

# **GONDWANA UNIVERSITY, GADCHIROLI**



## **FACULTY OF SCIENCE AND TECHNOLOGY BOARD OF STUDIES IN ZOOLOGY**

### **SUBMISSION OF CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS OF ZOOLOGY FOR UNDER GRADUATE (B.Sc.) PROGRAMME OF SEMESTER V AND SEMESTER VI FROM SESSION 2019 - 2020**

**SCHEME AND SYLLABUS UNDERCHOICE BASED CREDIT SYSTEM (CBCS)FOR B.Sc. ZOOLOGY**

<b>Semester</b>	<b>Core Course (12)</b>	<b>Ability Enhancement Compulsory Courses AEC(2)</b>	<b>Skill Enhancement (Foundation) Courses SEC(4)</b>	<b>Discipline Specific Elective (DSE)</b>
I	CC - Chemistry P -I CC - Chemistry P -II CC - Botany P -I CC - Botany P -II CC - Zoology P -I CC - Zoology P -II	English (1) Marathi (1)		
II	CC - Chemistry P -III CC - Chemistry P -IV CC - Botany P -III CC - Botany P -IV CC - Zoology P -III CC - Zoology P -IV	English (1) Marathi (1)		
III	CC - Chemistry P -V CC - Chemistry P -VI CC - Botany P -V CC - Botany P -VI CC - Zoology P -V CC -Zoology P -VI		Environmental Studies	
IV	CC - Chemistry P -VII CC - Chemistry P -VIII CC - Botany P -VII CC - Botany P -VIII CC - Zoology P -VII CC - Zoology P -VIII		Democracy, Elections and Good Governance	
V	CC - Chemistry P -IX CC - Chemistry P -X CC - Botany P -IX CC - Botany P -X CC - Zoology P - IX CC - Zoology P -X		(Any one) 1.Apiculture 2. Sericulture	DSE-Chem I DSE - Bot I DSE - Zoo I (Any Two) 1.Parasitology 2.Applied Zoology 3. Insect Vectors and disease 4 Aquatic Biology
VI	CC - Chemistry P -XI CC - Chemistry P -XII		(Any one) 1.Medical	DSE- Chem II DSE - Bot II

	CC - Botany P -XI CC - Botany P -XII CC - Zoology P -XI CC - Zoology P -XII		Diagnostics 2.Public Health & Hygiene	DSE - Zoo II (Any Two) 1. Immunology 2. Animal Biotechnology 3. Microtechnique, Bioinformatics and Biostatistics 4. Reproductive Biology
--	--	--	---	---

**Discipline Core Courses (DCC) : Zoology**

1. Animal Diversity
2. Cell Biology, Genetics and Evolutionary Biology
3. Comparative Anatomy and Developmental Biology of Vertebrates
4. Physiology and Biochemistry

**Discipline Specific Electives (DSE): Zoology (Any two)**

1. Applied Zoology
2. Animal Biotechnology
3. Aquatic Biology
4. Immunology
5. Reproductive Biology
6. Insect, Vector and Diseases

**Skill Enhancement Courses (SEC): Zoology**

1. Apiculture
2. Aquarium Fish Keeping
3. Aquatic Biology
4. Medical Diagnostics
5. Public Health and Hygiene
6. Sericulture

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CBCS SYLLABUS IN ZOOLOGY**

**SEMESTER - I**

PAPER CODE	CORE PAPER	TITLE OF THE PAPER	CREDIT
USCZOT01	I	NONCHORDATE - PROTOZOA TO ANNELIDA	02
USCZOT02	II	CELL BIOLOGY	02
USCZOP01	PRACTICAL	CORE COURSE I & II	02

**SEMESTER - II**

PAPER CODE	CORE PAPER	TITLE OF THE PAPER	CREDIT
USCZOT03	III	NONCHORDATE - ARTHOPODA TO HEMICHORDATA	02
USCZOT04	IV	GENETICS & EVOLUTION	02
USCZOP02	PRACTICAL	CORE COURSE III & IV	02

**SEMESTER- III**

PAPER CODE	CORE PAPER	TITLE OF THE PAPER	CREDIT	SEC
USCZOT05	V	ANIMAL DIVERSITY (CHORDATES) and COMPARATIVE ANATOMY	02	ENVIRONMENTAL STUDIES
USCZOT06	VI	PHYSIOLOGY & BIOCHEMISTRY - I	02	
USCZOP03	PRACTICAL	CORE COURSE V & VI	02	

**SEMESTER- IV**

PAPER CODE	CORE PAPER	TITLE OF THE PAPER	CREDIT	SEC
USCZOT07	VII	DEVELOPMENTAL BIOLOGY	02	DEMOCRACY, ELECTIONS AND GOOD GOVERNANCE
USCZOT08	VIII	PHYSIOLOGY & BIOCHEMISTRY - II	02	
USCZOP04	PRACTICAL	CORE COURSE VII & VIII	02	

**SEMESTER- V**

PAPER CODE	CORE PAPER	DSE(ANY TWO) TITLE OF PAPER	CREDIT	SEC(ANY ONE) (COLLEGE LEVEL)
USCZOT09	IX	1) PARASITOLOGY	02	1) APICULTURE
USCZOT10	X	2) APPLIED ZOOLOGY	02	2) SERICULTURE
USCZOT11	XI	3) INSECT VECTOR AND DISEASES	02	-
USCZOT12	XII	4) AQUATIC BIOLOGY	02	-
USCZOP05 USCZOP06 USCZOP07 USCZOP08	PRACTICAL	CORE COURSE - ANY TWO FORM CORE PAPER IX, X, XI, XII	02	02

**DSE- Scheme of Marks of Theory and Practical of semester V**

SEMESTER	PAPER	TITLE DSE(ANY TWO)	MARKS		TOTAL
			THEORY	INTERNAL ASSESSMENT (ANY TWO)	
V	I	1) PARASITOLOGY	50	10	120
	II	2) APPLIED ZOOLOGY	50	10	
	III	3) INSECT VECTOR AND DISEASES	50	10	
	IV	4) AQUATIC BIOLOGY	50	10	
	PRACTICAL	ANY TWO FROM DSE	30	-	30
					150

