MANGALORE UNIVERSITY
B.Sc.DEGREE
STATE EDUCATION POLICY (SEP-2024)
COURSE PATTERN AND SCHEME OF EXAMINATION –CORE SUBJECT: ZOOLOGY

Core/Elective	CourseCode	Titleofthecourse	Instruction Hours	Duration oftheExamination (Hrs)	Max.Marks			Credits
					Exam	IA	Total	
ISemesterB.Sc.								
GroupI Core Subject	TheoryBSCZOCS 101	Animal Diversity-I(Non chordata)	4	3	80	20	100	3
	Practical BSCZOPS 101	Animal Diversity-I(Non chordata)	4	3	40	10	50	2
Totalnumber ofCredits forCoreSubjectinISemester:05								
IISemesterB.Sc.								
GroupI Core Subject	TheoryBSCZOCS 201	Animal Diversity -II(Chordata)	4	3	80	20	100	3
	Practical BSCZOPS 201	Animal Diversity -II(Chordata)	4	3	40	10	50	2
Totalnumber ofCredits forCoreSubjectinIISemester:05								
IIISemesterB.Sc.								
GroupI Core Subject	Theory BSCZOCS 301	Physiology, Biochemistry and Immunology	4	3	80	20	100	3
	Practical BSCZOPS 301	Physiology, Biochemistry and Immunology	4	3	40	10	50	2
Group II Elective/Optional	BSCZOES 302	Parasitology and Vector Biology	2	2	40	10	50	2
Totalnumber ofCredits forCoreSubjectinIIISemester:07								
IV Semester B.Sc.								
GroupI Core Subject	TheoryBSCZOCS 401	Histology, Animal Behavior,Applied Zoology	4	3	80	20	100	3
	Practical BSCZOPS 401	Histology, Animal Behavior, Applied Zoology	4	3	40	10	50	2
Group II Elective/Optional	BSCZOES 402	Aquarium Fish Keeping	2	2	40	10	50	2
Totalnumber ofCredits forCoreSubjectinIVSemester:07								

V SemesterB.Sc.								
GroupI Core Subject	TheoryBS CZOCS 501	Cell Biology and Biotechnology	3	3	80	20	100	3
	TheoryBS CZOCS 502	Genetics,Biostatistics, Evolution and Paleontology	3	3	80	20	100	3
	Practical BSCZOPS 501	Cell Biology,Biotechnology, Genetics,Biostatistics, Evolution and Paleontology	4	4	40	10	50	2
Totalnumber ofCredits forCoreSubjectinVSemester:08								
VI SemesterB.Sc.								
GroupI Core Subject	TheoryBS CZOCS 601	Reproductive Biology and Developmental Biology	3	3	80	20	100	3
	TheoryBS CZOCS 602	Environmental Biology,Toxicology and Wildlife Biology	3	3	80	20	100	3
	Practical BSCZOPS 601	Reproductive Biology, Developmental Biology, Environmental Biology, Toxicology and Wildlife Biology	4	4	40	10	50	2
Total teaching hours			Theory- 32 Practical-24					
Totalnumber ofCredits forCoreSubjectinVI Semester: 10								
Totalnumber ofCredits forCoreSubjectinI-VI Semesters: 42								
Group II Compulsory course	BSCZOPRS 602	*Skill enhancement programme - Project work / Field training	3	3	40	10	50	2
*** Compulsory course to be offered either in IV/V/VI Semester by the college.**								

MANGALOREUNIVERSITY
STATE EDUCATION POLICY (SEP-2024)
B.Sc. DEGREE - ZOOLOGY

ProgramName	**B.Sc.**	**SEMESTER**	**I**
CourseTitle	**ANIMALDIVERSITY-I(NON-CHORDATA)(THEORY)**		
CourseCode:	**BSCZOCS 101**	No.ofCredits	**3**
Contacthours	**48Hrs(4hours/week)**	DurationofSEA/Exam	**3Hrs.**
Formativeassessmentmarks	**20**	Summativeassessmentmarks	**80**

Unit-I:Introduction,Biodiversity,Protozoa

1.1 Introduction 2Hrs

Principles of animal classification - Binomial nomenclature, Linnaean hierarchy; Criteriafor animal classification - body layers, coelom, body symmetry, metamerism,cephalisation; Definition of species; Phylogeny; Classification of Animal Kingdom up to phylum.

1.2 Biodiversity 4Hrs

Levels of biodiversity - species, genetic and ecosystem level diversity; Concept of Biodiversity hotspots; Biodiversity hotspots of India with emphasis on Western Ghats & Himalaya hotspots.

1.3 Phylum:Protozoa 6Hrs

General characters of the phylum and classification up to classes with suitable examples; Structure and life history of malarial parasite (*Plasmodium vivax*) and human parasitic protozoan (*Entamoeba histolytica*).

Unit-II:Porifera,Coelenterata,Ctenophora

2.1 Phylum:Porifera 6Hrs

General characters of the phylum andclassification up to classes with suitable examples;Sycon-morphology; canal system in sponges.

2.2 Phylum:CnidariaandCtenophora 6Hrs

Generalcharactersofthephylumandclassificationuptoclasseswithsuitable examples;Polymorphismin*Physalia*and *Halistemma*;Coralreefs–Fringing,Barrier, Atoll;Structure ofCorallite; Metagenesis in *Obelia*.

2.2.1 DistinctivecharactersofCtenophora,Externalsof*Pleurobrachia*.

Unit-III:Platyhelminthes,NemathelminthesandAnnelida

3.1 Phylum:Platyhelminthes 4Hrs

General characters of the phylum andclassification up to classes with suitable examples;Structure and life history of liver fluke and tapeworm.

3.2 Phylum:Nemathelminthes 4Hrs

Generalcharactersofthephylumwithsuitableexamples;Externalcharacters,lifecycle and pathogenicity and preventive measures of *Ascaris*.

3.3 Phylum:Annelida 4Hrs

General characters of the phylum and classification up to classes withsuitable examples; Tubicolous adaptations in *Sabella* and *Chaetopterus*; Externalfeatures and life history of earthworm.

Unit-IV:Arthropoda,Onychophora,MolluscaandEchinodermata

4.1 Phylum: Arthropoda and Onychophora 5Hrs

General charactersof the phylum and classification uptoclasses with suitable examples;Externals of marine prawn (*Penaeus*) with detailed account ofappendages; Metamorphosis in insects – Definition, types with examples – ametabola,hemimetabola and holometabola; Externals of *Peripatus*.

4.2 Phylum:Mollusca 3Hrs

General characters of the phylum andclassification up to classes with suitable examples;External features of *Unio* and *Pila*.

4.3 Phylum:Echinodermata 4Hrs

General characters of the phylum and classification up to classes with suitable examples; External features and water-vascular system of *Asterias*; Larval forms of Echinodermata – Bipinnaria, Echinopluteus.

Note:

1. Local examples with common and scientific names are to be given more emphasis forall the groups.
2. While selecting the examples, only such of the salient features of the examples have to bementioned whichare necessary to explain the general charactersof thephylum/class.

REFERENCES:

1. Adam, S. 1990. A Students Text Book of Zoology, Vol. I, II & Vol. III. Low Price Publications, New Delhi.
2. Agarwal, V.K. 2017. Zoology for Degree Students: Non-Chordata, S. Chand & Company, New Delhi.
3. Ayyar,E.1982.AManualofZoologyVol.I,PartI&II,S.VishwanathanPvt.Ltd.
4. Barnes, R.S.K., Calow. P., Olive, P.J.W., Golding, D.W., Spicer, J.I. 2002. The Invertebrates: Synthesis, Blackwell Publishing.
5. Dhami, P.S. & Dhami, J.K. 2021. Invertebrate Zoology, 5th Edition, R. Chand & Co. New Delhi.
6. Hickman, C., Roberts, L.S., Keen, S.L., Larson, A. and Eisenhour, D. 2018. Animal Diversity, McGraw-Hill.
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8. Hussain, S. A. & Achar, K.P. 1999. Biodiversity of the Western Ghats Complex of Karnataka. Resource Potential and Sustainable Utilization. Mangalore: Biodiversity Initiative Trust.
9. Jordan,E.L.&Verma,P.S.2022.InvertebrateZoology,S.Chand&Company,NewDelhi.
10. Kotpal,R.L.2017.ModemTextBookofInvertebrates,RastogiPublications,Meerut.
11. Kotpal, R.L. 2017. Protozoa to Echinodermata (Phylum Series), Rastogi Publications, Meerut.
12. Lal,S.S.2016.ATextbookofPracticalZoology–Invertebrates,RastogiPublications.
13. Verma, P.S. 2013. A Manual of Practical Zoology – Invertebrates, S. Chand & Co. New Delhi.

Program Name	**B.Sc.**		**SEMESTER**	**I**
CourseTitle	**ANIMALDIVERSITY-I(NON-CHORDATA)(PRACTICAL)**			
CourseCode:	**BSCZOPS 101**		No.ofCredits	**2**
Contacthours	**4Hrs/week**		DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks		**10**	Summativeassessmentmarks	**40**

A. Museumspecimensandslides.

Commonlyavailablespecimenscitedinthelistofexamplesaretobeselectedforpracticals.

B. Dissections(Demonstrationonly)

1. Prawn:Nervoussystem
2. Earthworm:Nervoussystem
3. Leech:a)Digestivesystem
   b)Reproductivesystem
4. Cockroach: a)Digestivesystem
   b) Nervoussystem
   c) Maleandfemalereproductivesystems
5. Observations of hay infusion culture to study living protozoans like *Euglena, Paramecium*, *Vorticella, Amoeba* etc.

C. MountingandWholemountpreparations

i) Demonstrationofmountingofthefollowing:
   a. Prawn:Appendages
   b. Leech:i)Salivaryglandcells
      ii) Jaw
   c.Cockroach:Salivaryglands,Mouthparts
   d.Earthworm:Ovary,Bodysetae

ii)Wholemountpreparation:Cnidariancolonies-*Obelia*,*Sertularia,Pennaria,Tubularia* (any two);Crustaceanlarvae–Nauplius,Zoea,Mysis(anytwo)-Processingandmounting.

