KOLHAN UNIVERSITY

CHAIBASA

COURSE CURRICULUM FOR UNDER GRADUATE COURSES UNDER CHOICE BASED CREDIT SYSTEM

B.Sc. Zoology [General]

Revised Syllabus

WITH EFFECT FROM 2020

Dr. S. B. Lal (Chairperson)

Dr. Uday Singh (Expert) Dr. Ravinder Singh

Dr. Anjali Srivastava Dr. Amar Kumar

Dr. A.P.V.Khalko

CREDIT SCHEME FOR CBCS IN UNDERGRADUATE
B.Sc. General (PROGRAMME)

Course	Credits	
	Theory + Practical	**Theory + Tutorials**
I. Core Course (12 Papers) 04 Courses from each of the 03 disciplines of choice	12x4= 48	12x5=60
Core Course Practical / Tutorial (12 Practical/ Tutorials) 04 Courses from each of the 03 Disciplines of choice	12x2=24	12x1=12
II. Elective Course (6 Papers) Two papers from each discipline of choice including paper of interdisciplinary nature.	06x4=24	06x5=30
Elective Course Practical / Tutorials (6 Practical / Tutorials*) Two Papers from each discipline of choice including paper of interdisciplinary nature	06x2=12	06x1=06
III. Ability Enhancement Courses 1. Ability Enhancement Compulsory Courses (AECC) (2 Papers of 2 credits each) Environmental Science English/MIL Communication	02x02=04	02x02=04
2. Skill Enhancement Courses (SEC) (4 Papers of 2 credits each)	04x02=08	04x02=08
	Total credit = 120	**Total credit = 120**

SCHEME FOR CBCS IN UNDERGRADUATE B.SC. PROGRAMME

Semester	Subject Code	Full Marks	Total Marks	Credit	Total Credit
I	DSC-1A (Theory)	70	350	4	20
	DSC-1A (T/P)	30		2	
	DSC-2A (Theory)	70		4	
	DSC-2A (T/P)	30		2	
	DSC-3A (Theory)	70		4	
	DSC-3A (T/P)	30		2	
	AECC-1 (Eng./MIL Communication)	50		2	
II	DSC-1B (Theory)	70	350	4	20
	DSC-1B (T/P)	30		2	
	DSC-2B (Theory)	70		4	
	DSC-2B (T/P)	30		2	
	DSC-3B (Theory)	70		4	
	DSC-3B (T/P)	30		2	
	AECC-II (Environmental Science)	50		2	
III	DSC-1C (Theory)	70	350	4	20
	DSC-1C (T/P)	30		2	
	DSC-2C (Theory)	70		4	
	DSC-2C (T/P)	30		2	
	DSC-3C (Theory)	70		4	
	DSC-3C (T/P)	30		2	
	SEC-1	50		2	
IV	DSC-1D (Theory)	70	350	4	20
	DSC-1D (T/P)	30		2	
	DSC-2D (Theory)	70		4	
	DSC-2D (T/P)	30		2	
	DSC-3D (Theory)	70		4	
	DSC-3D (T/P)	30		2	
	SEC-2	50		2	
	DSE-1A (Theory)	70		4	

V	DSE-1A (T/P)	30	350	2	20
	DSE-2A (Theory)	70		4	
	DSE-2A (T/P)	30		2	
	DSE-3A (Theory)	70		4	
	DSE-3A (T/P)	30		2	
	SEC-III	50		2	
VI	DSE-1B (Theory)	70	350	4	20
	DSE-1B (T/P)	30		2	
	DSE-2B (Theory)	70		4	
	DSE-2B (T/P)	30		2	
	DSE-3B (Theory)	70		4	
	DSE-3B (T/P)	30		2	
	SEC-IV	50		2	
Total			**2100**		**120**

NB : GE and DSC papers in B.Sc. General Programme (Theory and Practical) are same

COURSES OF STUDY FOR UNDERGRADUATE
B.Sc. General PROGRAMME

Table A-3: Basic Course structure for SCIENCE (Undergraduate Programme) **Total: 120 Credits**