**SEC (ANY ONE) (COLLEGE LEVEL)****Scheme of Marks of Theory and Practical of semester V**

SEMESTER	PAPER	TITLE SEC(ANY ONE)	MARKS		TOTAL
			THEORY	PRACTICAL	
V	I	1) APICULTURE	15	35	50
	II	2) SERICULTURE	15	35	50

**SEMESTER- VI**

PAPER CODE	CORE PAPER	DSE(ANY TWO) TITLE OF PAPER	CREDIT	SEC(ANY ONE) (COLLEGE LEVEL)
USCZOT13	XIII	1) IMMUNOLOGY	02	1) MEDICAL DIAGNOSTIC
USCZOT14	XIV	2) ANIMAL BIOTECHNOLOGY	02	2) PUBLIC HEALTH AND HYGIENE
USCZOT15	XV	3) MICROTCHNIQUE, BIOINFORMATICS AND BIOSTASTISTICS	02	-
USCZOT16	XVI	4) REPRODUCTIVE BIOLOGY	02	-
USCZOP09 USCZOP10 USCZOP11 USCZOP12	PRACTICAL	CORE COURSE - ANY TWO FROM CORE PAPER XIII, XIV, XV AND XVI	02	02

**Scheme of Marks of Theory and Practical of semester VI**

SEMESTER	PAPER	TITLE DSE(ANY TWO)	MARKS		TOTAL
			THEORY	INTERNAL ASSESSMENT (ANY TWO)	
VI	I	1) IMMUNOLOGY	50	10	120
	II	2) ANIMAL BIOTECHNOLOGY	50	10	
	III	3) MICROTCHNIQUE, BIOINFORMATICS AND BIOSTASTISTICS	50	10	
	IV	4) REPRODUCTIVE BIOLOGY	50	10	
	PRACTICAL	ANY TWO FROM DSE	30	-	30
					150

**SEC (ANY ONE) (COLLEGE LEVEL)****Scheme of Marks of Theory and Practical of semester VI**

SEMESTER	PAPER	TITLE SEC(ANY ONE)	MARKS		TOTAL
			THEORY	PRACTICAL	
VI	I	1) MEDICAL DIAGNOSTICS	15	35	50
	II	2) PUBLIC HEALTH AND HYGIENE	15	35	50

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.)**  
**SEMESTER – V AND SEMESTER VI**  
**SUBJECT – ZOOLOGY THEORY INTERNAL ASSESSMENT**  
**FOR DSE PAPER ONLY**  
**PAPER – I AND II (SELECTED)**

**Theory Internal Assessment – 20 Marks**

**Format for the theory internal assessment**

<b>Sr. NO.</b>	<b>Evaluation type</b>	<b>Marks for selected paper I and Paper II</b>	<b>Marks for selected paper I and Paper II</b>
<b>01</b>	<b>One assignment</b>	<b>02</b>	<b>02</b>
<b>02</b>	<b>One class test</b>	<b>05</b>	<b>05</b>
<b>03</b>	<b>Active participation in routine class activities/ seminars etc.</b>	<b>03</b>	<b>03</b>
	<b>Total</b>	<b>10</b>	<b>10</b>

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME - BACHELOR OF SCIENCE (B.Sc.)**  
**SEMESTER-V AND SEMESTER VI**

**SUBJECT- ZOOLOGY – THEORY QUESTION PAPER PATTERN**

**Maximum Marks – 50**

**Time – 3 Hours**

**Note : 1) All questions are compulsory**

**2) All questions carry equal marks**

**3) Draw well labeled diagram wherever necessary**

Q1) Unit I – Long question – 10 Marks

Or

a. Short question – 05 Marks

b. Short question – 05 Marks

Q2) Unit II – Long question – 10 Marks

Or

a. Short question – 05 Marks

b. Short question – 05 Marks

Q3) Unit III – Long question – 10 Marks

Or

a. Short question – 05 Marks

b. Short question – 05 Marks

Q4) Unit IV – Long question – 10 Marks

Or

a. Short question – 05 Marks

b. Short question – 05 Marks

Q5) Write short notes on any 10 out of 12(3 questions from each units) – 10 Marks

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY THEORY (CREDIT 2)**  
**SKILL ENHANCEMENT COURSE (SEC)**  
**PAPER – I – APICULTURE**

**MAX. MARKS - 15**

**UNIT – I**

1. History of bee keeping: Definition, Bee keeping in worldwide and India.
2. Traditional and Modern beekeeping, Urban or backyard beekeeping.

**UNIT – II**

1. Types of honey bees
2. Life cycle – Queen, Drone, Worker.

**Unit III**

1. Basic requirements of Tools for starting bee keeping
2. Bee keeping equipment - introduction to types of bee boxes

**UNIT – IV**

1. Economic importance of honey.
2. Processing of honey.

**Suggested Readings**

1. Prospective in Indian Apiculture - R.C. Mishra
2. Rearing queen bees in India - M.C. Suryanarayana et. al.
3. Bee Keeping in India - G. K. Ghosh • Technology and value addition of Honey - Dr. D. M. Wakhle and K. D. Kamble.
4. ABC & XYZ of Bee culture - A. I. Root
5. Indian Bee Journal - All India Bee Keeping Association • Asian Bee Journal

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY PRACTICAL (CREDIT 2)**  
**SKILL ENHANCEMENT COURSE (SEC)**  
**PRACTICAL**

**Max. Marks: 35**

1. To study the identification of different species of Honey bees
2. To Study different stages in life cycle of Honey bees.
3. To study the different instruments for bee keeping
4. Visit to Apiculture industry/Local Apiculture Unit

**Practical Question Paper and Distribution of Marks**

**Time: 4 Hrs.**

**Max. Marks: 35**

**Practical**

**Distribution of Marks**

- |  |    |
|--|----|
| 1. Identification of Honey bees through ICT .....  | 10 |
| 2. Identification of instruments through ICT ..... | 10 |
| 4. Visit tour report.....                          | 15 |