LISTOFMUSEUMSPECIMENSANDSLIDES

1. Slidesof*Elphidium,Euglena,Plasmodium,Parameciu*m,and*Vorticella.*
2. Specimensof*Euplectella,Sycon*,slidesofspongespicules.
3. *Obelia,Physalia,Aurelia,Seaanemone,Fungia.*
4. Planaria,Liverfluke,Tapeworm,*Ascaris*(MaleandFemale).
5. *Nereis,Chaetopterus,Pheretima,Leech.*
6. *Carcinus*(maleorfemalecrab),*Peripatus*,*Lepas,Scolopendra*,*Limulus*and*Palamnaeus* (Scorpion).
7. *Chiton,Dentalium,Xancus,Pila,Unio,Nautilus,Octopus*.
8. *Asterias* (Star fish), *Ophiothrix* (Brittle star), *Echinus* (Sea-urchin), *Cucumaria* (Sea-Cucumber), *Antedon* (Sea-lily), Bipinnaria larva, Pluteus larva.

SCHEME OF PRACTICAL EXAMINATION

B.Sc. ZOOLOGY: I SEMESTER

CourseTitle:ANIMALDIVERSITY-I(NON-CHORDATA)

Code:BSCZOPS 101

Duration:3hours **Max.Marks:40**

I. Dissection-Identify,drawlabeleddiagramand commentonthesystems **A**and**B**. **(**Identification of the system - 1 Mark; Labelled diagram of the entire system -2 Marks; Description - 1 Mark)(**A&B**indifferentanimals) 2x4=08

I. Mounting–Identifyandcommenton**C**.[AnyoneitemfromC(i)] 03
(Identification-1Mark;Diagram-1Mark;Minimumtwouniquecharacters-1Mark)

II. Mounting–Makeastained,temporarymountingofthegivenmaterial**D**.
[AnyoneitemfromC(ii)](Stainedpreparation-2Marks;Procedure-1Mark) 03

III. Identify, classify, draw labeled diagram and comment on **E**, **F**, **G**, and **H**.
(1 slide,3specimens).(Identification-½ Mark;Classification-½ Mark;Labelled diagram-1Mark;FourComments-2Marks) 4x4=16

IV. Classrecords 10

TOTAL=40

Note:

1. Questionsmustbeframedasperttheschemeprovided.
2. Internal assessment marks to be allotted after conducting one practical test at the end of the semester.

ProgramName	**B.Sc.**	**SEMESTER**	**II**
CourseTitle	**ANIMALDIVERSITY-II(CHORDATA)(THEORY)**		
CourseCode:	**BSCZOCS 201**	No.ofCredits	**3**
Contacthours	**48Hrs(4hours/week)**	DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks	**20**	Summativeassessmentmarks	**80**

Unit-I:Hemichordata,Chordata,andCyclostomata

1.1 Hemichordata 3Hrs

Generalcharactersofthephylumandexternalfeaturesof*Balanoglossus*;Tornaria larva.

1.2 Chordata 1Hrs

GeneralcharactersofChordataandoutlineclassificationuptosubphyla.

1.2.1 Protochordata 3Hrs

CharactersofUrochordataandCephalochordatawithexamples;Externalfeaturesof *Herdmania* and *Branchiostoma*.

1.3.Vertebrata 1Hrs

GeneralcharactersofVertebrata;Outlineclassificationuptoclasses.

1.4Cyclostomata 4Hrs

Generalcharacters;ExternalfeaturesanddifferencesbetweenLamprey(*Petromyzon*) and Hag fish (*Myxine*), Structure of Ammocoetes larva and its metamorphosis.

Unit-II:PiscesandAmphibia

2.1.Pisces-Generalcharacteristicsandaquaticadaptationsoffishes. 2Hrs

2.2 ChondrichthyesandOsteichthyes 3Hrs

GeneralcharactersofChondrichthyeswithexamples;Generalcharactersof Osteichthyes with examples.

2.3 Amphibia 2Hrs

General characters and classification up to orders; Distinguishing features of Anura, Apoda and Urodela with suitable examples.

2.3.1 EndoskeletonofFrog 5Hrs

Skull,lowerjaw,hyoidapparatus,vertebralcolumn,pectoralandpelvicgirdles,limb skeleton.

Unit-III:ReptiliaandAves

3.1 Reptilia 6Hrs

General characters and classification up to orders (living orders only) with suitable examples;Temporal fossae and arcades in reptiles; Indian snakes – Examples of poisonous and Non- poisonous snakes; Distinguishing poisonous from non-poisonous snakes; Poison apparatus and its working mechanism; Snake venom and anti-venom.

3.2 Aves 6Hrs

General characters and classification; Distinctive features of Archaeornithes and Neornithes with reference to Palaeognathae, Impennae and Neognathae giving suitable examples; Flight adaptations in birds.

Unit-IV:Mammalia

4.1 Classification and distinctive features 4Hrs

General characters and classification up to subclasses; Distinctive features of Prototheria, Metatheria and Eutheria with important examples.

4.2. Important characters of following Eutherian orders with examples. 5Hrs

Primates,Chiroptera,Cetacea,Perissodactyla,Artiodactyla,Carnivora,RodentiaandProbosci dia.

4.3.Organsystems 2Hrs

Studyofdigestivesystemandreproductivesystemofrat.

4.4Exoskeletalstructures 1Hrs

Structureofhorns,antlers,hooves&hairs.

Note:

1. Local examples with common and scientific names are to be given more emphasis for all the groups.
2. While selecting the examples, only such of the salient features of the examples have to be mentioned which are necessary to explain the general characters of the phylum/class.

REFERENCES:

1. Adam, S. 1990. A Students Text Book of Zoology, Low Price Publications, Delhi, Vol. I,II & Vo1.III.
2. Ayyar,E.1982.AManualofZoologyVo1.II,S.VishwanathanPvt.Ltd.
3. Colbert,E.H.2011.EvolutionoftheVertebrates,WileyStudentEdition.
4. Dhami&Dhami.2014.ChordateZoology,R.Chand&Co.NewDelhi.
5. Jordan,E.L.&Verma,P.S.2013.ChordateZoology,S.Chand&Company,NewDelhi.
6. Kotpal, R.L. 2016. Modern Text Book of Zoology – Vertebrates, Rastogi Publications, Meerut.
7. Lal,S.S.2009.PracticalZoologyVertebrate12thEd,RastogiPublications,Meerut.
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9. Prasad, S.N. and Kashyap, V. 2015. A text book of Vertebrate Zoology, New Age International Ltd, New Delhi.
10. PrabhakarAchar,K. &GeethaNayak, K.2000.BirdsofDakshinaKannada, Bhuvanendra Nature Club - India.
11. Prakash, M. & Arora, C. K. 1998. Laboratory Animals, Anmol Publicating, AnsariRoad,NewDelhi.
12. Verma, P.S. 2013. A Manual of Practical Zoology (Vertebrates), S. Chand & Company, New Delhi.

ProgramName	**B.Sc.**		**SEMESTER**	**II**
CourseTitle	**ANIMALDIVERSITY-II(CHORDATA)(PRACTICAL)**			
CourseCode:	**BSCZOPS 201**		No.ofCredits	**2**
Contacthours	**4Hrs/week**		DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks		**10**	Summativeassessmentmarks	**40**

A. Museumspecimensandslides

Commonlyavailablespecimenscitedinthelistofexamplesaretobeselectedforpracticals.

B. Dissections(Demonstrationonly)

1. Mouse
   a) Digestivesystem
   b) MaleandFemaleUrinogenitalsystems
2. Fish-Afferentbranchialsystem,CranialnervesV,VII,X.

C. Mounting

Fishscales(Placoid,CycloidandCtenoid)

D. Study of Exoskeletal structures: Bird feathers (Down feather, Contour feather); Horns (Cattle, Sheep); Hooves (Cattle, Horse/ Donkey)

E. Study of Endoskeletal structures: Skull (Amphibian, Reptilian, Avian, Mammalian); Vertebrae, Girdles and limb skeleton of Frog.

LISTOFMUSEUMSPECIMENSANDSLIDES

1. *Balanoglossus*,*Herdmania*,*Amphioxus*,Tornarialarva(all).
2. *Petromyzon*,*Myxine*,Ammocoeteslarva(all).
3. *Narcine*(Electricray),*Pristis*(Sawfish),*Trygon*(Stingray),*Scoliodon*(Shark)(Any two).
4. *Anguilla*, *Hippocampus*, *Anabas testudineus, Catla catla, Clarius batrachus, Gambusia affinis* (Any two).
5. *Ichthyophis* (Caecilian), *Bufo melanosticus* (Common Toad), *Rana hexadactyla* (Indian Pond Frog), *Rana cyanophlyctis* (Skipper Frog), *Hoplobatrachus tigerinus* (Indian Bull Frog), *Rhacophorus malabaricus* (Malabar Gliding Frog), *Ambystoma, Salamander,* Axolotl larva (1 limbless; 1 tailed; others -2).
6. *Hemidactylus frenatus* (Southern House Gecko), *Calotes versicolor* (Common garden Lizard), *Varanus benghalensis* (Common Indian Monitor), *Draco dussumieri* (Draco), *Calotes rouxi* (Forest Calotes), *Chameleon zeylancius* (Indian Chaemeleon), *Crocodylus porosus* (Mugger) - (any three).
7. *Ptyas mucosus* (Common rat snake), *Bungarus fasciatus* (Banded Krait), *Bungarus caeruleus* (Common Indian Krait), *Naja naja* (Indian Cobra), *Python molurus* (Indian Python),*Trimeresurusmalabaricus*(PitViper),*Eryxconicus*(Russell'sEarth Boa), *Daboia russelii* (Russell's Viper) - (any four).

