentalbiology.Structure&typesofSpermatozoa,Mammalianegg-Eggmembranes. types of egg - Spermatogenesis – Oogenesis.Fertilization–mechanism,theoriesandsignificance– Parthenogenesis.	12	CO1
UNIT II	**Blastulation&Gastrulation** Cleavage-PlanesandPatterns,Factorscontrollingcleavage - Fate map and its construction. Blastulation – typesofblastula.Morphogeneticmovements-Gastrulation offrog & chick.	12	CO2
UNIT III	**Organogenesis** DevelopmentofBrain,EyeandHeartinfrog.DevelopmentofNervoussysteminchick.Foetalmembranesinchick..DevelopmentofPro,MesoMetanephrickidneys.Placentationin Mammals.	12	CO3
UNIT IV	**AppliedEmbryology** Organizerconcept–Structure– mechanismofinductionandcompetence.Nucleartransplantation-teratogenesis –Regeneration:types-eventsandfactors.Embryonicstemcells&significance.Methodstocultureembryo	12	CO4
UNIT V	**Humanembryology** Reproductive organs,Menstrual cycleand menopause -Pregnancy– trimesters–development.Erythroblastosisfoetalis -Twins – types.Infertility – causes- Test tubebaby andAssisted ReproductiveTechnology– Embryotransfer –Amniocentesis.	12	CO5
		60	

MappingwithProgrammeOutcomes:		
Course Outcomes		
CO1	Todescribeandillustratethesignificanceofcellularprocessesinembryonicdevelopment.	PO1
CO2	Torelatethefactorsthatcontributetothedevelopmentalprocess,constructfatemapsandillustratethestepsinmorphogenesisandorganogenesis.	PO1,PO2
CO3	To correlate the involvement of specific cell types in theformation of specific organs and explain the importanceofmorphogens.	PO4,PO6
	Todistinguishbetweenthedifferenttypesofdevelopmentalmechanismsi	

CO4	nvariousorganismsandappraisethespecies-baseddifferencesindevelopment.	PO4,PO5,PO6
CO5	Tojustifyandvalidatetheroleofenvironmentand geneticsininfluencingembryonicdevelopment	PO3,PO8

Text Books (Latest Editions)	
1.	LewisWolpert2007.Principlesofdevelopment,3rdedition,OxfordUniversityPress,NewDelhi, India
2.	Subramoniam,T.2003.DevelopmentalBiology,NarosaPublishingHouse,New Delhi, India.
3.	Verma,P.S.,Agarwal,V.K.2010.ChordateEmbryology:DevelopmentalBiology, S.Chand&Company,NewDelhi.,India.

ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)	
1.	GilbertS.F.2010.DevelopmentalBiology,SinauerAssociates,Massachusetts, USA.
2.	Balinsky,B.I.1970.IntroductiontoEmbryology,Philadelphia&London,UK.
3.	Berril,N.J.1971.DevelopmentalBiology,McGrawHill,NewYork,USA.
4.	RussHodge2010.DevelopmentalBiology,FactsonFile,Inc.,NewYork,USA.
5.	Carlson,Bruce,M.2009.HumanembryologyandDevelopmentalBiology, Elsevier,Philadelphia,USA

WebResources	
1.	https://www.ncbi.nlm.nih.gov/books/NBK10052/
2.	https://www.cdc.gov/ncbddd/developmentaldisabilities/facts.html
3.	https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/dvdy.20468
4.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293490/

MethodsofEvaluation		
Internal Evaluation	ContinuousInternalAssessmentTest	25Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
External Evaluation	EndSemesterExamination	75Marks
	Total	100Marks

MethodsofAssessment	
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/Comprehend(K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview
Application(K3)	Suggestidea/conceptwith examples, Suggestformulae, Solveproblems, Observe,Explain
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge
Evaluate (K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion,Debatingor Presentations

S-Strong(3) M-Medium(2) L-Low(1)BN

SEMESTER IV

Course Code	CourseName	Category	L	T	P	S		Inst. Hours	Marks		
									CIA	External	Total
23BZO4P1	**DEVELOPMENTAL BIOLOGY PRACTICAL**	Core	-	-	P	-	3	3	25	75	100

LearningObjectives	
CO1	Toencouragestudentstointerprettheorganizationofgenomicmaterialandtoresearchtheoriesofgeneticinheritance.
CO2	Toimparttheskillsrequiredtopreparesamplesofgeneticmoleculesandtodeterminetheirpurity,structureandcharacteristicsandtoanalyzegenomic preparations.
CO3	Tostudythechangesingeneticmaterialandtopredictandconsiderthe consequencesofthosechanges.
CO4	Toencouragestudentstoreportandjustifytheresultsofmolecularandgenetic experimentsinanaccurateandmeaningfulmanner.

	Details	**No.of Hours**	**Course Objectives**
UNIT I	Mount any one Chick embryo and comment on it-18 hours,24 hours,48 hours,72hours,and 96 hours/whole mounting of chick blastodermObservation of Eggs Frog,Chick,Mammals	12	CO1
UNIT II	.Clevage Blastula Gastrula,stages of Frog Mounting of Live Sperm of Vertebrata	12	CO2
UNIT III	Studyof Placental developments in Human by Ultra sound Scan	12	CO3
UNIT IV	Placenta of Mammals/Pig,Sheep,Rabbit and Man Effect of Thyroxin in Tadpole (Group study)	12	CO4
UNIT V	Bonafide Record of the work done in Laboratory must be submitted while attending the Examination	12	CO5
	Total	**60**	

CourseOutcomes		
Course Outcomes	Oncompletionofthiscourse,studentswill;	
CO1	Todescribe,examineandinterprettheorganizationof genomicmaterialandtoresearchtheoriesofgeneticinheritance.	PO1
CO2	Toprepare samples of genetic molecules and to determinetheirpurity,structureandcharacteristics.	PO1,PO2
CO3	Toexperimentwithgenomicpreparationsanddevise techniquestodistinguishgeneticmaterialindifferentorganismstosurveybiodiversity.	PO4,PO6
CO4	Toassessthechangesingeneticmaterialandtopredict andconsidertheconsequencesofthosechanges.	PO4,PO5,PO6
CO5	Toreportandjustifytheresultsofmolecularandgeneticexperimentsinanaccurateandmeaningful manner.	PO3,PO8

TextBooks(LatestEditions)

1. SuryaNandanMeena,MilindNaik,2019.AdvancesinBiologicalScience Research:APracticalApproach,AcademicPress,NewYork,USA.
2. MichaelPerlin,WilliamBeckerson,AdarshGopinath,2017.Cell,Genetics,and MolecularBiology:ALabManual(FirstEdition),CognellaInc.,USA.
3. SaxenaJ.,BaunthiyalM.,RaviI.,2015.LaboratoryManualofMicrobiology, BiochemistryandMolecularBiology,ScientificPublishers,India.
4. BansalM.P.,2013.MolecularBiology and Biotechnology:basicexperimental protocols,TheEnergyandResourcesInstitute(TERI),NewDelhi,India.
5. ChaitanyaK.V., 2013. Cell and molecularbiology: A Lab Manual, Phi LearningPvt.Ltd.,NewDelhi,India.

ReferencesBooks
(Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)

1.	AndreasHofmann,SamuelClokie,2018.Wilsonand Walker'sPrinciplesand TechniquesofBiochemistryandMolecularBiology,CambridgeUniversityPress,UK.
2.	Bancroft,J.D.andGamble,M(2007)TheoryandPracticeofHistological Techniques,6thEdition,ChurchillLivingstone.
3.	IanFreshneyR.,2010.CultureofAnimalCells:AManualofBasicTechnique And SpecializedApplications,JohnWiley&Sons,USA.
4.	JohnKiernan(2008)HistologicalandHistochemicalMethods:Theoryand Practice,4thedition,ColdSpringHarborLaboratoryPress.
5.	Kerr,J.(2013)FunctionalHistology,Elsevier6.Kiernan,J.A.(2008)Histological&Histochemicalmethods:Theory &Practice(4thEd).ColdSpring HarborLaboratoryPress.
6.	LeonardDavis,MarkDibner,JamesBattey,2012.BasicMethodsinMolecular Biology,ElsevierSciencePubilshingCo.,NY,USA.
	LuizCarlos(2005)BasicHistology:TextandAtlas(11thEd).McGrawHill Medical.
7.	RobertF.Schleif,PieterC.Wensink,2012.PracticalMethodsinMolecular Biology,Springer-Verlag,NY,USA.
	Ross,M.H,,Kaye,G.I.&Pawlina,W.(2002)Histology:Atextandatlas(4th ed).LippincoatWilliams&Wilkins.
	SarahStauffer,AaronGardner,WilkoDuprez,DewiAyuKencanaUngu,PhilipWismer,2018.LabsterVirtualLabExperiments:BasicGenetics,Springer Publishers,NY,USA.