Sem	Course (Core Courses)		Allied (Elective Courses)		Ability Enhancement (Compulsory Courses)	
	Code	**4 x 3 = 12 Papers**	**Code**	**2 x 3 = 6 Papers**	**Code**	**1 + 1 + 4 = 6 Papers**
I	DSC 1 A DSC 2 A DSC 3 A	Core Subject 1; Paper A Core Subject 2; Paper A Core Subject 3; Paper A			Compulsory Language Communication ENG/ Hindi/ NH + MB	
II	DSC 1 B DSC 2 B DSC 3 B	Core Subject 1; Paper B Core Subject 2; Paper B Core Subject 3; Paper B			EVS	Environmental Science
III	DSC 1 C DSC 2 C DSC 3 C	Core Subject 1; Paper C Core Subject 2; Paper C Core Subject 3; Paper C			SEC 1	SEC 1:
IV	DSC 1 D DSC 2 D DSC 3 D	Core Subject 1; Paper D Core Subject 2; Paper D Core Subject 3; Paper D			SEC 2	SEC 2 of Either Core Subject 1, 2 or 3
V			DSE 1 A DSE 2 A DSE 3 A	Core Subject 1 Core Subject 2 Core Subject 3	SEC 3	SEC 3 of same subject opted in Sem III
VI			DSE 1 B DSE 2 B DSE 3 B	Core Subject 1 Core Subject 2 Core Subject 3	SEC 4	SEC 4 of same subject opted in Sem III

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM
B.Sc. Gen. in Zoology (Six Semester Course)

SEMESTER-I

Core Course (12 Papers)	Name of Papers	Credit	Total Credit
DSC 1 A	Animal Diversity	04	06
DSC 1 A Practical	Practical based in DSC 1A	02	
Ability Enhancement Compulsory Course (AECC) (2 Papers)	AECC 1 English/ MIL(Hindi) Communication	02	02

Semester - II

Core Course (12 Papers)	Name of Papers	Credit	Total Credit
DSC 1 B	Comparative Anatomy, Developmental Biology of Vertebrates	04	06
DSC 1 B PR.	Practical based in DSC 1 B	02	
Ability Enhancement Compulsory Course (AECC) (2 Papers)	AECC 2 Environmental Science	02	02

Semester –III

Core Course (12 Papers)	Name of Papers	Credit	Total Credit
DSC 1 C	Animal Physiology and Biochemistry	04	06
DSC 1 C PR	Practical based in DSC 1 C	02	
Skill Enhancement Course (SEC) (4 Papers)	SEC 1: Sericulture	02	02

Semester -IV

Core Course (12 Papers)	Name of Papers	Credit	Total Credit
DSC 1 D	Genetics and Cell & Molecular Biology	04	06
DSC 1 D PR	Practical based in DSC 1 D	02	
Skill Enhancement Course (SEC) (4 Papers)	SEC 2: Apiculture	02	02

SEMESTER - V

Discipline Specific Elective (DSE) (6 Papers)	Name of Papers	Credit	Total Credit
DSE 1 A Theory	Biotechnology, Evolution and Animal Behaviour	04	06
DSE 1 A PR	Practical based in DSE 1 A	02	
Skill Enhancement Course (SEC) (4 Papers)	SEC 3: Pisciculture	02	02

SEMESTER- VI

Discipline Specific Elective (DSE) (6 Papers)	Name of Papers	Credit	Total Credit
DSE 1 B Theory	Immunology and Reproductive Biology	04	06
DSE 1 B PR	Practical based in DSE 1 B	02	
Skill Enhancement Course (SEC) (4 Papers)	SEC 4: Public Health and Hygiene	02	02

GRADES AND GRADE POINTS

LATTER GRADE	GRADE POINT	MARKS PERCENTAGE
O(Outstanding)	10	100%
A++(Excellent)	9	90% to 99.99%
A+(Extremely Good)	8	80% to 89.99 %
A (Very Good)	7.5	75% to 79.99 %
B+(Good)	7	70% to 74.99 %
B(Above Average)	6	60% to 69.99 %
C(Average)	5	50% to 59.99 %
P(Pass)	4	40 % to 49.99 %
F(Fail)	0	Less than 40%
Ab(Absent)	0	

EXAMINATION FRAMEWORK
FOR B.Sc. [General]