8. *Geocheloneelegans*(StarredTortoise),*Geochelonetravancorica*(TravancoreTortoise), *Chelonemydas*(anytwo).
9. *Pycnonotus jocosus* (Red whiskered Bulbul), *Dicrurus adsimilis* (Black Drongo or King crow), *Oriolus xanthornus* (Black-hooded Oriole), *Sturnus pagodarum* (Black headed or Brahminy Myna), *Psittacula cyanocephala* (Blossom headed Parakeet), *Haliastur indus* (Brahminy Kite), *Centropus sinensis* (Crow Pheasant), *Ardea cinerea* (Grey Heron),*Corvus splendens* (House Crow), *Passer domesticus* (House Sparrow), *Tyto alba* (Indian BarnOwl), *Ploceus philippinus* (Indian Baya), *Oriolus oriolus* (Indian Golden Oriole), *Pavo cristatus* (Indian Peafowl), *Acridotheres tristis* (Common Myna), *Ardeola grayii* (Indian Pond Heron or Paddy bird), *Nectarinia asiatica* (Indian Purple Sunbird), *Copsychussaularis* (Magpie Robin), *Amauronis phoenicurus* (Indian Whitebreasted Waterhen), *Dinopium benghalense* (Lesser Golden backed Woodpecker),*Egrettagarzetta* (LittleEgret) - (any four).
10. Echidna, *Bandicota indica* (Bandicoot Rat), *Lepus nigricollis* (Blacknapedhare), *Macaca radiata* (Bonnet Macaque), *Presbytis entellus* (Common Langur), *Herpestusedwardsi* (Common Mongoose), *Paradoxurus hermaphrodites* (Common Palm Civet), *Petaursita philippensis* (Common giant flying squirrel), *Funambulus palmarum* (Three striped palm squirrel), *Rousettus leshenulti* (Fulvous fruit bat), *Mus musculus* (House Mouse), *Rattus rattus* (House Rat), *Pteropus giganteus* (Indian Flying Fox)- (any three).

Note: 1. Local examples with common and scientific names are to be given more emphasis for all the groups.
2. Only such of the salient features of the examples have to be mentioned which are necessary to explain the general characters of the phylum/class.
3. In the event of non-availability of specimens, related internet downloaded photos/movies can be shown.

SCHEME OF PRACTICAL EXAMINATION

B.Sc. ZOOLOGY: II SEMESTER

CourseTitle:ANIMALDIVERSITY-II(CHORDATA)

Code:BSCZOPS 201

Duration:3hours **Max.Marks:40**

I. Dissection- Identify,drawlabeleddiagramandcommentonthesystems **A**and**B**.
(Identification of the system - 1 Mark; Labelled diagram of the entire system - 2 Marks; Description - 1 Mark) (**A & B** in different animals) 2x4=08

II. Mounting–Makeastained,temporarymountingofthegivenmaterial**C**(FishScale)02
(Stainedpreparation-2Marks)

III. Identify,classify,drawlabeleddiagramandcommenton**D**,**E**,and**F**. 3x4=12
(Identification-½Mark;Classification-½Mark;Labelleddiagram-1Mark;FourComments-2Marks)

IV. Exoskeleton–Identifyandcommenton**G.** 02
(Identification-1Mark;Minimumtwouniquefeatures-1Mark)

V. Endoskeleton – Identify and comment on the material **H** and **I** (One Skull/Girdle/limb Skeleton; One vertebra).
(Skull/Girdle/LimbSkeleton:Identification-1Mark;Minimumsixuniquefeatures-3Marks)
(Vertebra:Identification-½Mark;Minimum3uniquefeatures-1½Marks) 4+2=06

VI. Classrecords 10

TOTAL=40

Note:

3. Questionsmustbeframedaspertheschemeprovided.
4. Internalassessmentmarkstobeallottedafterconductingonepracticaltestattheendofthesemester.

ProgramName	**B.Sc.**	**SEMESTER**	**III**
CourseTitle	**PHYSIOLOGY,BIOCHEMISTRYANDIMMUNOLOGY (THEORY)**		
CourseCode:	**BSCZOCS 301**	No.ofCredits	**3**
Contacthours	**48Hrs(4hours/week)**	DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks	**20**	Summativeassessmentmarks	**80**

Unit -I:Physiology

1.1 Introduction 1Hr

Definition;Branchesandscopeofphysiology.

1.2 Osmoregulation 2Hrs

Definition; Types of solutions-hypotonic, isotonic and hypertonic; Osmoconformers and Osmoregulators; Osmoregulation in shark, marine and freshwater teleosts, terrestrial mammals (Kangaroo rat and camel).

1.3 Thermoregulation 2Hrs

Ectotherms, Endotherms, and Heterotherms; Temperature regulation in Poikilotherms and Homeotherms; Aestivation and hibernation.

1.4 Digestion 4Hrs

Mechanicalandchemicaldigestion;Digestionandabsorptionofcarbohydrates,proteins and lipids.

1.5 Respiration 3Hrs

External and internal respiration; Respiratory pigments - Haemoglobin, haemocyanin and haemoerythrin; Physiology of respiration – breathing, exchange of gases - transport of oxygen - oxygen dissociation curves - Bohr effect - transport of carbon dioxide - chloride shift; Respiratory quotient.

Unit-II:Physiology(Contd...)

2.1. Circulation 4Hrs

Types of circulation; Structure and functions of human heart; Origin and conduction ofheart beat; Cardiac cycle; Blood pressure - hypertension and hypotension; Composition of human blood – Plasma, Erythrocytes, leucocytes and platelets.

2.2 NirtrogenExcretion 4Hrs

Nitrogen excretion in aquatic and terrestrial animals – Ammonotelism, Ureotelism and Uricotelism with examples; Ornithine cycle in humans; Physiology of urine formation in humans – ultrafiltration, tubular reabsorption and tubular secretion.

2.3 MuscleContraction 4Hrs

Principal typesof muscles; Ultrastructure ofstriated muscles; Contractile proteins -myosin, actin,tropomyosin,troponinandactinin;Mechanismofmusclecontractionandrelaxation - the sliding filament theory; Structure of neuromuscular junction; Properties of muscle - Muscle fatigue, muscle twitch, muscle tetanus, rigor mortis.

Unit-III:Physiology(Contd…)

3.1 NerveCoordination 4Hrs

Types of nervous systems; Structure and types of neurons; Nature and conduction of nerve impulse; Types of synapses and synaptic transmission.

3.2 SenseOrgans 4Hrs

Classification of sense organs – Photo-, chemo- and thermoreceptors; Structure of mammalian ear and mechanism of hearing; Structure of mammalian eye and mechanism of image formation.

3.3 EndocrineSystem 4Hrs

Human endocrine glands – Functions of Pituitary, thyroid, parathyroid, pancreas, adrenals, and pineal glands; Hormonal disorders in humans - Pituitary dwarfism, Cretinism,Cushing's disease, Diabetes mellitus; Hypothalamus - stimulating and inhibitory effects.

Unit-IV:BiochemistryandImmunology

4.1 Biochemistry

4.1.1 a.Carbohydrates–Definition,classification,examples;Biologicalimportance.
b.**Lipids**-Definition,classification,examples;Biologicalimportance. 1Hrs

4.1.2 Proteins – Definition; A brief account of amino acids; Classification of proteins, examples and biological importance of proteins. 1Hrs

4.1.3 Enzymes – Definition, types; Classification of enzymes (IUB system); Mechanism of enzyme action – Lock and key model; Factors affecting enzyme action; Mechanism of enzyme inhibition. 2 Hrs

4.1.4 Vitamins- Functions ofFat soluble vitamins (A,D, EandK), water soluble vitamins (B-complexand vitamin C); Deficiency symptoms: Night blindness, Scurvy, Beri-beri, Rickets. 2Hrs

4.2 Immunology 6Hrs

ImmuneSystem-innateandacquired;Cellsofimmunesystem;Organsofimmunesystem
- Primary lymphoid organs (Bone Marrow, Bursa of Fabricius, Thymus), Secondary lymphoid organs (Lymphoid follicles, lymph nodes, Peyer's patches); Antigens and Antigenecity; Immunoglobulins - structure and functions of IgG; Primary and secondary immune responses; Immunization; Autoimmune diseases – Definition, examples – TypeI Diabetes and Rheumatoid Arthritis.

REFERENCES:

1. Abul,K. A. andAndrew,H.L.2003.CellularandMolecular Immunology,Saunders Publications.
2. Chatterjee,C.C.2013.Human Physiology, Vol. I.,CBSPublishing.
3. Conn,E.E.,&Stumpf,P.F.1995.OutlinesofBiochemistry,JohnWileyandSons.
4. David,M.,Jonathan,B.,David,R.B.,and Ivan,R. 2006.Immunology,Mosby,Elsevier Publication.
5. Deb,A.C.2012.FundamentalsofBiochemistry,NewCentralBookAgency.
6. Giese,A.C.1969.CellPhysiology,SaundersCo.Ltd.
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ProgramName	**B.Sc.**		**SEMESTER**	**III**
CourseTitle	**PHYSIOLOGY, BIOCHEMISTRY AND IMMUNOLOGY (PRACTICAL)**			
CourseCode:	**BSCZOPS 301**		No.ofCredits	**2**
Contacthours	**4 Hrs/week**		DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks		**10**	Summativeassessmentmarks	**40**

MAJOREXPERIMENTS:

A. Physiology:

1. Totalerythrocytecountsinhumanbloodsample.
2. Totalleucocytecountsinhumanbloodsample.
3. Salivaryamylaseactivitytestofhumansaliva.
4. Osmotichaemolysisinanimalcells.

B. Biochemistry:

1. Qualitativetests:
   a. Carbohydrtes:Molisch'sTest,Benedict'stestforglucose,Iodinetestforstarch.
   b. Proteins:Biurettest,Xanthophoretictest,Ninhydrintest.
   c. Nitrogenousexcretorywastes:
      i. Ammonia-Nessler'sreagenttest.
      ii. Urea–Sodiumhypobromitetest.
      iii. Uricacid-Folin'suricacidreagenttest.
   d. AbnormalconstituentsofHumanurine:
      i. Sugar(glucose)–Benedict'stest.
      ii. Albumen–Heller'sNitricacidringtest.
      iii. Ketone–Rothera'stest.

C. Immunology:

1. Preparationofstainedbloodsmearandidentificationofdifferenttypesofblood cells – RBCs, Neutrophils, Lymphocytes, Eosinophils, Monocytes, and Basophils.
2. Identificationoforgansofimmunesystem –Bonemarrow,Thymus, Lymphnodes, Spleen, Peyer's patches, Tonsils – Specimens/slides/charts/models.