WebResources

1.	https://www.jove.com/
2.	https://vlab.amrita.edu/?sub=3&brch=77
3.	http://cbii-au.vlabs.ac.in/
4.	https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/index.html
5.	https://www.ibiology.org/biology-techniques/

MethodsofAssessment

Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions

MappingwithProgrammeOutcomes:

Understand/Comprehend(K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview
Application (K3)	Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe,Explain
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons
Create(K6)	Checkknowledgein specificoroffbeatsituations,Discussion,Debatingor Presentations

SCHEME OFEVALUATION	
I.Mounting of Live Sperm of Vertebrata/Mount any one of the Chick embryo and comment on it	20 Marks
II.Observation of Egg-Chick or Frog	5 Marks
III.Identify Sketch and Comment on the Placenta	5 Marks
IV.Identify sketch and comment on Chick Embryo Stage	10 Marks
V.Identify sketch and comment on the given spotters A,B,C,D and E	15Marks
Observation note book	20 Marks
Total	75 Marks

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium(2) L-Low(1)

Course Code	Course Name	Category	L	T	P	S		Inst Hours	Marks		
									CIA	Ext.	Tot.
23BZO4S1	**HUMAN REPRODUCTIVE BIOLOGY**	DSC-III	Y	-	-	-	2	2	25	75	100

LearningObjectives:

- Toenablestudentstounderstandtheendocrinestructuresandhormonesassociatedwiththe physiologyofreproductivesystem
- Toenablestudentstolearnaboutthemalereproductivesystemandaccessoryglands and regulation
- Toenablestudentstolearnaboutthefemalereproductivesystemandregulationofitsfunction
- Toenablestudentstocomprehendaboutfertilization,pregnancy,parturitionandlactation
- Toequipstudentswithknowledgeoncausesofinfertility,reproductivehealth,assisted reproductive technology and associated ethical issues

UNIT I	Gonadalhormonesandmechanismofhormoneaction,steroids,glycoproteinhormones,andprostaglandins ,hypothalamo–hypophyseal–gonadalaxis,regulation of gonadotrophin secretion inmale and female; Reproductive System: Development and differentiation ofgonads, genitalducts, externalgenitalia, mechanism ofsex differentiation;Puberty
UNIT II	Outlineandhistoarchitectureofmalereproductivesystem;Testis:Cellularfunctions;Spermatogenesisandi tshormonalregulation;Androgen synthesis and metabolism; Epididymal function and spermmaturation; Accessoryglandsfunctions; Spermtransportationinmaletract; Andropause
UNIT III	Outline andhistoarchitecture of femalereproductivesystem; Ovary: oogenesis and its hormonal regulation; Steroid ogenesis and secretion of ovarian hormones; Reproductive cycles and their regulation,changes in thefemaletract;Menopause
UNIT IV	Ovumtransportinthefallopiantubes;Spermtransportinthefemaletract,Fertilization; Hormonal control of implantation; Hormonal regulation of gestation,pregnancydiagnosis,foeto–maternalrelationship;Mechanismofparturitionanditshormonalregulation;Lactationanditsregulation
UNIT V	Infertilityinmaleandfemale:causes,diagnosisandmanagement;Sexually transmitted Infections; Modern contraceptive technologies; Assisted Reproductive Technology: sexselection, spermbanks, frozenembryos, Stem Cell banks,*invitro*fertilization,ET,EFT,IUT,ZIFT, GIFT,ICSI,PROST; ethicalissues relatedtoART;Surrogatemotherhood;ethicalissues;Consanguinity;FetalLossandBirthDefects; Adoption

BOOKSFORREFERENCE

Cassan,A.(2005).*HumanreproductionandDevelopment(InsidetheHumanBody).*Ne wYork:ChelseaClubhouse.

Field,M.A.(1990).*SurrogateMotherhood*.Massachusetts:HarvardUniversity.

Gardner, D. K.(2001). *Textbook of Assisted Reproductive Techniques: LaboratoryandClinicalPerspectives.*London:MartinDunitz.

Gardner, D. K.(2006). In vitro Fertilization: A Practical Approach. CRC Press.Johnson, M. H. (2018). *Essential Reproduction*. New Jersey: Wiley-Blackwell.Jones,R.E.(2013).*HumanReproductiveBiology*.Amsterdam:Elsevier.

Neill, Jimmy D. ed (2006). Knobil and Neill's Physiology ofReproduction.VolumeI.Thirdedn.ElsevierAcademicPress.

Pinon,R.(2003).*BiologyofHumanReproduction*.California:UniversityScienceBooks.

COURSEOUTCOMES

Onsuccessfulcompletionofthecourse,studentswillbeableto

- Recallthestructureandfunctioningofthemaleandfemalereproductivesystem,associatedendocrinolog y,causesforinfertilityandassistedreproductivetechnology
- Describethestructureandphysiologyfunctionsofmaleandfemalereproductivesystems.
- Explaintheroleofstructures,accessoryglandsandhormonesassociatedwithth ereproductivetractsandtheircontrol
- Explainthemechanismofsexdetermination.
- Discussage-associatedphysiologicalchangesinthereproductivetract
- Describephysiologicalchangesduringpregnancyandbenefitsofbreastfeeding.
- Identifycausesforinfertility,treatmentsavailableandethicalissuesrelatedtotreatments.
- Discussadvantagesanddisadvantagesofavailablecontraceptives.
- Analyzethe different techniques and associated ethicalissues related toreproductivetechnology

Course Code	Course Name	Category	L	T	P	S		Inst Hours	Marks		
									CIA	Ext.	Tot.
23BZO4S2	**WILD LIFE CONSERVATION AND MANAGEMENT**	DSC-IV	Y	-	-	-	2	2	25	75	100

LearningObjectives

1. To understand and discuss the importance of wildlife, its values, modern concepts inwildlifemanagement,andrelevant conservationpolicies.
2. To assess and instilstrong foundations on wildlife policies and be familiar with avarietyoflawsandregulations.
3. Toanalyseanddesignappropriateapproachestoturnconflictintotoleranceandcoexistence,with anemphasisonthehumandimensionsofhuman-wildlifeinteractions.
4. ToevaluateandintegrateallthereIatedareaslikeFundamentalsinEcology,Forestry, NaturalResourceConservationapproachesanddeveloptherolePVAmodelsforprotectionofEndangeredspecies.
5. ToexplainteadvancedscientificbasisforwildlifemanagementanddiscussNationalandInternationalEffortsforsuccessfulwildlifeconservation.

UNIT I	**BiodiversityExtinctionandConservationApproaches**: Perspectives and Expressions.Identification and prioritization ofEcologically sensitivearea(ESA).Coarsefilterandfinefilterapproaches.RegionalandNationalapproachesfor biodiversityconservation.
UNIT II	**TheoryandAnalysisofConservationofPopulations**: Stochastic perturbations-Environmental, Demographic, spatial and genetics to chasticity.Populationviabilityanalysis-conceptual foundation, uses of PVAmodels.Management Decisions for small populations using PVAmodels.Minimum viablepopulations&recoverystrategiesforthreatenedspecies.
UNIT III	**NationalandInternationalEffortsforConservation**: Internationalagreementsforconservingmarinelife,ConventiononwetlandsofInternationalImportance(Ramsarconvention),ConservationofNaturalResources.OverviewofconservationofForest&Grasslandresources.CITES,IUCN,CBD National Forest Policy, 1988, National Wildlife Action Plan 2017-2031, WildlifeProtection Act 1972, National and State Biodiversity Action Plans and other Forests andEnvironmentalActs.
UNIT IV	**Wildlife in India** : Wildlife wealth of India & threatened wildlife, Reasons forwildlife depletion in India, Wildlife conservation approaches and limitations. Wild lifeHabitat: Characteristic, Fauna and Adaptation with special reference to Tropical forest.Protected Area concept: National Parks, Sanctuaries and Biosphere Reserves, cores andBuffers,Nodesandcorridors.CommunityReserveandconservationReserves.
UNIT V	**ManagementofWildlife**:Distribution,status.Habitatutilizationpattern,threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle.Wild life Trade & legislation, Assessment, documentation, Prevention of trade, Wild lifelawsandethics.

TextBooks:

1. RobinsonWLandEricGBolen,1984.WildlifeEcologyandManagement,MaxmillanPublishingCompany,NewYork,p478.
2. Aaron,N.M.1973Wildlifeecology,W.H.FreemanCo.SanFrancisco,U.S.A.
3. DasmannRF,1964.WildlifeBiology,JohnWiley&Sons,NewYork,p231.
4. JusticeKuldipSingh1998.HandbookofEnvironment,ForestandWildlifeProtectionLawsinIndia,NatrajPublishers,Dehradun.
5. Hosetti,B.B.1997ConceptsinWildlifeManagement,DayaPublishingHouse,Delhi.
6. Sutherland,W.J2000.Theconservationhandbook:Research,ManagementandPolicy.BlackwellScience.
7. Caughley.GandSinclaire,A.R.E1994Wildlifeecologyandmanagement.BlackwellScience.
8. WoodroffeR,Thirgood,S.andRabinowitzA.2005.PeopleandWildlife,ConflictorCoexsistence?CambridgeUniversity.
9. Sinha,P.C.1998.WildlifeandForestConservation,AnmolPublishingPvt.Ltd.,NewDelhi.
10. Singh,S.K,2005.TextBookofWildlifeManagement.IBDC,Lucknow.

SuggestedReadings

1. GilasRHJr.(ed.),1984.WildlifeManagementTechniques,3rded.TheWildlifeSociety,WashingtonD.C.,NatarajPublishers,DehraDun,p547.
2. RodgersWA,1991. TechniquesforWildlifeCensusinIndia-AField

Manual:TechnicalManual-TM-2.WII.
3. SahariaVB,1982.WildlifeofIndia,NatrajPublishers,DehraDun.
4. GoutamKumarSahaandSubhenduMazumdar,2017.WildlifeBiology:AnIndianProspective, PHIPublisher,Delhi.
5. Katwal/Banerjee,2002.Biodiversityconservationinmanagedandprotectedareas,Agrobios,India.
6. Gopal,Rajesh,1992.FundamentalsofWildlifeManagement,JusticeHome,Allahabad,India.
7. Sharma,B.D,1999.IndianWildlifeResourcesEcologyandDevelopment,DayaPublishingHouse,Delhi.
8. Stephen,H.B.andV.B.Saharia,1995.Wildliferesearchandmanagement.AsianandAmericanApproaches,OxfordUniversityPress,Delhi.
9. Negi,S.S.1993.Biodiversityand itsconservationinIndia,IndusPublishingCo.,NewDelhi.
10. Moulton,M.P.&J.Sanderson,1997.WildlifeIssuesinaChangingWorld.St.LuciePress.

Webresources

1. https://bit.ly/39oPj44
2. https://bit.ly/3lHdEYJ
3. https://bit.ly/3CwBCfY
4. https://bit.ly/3EDYr3a
5. https://bit.ly/3tVtG4U

Courseoutcomes(COs)

1. Tounderstandandrecalltheimportanceofwildlife,extinctionandConservationApproachesofwildlife.
2. Tointegrate and assess theNational, international approaches forbiodiversityconservation.
3. To analyse and differentiate threats to wildlife,various actionplans,conservationstrategiesonwildlifeofIndiatoturnconflictintotoleranceandcoexistence.
4. ToexplaintherolePVAmodels,Wildlifeconservationapproaches,andlimitations.
5. ToconstructandsimulateNationalandInternationalstrategiesforConservation,Wildlifelawsandethics.