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY THEORY (CREDIT 2)**  
**SKILL ENHANCEMENT COURSE (SEC)**  
**PAPER – II – SERICULTURE**

**MAX. MARKS - 15**

**Unit - I**

1. Types of silkworms.
2. Sericulture industry in different states

**Unit II**

1. Mulberry silkworm structure and life cycle
2. Tasar silkworm structure and life cycle

**Unit III**

1. Eri silkworm structure and life cycle
2. Muga silkworm structure and life cycle

**Unit IV**

1. Appliances for silkworm rearing
2. Economic importance of sericulture

**Suggested Readings**

1. Text Book of Tropical Sericulture. Publ., Japan Overseas Corporation volunteers – 1975.
2. Silkworm Rearing Techniques in the Tropics, Dr. S. Omura, Japan International Cooperation Agency, 1980.
3. Manual on Sericulture; Food and Agriculture Organisation Rome 1976.
4. Handbook of Practical Sericulture : S.R. Ullal and M.N. Narasimhanna CSB, Bangalore 1987.
5. Modern Entomology: D. B. Tembhare, Himalaya Publishing House, Bombay

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY PRACTICAL (CREDIT 2)**  
**SKILL ENHANCEMENT COURSE (SEC)**  
**PRACTICAL**

**Max. Marks: 35**

1. To study the different varieties of silkworm
2. To study the different instruments of sericulture industry
3. Visit to Sericulture industry/Local Sericulture unit

**Practical Question Paper and Distribution of Marks**

**Time: 3 Hrs.**

**Max. Marks: 35**

**Practical**

**Distribution of Marks**

- |                                       |    |
|---------------------------------------|----|
| 1. Identification of Silkworm.....    | 10 |
| 2. Identification of instruments..... | 10 |
| 3. Visit tour report .....            | 15 |

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY THEORY(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – IX**  
**USCZOT09**  
**PAPER – I – PARASITOLOGY**

**Unit – I** **12 Periods**

1. Introduction and History of Parasitology
2. Parasitism, Host Parasite Relationship
3. Modes of Infection
4. Structure, Life Cycle, Pathogenicity and treatment of Parasitic Protozoan (Plasmodium, Trypanosome )

**Unit –II** **12 Periods**

1. Structure, Life Cycle, Pathogenicity and Treatment of helminthes parasites ( F. hepatica)
2. Ultrastructure of body wall of parasite
3. Respiration and excretion of helminthes
4. Parasitic adaptation

**Unit -III** **12 Periods**

1. Structure, Life Cycle, Pathogenicity and treatment of Nematode parasites (Wuchereriabancrofti)
2. Parasitic adaptations
3. Morphology of Arthropod parasite (Human lice, Sarcoptes scabiei, X. cheopis)
4. Causes and treatment of Arthropod parasite.

**Unit –IV** **12 Periods**

1. Structure, Pathogenicity and treatment of bacterial and fungal diseases in fishes
2. Pathogenicity and treatment of ( Typhoid, T.B )
3. Zoonotic diseases and pathogenicity (Swine flu, Bird Flu)
4. Study of Vectors as disease transmitters ( Flea, TseTse fly)

## **Suggested Readings**

1. Animal parasitology C.P. Read
2. Biology of Protozoa Sleials
3. Protozoology by Kudo
4. An introduction to parasitology Chandler
5. General Parasitology Cheng
6. Biology of Parasites Cheng
7. Nematode Parasites N.D. Levine
8. Structure of Nematode A.F. Bird
9. An introduction to Nematology Chitwood
10. Clinical Parasitology Faust
11. Medical Helminthology Watson
12. Parasitology K. D. Chatterji
13. Indian insect Life Lefrey
14. Hand book Entomology T.V. R Ayyar
15. Useful and destructive insect Metacalf& Flint
16. Applied Parasitology Hiware, Jadhav&Mohekar
17. Nematodes of Indian Mammals H.S. Nama , G. B. Shinde & B.V. Jadhav
18. T.Y B. Sc. Zoology Sem-V- Dhamani, Bakare, Harney & Bhute

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY PRACTICAL( CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – IX**  
**USCZOP05**  
**PRACTICAL**

**Section A - Study of Specimens**

1. Protozoa – *Entamoeba*, *Trypanosoma*, *Plasmodium*
2. Helminths – *Fasciola hepatica*, *T. solium*
3. Nematodes – *Ascaris*, *W.bancrofti*
4. Arthropods – *Pediculushumanus*, *Xenopsyllacheopsis*

**Section B - Study of Slides:**

1. T.S. of *Ascaris*, Mature and Gravid proglottids of *Taeniasolium*,
2. Larval Forms- *Redia*, *Cercaria* and *Cysticercus*
3. Study of Bacterial Slides
4. Study of fungal slides

**Section C - Haematological Study**

1. Test for bilirubin
2. Smear preparation for malarial parasite examination
3. Test for T.B. and Typhoid

**Section D - Case study**

1. Ectoparasite in human
2. Study of parasites in poultry and fish

## Practical Question Paper and Distribution of Marks

Time: 2 Hrs.

Max. Marks: 15

### **Practical                      Distribution of Marks**

1. Identification and salient features of spots: -..... 06  
(02 Specimens and 01 Slides )
2. Hematological Experiments..... 03
3. Project Work/ Case Study .....02
4. Certified practical record .....02
5. Viva- voce .....02

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY THEORY( CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER –X**  
**USCZOT10**  
**PAPER – II – APPLIED ZOOLOGY**

**Unit 1**

**12 Periods**

1. Type of Fisheries in brief: fresh water, Brackish Water and Marine
2. Pre and Post stocking management: Fertilization, caring capacity, artificial feeding,
3. Mono and Poly culture, Fish preservation.
4. Fish Diseases: Bacterial, fungal, protozoan and arthropods

**Unit II**

**12 Periods**

1. Life history and pathogenicity of *Ancylostoma duodenale* and *Wuchereria bancrofti*
2. Biology, Control and damage caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
3. Medical importance and control of *Pediculus humanus corporis*, *Anopheles*, *Culex*, *Aedes* and *Xenopsylla cheopis*
4. Economic importance of Agricultural pest

**Unit III**

**12 Periods**

1. Classification of Fowls based on their use – Broilers and Commercial layers.
2. Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs.
3. Poultry diseases - Viral, Bacterial, Fungal, Protozoan and Preventions
4. Management of a modern Poultry Farm, progressive plans to promote Poultry as a Self Employment venture.