***Note**: (Students have to identify the presence of the organic compound in the sample provided, giving the principle of reaction).

MINOREXPERIMENTS:

1. Preparationofhaematincrystalsfromhumanblood.
2. Determinationofbleedingtimeofhumanblood.
3. Determinationofclottingtimeofhumanblood.
4. Estimationofhemoglobininhumanblood(Sahli'smethod).
5. Detectionoflipids–Solubilitytest,Greasyspottest.

SCHEME OF PRACTICAL EXAMINATION

B.Sc. ZOOLOGY: III SEMESTER

CourseTitle:PHYSIOLOGY,BIOCHEMISTRYANDIMMUNOLOGY

Code:BSCZOPS 301

Duration:3hours **Max.Marks:40**

I.	Physiologyexperiment(bylots). (Conductingthetest-4Marks;Principle/Procedure/observation/calculation/Inference-4Marks; Result - 2 Marks)	10
II.	Biochemistryexperiment(bylots). Conductsuitablequalitativetestsforthedetectionof Organiccompounds/ Nitrogenous wastes/abnormal constituents of urine in the sample provided and report (Name of the test - 1 Mark; Principle - 2 Marks; Conducting the test - 3 Marks; Procedure/observation/inference (in tabular form) -3 Marks; Result -1 Mark)	10
III.	Immunology:IdentifyandcommentontheCell**A**andOrgan**B**(Commonforall). (CellA:Identification-½Mark,Diagram–1Mark,Comments–1Mark. Organ B: Identification - ½ Mark, Comments – 2 Marks)	05
IV.	Minorexperiment(anyone)-Commonforall. (Experiment-4Marks;Report-1Mark)	05
V.	Classrecord	10
		TOTAL=40

Note:

1. Questionsmustbeframedasperttheschemeprovided.
2. Internalassessment marks to be allotted after conducting one practical test at the end of the semester.

ProgramName	**B.Sc.**	**SEMESTER**	**IV**
CourseTitle	**HISTOLOGY, ANIMAL BEHAVIOUR, APPLIED ZOOLOGY (THEORY)**		
CourseCode:	**BSCZOCS 401**	No.ofCredits	**3**
Contacthours	**48Hrs(4hours/week)**	DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks	**20**	Summativeassessmentmarks	**80**

Unit-I:Histology 12Hrs

Studyofhistologicalstructureoffollowingmammalianorgans.
(a)Stomach(b)Intestine(c)Ovary(d)Testis
(e)Liver(f)Pancreas(g)Thyroid(h)Kidney(i)Adrenal(l)Pituitary

Unit-II:AnimalBehaviour

2.1 Introduction, Types of Animal Behavior 3Hrs

Innate behavior - taxes, reflexes, instincts and motivation;
Learnt behavior - habituation, imprinting, conditioned reflexes and insight learning;
Biological clock - circadian rhythms.

2.2 Socialorganizationinanimals 2Hrs

Socialbehavior–Definition;SocialbehaviorinHoneybees,termites,monkeys.

2.3 Animalmigration 3Hrs

Introduction; Advantages of migration; Migration in fishes - anadromous, catadromous; Migration in birds - types of migration, orientation and navigation, preparation for migration.

2.4 CourtshipandNestingBehavior 2Hrs

Introduction;CourtshipbehaviorinPeacock,RiverTern,andSarus Crane;Typesof nestsinbirds;NestingbehaviorinBayaWeaverBird andHornbill.

2.5 ParentalCare 2Hrs

Parental care in fishes (*Hippocampus*, *Tilapia* species, *Arius* species) and amphibians (*Rhacophorus*, salamander, *Hyla* and *Ichthyophis*).

Unit-III:AppliedZoology

3.1 Dairy 4Hrs

Introduction; Breeds of dairy animals; Cattle: Milch breeds - Red Sindhi, Gir; Draughtbreeds - Amrithmahal, Hallikar; Dual purpose breeds - Krishna valley, Ongole; Exoticbreeds – HF, Jersey; Buffalo breeds - Nagpuri, Surti; Goat breeds - Jamunapuri, Malabari; Milk - composition and uses; Milk products - Butter,Ghee, Cheese andPaneer- uses; Utility of cattle in agriculture and transport, biogas, fertilizer and gelatin production.

3.2 Poultry 4 Hrs

Introduction; Poultry breeds - layers, broilers and dual-purpose breeds with any two exampleseach; Desi breeds of poultry - Aseel, Chittagong, Kadaknath, Giriraja; Housing managementofpoultry–intensiveandsemi-intensivemethods;Poultrydiseases–Ranikhet,

Fowl pox, Tick fever (Spirochaetosis), Fowl cholera; Prevention and control of poultry diseases.

3.3 Vermitechnology 4Hrs

Ecological classification of earthworms (Epigeic, anesic, endogeic); Introduction to vermiculture; Methods of vermiculture – bin and pit methods; Preparation of vermicompost fromanyorganicwastematerial(weeds, waste,domesticwastes,paperwastesetc.);Uses of vermicompost and vermiwash.

Unit-IV:AppliedZoology(Contd...)

4.1 Aquaculture 4Hrs

Definition; Techniques of culturing freshwater fishes; Induced breeding and seed fish production; Fish diseases and their control – White spot disease,Gyrodactylosis, Bacterial gill rot; Shrimp culture.

4.2 Apiculture 4Hrs

Introduction; Bee species used for apiculture; Methods of bee keeping –Traditional method, Modern method – Langstroth model; Predators of honey bees; Extractionof honey; Nutritive value and uses of honey; Bee wax and its uses; Diseases of honey bees and control - Nosemosis, American Foulbrood, Thai Sac Brood.

4.3 PearlCulture 2Hrs

Species of Pearl Oysters and their occurrence; Formation of natural pearl; Pearl producing sites in India; Steps involved in pearl culture – Oyster collection, Rearing, Insertion of nucleus, Post-operational care, harvesting.

4.4 LacCulture 2Hrs

Lac insect – *Kerria lacca* – Structure and life history; Host plants; Cultivation of Lac; Economic importance of Lac.

REFERENCES:

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ProgramName	**B.Sc.**		**SEMESTER**	**IV**
CourseTitle	**HISTOLOGY,ANIMALBEHAVIOUR,APPLIEDZOOLOGY (PRACTICAL)**			
CourseCode:	**BSCZOPS 401**		No.ofCredits	**2**
Contacthours	**4Hrs/week**		DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks		**10**	Summativeassessmentmarks	**40**

1. Observationofmammalianhistologyslidesofthefollowingorgans:Stomach,Smallintestine, Liver, Pancreas, Kidney, Ovary, testis, Thyroid and Adrenal.

2. Preparation of permanent slides of mammalian Stomach, Liver, Pancreas, Small intestine, Kidney, Testis, Ovary, Thyroid and Adrenal of Rat. (Any two slides prepared by the studentshave to be submitted at the time of examination).

3. Animalbehavior:
   a. Socialbehaviorinhoneybees–Castes–Queen,Drone,Worker.
   b. Studyofbird'snests–Anyfourdifferenttypesofnests.
   c. StudyofParentalcare–*Hippocampus,Ichthyophis*.

4. a.Milkproducts–Curd,Butter,Ghee,Cheese,Paneer.
   b. Fishproducts–Fishoil,Fishmeal,Fishmanure.
   c. HoneyandBeewax.
   d. Poultry–Egg,Meat.
   e. PearlandLac.

5. Fieldorientedpractical's:

   i. Study of nesting androosting places in birds, studyof various types of bird nests (asper the availability).
   ii. Fieldvisittostudyanimalbehaviorinnaturalhabitat–
   Identification of castes/ Study of bee colonies, bee hives/ant colonies, ant nests/ termites and their mounds/ nesting behavior in solitary and social wasps/monkeytroops etc.
   iii. Preparationofvermicompostusingdifferentrawmaterials(suchasweeds,paperwaste, domestic waste, sugar cane etc.)
   iv. Visittohoneybeerearingcenters.
   v. Visittofish/shrimpbreedingcenters.
   vi. Visittodairy.
   vii. Visittopoultryfarm.

Note: The field studies should be based on the above mentioned topics which shall be allottedat the beginning of semester. Each student shall prepare separate field report which is to be certified by staff in-charge and HOD. It should be submitted during practical examinationwhich shall be evaluated by both internal and external examiners. Field work must besupported by proper documents and photographs of the field visit by individual students.

SCHEME OF PRACTICAL EXAMINATION
B.Sc. ZOOLOGY: IV SEMESTER
Course Title: HISTOLOGY, ANIMAL BEHAVIOUR, APPLIED ZOOLOGY (PRACTICAL)

Code:BSCZOPS 401

Duration:3hours **Max.Marks:40**

I. Histology-Stain,mount,andidentifytheparaffinsectionprovided. 06
(Slidepreparation-5Marks;Identification-1Mark)

II. Histology–Identify,drawlabelleddiagramandcommentonpermanentslides**A**and**B**.
(Identification-1Mark;Labelleddiagram-1Mark;Comments-2Marks) 2x4=08

III. Animalbehaviour:IdentifyandcommentonCand**D**. 2x2=04
(Identification-½Mark;Comments-1½Marks)

IV. AppliedZoology:IdentifyandcommentonE,**F**and**G**. 2x3=06
(Identification-½Mark;Comments-1½Marks)

V. FieldReport* 06
(Introduction-1Mark;Detailsoffieldvisited-1Mark;Observationsincludingphotographs-3Marks; References - 1 Mark)

VI. ClassRecord+Slides 8+2=10

TOTAL=40

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*The Hand written field report (not exceeding 10 A4 size sheets) should include introduction, details of fields visited, detailed account of observations made, original photographs and references.

Note:

1. Questionsmustbeframedasperttheschemeprovided.
2. Internal assessment marks to be allotted after conducting one practical test at the end of the semester.

ProgramName	**B.Sc.**	**SEMESTER**	**V**
CourseTitle	**CELLBIOLOGYANDBIOTECHNOLOGY(THEORY)**		
CourseCode:	**BSCZOCS 501**	No.ofCredits	**3**
Contacthours	**40Hrs(3hours/week)**	DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks	**20**	Summativeassessmentmarks	**80**

Unit-I:CellBiology

1.1 Introduction 1Hrs

Definition;Subdivisionsofcellbiology;Scopeofcellbiology.