SEMESTER-V

CourseCode	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO5C1	EVOLUTIONARY BIOLOGY	Core	Y	-	-	-	4	5	25	75	100

LearningObjectives	
CO1	Evolutionarybiologyisabranchofthebiologicalsciencesconcernedwiththeoriginoflifeandthediversificationandadaptationoflifeformsovertime.
CO2	Thiscoursehelpstounderstandtheimportantprocesses,principles,and conceptsonevolution.
CO3	ToprovideadequateinformationontheLamarckism-NeoLamarckism–Darwinism,NeutralTheoryofMolecularEvolution,andHumanGenomeProject.
CO4	Toexplaintheimportanceofthefossilrecordsinevolutionarystudies,andthe roleofphylogeneticstudiesinthewidercontextofbiodiversityandconservation.
CO5	In this course,we will apply the knowledge of human evolutionary history tosimulate how genetic variation within and among human populations affects risk,diagnosis,andtreatmentofmoderndiseases.

UNIT	Details	No.ofHours	Course Objectives
UNIT I	Inorganic and organic evolution-History of evolutionarythought,Primordialearthandprimevalatmosphere,Chemical origin of life: Synthesis of organic molecules,Urey-Miller experiment, Origin of prokaryotes and eukaryotes.	12	CO1
UNIT II	Lamarckism-NeoLamarckism-Darwinism-NeoDarwinismandmodernsynthetictheory-DeVrie'sMutationtheory–modernconceptsofmutation-Mutationandtheirroleinevolution-Animal Colouration andMimicry.	12	CO2
UNIT III	Isolatingmechanisms-Modesofspeciation-Hybridizationisanevolutionarycatalyst-LawofAdaptiveRadiation-Adaptiveradiation in reptiles andmammals-Convergenceandparallelism-Evolutionary constancy.	12	CO3
UNIT IV	Morphological,physiologicalandbiochemical,embryological,Taxonomicalandgeographicalevidences-Palaeontologicalevidences–evolutionary genomics.Types of rocks-Geological timescale– Natureoffossils-Datingoffossils-Fossilrecordsof man andfossilrecordsofhorse.	12	CO4
UNIT V	Naturalselectioninactioninman-levelofselection-Eugenics, Euphenics and Euthenics-Adaptation-HumanGenomeProject– Evolution and ethics.	12	CO5
	Total	**60**	

CourseOutcomes		
CourseOutcomes	Oncompletionofthiscourse,studentswill;	
CO1	TounderstandthePrimordialearthandtheorieson originoflife	PO1
CO2	TointegrateandassessLamarckism-NeoLamarckism –Darwinism	PO1,PO2
CO3	Toanalysevariousfossilrecordsofmanandfossilrecordsofhorse,varioustypesofrocks-Geological timescale.	PO4,PO6
	ToexplaintheNatureoffossils-	

CO4	Datingoffossils,evidencesofevolution,Adaptive radiation in reptiles and mammals,	PO4,PO5,PO6
CO5	To construct and compile the role of Human GenomeProject,Evolutioninthediagnosis,andtreatmentof diseases.	PO3,PO8

TextBooks (LatestEditions)	
1.	Ridley,M.,2004.Evolution.IIIEdition.BlackwellPublishing.
2.	Lull,R.S.2010.Organicevolution,TheMacmillan,NewYork.
3.	Minkoff,E.C.(1983).Evolutionarybiology.Reading,MA:Addison-Wesley PublishingCompany
4.	Sober,E.(1994).Conceptualissuesinevolutionarybiology.Cambridge,MA: MITPress.
5.	Dr.KishoreR.Pawar,Dr.AshokE.Desai,2019.AtextbookofOrganic Evolution,NiraliPrakashan,
6.	RastogiVB.1991.OrganicEvolution.KedarNathRamNathPublications, Meerut,UttarPradesh,India.
7.	Stricberger,M.W.,1996.Evolution.Jones&Bartlett,USA
8.	Colbert,E.H.Morales,M.andMinkoff,E.C.2011.Colbert'sEvolutionofThe Vertebrates:AHistoryoftheBackbonedAnimalsThroughTime,Wiley,India.

ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)	
1.	BurnsGW.1972.TheScienceofGenetics.AnIntroductiontoHeredity.Mac MillanPubl.Co.Inc.
2.	GardnerEF.1975.PrinciplesofGenetics.JohnWiley&Sons,Inc.NewYork.
3.	HarthandJonesEW.1998.Genetics–PrinciplesandAnalysis.Jonesand BarHettPubl.Boston.
4.	LevineL.1969.BiologyoftheGene.Toppan.
5.	PedderIJ.1972.GeneticsasaBasicGuide.W.Norton&Company,Inc.
6.	RastogiVB.1991.ATextBookofGenetics.KedarNathRamNathPublications, Meerut,UttarPradesh,India.
7.	WhiteMJD.1973.AnimalCytologyandEvolution.CambridgeUniv.Press.

MappingwithProgrammeOutcomes:

WebResources	
1.	https://bit.ly/3nPD09m
2.	https://bit.ly/3CHOdgL
3.	https://bit.ly/2XvcCXl
4.	https://bit.ly/2XAL1Vh
5.	https://bit.ly/3zoU9Jl

MethodsofEvaluation		
InternalEvaluation	ContinuousInternalAssessmentTest	25Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
External Evaluation	EndSemesterExamination	75Marks
	Total	100Marks

MethodsofAssessment

Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/ Comprehend (K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview
Application(K 3)	Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe,Explain
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion, Debatingor Presentations

S-Strong(3) M-Medium(2) L-Low(1)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

SEMESTER-V

CourseCode	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO5C2	**ANIMAL PHYSIOLOGY**	Core	Y	-	-	-	4	5	25	75	100

Learning Objectives	
CO1	TofamiliarisestudentswiththeprinciplesandbasicfactsofAnimalPhysiology
CO2	Togivestudentsaninsightaboutthemolecularandcellularbasisofphysiologicalfunctions inanimals.
CO3	Togiveanideaabouttheregulationoforgansystemfunctionsinawholeanimalusingac onceptualmodeloffeedbacktoexplainhomeostasis.
CO4	Tomakethestudentsawareabouthowthestructure-functionrelationshipsandits synchronisationwiththemolecularsignals.

UNIT	Details	No.ofHours	CourseObjectives
UNIT I	**Nutrition&Respiration** Nutrition:Digestion and absorption of carbohydrates proteins and lipids. Minerals &Vitamins–their deficiency. Hormonal control of digestion.Types of Respiration, Respiratory pigments-structure of Haemoglobin,Transportation of gases- Bohreffect-Regulation of respiration-bronchitis,asthma-Physiological effects of smoking.	12	CO1
UNIT II	**Circulation&Excretion** Blood-composition and functions, Mechanism of clotting.Types of Hearts–Heartbeatanditsregulation -pace maker – Cardiac cycle – ECG - Pulse and bloodpressure.Nephronstructure&mechanismofurineformation, Regulation of acid base balance, Excretoryproducts,Osmoregulationinfishes.	12	CO2
UNIT III	**Muscle&NervePhysiology** Typesofmuscles–Ultra structure of striated muscle,Musclecontraction&properties,Neurons–structure&types-Impulse propagation,synaptic transmission, neurotransmitters-Reflexaction, Nervedisorders–epilepsy, Alzheimer'sdisease, Parkinson'sdisease.	12	CO3
UNIT IV	**SenseOrgans** Structureof eye,physiology ofvision,visual elements and pigments, photochemistry of vision-Eyedefects–myopia, hyperopia, presbyopia, astigmatism,cataract-Structure of ear and mechanism of hearing-Hearing impairments – deafness, labyrinthine disease - Olfactory, gustatory and tactile sense organs.	12	CO4
UNIT V	**ReproductivePhysiology** Endocrineglandsinman-Hormones,actionanddisorders - Feed-back mechanism, Outlines of mechanism of hormonal activity. Puberty, adolescence, pregnancy, parturition,lactation and birthcontrol.	12	CO5
	Total	**60**	

CourseOutcomes	
Course Outcomes	Oncompletionofthiscourse,studentswill;

CO1	beabletoexplainhowthevariousorgansystemsarecoordinatedandcontrolled.	PO1
CO2	beabletolistthefunctionsofvariousorgansinrelationtophysiologicalprocess.	PO1,PO2
CO3	be able todeveloptheideaofmultilevelcontrollingandfeedbackmechanisminrelationtovariousphysiologicalfunctions.	PO4,PO6
CO4	beabletounderstandthebasicphysiologicalprocessrelated toadaptation,metabolismandmajorrequirements.	PO4,PO5,PO6
CO5	beabletocorrelateandunderstandhumanphysiology.	PO3,PO8
TextBooks(Latest Editions)		
1.	AgarwalRA.,AnilKSrivastava.,KaushalKumar.,1978.AnimalPhysiology andBiochemistry,S.Chand&Co.Ltd.,NewDelhiPublishing.,377pp.	
2.	AmbikaShanmugam,2001.FundamentalsofBiochemistryforMedicalstudents, KarthikOffsetPrinters,Chennai,590pp	
3.	BerryA.K.1998.AtextbookofAnimalPhysiologyandBiochemistry.Emkay Publications,NewDelhi,320pp.	
4.	Parameswaran,AnantakrishnanandAnantaSubramanian,1975.Outlinesof AnimalPhysiology,S.Viswanathan(Printers&Publishers)Pvt.Ltd.,329pp.	
5.	VermaP.S.,TyagiB.S&AgarwalV.K.,2010.AnimalPhysiology,S.Chand& Co.Ltd.,NewDelhiPublishing.,417pp.	
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)		
1.	Guyton,A.C.andHall,J.B.,2011.TextBookofMedicalPhysiology,9th Edition,W.B.SandersCompany,PrismBooks(Pvt.)Ltd.,Bangalore.,1064pp.	
	Ganong,W.F.,2019.ReviewofMedicalPhysiology,McGrawHill,NewDelhi., 340pp.	
	Hill,W.R.,Wyse, G.AandAnderson, M.2016.AnimalPhysiology(4thedn). SinauerAssociatesisanimprintofOxfordUniversityPress;USA,828pp.	
2.	Hoar,W.S.1983.GeneralandComparativePhysiology.PrenticeHallofIndia,	

MappingwithProgrammeOutcomes:

	NewDelhi,928pp.
3.	ProsserC.L.,1985.ComparativeAnimalPhysiology,SatishBookEnterprise, Agra-282003,966pp.
4.	SaradaSubrahmanyam,MadhavanKutty,K.,&SinghH.D.,2018.TextBookof HumanPhysiology,S.Chand&Co,NewDelhi.
5.	Singh,H.RandKumar,N.2017.Animalphysiologyandbiochemistry,Vishal publishingcompany,Jalandhar,864pp.
6.	Sreekumar,S.2010.Basicphysiology,PHIlearningprivateltd.,NewDelhi.210 Pp
7.	TortoraG.J.&DerricksonB.,2016.PrinciplesofAnatomyandPhysiology,John Sons,Inc.1232pp.