## Unit IV

12 Periods

1. Introduction, Dairy farm and its management.
2. Preservation of semen and artificial insemination in cattle;
3. Induction of early puberty and synchronization of estrus in cattle, Cattle diseases - Viral, Bacterial, Fungal, Protozoan and Preventions.
4. Management of a modern Dairy Farm, progressive plans to promote Dairy Farming as a Self Employment venture.

### SUGGESTED READINGS

1. Park, K. (2007). *Preventive and Social Medicine*. XVI Edition. B.B Publishers.
2. Arora, D. R and Arora, B. (2001). *Medical Parasitology*. II Edition. CBS Publications and Distributors.
3. Kumar and Corton. *Pathological Basis of Diseases*.
4. Atwal, A.S. (1986). *Agricultural Pests of India and South East Asia*, Kalyani Publishers.
5. Dennis, H. (2009). *Agricultural Entomology*. Timber Press (OR).
6. Hafez, E. S. E. (1962). *Reproduction in Farm Animals*. Lea & Fabiger Publisher
7. Dunham R.A. (2004). *Aquaculture and Fisheries Biotechnology Genetic Approaches*.
8. CABI publications, U.K.
9. Pedigo, L.P. (2002). *Entomology and Pest Management*, Prentice Hall.
10. T.Y B. Sc. Zoology Sem-V- Dhamani, Bakare, Harney & Bhute

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY PRACTICAL (CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – X**  
**USCZOP06**  
**PRACTICAL**

Max. Marks: 15

1. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
2. Estimation of quality of milk from different dairy farm units – specific gravity, fat content, pH and viscosity.
3. Field visits to a poultry / dairy farm-submission of reports
4. Laboratory Record work shall be submitted at the time of practical examination
5. Computer aided techniques should be adopted as per UGC guide lines.

**Practical Question Paper and Distribution of Marks**

**Time: 2 Hrs.**

**Max. Marks: 15**

**Practical**

**Distribution of Marks**

- |   |    |
|---|----|
| 1. Identification and salient features of spots: -..... | 06 |
| (02 Specimens and 01 Slides)                            |    |
| 2. Life cycle .....                                     | 03 |
| 3. Project Work/ Case Study .....                       | 02 |
| 4. Certified practical record .....                     | 02 |
| 5. Viva voce .....                                      | 02 |

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY THEORY(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER –XI**  
**USCZOT11**  
**PAPER – III – INSECT VECTOR AND DISEASES**

Max. Marks: 50

**Unit I** **12 Period**

1. General Features of Insects, Head – Eyes, Types of antennae,
2. Types of Mouth parts.
3. Brief introduction of Carrier and Vectors (mechanical and biological vector)
4. Host-vector relationship, Adaptations as vectors.

**Unit II:** **12Period**

1. Classification of insects up to orders, detailed features of orders with insects as a Vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera
2. Dipterans as important insect vectors – Mosquitoes, Houseflies;
3. Study of mosquito-borne diseases – Chickungunya, Filariasis.
4. Breeding and control of mosquitoes.

**Unit III:** **12Period**

1. Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly.
2. Study of house fly as important mechanical vector, Myiasis, Control of house fly.
3. Bugs as insect vectors; Blood-sucking bugs; Chagas disease.
4. Bed bugs as mechanical vectors and control and prevention measures.

**Unit IV:** **12Period**

1. Fleas as important insect vectors; Host-specificity,
2. Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas.
3. Human louse (Head, Body and Pubic louse) as important insect vectors.
4. Study of louse-borne diseases – Relapsing fever, Trench fever, Control of human louse.

## SUGGESTED READINGS

1. D. B. Tembhare. Modern Entomology: Himalaya Publishing House
2. Imms, A. D.(1977). A General Text Book of Entomology. Chapman & Hall, UK
3. Chapman, R.F.(1988).The Insects: Structure and Function.IV Edition, Cambridge University Press, U.K.
4. Pedigo L.P. (2002).Entomology and Pest Management. Prentice Hall Publication
5. Mathews, G.(2011). Integrated Vector Management : Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell.
6. T.Y B. Sc. Zoology Sem-V- Dhamani, Bakare, Harney & Bhute

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY PRACTICAL(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – XI**  
**USCZOP07**  
**PRACTICAL**

### PRACTICAL

1. Study of Life cycle of Mosquito, house fly, bed bug through ICT tools/ models or charts.
2. Study of different kinds of mouth parts of insects.
3. Study of following insect vectors through permanent slides/ photographs: *Aedes*, *Culex*, *Anopheles*, *Pediculushumanuscapitis*, *Pediculushumanus corporis*, *Phithirus pubis*, *Xenopsyllacheopis*, *Cimexlectularius*, *Phlebotomusargentipes*, *Muscadomestica*.
4. Study of types of antennae through available permanent slides, charts or photographs.
5. Study of different diseases transmitted by above insect vectors.
6. Control appliances – sprayers and dusters.
7. Submission of a project report or case study on any one of the insect vectors and disease transmitted.

## Practical Question Paper and Distribution of Marks

**Time: 2 Hrs.**

**Max. Marks: 15**

### **Practical**

### **Distribution of Marks**

1. Identification and salient features of spots: -.....	06
(02 Specimens and 01 Slides )	
2. Life cycle .....	03
3. Project Work/ Case Study .....	02
5. Certified practical record .....	02
6. Viva voce .....	02

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY THEORY(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – XII**  
**USCZOT12**  
**PAPER – IV – AQUATIC BIOLOGY**

**Max. Marks: 50**

**UNIT – I**

**12 periods**

1. Brief introduction of the aquatic biomes
2. Freshwater ecosystem (lakes, streams and rivers),
3. Estuaries, intertidal zones,
4. Oceanic pelagic zone and benthic zone.