ESUE

- **There will be a uniform pattern of question for all course and of all the programs . the question pattern will be divided in to three groups .**
- **In which GROUP - I is objective type and is COMPULSORY [10 X 2 = 20].**
- **A total of SEVEN Question will be set in group - B out of which only FOUR questions to be attended Consisting of "05" marks each .**
- **In GROUP - C there will be a total of FOUR Question and only TWO shall have to be answered by the examinees carrying "15" marks each .**

SIA

- **Written Examination :- 15 Marks**
- **Co-curricular activities and Regularity :- 05 Marks**
- **Project Work / Seasonal Work / Field Study / Viva - Voce :- 10 Marks**

[NOTE :-SIA :-Sessional Internal Assessment & ESUE :- End Semester University Examination]

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc. General in Zoology

(Six Semester Course)

1ST SEMETER

DSC 1 A - ANIMAL DIVERSITY

Non-Chordates

Unit 1: Kingdom Protozoa
General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa

Unit 2: Phylum Porifera
General characters and classification up to classes; Canal System in Porifera

Unit 3: Phylum Ctenophora
General characters and classification up to classes of Coelenterata, Polymorphism in Hydrozoa and Life Cycle of Obelia.

Unit 4: Phylum Platyhelminthes
General characters and classification up to classes; Life history of Taeniasolium, Life Cycle of Fasciola hepatica

Unit 5: Phylum Nemathelminthes
General characters and classification up to classes; Life history of Ascaris lumbricoides and its parasitic adaptations

Unit 6: Phylum Annelida
General characters and classification up to classes; Excretion in Annelida

Unit 7: Phylum Arthropoda
General characters and classification up to classes; Vision in Arthropoda, Larval forms of Crustacea, Respiration in Arthropoda

Unit 8: Phylum Mollusca
General characters and classification up to classes; Torsion and Detorsion in gastropods

Unit 9: Phylum Echinodermata
General characters and classification up to classes; Water-vascular system in Asteroidea

Chordates

Unit 10: Protochordates
General features of Protochordata, Hemi, Cephalo and Urochordata, Retrogressive Metamorphosis

Unit 11: Pisces
General features and Classification up to orders; Cartilaginous and Bony Fishes, Scales in Fishes

Unit 12: Amphibia **(4 lectures)**
General features and Classification up to orders;

Unit 13: Reptiles **(4 lectures)**
General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes,

Unit 14: Aves **(5 lectures)**
General features and Classification up to orders; Flight adaptations in birds, Migration,

Unit 15: Mammals **(5 lectures)**
Classification up to orders; Origin and Evolution of mammals, Dentition in mammals, Aquatic adaptations in Mammals.

ZOOLOGY PR.- DSC 1 A- LAB:

1. Dissection of earthworm, prawn, pila. **[5 Marks]**

2. Spottings: **[10 marks]**

Museum Specimen:

Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taeniasolium, Male and female Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Any six common birds from different orders, Sorex, Bat, Funambulus, Loris

Permanent slides:

WM of Amoeba, Plasmodium and Paramecium, T.S. and L.S. of Sycon, Study of life history stages of Taenia, T.S. of Male and female Ascaris, TS of Earthworm, Larval form of Earth Crusticia, Gills of Pila, glochidium larvae

3. Key for Identification of poisonous and non-poisonous snakes/ Preparation of temporary mount **[05 marks]**

4. Practical Record. **[05 marks]**

5. Viva- voce. **[05 marks]**

SUGGESTED READINGS

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.

2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002).

3. The Invertebrates: A New Synthesis, III Edition, Blackwell Science

4. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.

5. Pough H. Vertebrate life, VIII Edition, Pearson International.

6. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

7. Pechnek, J.A.2000. Biology of Invertebrates. Tata McGraw-Hill Publishing Company, New Delhi.

8. Kardong, K.V.2002. Vertebrates. Tata McGraw-Hill Publishing Company, New Delhi.

9. S.S.Lal, Zoology Invertebrate and Vertebrate Practical

10. Invertebrate, Kotpal series

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc. General in Zoology

(Six Semester Course)

2ND SEMETER

CORE COURSE –DSC-1B:

(Credits: Theory-04, Practicals-02)

Comparative Anatomy of Vertebrates

Unit 1: Integumentary System

Unit 2: Respiratory System

Unit 3: Urinogenital System

Unit 5: Nervous System

Comparative account of brain

Unit 6: Sense Organs

Types of receptors

DEVELOPMENTAL BIOLOGY OF VERTEBRATES

Unit 7: Early Embryonic Development

Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, Fertilization: internal (mammals), blocks to polyspermy; Types of Eggs, patterns of cleavage, fate map, up to formation of gastrula);types of morphogenetic movements and Gastrulation; Fate of germ layers; Neurulation in frog embryo.