	Wood,D.W.,1968.PrinciplesofAnimalPhysiology,EdwardArnoldLtd, London.,342pp.	
WebResources		
1.	https://microbenotes.com/category/biochemistry/	
2.	https://www.stem.org.uk/resources/collection/3931/animal-physiology	
3.	https://animalphys4e.sinauer.com	
4.	https://nptel.ac.in/courses/102/104/102104042/	
5.	https://biochem.oregonstate.edu	
MethodsofEvaluation		
InternalEvaluation	ContinuousInternalAssessmentTest	25Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
External Evaluation	EndSemesterExamination	75Marks
	Total	100Marks
MethodsofAssessment		
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions	
Understand/ Comprehend (K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview	
Application(K3)	Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe,Explain	
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge	
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons	
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion, Debatingor Presentations	

S-Strong(3) M-Medium(2) L-Low(1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

SEMESTER-V

CourseCode	CourseName	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
23BZO5C3	**ENVIRONMENTAL BIOLOGY**	Core	Y	-	-	-	4	5	25	75	100
LearningObjectives											
CO1	Tounderstandthestructureandfunctionsoftheecosystem.										
CO2	Toexplaintherelationshipbetweenbioticandabioticfactorsinanecosystem.										
CO3	Toknowthecausesandeffectsofclimatechangeandhabitatloss.										
CO4	Tobringawarenessabouttheimpactofsocio-economic development on the environment and the solutions put forward by the government to reduce environmental damage.										
	Details							**No.of Hours**		**Course Objectives**	
UNIT I	**Ecosystem**:Conceptofanecosystem-Structureandfunctionofanecosystem-Producers,consumersanddecomposers-Energyflowintheecosystem-Ecologicalsuccession-Foodchains,foodwebsandecologicalpyramids-Introduction,types,characteristicfeatures,structure and function of the following ecosystem: Forest ecosystem-Grasslandecosystem- Desertecosystem-Aquaticecosystems (ponds,streams,lakes, rivers, oceans, estuaries).							12		CO1	
UNIT II	**PopulationAndBiologicalCycles:**Structureanddistribution –Growthcurves-Groups,natality,Mortality-Densityindices,Lifestudytables-factorsaffectingpopulationgrowth-Carrying capacity.Population regulation and human population control.Complete and incomplete biogeochemicalcycles-Sedimentarycycle.							12		CO2	
UNIT III	**EnvironmentalStressesAndManagement**:Globalclimatic pattern,globalwarming,atmosphericozone,acidandnitrogendeposition.Uptake,biotransformation, elimination and accumulation of toxicants. Factors influencing bioaccumulation from foodand trophic transfer.Pesticides and other chemicalin agriculture, industry and hygiene and their disposal.Bioindicatorandbiomarkersofenvironmental health. Biodegradation and bioremediation of chemicals.							12		CO3	
UNIT IV	**EnvironmentalPollution**:Definition-cause,effectsandcontrolmeasuresof:-Airpollution-Waterpollution-Soilpollution-Marinepollution-Noise pollution-Thermal pollution-Nuclear hazards.							12		CO4	

UNIT V	**BiodiversityConservation**: Biodiversity crisis –habitat degradation, poaching of wildlife.-Socio economic and political causes of loss of biodiversity.-InsituandexsituconservationofbiodiversityHotspotsofBiodiversity.Greenpeacemovement-Chipko Movement-Roleofgovernmentagencies:CentralandState Pollution Control Boards - Ministry of Environment and Forests-National Biodiversity Authority. Awareness, Programme, NGOs, Natural Disaster Management, Legislations for environmental Protection, Biovillages–sustainable utilization and development, Environmental ethics.	12	CO5
	Total	**60**	

CourseOutcomes		
Course Outcomes	Oncompletionofthiscourse,studentswill;	
CO1	Understandthefundamentalstructureandfunctionsof the ecosystem.	PO1
CO2	Assesstheinter-relationshipbetweenorganismsand Between bioticandabioticfactorsinanecosystem.	PO1,PO2
CO3	Analyzethefactorsthatcausepollution,climatechange, lossofbiodiversityanddepletionofresources.	PO4,PO6
CO4	Evaluatetheimpactofhumanpopulationgrowthand socio-economicdevelopmentonthestructureandfunctionof theecosystem.	PO4,PO5,PO6
CO5	Designplans to scientifically solve environmental problemsusingbiologicaltools,technologiesandgovernmentpolicies.	PO3,PO8

TextBooks (LatestEditions)	
1.	MatthewR. Fisher, 2018. EnvironmentalBiology.OpenOregonEducational Resources.JamesMadisonUniversity.
2.	Asthana,D.K.andMeera,A.2009.Atextbookofenvironmental studies,S. Chand,NewDelhi.
3.	Sanyal,K.Kundu,M.andRana,s.2009.Ecologyandenvironment,Booksand
	allied,Kolkata.
4.	Grant,W.E.andSwannack,T.M.,2008,EcologicalModelling,Blackwell.

ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)	
1.	OdumE.P.1983.BasicEcology,Saunders,NewYork
2.	Wilkinson,D.M.,2007,FundamentalProcessesinEcology:AnEarthsystem Approach,OxfordUniversityPress,UK.
3.	Saha,T.K.2010.EcologyandEnvironmentalbiology,BooksandAllied, Kolkata.

WebResources	
1.	https://bit.ly/2VYWOM5
2.	https://bit.ly/2VZQFiT
3.	https://bit.ly/3kqdXYA
4.	https://bit.ly/39rvvgt

MethodsofEvaluation		
InternalEvaluation	ContinuousInternalAssessmentTest	25Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	

External Evaluation	EndSemesterExamination	75Marks
	Total	100Marks
MethodsofAssessment		
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions	
Understand/ Comprehend (K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview	
Application(K 3)	Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe,Explain	
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge	
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons	
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion, Debatingor Presentations	

MappingwithProgrammeOutcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium(2) L-Low(1)

CourseCode	CourseName	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
23BZO5E1	**FOOD, NUTRITION AND HEALTH**	DSE-I	Y	-	-	-	4	5	25	75	100

Learning Objectives

The course covers the basic concepts of balanced diet for people of different ages besides focusing on the consequences of malnutrition and the deficiency diseases and the diseases caused due to poor hygiene.

Unit I	**Nutrition and dietary nutrients:** Basic concepts of Food: Components and nutrients.Concept of balanced diet, nutrient requirements and dietary pattern for different groupsviz.,adults, pregnant and nursing mothers,infants,schoolchildren,adolescents and elderly people.
Unit II	**Macronutrientsandmicronutrients**: Macronutrients.Carbohydrates,Lipids,Proteins-Definition,Classification,their dietarysourceandrole.Micronutrients.Vitamins-Water-solubleandFat-solublevitamins-theirsourcesandimportance.Importantmineralsviz.,Iron,Calcium,Phosphorus,Iodine, Selenium and Zinc: their biologicalfunctions.
Unit III	**Malnutrition and nutrient deficiency diseases:** Definition and concept of health: Common nutritional deficiency diseases-Protein Malnutrition(e.g.,KwashiorkorandMarasmus),Vitamin Adeficiency, Iron deficiency and Iodine deficiency disorders-their symptoms, treatment, prevention and government initiatives.
Unit IV	Life style dependent diseases- hypertension, diabetes mellitus, and obesity their causes and prevention. Social health problems-smoking, alcoholism, narcotics. Acquired Immuno Deficiency Syndrome(AIDS):causes,treatmentandprevention.
Unit V	**Diseases caused by microorganisms:** Food hygiene: Potable water- sources and methods of purification at domestic level. FoodandWater-borne infections: Bacterial diseases: cholera, typhoid fever - viral diseases: Hepatitis,Poliomyelitis - Protozoan diseases: amoebiasis, giardiasis - Parasitic diseases: taeniasis andascariasis their transmission, causative agent, sources of infection,symptoms and prevention.Causesoffood spoilageanditsprevention.

References

1. Mudambi,S.R.andRajagopal,M.V.(2007).FundamentalsofFoods,Nutritionan dDietTherapy;FifthEd;;NewAgeInternationalPublishers.
2. Srilakshmi,B.(2007).FoodScience;FourthEd;NewAgeInternational(P)Ltd.
3. Swaminathan,M.(1986).HandbookofFoodsandNutrition;FifthEd;BAPPCO.
4. Bamji,M.S.;Rao,N.P.andReddy,V.(2009).TextBookofHumanNutrition; Oxford&IBH PublishingCo.PvtLtd.
5. Lakra,P.andSinghM.D.(2008).TextbookofNutritionandHealth;First Ed;AcademicExcellence.
6. Gibney,M.J.etal.(2004).PublicHealthNutrition;BlackwellPublishing.