**UNIT – II**

**12 periods**

1. Lakes: Origin and classification, Ecosystem and Morphometry
2. Physico-chemical Characteristics: Light, Temperature, Turbidity, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Dissolved gases (Oxygen, Free Carbon dioxide).
3. Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous
4. Study of Zooplankton -Rotifers, Cladocera, Copepoda and Ostracoda

**UNIT III**

**12 Periods**

1. Marine Ecosystem, Salinity and density of Sea water, Continental shelf.
2. Adaptations of deep sea organisms.
3. Coral reefs, Sea weeds.
4. Nutrient Cycles in Sea/ Ocean -Nitrogen, Sulphur and Phosphorous.

## **UNIT – IV**

**12 periods**

1. Aquatic pollution - Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills.
2. Eutrophication , Management and conservation.
3. Water pollution acts of India.
4. Sewage treatment and water quality assessment - BOD and COD.

### **Suggested Readings –Aquatic Biology**

1. Ananthakrishnan : Bioresources Ecology 3rd Edition
2. Goldman – Limnology, 2nd Edition 3. Odum and Barrett – Fundamentals of Ecology, 5th Edition\
3. Pawlowski: Physicochemical Methods for water and Wastewater Treatment, 1st Edition
4. Wetzel: Limnology, 3rd edition
5. Trivedi and Goyal: Chemical and biological methods for water pollution studies Welch: Limnology Vols.I-II
6. T.Y B. Sc. Zoology Sem-V- Dhamani, Bakare, Harney & Bhute

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – V**  
**SUBJECT – ZOOLOGY PRACTICAL( CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER –XII**  
**USCZOP08**  
**PRACTICAL**

Time – 2 hours

Max. Marks: 15

1. Study of the topography of a lake
2. Determination of - Turbidity / Transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake or water body.
3. Zooplankton – Identification and population density of zooplankton
4. Instruments used in limnology and their significance (Secchi disc, Van dorn bottle, Conductivity meter, Turbidity meter, PONAR grab sampler)
5. A Project Report on a visit to a Sewage treatment plant / Marine bio-reserve/Fisheries Institutes.
6. Study of Fresh water and Marine water common Fish Fauna.

**Practical Question Paper and Distribution of Marks**

**Time: 2 Hrs.**

**Max. Marks: 15**

**Practical**

**Distribution of Marks**

- |   |    |
|---|----|
| 1. Identification and salient features of spots: -..... | 06 |
| (02 Specimens and 01 Slides )                           |    |
| 2. Haematological Experiments.....                      | 03 |
| 3. Project Work/ Case Study .....                       | 02 |
| 4. Certified practical record .....                     | 02 |
| 5. Viva voce .....                                      | 02 |

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY THEORY (CREDIT 2)**  
**SKILL ENHANCEMENT COURSE (SEC)**  
**PAPER – I –MEDICAL DIAGNOSTICS**

MAX. MARKS - 15

**Unit I**

1. Blood composition.
2. Blood group (ABO type, Rh factor)

**Unit II**

1. Physical characteristics of urine, Normal and abnormal constituent of urine.
2. Causes, types and symptoms of Diabetes (Type I and Type II)

**Unit III**

1. Causes, types, symptoms, diagnosis and prevention of Tuberculosis.
2. Causes, types, symptoms, diagnosis and prevention of Hepatitis.

**Unit IV**

1. Types of tumours, Benign and Malignant.
2. Medical imaging : X ray, Ultrasonography, MRI, CT Scan

**Suggested Readings :**

- 1) Text Book Of Medical Physiology by Guyton and Hall. 11<sup>th</sup> Edition W.B. Saunders and Company 2006
- 2) Text Book Of Medical Laboratory Technology by Godkar P. B. and Godkar D. P. II Edition Bhalani Publishing House.
- 3) A Laboratory Manual for Rural Tropical Hospitals A Basic for Training Courses by Chesbrought M.
- 4) Lab Manual on Blood Analysis and Medical Diagnostics. By Prakash G. (2012), S, Chand and Co. Ltd.
- 5) T.Y B. Sc. Zoology Sem-VI- Dhamani, Bakare, Harney & Bhute

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY PRACTICAL (CREDIT 2)**  
**SKILL ENHANCEMENT COURSE (SEC)**  
**PRACTICAL**

**Max. Marks: 35**

- 1) Study of ABO blood grouping and Rh factor through ICT/charts
- 2) Identified the different medical instruments through ICT/charts
- 3) Visit to local Govt. Hospital or Private Pathology Lab

**Practical Question Paper and Distribution of Marks**

**Time: 4 Hrs.**

**Max. Marks: 35**

**Practical**

**Distribution of Marks**

- 1) To study ABO blood grouping and Rh factor through ICT/charts.....10
- 2) Identified the different medical instruments through ICT/charts.....10
- 3) Visit tour report .....15

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY THEORY (CREDIT 2)**  
**SKILL ENHANCEMENT COURSE (SEC)**  
**PAPER –II – PUBLIC HEALTH AND HYGIENE**  
**MAX. MARKS - 15**

**UNIT I**

1. Personal Health, Community Health, Environmental Hygiene.
2. Government and its policies for public Health.

**UNIT II**

1. TB, polio, diphtheria, tetanus, MMR, Diarrhea, typhoid, worm infestations.
2. Vaccination, sterilization programmes - family planning, child obesity, malnutrition.