1.2 Chromosomes 4Hrs

Morphology of chromosomes - centromere, telomere; Heterochromatin and Euchromatin; Types of chromosomes, chromosome number; Ultrastructure of chromosomes -Nucleosome model, Giant chromosome - Polytene and Lampbrush chromosomes.

1.3 NucleicAcids 5Hrs

Introduction - Identification of genetic material - Griffith's experiment, experiments of Avery,MacLeod and McCarty, Hershey-Chase experiment; Chemistry of nucleic acids - structure of DNA - Watson and Crick DNA model; Mechanism of DNA replication – Meselson and Stahl's experiment. DNA repair - Excision repair, photoreactivation and recombinationalrepairs;TypesofRNA;TranscriptionandRNA processing (Intron splicing and post transcriptional modifications).

Unit-II:CellBiology(Contd…)

2.1 Plasma membrane and cell junctions 3 Hrs

Fluidmosaicmodelofplasmamembrane;Functionsof plasmamembrane;Typesofcell junctions; Extracellular matrix.

2.2 Cytoskeletonelements 2Hrs

Microtubules;Microfilaments;Intermediatefilaments-organizationandfunctions.

2.3.Celldifferentiation 1Hrs

Definition;Nucleo-cytoplasmicinteractions(Experimentswith*Acetabularia*).

2.3 CancerandCarcinogenicAgents 4Hrs

Concept of cancer; Types of cancer; Characteristics of cancerous cells; Oncogenes;Immunesystem in cancer; Carcinogenic agents - physical, chemical and biological; Strategiesofcancer therapy - Immunotherapy, Radiotherapy, Chemotherapy; Role of telomere in cell ageing and cancer; A brief account on apoptosis.

Unit-III:**CellBiology(Contd…)**

3.1 Genetic Code and Protein Biosynthesis 3 Hrs

Geneticcode:DefinitionandProperties,Wobblehypothesis;ProteinBiosynthesis- Components of protein biosynthesis; Mechanism of protein biosynthesis.

3.2.Mitosis 3Hrs

Cellcycle-Phasesofcellcycle–interphase–prophase-centriolecycle -mitoticapparatus -metaphase, anaphase and telophase; Cytokinesis;Differences between mitosis in animaland plant cells; significance of mitosis; Mitotic inhibitors - examples and applications.

3.3.Meiosis 4Hrs

Phases of meiotic cycle - I meiotic division - Synaptonemal complex and recombination; Mechanism of crossing over; cytological basis of crossing over (Stern's experiment); Significance of crossing over; Interkinesis; Second meiotic division; Significance of meiosis; Differences between mitosis and meiosis.

Unit-IV:Biotechnology

4.1 Introduction to Genetic Engineering 4Hrs

Introduction;Restrictionendonucleases(I,IIandIII);Cloningvehicles-plasmids, episomes,transposons,animalviruses,shuttlevectors;Genelibraries-genomic library - cDNAlibrary;IntroducingClonedGenesintotheHostCells-Transformation, Transduction,Particle Gun, Electroporation.

4.2 TechniquesinBiotechnology 3Hrs

PCRtechnique,Southern,NorthernandWesternblottingtechnique;DNAfingerprinting - principle, method and applications; DNA sequencing – Sanger and Cohlson's Method; Proteomics and genomics; Protein engineering; FISH, RAPD, RFLP - Definition and applications.

4.3 ApplicationsofBiotechnology 3Hrs

Introduction; Microbes in pollution control; Biotechnology in bioremediation; Biotechnology in disease prevention and diagnosis, Pharmaceuticals, Vaccines; Transgenic animals; Stem cells in transgenesis; Gene therapy.

REFERENCES:

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14. VermaandAgarwal.1999.ATextBookofCytology,S.Chand&Company.NewDelhi.
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ProgramName	**B.Sc.**	**SEMESTER**	**V**
CourseTitle	**GENETICS, BIOSTATISTICS, EVOLUTION AND PALAEONTOLOGY (THEORY)**		
CourseCode:	**BSCZOCS 502**	No.ofCredits	**3**
Contacthours	**40Hrs(3hours/week)**	DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks	**20**	Summativeassessmentmarks	**80**

Unit-I:Genetics

1.1. Introduction and Laws of Inheritance 4Hrs

Introduction and branches of genetics; Heredity and variation; Mendel'sexperiments-MonoandDihybridcrosses,TestcrossandBackcross;Mendel'slawsof inheritance; Use of *Drosophila* in genetic studies; Dihybrid crosses in *Drosophila*.

1.2 Interaction of Genes (Modified genetic ratios) 3Hrs

Incomplete dominance - 1:2:1 - Plumage pigmentation in fowl.
Supplementaryfactors-9:3:3:1-Combpatterninfowls.
Dominant Epistasis - 12:3:1 - Plumage colour in Leghorn and Wyandotte.
Recessive Epistasis - 9:3:4 - Coat colour in Guinea pigs.
Complementary factors - 9:7 - Flower colour in sweet peas.
Lethal genes - Coat colour in mice.

1.3 Multiple Alleles, Polygenic inheritance and Pleiotropism 3 Hrs

ABO blood groups in humans; Rh factor - Erythroblastosis fetalis; Blood typing and blood transfusion; Inheritance of coat color in rabbit; Polygenic inheritance in man - skin color; Pleiotropism (Cystic fibrosis in humans and vestigial wing in*Drosophila*).

Unit-II:Genetics(Contd….)

2.1 NatureandNurture 1Hrs

Definition;Normofreaction,ExperimentsonHimalayanAlbinorabbitandHuman twins; Phenocopy; Penetrance and expressivity with examples.

2.2 Linkageandgenemapping 3Hrs

Linkage – Definition; Complete and partial linkage in *Drosophila*; Significance of linkage; Linkage maps - Construction of chromosome maps;Two-point test cross, three point test cross.

2.3 Sex-determination and Sex linked inheritance 3Hrs

TypesofSexchromosomes;Chromosomalmechanismofsexdetermination(XX-XY, XX-XO,ZZ-ZWandZZ-ZOtypeswithspecificexamples);Sexlinkedinheritancein *Drosophila*(Whiteeye);Haemophiliaandcolourblindnessinman;Sexlinkageinbirds (barredplumagepatterninpoultry);Sexlimited(plumagepatterninLeghornfowls)and sex influenced traits (baldness in humans).

2.4 Gene, gene regulation and Gene Mutation 3Hrs

Finestructureofgene-cistron,muton,recon,introns;Regulationofgeneexpressioni n p r o k a r y o t e s - Lac Operon; Mutation –pointmutation,frame-shiftmutation,insertions. ClB technique.

Unit-III:HumanGeneticsandBiostatistics

3.1 HumanGenetics 4Hrs

Humankaryotype;Idiogram;Pedigreeanalysis;Commonhumanchromosomalsyndromes - Klinefelter's and Turner's Syndromes, Down's syndrome; Inborn errors of metabolism – Albinism, Phenylketonuria, Alkaptonuria, Sickle cell anemia, Thalassemia, Huntington's chorea;Prenataldiagnosis-Amniocentesis,chorionicvillussampling;Geneticcounseling.

3.2 Biostatistics 6Hrs

Introduction to biostatistics - Basic concepts; Presentation of data - Tabulation, frequency distribution, graphical and diagrammatic representation; Analysis of data - mean, median and mode; Standard deviation; Tests of significance - Student t - test, chi-square test. (Wherever necessary, appropriate problems should be worked out).

Unit-IV:EvolutionandPalaeontology

4.1 Theories of Organic Evolution and Speciation 4Hrs

Lamarckism;Darwin-WallacetheoryofNaturalSelection;Synthetictheoryofevolution -Neo-Darwinism; Hardy-Weinberg law of equilibrium; Factors influencing change in genefrequenciesofapopulation-genemutation,geneflow,geneticdrift;Natural Selection –types - Stabilizing selection, Directional selection and Disruptive selection; Artificial selectionwithexamples(insecticidalresistanceininsectsorindustrial melanism); IsolationandIsolatingmechanisms–i.Geographicalisolation. ii. Reproductive isolation - Prezygotic/Prematingisolation–Ecological,Seasonal, Ethological, Mechanical,PhysiologicalandGameticmortality; Post zygotic/Post mating isolation– Cytological,Zygoticmortality,Hybridinviability,Hybridsterility;Speciation -sympatricandallopatricspeciation.

4.2 EvidencesofOrganicEvolution 2Hrs

Evidences from comparative morphology and anatomy, comparative physiology and biochemistry, comparative embryology and palaeontology.

4.3 Palaeontology 2Hrs

Briefaccountofgeologicaltimescale;Fossilsandfossilization;Dinosaurs;Studyofconnecting links: *Peripatus* and *Archaeopteryx*.

4.4.EvolutionofHorseandMan 2Hrs

Origin and evolution of horse (*Eohippus*, *Mesohippus*, *Merichyppus*and *Equus*) and man(*Australopithecus*, Java ape man, Neanderthal man and Cro-Magnon Man).