Courseoutcomes:

Studentswillbeableto:

- Understandtheroleoffoodandnutrientsinhealthanddisease.
- Gainknowledgeabouthygiene,foodsafety,diseasetransmission.
- Performfoodsystemmanagementandleadershipfunctionsthatconsidersustainabili tyinbusiness,healthcare,communityandinstitutionalareas.

SEMESTER-V

CourseCode	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO5P1	**ECO-PHYSIOLOGY PRACTICAL**	Core		-	P	-	2	4	25	75	100
LearningObjectives											
CO1	Todemonstrateanunderstandingofcoreecologicalprinciples,anddefine scientificprinciplesandconceptsasrelatedtoenvironmentalstudiesandsustainability.										
CO2	Tounderstandthephysiologicalprocessesthatregulatebodyfunctions.										
CO3	Tostrive to demonstrate the role of experimentation in developing our understandingoflivinganimals.										
CO4	Toattainknowledgeofimportantbiomoleculessuchascarbohydrates,lipids, aminoacids,proteinsandenzymes.										
CO5	Measureandinterpretexperimentaldataanddemonstratelaboratoryskillsinanimal physiology and ecology.										

UNIT	Details	No.of Hours	Course Objectives
UNIT I	**EstimationofAbioticFactors**: Estimation ofdissolved Oxygen,Dissolvedcarbon-di-oxide,Determinationofalkalinityinwatersamples,Determinationofsalinityofwatersamples, Determinationofbicarbonateandcarbonates.	12	CO1
UNIT II	**DigestiveEnzymes**:SurveyofdigestiveenzymesinCockroach,countingofcockroachhaemocytesusinghaemocytometer.Ptyalinactivityinrelationtotemperatureandp Hinhumansaliva. EcologicalMethods:Estimationofoxygenconsumptioninan aquaticandaterrestrialanimal.	12	CO2
UNIT III	**BiochemicalTests**:Use ofpH meter forestimationofpH in water and soil samples, Study of micro arthropodsof water and soil samples (Tullgren's funnel method andLadell'sFloatingMethod).Collection,isolation,identification andmountingofmarineandfreshwaterplankton.Studyof sandyshorefauna-Studyofrocky shorefauna-StudyofanimalAssociation.	12	CO3
UNIT IV	**Qualitative Detection of Biomolecules**: Qualitativetests for identification of carbohydrates, proteins and lipids. Aminoacid in haemolymphofanyinsectbychromatographictechnique. EstimationofHaemoglobinbyCyanmethemoglobinmethod, Bloodgrouping-totaland differential counts. Determination of plasma hemoglobin,Totalerythrocytecountbyhemocytometer.	12	CO4

UNIT V	**FieldWork**: Visit to a local area to document environmentalassetsriver/forest/grassland/hill/mountain.Visittoalocalpolluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond,river,hillslopes,etc.	12	CO5
	Total	**60**	
CourseOutcomes			
CourseOutcomes	Oncompletionofthiscourse,studentswill;		
CO1	Listandrecallthebasicequipmentusedinphysiologyandecologylabanddevelopskillaboutquantitativedeterminationofbiomoleculesandquantitativeanalysis ofblood.	PO1	
CO2	Demonstrate the instruments, discuss the clinicalimportanceanditsapplications,andexplainthe Principle ofbioinstruments.	PO1,PO2	
CO3	Understandandidentifythechemicalcompositionofmajorandminornutrientsandanalysis Physio- Chemical parametersthatregulatemetabolism.	PO4,PO6	
CO4	EvaluateandExaminethevariousparametersofhaematologyand biochemistry and Identifythe Nitrogenous wasteproductsofanimals.	PO4,PO5,PO6	
CO5	Summarise the effect of various physical and chemicalfactors on enzymeactivity/. Compile the changes invariousphysiologicalparametersinmanandother animalsusingvarioustoolsandtechniques.	PO3,PO8	
TextBooks(LatestEditions)			
1.	Widmaier,E.P.,Raff,H.andStrang,K.T.2008.Vander'sHumanPhysiology,XI Edition.,McGrawHill.,770PP.		
2.	Bishop,ML.,Fody,E.P.,Schoeff,LE.2010.ClinicalChemistry:Principles, Procedure,correlations.WoltersKluwer,Inida,298PP.		
3.	Burtis,C.A.andAshwood,E.R.2008.TietztextbookofFundamentalsofclinical chemistryandmoleculardiagnostics,Elsevier,Philadelphia.		
4.	TortoraG.J.&DerricksonB..,2016.PrinciplesofAnatomyandPhysiology,John WileyandSons,Inc.1232PP.		
5.	AgarwalRA.,AnilKSrivastava.,KaushalKumar.,1978.AnimalPhysiologyand		
	Biochemistry,S.Chand&Co.Ltd.,NewDelhiPublishing.,377PP.		
6.	AbhijitDutta,2009.Experimentalbiology:ALaboratoryScience,Narosa, NewDelhi.		
7.	Michael,P,1984.EcologicalMethodsforfieldvisitandlaboratory investigation.TataMcGrawHill,NewDelhi.		
8.	APHA,1992.StandardMethodsfortheexaminationofwaterandwaste water,AmericanPublicHealthassociation,WashingtonD.C.		
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)			
1.	Hoar,W.S.1983.GeneralandComparativePhysiology.PrenticeHallofIndia, NewDelhi.,928PP.		
2.	ProsserC.L.,1985.ComparativeAnimalPhysiology,SatishBookEnterprise, Agra-282003,966PP.		
3.	Wood,D.W.,1968.PrinciplesofAnimalPhysiology,EdwardArnoldLtd, London.,342PP.		
4.	Guyton,A.C.andHall,J.B.,2011.TextBookofMedicalPhysiology,9th Edition,W.B.SandersCompany,PrismBooks(Pvt.)Ltd.,Bangalore.,1064PP.		

5.	Wilson,J.A.1984,PrinciplesofAnimalPhysiology,MacmillanPublishing.,426 PP.
6.	Eugenia,2008.EnvironmentalBiotechnologyandcleaversBioprocesses, London.
7.	Ramesh,R&M,Anbu1996.Chemicalmethodsforenvironmental Analysisofwaterandsediment.MacmillanIndiaLimited,Chennai.

WebResources	
1.	https://bit.ly/3hNyeFN
2.	https://www.medicinenet.com/alp_test/article.htm
3.	https://vlab.amrita.edu/?sub=3&brch=63
4.	https://www.asbmb.org/education/online-teaching/online-lab-work
5.	https://open.umn.edu/opentextbooks/textbooks/687
	https://bit.ly/3lO29yP

MethodsofAssessment	
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/Comprehend(K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview
Application(K3)	Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe,Explain
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion, Debatingor Presentations

MappingwithProgrammeOutcomes:

SCHEME OFEVALUATION	
I. Estimation of Oxygen Cosumption by a Fish Estimation of Salt loss /Salt gain /Salivary amylase of Man in relation to the Temperature Variation	20 Marks
II.Mount any One of the Plankton from the given sample sketch and label the parts/Qualitative analysis of Carbohydrate,Protein and Lipid	10Marks
III.Identify Sketch and Comment on the given apparatus	10 Marks
IV.Identify sketch and comment on the given spotters(Two from Environmental biolgy Three from Physiology)	15Marks
V.Observation note book and Field visit Report	20 Marks
Total	75 Marks

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium(2) L-Low(1)

SEMESTER-V

CourseCode	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO5P2	**EVOLUTION AND ENVIRONMENTAL TOXICOLOGY PRACTICAL**	Core	-	-	P	-	2	4	25	75	100

LearningObjectives	
CO1	Toexplainthemainmechanismsofenvironmentaltoxicantsincausingatoxicresponse inliving organisms.
CO2	Todescribetheoptimaluseofnature,intheformofplants,animals,bacteria,fungiandalgae,toproducerenewableenergy,foodandnutrientsinasynergistic integratedcycleofprofit-makingprocesses
CO3	Toprovidepracticalknowledgeandhandsontoolsandtechniquesfordose-responseassessmentofhazardoussubstances.
CO4	Theuseofbiologicalsystemsforremediationofcontaminatedenvironments (land,air,water),andforenvironment-friendlyprocesses.
CO5	Todevelopdatathatcanensureappropriateprotectionofpublichealthfromtheadverseeffectsofexposurestoenvironmental agents.

UNIT	**Details**	**No.of Hours**	**CourseObjectives**
UNIT I	Evolution: Fossiles:Trilobite,Nautilus, Living fossile limulus and Peripatus Animals of Evolutionary importances-Archaeopterux,Darwin's Finches Mimicry-Leaf insects,Stick insects Monarch and viceroy butterfly Adaptive Colouration Chameleon and Lycodon	12	CO1
UNIT II	**Estimation Methods**: Estimation of Ammonia, Nitrites,Iron, soil alkalinity, Determination of hardness of water.Estimationofchlorinewater.EnvironmentalDeterminants:EstimationofBOD/EstimationofCOD. Physicochemicalpropertiesofwater. **ToxicityTesting**:Methodologyoftoxicitytesting–acuteandchronictests(demonstration),UseofLC50 values–sublethaleffectsofcriticalpollutantsonfish.	12	CO2
UNIT III	**Preparation of nutrient agarmedium**. Settling rate ofbacteria from air. Bacterial Gram staining. Identificationofbacteriafromairuptocolonycharacteristics. Enumerationof bacteriafromair.Studyofcollection,concentrationandpreservationtechniquesofalgae.Identificationtechniquesofalgae(Studyofmorphologicalcharacteristicsofalgae).Identificationandsignificanceofmajaoralgaewithregardtopollution. CalculationofNygaard'sIndices.Calculationofspeciesdiversity-Margalefdiversity index,CalculationofKothe'sspeciesdeficitindex.	12	CO3
	EstimationofStandardPlateCount(SPC)fromwater. EstimationofMPNofcoliformsfromwater.		