**UNIT III**

1. Environment and health Impact assessment
2. Health care legislation in India

**UNIT IV**

1. Hygiene education in communities.
2. Role of surveillance agency in hygiene education.

**Suggested Reading**

1. Oxford textbook of Public Health Ed. Roger Detels, James McEwen, Robert Beaglehole, and Heizo Tanaka Oxford University Press (OUP) 4th Edition: 2002.
2. Public Health at the Crossroads – Achievements and Prospects. Robert Beaglehole and Ruth Bonita 2nd Edition Cambridge University Press
3. Preventive and Social Medicine, K Park, Bansaridas Bhanot Publishing House.
4. Health: Diseases, Programs, Systems, and Policies, Bartlett Publishers.
5. T.Y B. Sc. Zoology Sem-VI- Dhamani, Bakare, Harney & Bhute

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE (B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY PRACTICAL (CREDIT 2)**  
**SKILL ENHANCEMENT COURSE (SEC)**  
**PRACTICAL**

**Max. Marks: 35**

1. Study of TB, Polio, Malaria, Filariasis, Measles, Chickenpox, Rabies, Leprosy through ICT/charts
2. Preparation of charts or posters related to health
3. Visit to community water purification and treatment plant/ industry to study occupational health hazard and safety of industrial workers/ agricultural fields to study occupational health of farmers and agricultural laborers.

**Practical Question Paper and Distribution of Marks**

**Time: 4 Hrs.**

**Max. Marks: 35**

**Practical**

**Distribution of Marks**

1. To study of TB, Polio, Malaria, Filariasis, Measles, Chickenpox, Rabies, Leprosy through ICT/charts .....10
2. To prepare the charts or posters related to health .....10
3. Visit tour report .....15

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS**  
**PROGRAMME- BACHELOR OF SCIENCE (B.Sc.), SEMESTER-VI**  
**SUBJECT- ZOOLOGY, THEORY (CREDITS 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER XIII**  
**USCZOT13**  
**Paper I – IMMUNOLOGY**

**Max. Marks: 50**

**Unit I**

**12 periods**

1. A historical Perspective of Immunology
2. Introduction to basic concepts in immunology, Primary and secondary line of defense
3. Innate Immunity- Anatomical barriers to infection, Macrophages, Natural Killer (NK) Cells, Inflammatory response
4. Adaptive immunity- Cell Mediated Immunity and Humoral Immunity

**Unit II**

**12 periods**

1. Haematopoeisis – Lymphoid and Myloid lineage
2. Primary lymphoid organs - Bone marrow, Thymus
3. Secondary lymphoid organs –Lymph node, Spleen, MALT, GALT, Peyer's patches
4. Interaction of antigen in secondary lymphoid organ

**Unit III**

**12 periods**

1. Basic properties of antigens, Haptens and adjuvants
2. B and T cell epitopes
3. Structure, classes and functions of antibodies
4. Monoclonal antibodies

## Unit IV

12 periods

1. Structure and functions of MHC I and II
2. Exogenous and endogenous pathways of antigen presentation and processing
3. Autoimmunity - Type I Diabetes mellitus, Psoriasis, Systemic Lupus Erythematosus,
4. Vaccines: Live, killed, recombinant and toxoid

### Suggested Readings – Immunology

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
2. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology*, VII Edition, Mosby, Elsevier Publication.
3. Abbas, K. Abul and Lichtman H. Andrew (2003.) *Cellular and Molecular Immunology*. V Edition. Saunders Publication.
4. Roitt, I.M., J. Brostoff and D.K. Male. *Immunology* (1993) Gower medical publishing, London
5. J. Kuby *Immunology* (1991) W. H. Freeman and Co.
6. Donald M. Weir, John Stewart, 1993. *Immunology* VII edition. ELBS, London.
7. Richard M. Hyde. 1995. *Immunology* III edition. National Medical Series, Williams and Wilkins. Harvard Publishing Co.
8. T.Y B. Sc. Zoology Sem-VI- Dhamani, Bakare, Harney & Bhute

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY PRACTICAL(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – IX**  
**USCZOP09**  
**PRACTICAL**

1. Demonstration of lymphoid organs through ICT tools /Charts/Photographs.
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells (Minor Expt.)
4. Ouchterlony's double immuno-diffusion method (Major Expt.).
5. ABO blood group determination (Minor Expt.).
6. Demonstration of - a) ELISA b) Immuno-electrophoresis (Major Expt.)

**Practical Question Paper and Distribution of Marks**

**Time: 2Hrs.**

**Max. Marks: 15**

<b>Practical</b>	<b>Distribution of Marks</b>
1. Identification(05 spots) .....	05
2. Major Experiment .....	04
3. Minor Experiment .....	02
4. Certified practical record .....	02
5. Viva voce .....	02

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY THEORY(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – XIV**  
**USCZOT14**  
**PAPER – II – ANIMAL BIOTECHNOLOGY**

**Max. Marks: 50**

**Unit I**

**12 Periods**

1. Concept and scope of biotechnology.
2. Scope of animal cell and tissue culture, Types of media for animal cell and tissue culture.
3. Sterilization techniques (chemical and physical sterilization).
4. Advantages and disadvantages of tissue culture.

**Unit II**

**12 Periods**

1. Cloning vectors: Plasmids, Cosmids, Phagemids, Bacteriophage ( $\lambda$ Phage, M13Phage), BAC, YAC and MAC.
2. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization.
3. Southern, Northern and Western blotting; DNA sequencing: Sanger method
4. Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

**Unit III**

**12 Periods**

1. Gene transfer methods in Animals- Direct gene transfer (Microinjection, Embryonic stem cell gene transfer) and vector based gene transfer (retrovirus gene transfer).
2. Applications of transgenic animals: Production of pharmaceuticals, milk production meat production and aquaculture.

3. Animal propagation -artificial insemination, animal clones.
4. Conservation of genetic resources of economically important livestock.

#### **Unit IV**

**12 Periods**

1. Animal cell culture, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia).
2. Recombinant DNA in medicines: Recombinant insulin and human growth hormone,
3. Gene therapy and its types.
4. Hybridoma technology and production of monoclonal antibody.