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2. Gardner.1991.PrinciplesofGenetics,JohnWiley&SonsInc.,NewYork.
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ProgramName	**B.Sc.**	**SEMESTER**	**V**
CourseTitle	**CELL BIOLOGY, BIOTECHNOLOGY, GENETICS, BIOSTATISTICS, EVOLUTION AND PALAEONTOLOGY (PRACTICAL)**		
CourseCode:	**BSCZOPS 501**	No.ofCredits	**2**
Contacthours	**4Hrs/week**	DurationofSEA/Exam	**4Hrs**
Formativeassessmentmarks	**20**	Summativeassessmentmarks	**80**

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1. Observationofpermanentslidesofonionroottiptostudyallstagesofmitosis.
2. Observationofpermanentslidesofgrasshoppertestistostudyvariousstagesofmeiosis.
3. Squashpreparationofonionroottiptodemonstratestagesofmitosis.
4. Squashpreparationofgrasshoppertestistodemonstratestagesofmeiosis.
5. Squashpreparationofsalivaryglandchromosomesof*Drosophila/Chironomous*larva.
6. IsolationofDNAfromcoconutendosperm/chickenliver.
7. Experimentswith*Drosophila.*
    - Phenotypiccharactersandsexualdimorphismin*Drosophila.*
    - Mutants of *Drosophila* (white eye, bar eye, sepia eye, vestigial wing, curly wing,ebony body and yellow body – any four).
    - Mountingofsexcomb.
8. BloodtypingforthedetectionofABObloodgroupandRhfactor.
9. Geneticsproblems
    - Geneticproblems:Monohybridinheritance(1)
    - Geneticproblems:Dihybridinheritance(1)
    - Geneticproblems:Multiplealleles-ABObloodgroupinhumans(1)
    - Sex-linkedinheritanceinDrosophila(1)
    - Sexlinkedinheritanceinhumans(1)
10. Biostatisticsproblems
    - Graphical/diagramaticrepresentation(2)
    - Mean,median,mode(2)
    - Chi-squaretest(1)
    - Studentt-test(1)
11. Evolution
    - Study of homologous organs - forelimbs of frog and bird; mouth parts ofcockroach, mosquito and butterfly.
    - Studyofanalogousorgans-wingsofinsectandbird.
    - Studyofvestigialorgans-appendixandthirdmolartoothinman.
12. Palaeontology
    - Connectinglinks:*Peripatus*and*Archaeopteryx*.
    - Livingfossil:*Nautilus.*
    - Models of Dinosaurs: (Tyrannosaurus, Brontosaurus, Stegosaurus and Triceratops).
    - Studyofmodelsoffossilman.(Anytwoavailablemodels).

SCHEMEOFPRACTICALEXAMINATION

B.Sc.Zoology:VSemester

Course Title:CELL BIOLOGY, BIOTECHNOLOGY, GENETICS, BIOSTATISTICS, EVOLUTION AND PALEONTOLOGY

Code:BSCZOPS 501

Duration:4hours **Max.Marks:80**

I. Squash-Makeastainedsquashpreparationofonionroottiporgrasshoppertestis. 10
(Stainedslidepreparationwithatleastonedividingstage-6Marks;Report-1Mark;labelleddiagram-1 Mark; comment – 2 Mark)

II. Squash-Makeastainedsquashpreparationofsalivaryglandchromosomes. 10
(Dissectingthegland-3Marks;Salivaryglandchromosomesslidepreparation-4Marks;comment-3Marks)

III. IdentifyandcommentonthepermanentslidesA&Bwithlabeleddiagrams. 2x5= 10
(1-mitosisand1-meiosis)(Identification-1Mark;Labeleddiagram–2Marks;Comments-2Marks)

IV. SolvethegeneticsproblemAandbiostatisticsproblemB. 2x5=10
(Workingouttheproblem-4Marks;Result–1Mark)

V. Mounting:

a. Makeatemporarymountingofthesexcomb. 05
(Mountingofentiretarsuswithsexcombonaglassslide withcoverslipandfocusedunderlowpower)

b. Identify the ABO and Rh blood group of the given blood sample and comment on the significance of blood grouping. 05
(IdentificationofABOandRhgroup½+½=1 Mark;Reasons2+1=3Marks(studentshouldwritethe antigen antibody reaction of the identified blood group; Significance - 1 Mark)

VI. Identifythe*Drosophila*mutantsCandDwithreasons. 2x3=06
(Identification-½Mark;Chromosomenumberandsite-½Mark;Characters-2Marks)

VII. IdentifyandcommentonE(specimenormodelfromEvolutionorPaleontology). 04
(Identification1Mark;Labeleddiagram-1Mark;Comments-2Marks).

VIII. ClassRecord(15)+Viva(05) 20

Total=80

Note:1.Questionsmustbeframedasperthe schemeprovided.

2.Internal assessment marks to be allotted after conducting one practical test at the end of the semester.

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ProgramName	B.Sc.		SEMESTER	VI
CourseTitle	REPRODUCTIVE BIOLOGY AND DEVELOPMENTAL BIOLOGY (THEORY)			
CourseCode:	BSCZOCS 601		No.ofCredits	3
Contacthours	40Hrs(3hours/week)		DurationofSEA/Exam	3Hrs
Formativeassessmentmarks		20	Summativeassessmentmarks	80

Unit-I:ReproductiveBiology

1.1 Reproductivesystem 2Hrs

Male reproductive system: primary sex organs - male accessory ducts - copulatory organ - accessory glands; Female reproductive system - primary sex organs - femaleaccessory organs - accessory glands- external genitalia; Secondary sexual characters in humans.

1.2 Gametogenesis 3Hrs

Spermatogenesis - Formation of spermatids - Spermiogenesis - Structure of mature Spermatozoan; Oogenesis - Previtellogenesis and Vitellogenesis - Estrous cycle in non-primate mammals and menstrual cycle in humans; Comparison between spermatogenesis and Oogenesis.

1.3 Parthenogenesis 2Hrs

Kinds of parthenogenesis - Natural – Arrhenotoky, Thelytoky - automixis and apomixes; Cyclical parthenogenesis in gall wasps and aphids; Larval parthenogenesis in liver flukes; Artificial parthenogenesis; Significance of parthenogenesis.

1.4.ModerntrendsinReproduction 3Hrs

Manipulation of reproduction - Gene bank, Sperm bank, Superovulation, Cryopreservation; *In-vitro* fertilization (IVF)and embryo transfer(ET); Zygote intrafallopian transfer(ZIFT); Intra uterine transfer (IUT); Gamete intra fallopian transfer (GIFT); Intra cytoplasmicsperm injection (ICSI); Intra-uterine insemination (IUI); Artificial insemination (AI); Surrogate mother; Animal cloning; Cloning of Dolly.

Unit-II:DevelopmentalBiology

2.1 Introduction 3Hrs

Definition and scope; Theories of development - Preformation theory, Epigenetic theory, Baer's Law and Biogenetic law; Branches of embryology; Phases of ontogenetic development – Development and differentiation; Patterns of development - Oviparity, ovo-viviparity and viviparity with examples.

2.2 TypeofEggsandSperms 1Hr

Types of eggs based on amount and distribution of yolk with examples; Mosaicand regulative eggs; Cleidoic egg and its significance;Types of sperms with examples.

2.3 Fertilization 3Hrs

Kinds of fertilization - external, internal, self and cross fertilization with examples; Mechanism of fertilization - approximation of gametes – chemotaxis - fertilizin and antifertilizin–capacitation-acrosomereactionandspermpenetration-activationofovum

- cortical reaction and fertilization membrane formation – Amphimixis; Monospermic & polyspermic fertilization; Significance of fertilization.

2.4 Cleavage 3Hrs

Definition; Types of cleavage - holoblastic and meroblastic; Patterns of cleavage – radial, biradial, spiral and bilateral cleavage with examples; Effects of yolk on cleavage; Types of blastula with examples.

Unit-III:DevelopmentalBiology(Contd…)

3.1 OrganizerPhenomenon 3Hrs

Definition - The amphibian organizer; The organizer's role in development; Potencies ofthe dorsal lip of the blastopore of amphibian gastrula; Brachet's experiment; Experiment of Spemann and Mangold; Induction of Organizer; Chemical nature of organizer; Parts of organizer; Theories of organizer phenomenon.

3.2 EarlyDevelopmentofFrog 4Hrs

Cleavage-Blastula-FatemapsofBlastula-Gastrulation-Mesogenesis-Notogenesis and Neurulation.

3.3 EarlyDevelopmentofChick 3Hrs

Structureofhen'segg-cleavage-blastula-gastrulation-originandstructureof primitive streak - structure of 18, 24 and 48 hours chick embryos.

Unit-IV:DevelopmentalBiology(Contd...)

4.1 ExtraembryonicMembranes of Chick 2Hrs

Development, Structure and functions of Yolk-sac, Amnion, Chorion and Allantois.

4.2 Placenta 3Hrs

Definition; Types of placenta- Yolk sac placenta (marsupials), Allantoic placenta -Structure and functions;Morphologicaland histological classification of placenta with examples.

4.3 Early Development of Human Foetus 3 Hrs

StructureofGraafianfollicle;Ovulation;Fertilization;Morula-blastocyst-implantation – gastrulation;Placenta-structureandfunctions;Twinsand multiple births.

4.4 RoleofHormonesinDevelopment 2Hrs

Gonadotropinsandtheirfunctions;Hormonessecretedbytestisandovariesandtheir functions; Hormones of placenta and their functions.

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3. Balinsky,B.I.2012.AnIntroductiontoEmbryology,CengageLearning.
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13. Subramanian.2013.DevelopmentalBiology,MJPPublishers.
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ProgramName	B.Sc.	SEMESTER	VI
CourseTitle	ENVIRONMENTAL BIOLOGY, TOXICOLOGY AND WILDLIFEBIOLOGY (THEORY)		
CourseCode:	BSCZOCS 602	No.ofCredits	3
Contacthours	40Hrs(3hours/week)	Durationof SEA/Exam	3Hrs
Formativeassessmentmarks	20	Summativeassessmentmarks	80

Unit-I:EnvironmentalBiology

1.1 Introduction 2Hrs

Definitionandsubdivisionsofecology;Conceptofhabitat-Micro-habitatandMacro-habitat;Ecological Niche - Spatial, Trophic and Multidimensional.

1.2 AbioticFactors 2Hrs

Major abiotic factors – Light and Temperature; Adaptation to extreme environment - Effectof light and temperature on animals – Cyclomorphosis. Soil types and profile.

1.3 BioticFactors 3Hrs

Mutualismwithexamples;Protoco-operationandcommensalismwithexamples; Parasitism - types with examples; Ammensalism and predation - examples and their importance; Competition - intraspecific and interspecific - Gause's principle.

1.4 Habitats 3Hrs

Marine habitat - zonation of the sea and ecological classification of marine biota; Coastal ecology; Estuarine ecology and mangroves; Freshwater habitat - lentic and lotic systems; Ecological classification of freshwater animals; Terrestrial habitats - A brief account of biomes.

Unit-II:EnvironmentalBiology(Contd…)

2.1 PopulationEcology 2Hrs

Population attributes - population density - natality and mortality; Age distribution, age pyramids; Population growth rate - population growth curves - logistic and exponential;Biotic Potential - Allee's principle.