Unit: 8: Embryonic Induction, Competence

Unit 9: Late Embryonic Development

Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.

Unit 10: Control of Development

Fundamental processes in development (brief idea) – Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death.

ZOOLOGY PRACTICAL-DSC 1 B - LAB

1. SPOTTING ..... [**10marks]**

(i) Osteology:

a) Disarticulated skeleton of fowl and rabbit: Limb bones, Girdles, Vertebrae

b) Carapace and plastron of turtle /tortoise

c) Mammalian skulls: One herbivorous and one carnivorous animal.

(ii) Study of developmental stages - whole mounts and sections through permanent slides

- Cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.

(iii) Study of the different types of placenta- histological sections through permanentslides or photomicrographs.

2. Preparation of temporary stained mount of Grasshopper testes to show stages ogf Gametogenesis [05 marks]

3. Study of developmental stages of Chick embryo and/or Study of placental development in humans by ultrasound scans.

[05 Marks]

4. practical Record [05Marks]

5. Viva [05 Marks]

SUGGESTED READINGS

1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. Mc Graw- Hill Higher Education.
2. Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons.
3. Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
4. Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
5. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
6. E.L.Jordan and P.S. Verma 'Chordate Zoology' -. S. Chand Publications.
7. Mohan P.Arora. 'Chordata –I, Himalaya Publishing House Pvt.Ltd.
8. Marshal, Parker and Haswell 'Text book of Vertebrates'. ELBS and McMillan, England.

9. Alfred Sherwood Romer. Thomas S. Pearson 'The Vertebrate Body, Sixth edition, CBS college Publishing, Saunders College Publishing

10. George C. Kent, Robert K. Carr. Comparative Anatomy of theVertebrates, 9th ed. McGraw Hill.

11. J.W. Young, The Life of Vertebrates, 3rd ed, Oxford University press.

12. Harvey Pough F, Christine M. Janis, B. Heiser, Vertebrate Life, Pearson, 6th ed, Pearson Education Inc.2002.

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc. General in Zoology

(Six Semester Course)

3RD SEMETER

DSC 1 C :
ANIMAL PHYSIOLOGY

Unit 1: Nerve and muscle

Structure of a neuron, resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibers, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction

Unit 2: Digestion

Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids

Unit 3: Respiration

Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood in mammals.

Unit 4: Excretion

Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism in mammals.

Unit 5: Cardiovascular system

Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, cardiac cycle.

Unit 6: Reproduction and Endocrine Glands

Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle in mammals. Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal.

BIOCHEMISTRY

Unit 7: Structure and biological significanc of Carbohydrates, Protein , Lipids and Nucleic Acids

Unit 8: Carbohydrate Metabolism

Glycolysis, Krebs cycle, Glycogen metabolism, Review of electron transport chain

Unit 9: Lipid Metabolism

Biosynthesis and β oxidation of Fatty acid

Unit 10: Protein metabolism

Transamination, Deamination and Urea Cycle

Unit 11: Enzymes and Homeostasis

Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation, Michelle-Menten's equation of Enzyme kinetics, Concept ofHomeostasis,

ZOOLOGY PRACTICAL-DSC 1 C

1. SPOTTING .....**[10 marks]**

(i) Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenalgland

(ii) Study of permanent slides of spinal cord, different parts of Alimentary canal, liver, lung, kidney, bone, cartilage,