#### **SUGGESTED READINGS**

1. Brown, T.A. (1998). *Molecular Biology Labfax II: Gene Cloning and DNA Analysis*. II Edition, Academic Press, California, USA.
2. Glick, B.R. and Pasternak, J.J. (2009). *Molecular Biotechnology - Principles and Applications of Recombinant DNA*. IV Edition, ASM press, Washington, USA.
3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009).
5. Snustad, D.P. and Simmons, M.J. (2009). *Principles of Genetics*. V Edition, John Wiley and Sons Inc.
6. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). *Recombinant DNA Genes and Genomes- A Short Course*. III Edition, Freeman and Co., N.Y., USA.
7. Beauchamp, T.I. and Childress, J.F. (2008). *Principles of Biomedical Ethics*. VI Edition, Oxford University Press.
8. Elements of Biotechnology: P. K. Gupta; Rastogi publication.
9. Text book of Biotechnology – U Satyanarayan –Book & Allied
10. Jogdand S.N- Gene Biotechnology-Himalaya Publishing House, Delhi
11. T.Y B. Sc. Zoology Sem-VI- Dhamani, Bakare, Harney & Bhute

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY PRACTICAL(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – XIV**  
**USCZOP10**  
**PRACTICAL - ANIMAL BIOTECHNOLOGY**

**Section A**

1. Genomic DNA isolation from E. coli
2. Plasmid DNA isolation (pUC 18/19) from E. coli
3. Calculation of transformation efficiency from the data provided.
4. Electrophoresis of DNA (Major)

**Section B**

To study following techniques through ICT tools (Video/ images)

1. Southern Blotting
2. Northern Blotting
3. Western Blotting
4. DNA Sequencing (Sanger's Method)
5. PCR
6. DNA fingerprinting

**Section C**

1. Submission of Project report on animal cell culture.
2. Visit to any tissue culture laboratory/ Genetic Engineering Research Laboratory.

**Practical Question Paper and Distribution of Marks**

**Time: 2 Hrs.**

**Max. Marks: 15**

**Practical**

**Distribution of Marks**

1. Identification of spots(05 spots) .....	05
2. Experiment from section A.....	03
3. Experiment from section B.....	03
4. Certified Practical Record .....	02
5. Viva voce .....	02

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY THEORY(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – XV**  
**USCZOT15**  
**PAPER – III – MICROTECHNIQUE, BIOINFORMATICS AND**  
**BIOSTATISTICS**

**Max. Marks: 50**

**Unit – I**

**12 Period**

1. Visualization of cells and sub-cellular components by light microscopy.
2. Concept of resolving powers of different microscopes, microscopy of living cells, scanning and transmission electron microscopes.
3. Different fixation and staining techniques for EM, freeze-etch (fracture) and freeze- methods for EM.
4. Image processing methods in microscopy.

**Unit – II**

**12 Period**

1. Structure and working of microtomes (Rocking and Rotary microtomes)
2. Fixation, dehydration, clearing, embedding
3. Section cutting and problems encountered during section cutting (causes and remedies),
4. Double staining with Haematoxylin and Eosin, Histochemical staining techniques for carbohydrates (Periodic acid schiff), proteins (Mercury-bromophenol blue) and lipids (Sudan black-B).

**Unit-III**

**12 Period**

1. General introduction, Bioinformatics tools (BLAST, FASTA, Clustal W, PFAM, SCANS).
2. Biological databases (Objectives, properties and Classification), Sequence retrieval system (SRS).
3. Structure of nucleotide sequence database, RNA databases, Protein sequence databases (TrEMBL, PIR, UniProt, PDB, MMDB, SCOP, CATH), HGP

(General information), Phylogenetic analysis (Phenetic method and Cladistic method).

4. Applications of bioinformatics.

#### **Unit-IV**

**12 Period**

1. Tabulation and presentation of data, Sampling errors
2. Measures of central tendency (mean, mode, median,) SD, SE.
3. Dispersal, probability distributions (Binomial, Poisson and normal)
4. Regression and correlation; t-test; analysis of variance; Chi Square test.

#### **Suggested Readings**

##### **Microtechnique**

1. Devenport, H.A. (1960) Histological and histochemical techniques. Published by W.B. Saunders Company, Philadelphia, PA (U.S.A.).
2. Dhande, R.R., Wankhede, G.N. and Akarte. Text book of Microtechniques and Environmental Biology by Bajaj Publications, Amravati.
3. Humason, G.L. (1979) Animal Tissue Technique, 4<sup>th</sup> edition, Published by W H Freeman & Co., San Francisco.
4. Patki L.R, Bhalchandra B.L, Jeevaji I.H.(1987). An introduction to Microtechnique, S.Chand and company (Pvt)ltd, New Delhi.
5. Presnell, J.K. and Schreibman M. (1997) Humason Tissue Technique (5<sup>th</sup> edition), Published by The Johns Hopkins University Press, Baltimore, Maryland.
6. Tembhare, D.B. (2010). Techniques in Life Sciences, Published by Himalaya Publishing House, New Delhi.
7. Verma, P.S. and Agarwal, V.K. (2005). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S.Chand and Company Ltd., New Delhi.
8. **T.Y B. Sc. Zoology Sem-VI- Dhamani, Bakare, Harney & Bhute**

##### **Bioinformatics and Biostatistics**

1. Baxevanis, A.D. Ouellate, B.F.F. (2009). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 2<sup>nd</sup> Edition , Published by John-Wiley and Sons Publications, New York.
2. Bergman, N.H. (2007). Comparative Genomics: Methods in Molecular Biology, Vol-1 & Vol-2, Humana Press, Totowa (NJ).
3. Campbell, A.M. and Heyer, L.J. (2007). Discovering Genomics, Proteomics and Bioinformatics, 2<sup>nd</sup> Edition. Benjamin Cummings.
4. Gibas, C. and Jambeck P. (2001). Developing Bioinformatics Computer Skills: Shroff Publisher sand Distributors Pvt. Ltd. (O'Reilly), Mumbai.
5. Higgins, D. and Taylor, W. (2000). Bioinformatics: Sequence, Structure and Databanks. Oxford University Press, UK.
6. Mahajan, B.K. (2008). Methods in Biostatistics, 8<sup>th</sup> Edition, J.P. Medical Ltd.
7. Mount, W. (2004). Bioinformatics and Sequence Genome Analysis 2<sup>nd</sup> Ed CBS, Pub. New Delhi.
8. Rashidi H. H. and Buehler (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London.
9. Sadguru Prasad (2013). Elements of Biostatistics, 3<sup>rd</sup> Edition, Rastogi Publication, New Delhi.
10. Suderlingam, S. And Kumaresan, V. (2013). Bioinformatics, 2<sup>nd</sup> Edition, Saras Publication, Kanyakumari, India.
11. Xhiong, J. (2006) Essential Bioinformatics, Published by Cambridge University Press, New York.