2.2 CommunityEcology 3Hrs

Community structure; Ecological determinants; Ecotone and edge effect; Ecological stratification; Alpha, beta, and gamma diversity; Shannon Index and Simpson's Index; Significance of biodiversity indices.

2.3 Ecosystem 5Hrs

Types of ecosystems with examples; Natural ecosystems; Man engineered ecosystems; Microecosystem; Biosphere and ecotone; Ecosystem - Structural components; Functions of ecosystem – productivity - primary and secondary, decomposition, energy flow – I andII laws of thermodynamics; Food chains - types with examples; Food webs with examples; Ecological pyramids - Types with examples; Nutrient cycling - nitrogen, carbon and phosphorus.

Unit-III:EnvironmentalPollutionandToxicology

3.1 Environmental Pollution with Reference to India 4 Hrs

Airpollution–Majorair pollutants(Carbon dioxide,oxides ofsulphur andnitrogen);Control ofgaseouspollutants–combustion–absorption–adsorption;Controlofparticulate pollutants-filters,electrostaticprecipitators,cycloneseparators,scrubbersandcatalytic converters;Air(PreventionandControlofPollution)Act;AutofuelpoliciesinIndia- Bharath stage; A brief account of Acid rain, photochemical smog and ozone hole; Montrealprotocol;Controlofwater pollution-Sewage/effluenttreatment–primaryandsecondary treatments;WaterAct – Riveraction plan;Abriefaccounton BODandEutrophication;Solid wastemanagement;Bioindicatorsandgeoindicators-definitionand examples; Environmental Protection Act 1986.

3.2 GlobalImpacts 2Hrs

Climatechange-Globalwarming-Sources,effectandcontrolmeasures-Kyotoprotocol.

3.3 Toxicology 4Hrs

Definition; Major subdivisions of toxicology and dose response curve; Toxicological parameters - acute and chronic toxicity; LD50, LC50; Factors influencing toxicity - route of administration,hostfactors-species,age,sex;Bioactivationanddetoxificationof xenobiotics - types of xenobiotics; Mechanism of biotransformation - phase I and IIreactions; Pesticide toxicity - toxicity of organophosphate, organochloride, carbamate and pyrethroid pesticides citing two examples for each; Biomagnification - Biomagnification of DDT and Mercury;Antidotal therapy - Definition and types of antidotes with examples.

Unit-IV:WildlifeBiology

4.1. Zoogeography and Distribution of Wildlife 3 Hrs

Zoogeographical realms of world with climatic conditions and examples of characteristicfauna;AbriefaccountofWallace'sline;Continuousanddiscontinuous distributionswithexamples;Barriersofdispersal-topographicandvegetationbarriers- large bodiesofwater as barriers – climatic barriers.

4.2 ThreatstoWildlife 1Hrs

Anthropogenicfactors-Hunting,over harvesting,habitatdestruction, degradation,habitat shrinkage, climate change; Human animal conflict.

4.3 WildlifeConservation 6Hrs

Agencies engaged in wildlife conservation - Government organisations and non-government organizations (NGOs); Wildlife (protection) Act 1972; CITES (Convention on International TradeinEndangeredSpeciesofWildlife Floraand Fauna);EndangeredfaunaofIndia; IUCN categories of endangered animals; Unique Indian animals; Endemic species with examples; Red Data Book; Ramsar convention; CBD; Biosphere reserves - Important National Parksand Wildlife sanctuaries of India (with special emphasis on Karnataka); Special Projects - Project Tiger; Project Elephant; ProjectRhino; Biodiversity Protection Act.

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3. Darlington, P.J. 1996. Zoogeography- The Geographic distribution of animals, John Wiley & Sons, New York.
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14. Sinha, K. (Ed.). 1996. Biodiversity-Global Concerns, Commonwealth Publishers, New Delhi.
15. VermaandAgarwal.2000.PrinciplesofEcology,S.Chand&Co,NewDelhi.

ProgramName	**B.Sc.**		**SEMESTER**	**VI**
Course Title	**REPRODUCTIVEBIOLOGY,DEVELOPMENTALBIOLOGY ENVIRONMENTAL BIOLOGY, TOXICOLOGY AND WILDLIFEBIOLOGY (PRACTICAL)**			
CourseCode:	**BSCZOPS 601**		No.ofCredits	**3**
Contacthours	**4Hrs/week**		DurationofSEA/Exam	**4Hrs**
Formativeassessmentmarks		**20**	Summativeassessmentmarks	**80**

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1. Studyofdifferenttypesofeggsandsperms:
   Type of eggs: Insect, amphioxus, frog, chick and human (any 4)Type
   of sperms: Frog, domestic fowl, rat, mouse and human (any 4)
2. Stages of development of frog: Study of cleavage stages, blastula, gastrula and neurula (sections) and various stages of tadpole.
3. Study of permanent slides of chick embryo: 18 hrs, 24 hrs, 36 hrs and 48 hrs (WM); T.S. of 18 hrs and 24 hrs chick embryo.
4. Studyofpermanentslides/chartsofhistologicaltypesofplacenta(Allfive)
5. Studyofchartsormodelsofmorphologicaltypesofplacenta:Diffuse,cotyledonary, intermediate, zonary and discoidal placenta.
6. Wholemountpreparation(Permanent)
   a. Mosquitolarvae.
   b. Zoea,Nauplius,Mysis.
7. Studyofaquariumasanecosystem:Studyoffaunaandfloraandinteractionbetweenthe various constituents.
8. Waterqualityparametersassessment:
   - EstimationofDissolvedOxygen(O_2)
   - EstimationofCarbondioxide(CO_2)
   - Estimationofhardnessandsalinityofwater.
9. Study of ecological adaptations and morphological peculiarities: Hermit crab, Stick insect, Glow worm, Stink bug, Puffer fish, Angler fish, Exocoetus, Phrynosoma, Draco, Chaemeleon and Bat.
10. Study of biotic relationship: Leguminous plants, Termites, Liver fluke, Tape worm, Sucker fish, Insectivores plant.
11. Identification of wild animals: Pugmarks (tigers) and hoof marks (gaur); Scates (elephants) andpellet counts (deer); Antlers (sambhar).
12. Study of threatened animals of India (by models/pictures/charts): Sarus crane,Common leopard, Great Indian bustard, Himalayan quail, House sparrow, Nilgiri tahr, Gharial, Asiatic lion, Ganges river dolphin, Black-necked crane, Smooth-coated otter, Golden mahseer, Indian pangolin, Brow-antlered deer- **Any five**.

SCHEME OF PRACTICAL EXAMINATION
B.Sc. ZOOLOGY: VI SEMESTER
Course Title:REPRODUCTIVE BIOLOGY, DEVELOPMENTAL BIOLOGY, ENVIRONMENTALBIOLOGY,TOXICOLOGYANDWILDLIFEBIOLOGY
Code:BSCZOPS 601

Duration:4hours **Max.Marks:80**

I. Identify,drawlabeleddiagramandcommentonpermanentslidesofdevelopmentalstages **A**and**B**.(1fromfrog+1fromchick) 2x6 =12
(Identification-1Mark,Labeleddiagram-2Marks,Comments-1x3=3Marks)

II. a.Identify,drawlabeleddiagramandcommenton**C** 04
(C- Eggorsperm)
(Identification-1Mark,Labeleddiagram-1Mark,Comments-2Marks)
b.Submissionofonepermanentslide(Wholemount) 02

III. Identify,draw labelled diagram and comment on the given placental charts/slides/models/specimensDandE. 2x6 12
(D-histologicalplacenta &E-morphological placenta)(Identification -1 Mark, Example -1Mark, Labeled diagram -1 Mark, Comments – 3 Marks)

IV. EstimationofdissolvedO2/CO2/Salinity/Hardnessofwater. 08
(Principle-1Mark,Procedure-4Marks,Readings&calculation-2Marks,Results-1Mark)

V. Commentonaquariumecosystem. 06
(Diagram-2Marks,Comments-4Marks)

VI. Identifyandcommentontheecologicaladaptationsandmorphologicalpeculiarities of F & G.
(Identification-1Mark,Diagram-1Mark,Comments-2Marks) 2x4=08

VII. CommentonthebioticrelationshipsofH. 04
(Identification-1Mark,Diagram-1Mark,Comments-2Marks)

VIII. IdentifyandcommentonI. 04
(QuestionfromExpt.-11/12)(Identification-1Mark,Comments-3Marks))

IX. ClassRecord(15)+Viva(5) 20
Total=80

Note:
1. Questionsmustbeframedasperttheschemeprovided.
2. Internal assessment marks to be allotted after conducting one practical test at the end of the semester.

ProgramName	B.Sc.	SEMESTER	IV/V/VI
Compulsory Course	**SKILLENHANCEMENTPROGRAMME-PROJECTWORK/FIELDTRAINING**		
CourseCode:	**BSCZOPRS 602**	No.ofCredits	**2**
Contacthours	**3Hrs/week**	DurationofSEA/Exam	**3Hrs**
Formativeassessmentmarks	**10**	Summativeassessmentmarks	**40**

Proposedtopicsforprojectwork/fieldtraining:

1. Study of animal diversity in various habitats - Gardens/croplands/grasslands/forests/ponds/rivers/streams/seashores.
2. Birdwatchingandpreparationofchecklistofbirdsfromdifferenthabitats.
3. Identificationandstudyoflocalediblefishes.
4. Listingandidentifyinglocalbutterfliesandpreparationofchecklistofbutterflies.
5. Listingandidentifyingcommonspidersandants.
6. Listingandidentifyingterrestrialandfreshwatermollusks.
7. Identificationofmolluscanshellsfromnearbycoasts.
8. Diversityofornamentalfishes.
9. Diversityofinsects.
10. Insectpestsofvegetables,fruitcrops,horticulturalplants,paddyetc.
11. Storepests.
12. Studyofbiodiversityinsacredgroves.
13. Study of community: By quadrat method to determine frequency, density and abundance of different species present in the community.
14. Diversityofmosquitospecies.
15. Diversityofwildvarietiesof*Drosophila.*
16. Listingandstudyingtheuseoffertilizersandpesticidesinagriculturalfields.
17. Identificationandbehavioralstudyofwasps.
18. Identificationandstudyoflocalediblesheilfishes.
19. StudyofsimpleMendeliantraitsinhumanpopulations.
20. Studyingorganicfarming.
21. Study ofsoilfauna.
22. Evaluation of larvicidal / adulticidal properties of chemicals or plant extracts on mosquito or other pests.