UNIT IV	Determination of phosphate levels in clean and pollutedwaters. Determination of pH of soil. Determination oforganicmatterinsoil.Determinationofpercentcompositionofsolubleandinsolublecomponentsofcommunitysolidwaste.Determinationofpercentcomposition of various components of community solidwaste.Studyoftreatmentefficiencyofwater-hyacinth inremovalofTDSandchangesinpH.	12	CO4
UNIT V	MiniProject and Spotters:Bio gas production - Foodtoxicitytests- Fieldvisit,Refluxcondenser,BODincubator,Spectrophotometer,Colorimeter,Atomicabsorptionspectroscopy,Ultracentrifuge,Incubator,HPLC. Visit to wastewater and drinking water treatmentplants.Studyofavermicompostplant.Biogasproduction-Foodtoxicitytests- Fieldvisit,Refluxcondenser,BODincubator,Spectrophotometer,Colorimeter,Atomicabsorptionspectroscopy,Ultracentrifuge,Incubator,HPLC.Visittowastewateranddrinking watertreatmentplants.Studyofa vermicompostplant.	12	CO5
	Total	**60**	

CourseOutcomes		
CourseOutcomes	Oncompletionofthiscourse,studentswill;	
CO1	Understandthepropertiesoftoxicants,effects,originandoccurrenceintheenvironmentandexplaintheprincipleandprocedureforqualityevaluation,monitoring and remediation of contaminated environments.	PO1
CO2	Estimate the toxic chemicals in the environment. Applytoolsandtechniquesforexperimentingwithenvironmentalproblems.Identifyandimplement solutions to the problems.	PO1,PO2
CO3	Analysetheconsistentandinconsistentrangeofelements.Interpret the role of the elements in Environmental pollution and the effects on organisms.	PO4,PO6
CO4	Relatethemetabolicactivity,diseases,illhealthanddeathwith referencetoexposuretochemicals.Selectthesuitableexperimentaldesigntoassessthetoxic effects of pesticides and pollutants.	PO4,PO5,PO6
CO5	Discussthe applicability of chemical analysis and toxicitydata,bothindividuallyandtogether,inrisk assessmentandenvironmentalmonitoring.	PO3,PO8

TextBooks (LatestEditions)	
1.	AbhijitDutta,2009.Experimentalbiology:ALaboratoryScience,Narosa,New Delhi.
2.	DASH.K.,2005.TextBookofBiotechnology.WileyDreamtechPvtLtd, NewDelhi.
3.	Rastogi,S.C., 2005. Experimental physiology, New age International publishers,NewDelhi.
4.	Ramesh,RandM,Anbu1996.ChemicalmethodsforenvironmentalAnalysisofwaterandsediment.MacmillanIndiaLimited,Chennai.

5.	Micheal,P,1984.EcologicalMethodsforfieldvisitandlaboratoryinvestigation. TataMcGrawHill,NewDelhi.
6.	Agarwal,A.StateofIndia'sEnvironment:ACitizensReport,CentreforScience andEnvironment,NewDelhi.
7.	Goel,P.K.WaterPollution:Causes,EffectsandControl.NewAgeInternational, Publishers,NewDelhi(2006).
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)	
1.	AllanS.Cragg,2010.EnvironmentalBiotechnology,OxfordUniversityPress. UK.
2.	APHA,1992.StandardMethodsfortheexaminationofwaterandwastewater, AmericanPublicHealthassociation,WashingtonD.C.
3.	APHA,2005.StandardMethodsfortheexaminationofwaterandwastewater, 21st Ed.,AmericanPublicHealthassociation,WashingtonD.C.
4.	BoydC.E.,1992.WaterQualityandPondSoilAnalysisforAquaculture,C.E. Boyd,C.S.Tucker,AuburnUniversity.
5.	Csuros, M., 1994. Environmental Samplingand Analysis for Technicians,M.LewisPublishers,BocaRaton.Florida.
6.	Eugeniaetal,2008.EnvironmentalBiotechnologyandcleanerBioProcess, Taylor&FrancisLondon,UK.
7.	Francis,B.M.,1994.ToxicSubstancesintheEnvironment,JohnWileyandSons.
8.	Hauser,B.A.,2001.DrinkingWaterChemistry:ALaboratory Manual,LewisPublishers,BocaRaton,Florida
9.	Maier,R.M.,PepperI.L.andC.P.Gerba,2009.EnvironmentalMicrobiology.2nd ed.AcademicPress.USA
10.	Rastogi,S.C.,2005.Experimentalphysiology,NewageInternationalPvt.Ltd. NewDelhi.
11.	Rump,H.H.,1999.Laboratory ManualfortheExaminationofWater, WastewaterandSoil,3rd Ed.,Wiley-VCH,NewYork.
WebResources	
1.	http://www.envexp.com/technical/method-downloads/cod-method-410
2.	https://bit.ly/3u6o0Fb
3.	https://bit.ly/3hX8Ux0
4.	https://bit.ly/3EN2nz0
5.	https://www.ncbi.nlm.nih.gov/pubmed/2170158
MethodsofAssessment	
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/ Comprehend (K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview
Application(K 3)	Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe,Explain
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion, Debatingor Presentations

MappingwithProgrammeOutcomes:

SCHEME OFEVALUATION	
I.Estimation of Ammonia/Soil Alkanity /Estimation of BOD	20 Marks
II.Determine the PH of Soil/Organic Matter in Soil/Determination of Phosphate level in clean and Polluted water	10Marks
III.Identify Sketch and Comment on the given apparatus /Living fossils	10 Marks
IV.Identify sketch and comment on the given spotters from Evolution	15Marks
V.Observation note book and Field visit Report	20 Marks
Total	75 Marks

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium(2) L-Low(1)

SEMESTER-VI

Course Code	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO6C1	**ANIMAL BIOTECHNOLOGY**	Core	Y	-	-	-	4	6	25	75	100

LearningObjectives	
CO1	Toimparttheskillsrequiredtoexplaintheprotocolsforgeneticallymanipulatingcellsandproducetransgenicanimals.
CO2	Toencouragetheuseoftheaptmoleculartechniquestoevaluateandanalyzeanimaltraitsanddiseasesatthegenomiclevelandemploymethodsforeasytaxonomicalidentificationand classificationforbiodiversityandenvironmental studies.
CO3	Tostudymethodsoftransgenesisandtoconsidertheiruseinimprovinganimal husbandryandanimalhealth.
CO4	Tomotivatestudentstoreviewtheethicsandspeculateontheenvironmental implicationsofanimalbiotechnologicalmethods

	Details	**No.ofHours**	**Course Objectives**
UNIT I	**Fundamentals of Biotechnology** : Animalcellculture: Basic requirements and techniques of cellculture, natural and synthetic culturemedia,primary cultureand celllines;Stem cells: types,culture and applications; r-DNA technology: Enzymes;Vectors–pBR322, Phagelambda, Cosmid, HAC,BAC,YAC; Hostcells; Genecloning: steps in cloning, selection of clones–chromogenic substrate, antibiotics.	12	CO1
UNIT II	**TechniquesinAnimalBiotechnology**:Isolationandpurification: DNAandmRNA;Blottingtechniques:Methodsofdifferenttypesof blotting;DNAsequencing:Sangermethod,DNAchips,microarray; PCR:principle,typesandapplication;Genelibrary:screeningwithprobes;Sitedirectedmutagenesis:principle and application; Gene transfer in animal cells: transfection,liposomal, viral mediated, electroporation, biolistic, directDNAinjection.	12	CO2
UNIT III	**Transgenic AnimalTechnology** :Transgenesis: Concept, transgenes, transgenic animal models- knockoutmice, sheep; Applications of transgenesis : Molecular farming,Transgenic fishes,transgenic live stocks, and animals as bio reactors.	12	CO3
UNIT IV	**AnimalBiotechandHealthCare**:Medical biotechnology: Monoclonal antibodies, recombinant vaccines–hepatitis B, hormones–insulin. DNA diagnostic systems: tuberculosis,AIDS,genetic diseases; Gene therapy: Exvivo and invivo, role in cancer treatment; CRISPRgeneediting.Molecularmarkers:RFLP,RAPD,DNAfinger printing and application.	12	CO4
UNIT V	**ApplicationsandEthics**:Humangenomeproject:Mappingofhuman genome,applications,ethics;Industrial biotechnology: Bioreactors-Basic concepts of fermentation, bioreactor design, production of ethanol andstreptomycin;Ethics:Socio ethicalproblem,recent Trendsinanimal biotechnology,ethicalimplications.	12	CO5
	Total	**60**	

CourseOutcomes	
Course Outcomes	Oncompletionofthiscourse,studentswill;

CO1	To describe the methodologies for handling animal cellsbasedontheirdiversecharacteristicsandidentifythecorrectbiotechnologicaltoolstoobtainthedesired Products from the cells.	PO1
CO2	Todevelopandexplaintheprotocolsforgenetically manipulatingcellsandproducetransgenicanimals	PO1,PO2
CO3	To select the apt molecular techniques to evaluate andanalyzeanimaltraitsanddiseasesatthegenomicleveland devise methods for easy taxonomical identificationandclassificationforbiodiversityandenvironmental studies.	PO4,PO6
CO4	Tochoosethecorrectmethodsoftransgenesisandtoconsidertheiruseinimprovinganimalhusbandry Nationallyandglobally	PO4,PO5,PO6
CO5	Tospeculateontheenvironmentalimplicationsofanimalbiotechnologicalmethodsanddesignresponsible,ethicalsolutionstolivestockproduction andhealthissues.	PO3,PO8
TextBooks (LatestEditions)		
1.	SinghB.D.,2015.Biotechnology:Expandinghorizon,Kalyanipublishers.	
2.	Sasidhara,R.,2015.Animalbiotechnology,MJPpublishers.	
3.	DubeyR.C.,2014.AtextBookofBiotechnology,S.Chand&CoLtd,Ram	
	Nagar,NewDelhi.	
4.	DubeyS.K.,BandanaGhosh,2012.Fishbiotechnology,WisdomPress.	
5.	DubeyR.C.,2014.AdvancedBiotechnology,S.ChandPublication.	
6.	Ruby,R.C.,2012.Atextbookofbiotechnology,S.ChandCompany,NewDelhi.	
7.	SambamurthyK.,AshutoshKar.,2009.PharmaceuticalBiotechnology,NewAge International(P)Ltd.	
8.	Ramdoss P.,2009. AnimalBiotechnology-Recent conceptsand developments,MJPpublishers.	
9.	SathyanarayranU.,2008.Biotechnology,BooksandAllied,Kolkata.	
10.	Ignacimuthu,S.,2008.BasicBiotechnology,TataMcGrawhill,NewDelhi.	
11.	RastogiS.C.,2007.Biotechnology:Principlesandapplications,AlphaScience publishers.Ranga,M.M.,2003.Animalbiotechnology,Agrobios,NewDelhi.	
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)		
1.	VeerBalaRastogi,2016.PrinciplesofMolecularbiology,Medtech,Maine, USA.	
2.	MichaelCrichton,2014.EssentialsofBiotechnology,Medtech,Maine,USA.	
3.	GodbeyW.T.,2014.AnIntroductiontoBiotechnology,Academicpress,New York,USA.	
4.	Peters,P.,2009.Biotechnology–Aguidetogeneticengineering,WMCbrown publisher,UK.	
5.	Ramawat,K.GandShaileyGoyal,2009.Comprehensivebiotechnology, S.Chandcompany,NewDelhi,India.	
6.	PrimroseS.B.,R.M.TwymanandR.W.Old,2001.Principlesofgene manipulation,Wiley-Blackwell,UK.	
7.	PrimroseS.B.,2001.MolecularBiotechnology,PanimaPublishingCorporation, NewDelhi,India.	