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY PRACTICAL(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – XV**  
**USCZOP15**  
**PRACTICAL - MICROTECHNIQUE, BIOINFORMATICS AND**  
**BIOSTATISTICS**

**Section A - Micro technique**

1. Studies of electron microscope photographs: SEM and TEM (ICT, charts etc.)
2. Preparations-
  - a. Preparation of different grades of alcohol by using rectified spirit,
  - b. Preparation of Bouin's fixatives, Cornoy's fixative,
  - c. Phosphate Buffer Saline (0.01 M, PBS, pH-7-45),
  - d. Preparation of Eosin solution,
  - e. Preparation of Hematoxyline solution (Ehrlich or Delafield),
  - f. Meyer' s albumen.
3. a) Fixation of tissues of your interest procured from slaughter house or fish market. b) Paraffin block preparation for general histological study and histochemical studies.
4. Block cutting, spreading
5. Staining by haematoxyline and eosine.
6. Histochemical study for protein (Bromophenol blue), glycogen (Schiffs reagent) and lipid (Sudan black B).

**Section B - Bioinformatics**

1. Use of BLAST and FASTA for the retrieval of Nucleotide sequences and Protein sequences.
2. Preparation of phylogenetic tree by using Phenetic and Cladistic method.

**Section C- Biostatistics**

1. Collection of any biological information, preparation of table by using Excel,
2. Calculation of mean, mode, median, standard deviation, standard error etc.
3. Preparation of line graph, bar diagram, Pie diagram by using Excel.

**Practical Question Paper and Distribution of Marks**

**Time: 2 Hrs.**

**Max. Marks: 15**

**Practical**

**Distribution of Marks**

1. Section cutting and spreading of ribbon .....	02
2. Histological/ Histochemical Staining.....	03
3. One experiment from bioinformatics.....	02
3. One experiment from biostatistics .....	03
4. Certified practical record .....	03
5. Viva voce .....	02

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY THEORY(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – XVI**  
**USCZOT16**  
**PAPER – IV – REPRODUCTIVE BIOLOGY**

**Max. Marks: 50**

**Unit I**

**12 Period**

1. Reproductive System: Sex Differentiation (Gonadogenesis, Genital Duct and External Genitalia), Abnormalities of Human Sex Development.
2. Hypothalamo – Hypophyseal – Gonadal axis: Location, Regulation, Function and Factors affecting it.
3. Gonadal hormones: Types (steroids, glycoprotein hormones and prostaglandins) and mechanism of hormonal action.
4. Reproductive Endocrine Disorders in Male and Female: Hypogonadism, ED (Erectile Dysfunction), Gynecomastia, POS (Polycystic Ovarian Syndrome), Hirsutism, Perimenopause.

**Unit II**

**12 Period**

1. Histology of male reproductive system in rat and human: Testis: Structure, Cellular Function, Spermatogenesis.
2. Structure and Function of Epididymis and Sex Accessory Glands.
3. Androgen metabolism and Biochemistry of Semen.
4. Cryptorchidism and Castration.

**Unit III**

**12 Period**

1. Histology of female reproductive system in rat and human: Ovary: Structure, folliculogenesis, ovulation, corpus luteum formation and regression.
2. Reproductive cycles in rat and human and their regulation.
3. Gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation.
4. Lactation and its regulation.

## **Unit IV**

**12 Period**

1. Infertility in male and female: causes, diagnosis and management.
2. Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST.
3. Modern contraceptive measures.
4. Demographic terminology used in family planning- birth limiting, birth spacing, contraceptive continuation rates, contraceptive prevalence, CYP, HTSP, Informed choice, unmet need, total fertility rate, method mix.

### **SUGGESTED READINGS**

1. Austin, C.R. and Short, R.V. reproduction in Mammals. Cambridge University Press.
2. Degroot, L.J. and Jameson, J.L. (eds). Endocrinology. W.B. Saunders and Company.
3. Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
4. Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.
5. Developmental Biology by Gilbert
6. Human Physiology by Vander
7. Human Physiology by Dr. A.K. Jain
8. T.Y B. Sc. Zoology Sem-VI- Dhamani, Bakare, Harney & Bhute

**GONDWANA UNIVERSITY, GADCHIROLI**  
**CHOICE BASED CREDIT SYSTEM(CBCS) SYLLABUS**  
**PROGRAMME – BACHLOR OF SCIENCE(B.Sc.), SEMESTER – VI**  
**SUBJECT – ZOOLOGY PRACTICAL(CREDIT 2)**  
**DISCIPLINE SPECIFIC ELECTIVES (DSE) CORE PAPER – XVI**  
**USCZOP16**  
**PRACTICAL - REPRODUCTIVE BIOLOGY**

1. Observation of histological sections from photomicrographs/ charts/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
2. Study of modern contraceptive devices.
3. Examination of vaginal smear of rats/ Human (Major).
4. Sperm count and sperm motility in rat/human (Major).
5. Pregnancy diagnosis by using kit(Minor).
6. Estimation of fructose in semen (Minor).
7. Surgical techniques: Principles of surgery in endocrinology. Ovaryectomy, hysterectomy, castration and vasectomy in rats through ICT tools.
8. A case Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.

**Practical Question Paper and Distribution of Marks**

**Time: 2 Hrs.**

**Max. Marks: 15**

**Practical**

**Distribution of Marks**

1. Spotting .....	06
2. One experiment Major.....	03
3. One experiment Minor .....	02

4. Certified practical record .....	02
5. Viva voce .....	02