Note: In addition to the above-mentioned exercises any faunal diversity of local interest and their characteristic features/Environmental pollution problems/Toxicological problems/Human population studies/Ecosystem studies/Utilization of energy resources/Wildlife depletion and conservation topics may be chosen for project work.

Note:Duringfieldstudiescareshouldbetakennottodisturb/removethespecimens/nestsetc.

Guidelinesforprojectwork

1. Project allotment should be done at the beginning of semester and topic should be finalized in consultation with the guide by the student.
2. Each project work will be carried out as individual (preferably) or in a batch of 2/3/4 students. There shall not be more than 4 students in each group.
3. Dissertationworkhastobesubmittedintheformatprescribed.

4. Title page, Page I - Certificate, Page II - Declaration, Page III - Acknowledgements, Page IV – contents followed by the body of the dissertation.
5. Contentsshouldincludethefollowingsubheadings:
    1. IntroductionwithReviewofLiterature
    2. MaterialsandMethods
    3. ResultandDiscussion.
    4. Summary
    5. References
    6. Platescontainingoriginalphotographs(Minimum6photos/page)
    7. Annexure(notcompulsory)
6. Dissertation should contain a minimum of 20 pages excluding photographs (A4 sheets with 1inch margin on all sides, Times New Roman font, font size -12 and line spacing - 1.5).
7. Astudentwhoisgoingtootherinstitutions/industry/laboratory/fieldsforany assistance has to take permission letter by the HOD/Principal of the college.
8. Dissertation has to be submitted individually even if the work is done in group, i.e. one student has to submit his/her dissertation exclusively. No joint author submission. The dissertation to be certified by project guide and HOD. Certified dissertation shall be submitted during practical examination which shall be evaluated by both internal and external examiners.

SCHEME OF EXAMINATION

B.Sc.ZOOLOGY:VISEMESTER

COMPULSORYPAPER-SKILLENHANCEMENT(PROJECTWORK/FIELDTRAINING)

Code:BSCZOPRS 602

Duration:3hours **Max.Marks:40**

I. Field work and preparation of dissertation 20 Marks

(Tobeevaluatedbyprojectguide*+internalexaminer**+externalexaminer**eachfor20marksand average shall be taken).

*Projectguideshallassesthe candidatebasedonhis/herinvolvementinthefieldworkandpreparation ofdissertation.Marksallotmentforthesameshallbehandedovertohodinasealedcoverwhichwill be transmitted to examiners.

** Distribution of marks: Introduction with review of literature - 3 Marks, Materials and methods - 3 Marks, Result and discussion - 8 Marks, Summary – 1 Mark, References – 1 Mark, Plates containing original photographs - 4 Marks)

II. Presentationbythecandidate*(PPTslidespreferablyorcharts) 10Marks

(PreparationofPPTslidesorcharts–4Marks,presentation–6Marks)

*Presentationtobedoneindividuallyevenifthepprojectiscarriedoutinteam.

III. Viva-voce (Based on the contents of dissertations) 10 Marks

Total=40Marks

Note: Internal assessment marks to be allotted based on the preparation and presentation ofthe dissertation topic.

SCHEME OF EXAMINATION: B.Sc. - I to VI SEMESTERS (THEORY)

CORE SUBJECT: ZOOLOGY

QuestionNo.	**PART-A**	Marks
I	Answer any TEN Questions out of TWELVE Questions (Give 3 questions from each unit)	10x2=20
	PART-B	
	Unit-I	
II **III**	4MarksQuestions(AnsweranyTWOoutofTHREE) 7MarksQuestions(AnsweranyONEoutofTWO)	4x2=8 7x1=7
	Unit-II	
IV **V**	4MarksQuestions(AnsweranyTWOoutofTHREE) 7MarksQuestions(AnsweranyONEoutofTWO)	4x2=8 7x1=7
	Unit-III	
VI **VII**	4MarksQuestions(AnsweranyTWOoutofTHREE) 7MarksQuestions(AnsweranyONEoutofTWO)	4x2=8 7x1=7
	Unit-IV	
VIII **IX**	4MarksQuestions(AnsweranyTWOoutofTHREE) 7MarksQuestions(AnsweranyONEoutofTWO)	4x2=8 7x1=7

GROUPII:ELECTIVE(SUPPORTIVETOTHEDISCIPLINEOFSTUDY)

BSCZOES 302 :PARASITOLOGYANDVECTORBIOLOGY
(TobestudiedintheIIISemesterB.Sc.)
(Hours of instruction: 2 hours per week. Total: 24 Hours)
Syllabus

Unit -I:Parasitology : 12 Hrs.

Brief account of the disease caused, mode of infection, transmission, pathogenecity and control measures of following parasites:

1. Protozoan:*Giardia*and*Trichomonas*.
2. Helminthes:*Taenia*and*Anycylostoma*.
3. Bacterial:TyphoidandCholera.
4. Viral:HepatitisandH1N1.

Unit-II:VectorBiologyandIntegratedVectorManagement 12Hrs.

1. Vectors: Introduction, typesof vectors with examples; Tools for vector control, Sources –biological, chemical, adulticides and larvicides.
2. Causative organism, transmission and control measures of following vector borne diseases: Filariasis, Japanese Encephalitis, Dengue and Chikungunia.
3. Arthropods vectors: Diseases transmitted and control Mosquitoes with reference to Mosquitoes (*Anopheles*, *Culex*, *Aedes* and *Mansonia*), Sand fly, Fleas, Stable or Dog Fly, Tsetse Fly, Bed Bugs, Cockroach, House Fly, Human Louse, Bed Bug, Ticks and Mites.
4. Avian and mammalian vectors: diseases transmitted and control measures withreference to Domestic Fowl, Rat, Bat, Dog, Cattle, Monkey.

REFERENCES:

1. Apurba, S. S and Sandhya, B. 2014. Essentials of Medical Parasitology, Jaypee BrothersMedical Publishers.
2. Arora,D.R.andArora,B.2001.MedicalParasitology,CBSPublications.
3. Chandler,A.C.&Read,C.P.1961. IntroductiontoParasitology,JohnWiley& SonsInc.
4. Chatterjee, K.D. 2009. Parasitology: Protozoology and Helminthology, CBS Publishers &Distributors.
5. David,D.V.andKumaraSwami.1988.ElementsofEconomicEntomology, PopularBook Depot, Madras.
6. Mathews, G. 2011. Integrated Vector Management: Controlling Vectors of Malariaand Other Insect Vector Borne Diseases, Wiley-Blackwell.
7. Pedigo,L.P.2002.EntomologyandPestManagement,PrenticeHallPublication.
8. Smyth,J.D.1994.IntroductiontoAnimalParasitology,CambridgeUniversityPress.
9. William,H.M., Richard,S.D., Robert,B.G. 1999. Parasitology&VectorBiology, Academic Press.

GROUPII:ELECTIVE(NURTURINGSTUDENT'SPROFICIENCY/SKILL)
BSCZOES 402 :AQUARIUMFISHKEEPING
(TobestudiedintheIVSemesterB.Sc.)
(Hours of instruction: 2 hours per week. Total: 24 hours)
Syllabus

Unit-I:IntroductiontoAquariumFishKeeping

1. **BiologyofAquariumFishes** 6Hrs
   Importance and scope of aquarium fish keeping; Exotic and endemic species of aquarium fishes; Common characters and sexual dimorphism in aquarium fishes:Guppy,Molly,Sword tail,Goldfish,Angelfish,Koi, Gourami,Zebrafish,Fighterfish.
2. **AquariumSetup** 6Hrs
   Construction and preparation – size, shape, substrate, ornamental aquatic plants, bio-filters, aerators; Accessories for fish tank - hood and light, nets, suction tube, feeding cupsand breeding traps; Water quality management - pH, hardness, salinity, oxygen, carbon dioxide, chlorine, ammonia and temperature.

Unit-II:AquariumManagement

1. **Food,FeedingandReproduction** 6Hrs
   Nutritional requirement of fishes, fish feed, composition of fish feed; Feeding methods-live feed, artificial feed; Reproductive Biology of Gold fish, Fish seed collection.
2. **Transportation and Disease Management** 6 Hrs
   Live fish transport - fish handling, packing and forwarding techniques; Aquarium fish diseases - Bacterial, Viral, Fungal and Protozoan infections, treatment and control.

REFERENCES:

1. Ahilan, B., Felix, N., SanthnamR. 2008. TextbookofAquariculture,Daya Publishing House.
2. Alappat,H.J.&Biju,K.2011.AquariumFishes:AColourfulProfile,B.R. Publishing Corporation.
3. Amita,S.2003.AquariumManagement,DayaPublishingHouse.
4. Biju, K. & Alappat, M. 1995. A Complete Guide to Aquarium Keeping, Low Price Publications.
5. David,A.2011.EncyclopediaofAquarium&PondFish,Penguin,UK.
6. Rolf,G.1963.AquariumFishDiseases,TFHPublications.
7. Tharadevi, C.S., Jayashree, K.V., Arumugam,N. 2015.Home Aquariumand OrnamentalFish Culture, Saras Publication.
8. Ulrich,S. 2005.TropicalFreshwaterAquariumFishfromAtoZ,Barron's Educational Series Inc., U.S.
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SCHEMEOFEXAMINATION

ELECTIVEPAPERS(BSCZOES 302 andBSCZOES 402)

QuestionNo.	**PART-A**	Marks
I	Answer any FIVE Questions out of SIX Questions (Give 3 questions from each unit)	5x2=10
	PART-B	
	Unit-I	
II **III**	4MarksQuestions(AnsweranyTWOoutofTHREE) 7MarksQuestions(AnsweranyONEoutofTWO)	4x2=8 7x1=7
	Unit-II	
IV **V**	4MarksQuestions(AnsweranyTWOoutofTHREE) 7MarksQuestions(AnsweranyONEoutofTWO)	4x2=8 7x1=7