8.	HamesB.D.andHigginsS.J.1995.GeneProbes:APracticalApproach,Oxford UniversityPress,UK.
WebResources	
1.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612824/
2.	https://www.isaaa.org/resources/publications/pocketk/40/default.asp
3.	https://www.ncbi.nlm.nih.gov/books/NBK207574/
4.	https://iopscience.iop.org/article/10.1088/1755-1315/492/1/012035/pdf
5.	https://go.nature.com/3zAZmO9

MethodsofEvaluation		
Internal Evaluation	ContinuousInternalAssessmentTest	25Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
External Evaluation	EndSemesterExamination	75Marks
	Total	100Marks

MethodsofAssessment

MappingwithProgrammeOutcomes:

Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions
Understand/ Comprehend (K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview
Application (K3)	Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe,Explain
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion, Debatingor Presentations

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium(2) L-Low(1)

SEMESTER-VI

CourseCode	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO6C2	**MICROBIOLOGY AND IMMUNOLOGY**	Core	Y	-	-	-	4	6	25	75	100

LearningObjectives	
CO1	TobecomefamiliarwiththefoundationconceptsofhistoryofMicrobiology
CO2	Tounderstandthestructureandfunctionsofatypicalprokaryoticcell
CO3	Togaintheknowledgeofmicroscopyandstainingconcepts
CO4	Tounderstandandimplementdisposalandsafetymeasures

	Details	**No.of Hours**	**Course Objectives**
UNIT I	**Introductiontomicrobiology** History,scope, branches ofmicrobiology.ContributionofLeeuwanhoek,Jenner, Pasteur,Koch,Systematicposition: 5 kingdom classification of Whittaker and 3kingdom classification of CarlWoese.ComparisonofBacteria,Archaea,Eukarya (tabular and diagrammatic).Controlling microbes.	12	CO1
UNIT II	**IntroductoryMycology,Bacteriology and Virology** Generalcharacteristicsandoutlineclassificationoffungi,Morphologyofsomecommonfungi Rhizopus,Aspergillus, Penicillium- Yeasts:General characteristics andoutlineclassificationofyeasts3.Generalcharacteristicsof Lichens andMycorrhiza. Classificationofbacteria.General characteristics of Cyanobacteria :General characteristics, Magnetosomes, Enrichmentandisolationof Magnetotacticbacteria.Types of staining Virus General characteristics, Structure and Classification.DNAviruses: Herpesviruses and Poxviruses.RNAviruses Paramyxoviruses,Rhabdoviruses.	12	CO2
UNIT III	**ImmuneCellsandOrgans**:OverviewofImmuneSystem - General concepts and Haematopoeisis. Cells ofthe immune system - Immune Cells. Organs ofthe Immune system: Primary lymphoid organs - SecondaryLymphoidorgans- **Innate and Adaptive Immunity:** Innate and AdaptiveImmunity;(Cellmediatedandhumoral).MajorHistocompatibilityComplex(MHC):HLAantigens.	12	CO3
UNIT IV	Antibodies:Structure,functionandpropertiesoftheImmunoglobulins,DifferentclassesofImmunoglobulins;antigenicdeterminantsonantibodies(isotype,allotypeandidiotype).Hybridomatechnology-productionofmonoclonalantibodiesandcatalyticantibodies (abzymes).Hypersensitivity: classification and brief description of various types of hypersensitivities. Autoimmunity: cause of auto immune diseases-classification of auto immune diseases.	12	CO4
UNIT V	Transplantationimmunology:Typesofgrafts,immunologicbasisofgraftrejection, immunosuppressivetherapyandclinicaltransplantation.**ClinicalImmunology:**Immunityandtumors-tumorantigens (TSTA and TAA), immune response to tumors.Tumor evasion of theimmune system, Immunotherapyfortumors.Immunityagainst-viral,bacterialandparasiticinfections.Vaccines:Types and	12	CO5

	uses- Immunization schedule for children.		
	Total		
CourseOutcomes			
CourseOutcomes	Oncompletionofthiscourse,studentswill;		
CO1	Tounderstandhistory,relevanceofmicrobiologyand classificationofbacteria	PO1	
CO2	Tounderstandtheworkingofvariousmicroscopesand	PO1,PO2	
	theirapplication		
CO3	Togainknowledgeofvarious(physicalandchemical)method sofcontrolofmicroorganismsandsafety measurestobefollowedwhilehandlingmicrobes	PO4,PO6	
CO4	Tounderstand the structure of bacterial cells, its organelles,physiologyandbehaviour.	PO4,PO5,PO6	
CO5	Tolearndifferentmethodsofstainingbacteriaanddemonstrat e proficiency in handling aseptic bacteriologicalspecimen.	PO3,PO8	
TextBooks(Lates tEditions)			
1.	AnejaK.R.,ExperimentsinMicrobiology,plantpathology,Tissuecultureand MushroomCultivation,NewAgeInternational,NewDelhi.		
2.	AtlasR.M.,Microbiology–fundamentalsandapplications,Macmillan PublishingCompany,NewYork.		
3.	RavindraNath,FundamentalsofBiologyCoursesforBiotechnology,-Vol.1, SpecialBangaloreUniversityedition,KalayaniPublishers.		
4.	GreenwoodD,RichardCD,JohnSandPeutherF(1992).MedicalMicrobiology, 16thedition.ELBS,Churchilllivingstone.		
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)			
1.	Alexopoulos C.J. Mims C.W., Introductory Mycology, Age and New International,NewDelhi.		
2.	ThomasM. Bell, 1965. An Introduction to General Virology, William HeinemannMedicalbooks,London.		
3.	StanierR.Y.,IngrahamJ.L.,GeneralMicrobiology,PrenticeHallofIndiaPrivate Limited,NewDelhi.		
4.	SalleA.J., Fundamental Principlesof Bacteriology, Tata McGraw – Hill PublishingCompanyLimited,NewDelhi.		
5.	Pelczar.J.ChanE.C.S.andKriegN.R.,Microbiology,McGrawHillBook Company,NewYork.		
6.	BensonHaroldJ,MicrobiologicalApplications,WCBMcGraw–Hill,New York.		
7.	BrockT.D.andMadiganM.T.,BiologyofMicroorganisms,PrenticeHallof IndiaPrivateLimited.		
8.	CollinsCH,PatriciaM,andLyneJM(1995).CollinsandLynesMicrobiological Methods7thedition.Grange,ButterWorth,Oxford.		
9.	CappucinoJGandShermanN(1996).Microbiology,ALaboratoryManual4th edition.BenjaminCumingsInc.California.		

10.	PelczarMJ,ChanECSandKriegNR(1993).Microbiology5thedition,Tata McGrawHill.
11.	MadiganMT, Martinko JM and Parker J (2012). Brock Biology of Microorganism,11theditionPrenticeHallInternationalInc.London.

MappingwithProgrammeOutcomes:

WebResources		
1.	https://vlab.amrita.edu/?sub=3&brch=73	
2.	https://learn.chm.msu.edu/vibl/	
3.	https://mvi-au.vlabs.ac.in/	
4.	https://virtuallab.tlc.ontariotechu.ca/intro.php	
5.	https://www.merlot.org/merlot/viewMaterial.htm?id=79694	
MethodsofEvaluation		
InternalEvaluation	ContinuousInternalAssessmentTest	25Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
External Evaluation	EndSemesterExamination	75Marks
	Total	100Marks
MethodsofAssessment		
Recall(K1)	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions	
Understand/ Comprehend (K2)	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryoroverview	
Application(K3)	Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe,Explain	
Analyze(K4)	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge	
Evaluate(K5)	Longeressay/Evaluationessay,Critiqueorjustifywithprosandcons	
Create(K6)	Checkknowledgeinspecificoroffbeatsituations,Discussion, Debatingor Presentations	

S-Strong(3) M-Medium(2) L-Low(1)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

CourseCode	CourseName	Category	L	T	P	S		Inst .Hours	Marks		
									CIA	External	Total
23BZO6E1	**AGRICULTURAL ENTOMOLOGY**	DSE-II	Y	-	-	-	4	6	25	75	100

LearningObjectives

1. Explainthebasicconceptsofentomologyandobservethepeststatusofagriculture.
2. Illustrateandexaminethesystemicandfunctionalmorphologyofvariousgroupofagricultural insectpests.
3. Differentiateandclassifythevariousgroupsofinsectanimalsandestimatebiodiversity.
4. Tocompareand distinguishthegeneralandspecificcharacteristics integratedpestmanagement.
5. Inferandintegratetheeconomicimportanceofinsectspecies.

UNIT I	Outline classification of insects - Causes for insect assuming pest status - Methods ofcollection,mountingandpreservationof insectpests.
UNIT II	Insect vectors of plant diseases, Insect pests of stored grains their preventive andcurativemethods,Mostcommoninsectpestsofthefollowingplantsandtheircontrol measures: Paddy, Sugarcane, Groundnut, Coconut and Cotton. Locust and its control.Insectpollinatorsandscavenger.
UNIT III	Apiculture: Introduction, types of honey bees, hive, apiary, selection of bees forapiary,Newton's beehive,enemies and diseases ofhoney bees.Sericulture: Introduction,typesofsilkworms,silkwormraces,lifehistoryofmulberrysilkworm,features ofsericultureindustry,pestsanddiseasesofsilkworm.LacCulture.
UNIT IV	IPM, physical, mechanical, chemical and biological control methods,Pesticideapplicationequipment.
UNIT V	Introduction and steps towards IPM, Pheromones, antifeedents, repellents and biopesticide.

TextBooks

1. David,BandAnanthakrishnan,T.N.2006.Generaland AppliedEntomology, Secondedition,TataMcGrawhillpublishing companyLtd.,NewDelhi,India.
2. VasanthrajDavid,B.andRamamurthy,VV.2012.ElementsofEconomicEntomology,Seventhedition,Namruthapublications,Chennai.
3. Pruthi,H.S.1969.TextbookonAgriculturalEntomology,I.C.A.R.Publication,NewDelhi.
4. Awasthi,V.B.2012.IntroductiontoGeneralandAppliedEntomology,thirdedition,Scientificpublishers.

SuggestedReadings

1. AbishekShukla,D.2009.AHandBookofEconomicEntomology,VedamseBooks,NewDelhi.
2. MinistryofAgriculture,GovernmentofIndia,1995.ManualonIntegratedPestManagementinRiceandCotton.
3. JohnWilliamS.1995.ManagementofNaturalWealth,LoyolaCollegePublications,Chennai.

Webresources

1. http://www.fao.org
2. http://flybase.bio.indiana.edu/
3. http://www.ipm.ucdavis.edu
4. http://www.ent.iastate.edu/list/
5. www.entsoc.org

Course Outcomes(COs)

1. Examineand identify thesystemic and functional morphology of various groupofagriculturalinsectpests.
2. Differentiateandclassifythevariousgroupsofinsectsandestimatethebiodiversity.
3. Explainthepeststatusinagricultureandcontrolmeasures.
4. Tocomparethemethodsandoutcomesofintegratedpestmanagement.
5. Listtheeconomicimportanceofagriculturalinsectspecies.

SEMESTER-VI

CourseCode	CourseName	Category	L	T	P	S		Inst.Hours	Marks		
									CIA	External	Total
23BZO6P1	**ANIMAL BIOTECHNOLGY, MICROBIOLOGY AND IMMUNOLOGY PRACTICAL**	Core		-	P	-	2	3	25	75	100

LearningObjectives	
CO1	Toencouragestudentstointerprettheorganizationofgenomicmaterialandtoresearchtheories ofgeneticinheritance.
CO2	Toimparttheskillsrequiredtopreparesamplesofgeneticmoleculesandtodeterminetheirpurity ,structure and characteristics andtoanalyzegenomic preparations.
CO3	Tostudythechangesingeneticmaterialandtopredictandconsiderthe consequencesofthosechanges.
CO4	Toencouragestudentstoreportandjustifytheresultsofmolecularandgenetic experimentsinanaccurateandmeaningfulmanner.

UNIT	Details	No.of Hours	CourseObjectives
UNIT I	**Isolationofgeneticmolecules:**IsolationofDNAfrom spleen.TotalRNAisolationfromplant/animalcells	12	CO1
UNIT II	Qualitativeandquantitativeanalysis of geneticmolecules: Determination of the purity of isolated DNAandRNAsamplesbyUVspectrophotometry.Quantitative estimation of DNA by Spectrophotometry	12	CO2
UNIT III	**Molecularanalysis**: AgarosegelelectrophoresisofDNA.Restrictionfragmentlengthpolymorphismstudy.Eliza,WesternBlot.	12	CO3
UNIT IV	BloodGrouping.Total WBCandRBC.Estimation ofHaemoglobin. Aggutination test to show Antigen -Antibody reaction. Preparation of Serum components. RadialImmunodiffusiontest.DoubleImmunodiffusiontest.RestrictionDigestionofplasmidDNA.Ligationof restrictedfragments.Hanging drop experiment for observation of live bacteria from given sample.	12	CO4
UNIT V	Basicanimalcellculturetechniqueandtransgenesis:Trypsinization oflivercells.Determinationoftheviabilityoftrypsinizedcellsby TrypanBluemethod.Creation of transgenic flies through virtual lab activity(https://media.hhmi.org/biointeractive/vlabs/transgenic_fly/index.html)	12	CO5
	Total	**60**	

MappingwithProgrammeOutcomes: CourseOutcomes	
Course Outcomes	Oncompletionofthiscourse,studentswill;
CO1	Todescribe,examineandinterprettheorganizationof genomicmaterialandtoresearchtheoriesofgeneticinheritance. PO1
CO2	Toprepare samples of genetic molecules and to determinetheirpurity,structureandcharacteristics. PO1,PO2
CO3	Toexperimentwithgenomicpreparationsanddevisetechniquestodistinguishgeneticmaterialindifferent Organisms to survey PO4,PO6

	biodiversity.	
CO4	Toassessthechangesingeneticmaterialandtopredict andconsidertheconsequencesofthosechanges.	PO4,PO5,PO6
CO5	Toreportandjustifytheresultsofmolecularandgeneticexperimentsi nanaccurateandmeaningful manner.	PO3,PO8
TextBooks (LatestEditions)		
1.	SuryaNandanMeena,MilindNaik,2019.AdvancesinBiologicalScience Research:APracticalApproach,AcademicPress,NewYork,USA.	
2.	MichaelPerlin,WilliamBeckerson,AdarshGopinath,2017.Cell,Genetics,and MolecularBiology:ALabManual(FirstEdition),CognellaInc.,USA.	
3.	SaxenaJ.,BaunthiyalM.,RaviI.,2015.LaboratoryManualofMicrobiology, BiochemistryandMolecularBiology,ScientificPublishers,India.	
4.	BansalM.P.,2013.MolecularBiology and Biotechnology:basicexperimental protocols,TheEnergyandResourcesInstitute(TERI),NewDelhi,India.	
5.	ChaitanyaK.V., 2013. Cell and molecular biology: A Lab Manual, Phi LearningPvt.Ltd.,NewDelhi,India.	
ReferencesBooks (Latesteditions,andthestyleasgivenbelowmustbestrictlyadheredto)		
1.	AndreasHofmann,SamuelClokie,2018.WilsonandWalker'sPrinciplesand TechniquesofBiochemistryandMolecularBiology,CambridgeUniversityPress,UK.	
2.	SarahStauffer,AaronGardner,WilkoDuprez,DewiAyuKencanaUngu,Philip Wismer,2018.LabsterVirtualLabExperiments:BasicGenetics,SpringerPublishers,NY,USA.	
3.	LeonardDavis,MarkDibner,JamesBattey,2012.BasicMethodsinMolecular Biology,ElsevierSciencePubilshingCo.,NY,USA.	
4.	RobertF.Schleif,PieterC.Wensink,2012.PracticalMethodsinMolecular Biology,Springer-Verlag,NY,USA.	
5.	IanFreshneyR.,2010.CultureofAnimalCells:AManualofBasicTechnique andSpecializedApplications,JohnWiley&Sons,USA.	
WebResources		

S-Strong(3) M-Medium(2) L-Low(1)

SCHEME OFEVALUATION	
I. Isolation of DNA from Spleen/Isolation of total RNA from plant/Animal cells/ Quantitative estimation of DNA by SpectrophotometryFinding out the blood group based on Antigen-antibody reaction	20 Marks
II.Qualitative vanalysis of doned milk by methylene blue test/	10Marks
III.Motility of bacteria-Hanging drap technique/Isolation of microorganism from soil and water	10Marks
IV.Identify sketch and comment on Blotting technique/DNA chip/Sterlization apparatus	5 Marks
V.Identify sketch and comment on the given spotters	15Marks
Observation note book	15Marks
Total	75 Marks

<table>
<tr><td>Title of the Course</td><td colspan="6">ESSENTIAL REASONING AND QUANTITATIVE APTITUDE</td></tr>
<tr><td>Paper Number</td><td colspan="6">Professional Competency Skill</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">PCS</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code
23BZO6S1</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">1</td><td>1</td><td colspan="2">-</td><td>2</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">• Develop Problem solving skills for competitative examinations
• Understand the concepts of averages , simple interest , compound interest</td></tr>
<tr><td>UNIT-I:</td><td colspan="6">Quantitative Aptitude: Simplifications=averages-Concepts –problem-Problems on numbers-Short cuts- concepts –Problems</td></tr>
<tr><td>UNIT-II:</td><td colspan="6">Profit and Loss –short cuts-Concepts –Problems –Time and work - Short –uts -Concepts -Problems.</td></tr>
<tr><td>UNIT-III:</td><td colspan="6">Simple interest –compound interest- Concepts- Prolems</td></tr>
<tr><td>UNIT-IV:</td><td colspan="6">Verbal Reasoning : Analogy- coding and decoding –Directions and distance –Blood Relation</td></tr>
<tr><td>UNIT-V:</td><td colspan="6">Analytical Reasoning :Data sufficiency
Non-Verbal Reasoning : Analogy ,Classification and series</td></tr>
<tr><td></td><td colspan="6"></td></tr>
<tr><td>Skills acquired from this course</td><td colspan="6">Studnets relating the concepts of compound interest and simple interest</td></tr>
<tr><td>Recommended Text</td><td colspan="6">1.”Quantitative Aptitude” by R.S aggarwal ,S.Chand & Company Ltd 2007</td></tr>
<tr><td></td><td colspan="6"></td></tr>
<tr><td>Website and e-Learning Source</td><td colspan="6">https://nptel.ac.in</td></tr>
</table>