2. ESTIMATION OF PROTEIN, FATS & CARBOHYDRATES… **[05 marks]**

3. Haemocytometer (Blood cell counts, RBC indices), Hemoglobin estimation [05 Marks]

4. Record. **[05 marks]**

5. Viva- voce. **[05 marks]**

SUGGESTED READINGS

1. Tortora, G.J. and Derrickson, B. H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley &Sons, Inc.

2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition., McGraw Hill

3. Guyton, A.C. and Hall, J.E. (2011). T*extbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company

4. Berg, J.M., Tymoczko, J.L. and Stryer, L.(2006). *Biochemistry*. VI Edition.

5. W.H Freeman and Co. Nelson, D.L., Cox, M. M. and Lehninger, A.L.(2009). *Principles of Biochemistry*. IV Edition.

6. W.H. Freeman and Co. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/ McGraw3Hill.

7. Ganong's Review of MedicalPhysiology

SEC 1- SKILL ENHANCEMENT COURSE: SERICULTURE

Objectives: To train and impart knowledge of Mulberry and silkworm, their culture practices, maintenance and management practices. Entrepreneur motivation for practicing sericulture as small scale cottage industry.

Unit: I

History and economic importance of sericulture –types of silkworm –Mulberry and non-Mulberry (Tassar, Eri and Muga). Systematic position of Bombyx and Life Cycle - Morphology of silk gland.

Horticulture –mulberry cultivation –Environmental conditions for mulberry cultivation – soil, climatic factors, preparation of land. Inter-cultivation –pruning methods –harvesting

Diseases and pests of mulberry and control methods.

Unit: II

Silkworm rearing –general principles of silkworm rearing –primary requisite for successfulrearing.

Feeding of silkworm, bed cleaning, sparing, moulting, late age silkworms –Moulting andharvesting economics of silkworm.

Diseases and pests of silkworm.

Reeling –reeling appliances and process of reeling cocoons.

Sericulture as cottage industry.

SUGGESTED READINGS

1. Handbook of sericulture –S.R. Ullal and M. N. Varasimhanna

2. An introduction to sericulture –G. Ganga, J. Sulochana Chetty

3. Manual of Sericulture –FA O Volumes.

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc. General in Zoology

(Six Semester Course)

4TH SEMETER

DSC 1 D
GENETICS

Unit 1: Mendelian Genetics and its Extension

Monohybrid and Dihybrid cross, Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and co- dominance, Multiple alleles, lethal alleles, Epistasis, Pleiotropy, sex linked inheritance, extra- chromosomal inheritance

Unit 2: Linkage, Crossing Over and Chromosomal Mapping

Unit 3: Mutations

Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Detection of Mutation

Unit 4: Sex Determination

Chromosomal mechanisms, dosage compensation

CELL AND MOLECULAR BIOLOGY

Unit 05: Cell Biology

Cell theory, Differences of Prokaryotic and Eukaryotic cells, Ultrastructure of animal cell, Structure and functions of plasma membrane proteins, Structure and functions of cell organelles – Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, Protein sorting and trafficking, Cell secretion, centrosomes, Mitochondria and Nucleus, Chromosomes – Structure, types, giant chromosomes, Cell Division -Mitosis, Meiosis, Cell cycle and its regulation, Canver, Apoptosis.

Unit 06: Molecular Biology

DNA (Deoxyribo Nucleic Acid) –Structure, RNA (Ribo Nucleic Acid) -Structure, types, DNA Replication, Protein Synthesis –Transcription and Translation, Gene Expression – Genetic Code; operon concept, Molecular Biology Techniques-Polymerase Chain Reaction, Electrophoresis

ZOOLOGY LAB –DSC-1 D PRACTICAL

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1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test. [5 Marks]

2. Study of Linkage, recombination, gene mapping using the data.

   Study of polytene chromosomes from Chironomus / drosophila larvae. [5 Marks]

3. Quantitative estimation of salmon sperm/calf thymus DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A260 measurement)

   Quantitative estimation of RNA using Orcinol reaction. [5 Marks]

4. Preparation of liquid culture medium (LB) and raise culture of E. coli. Estimation of the growth kinetics of E. coli by turbidity method.

   Preparation of solid culture medium (LB) and growth of E. coli by spreading and streaking.

   Demonstration of antibiotic sensitivity/resistance of E. coli to antibiotic pressure and interpretation of results. [5 Marks]

5. Record. **[05 marks]**

6. Viva- voce. **[05 marks]**

SUGGESTED READINGS

1. Gardner, E.J., Simmons, M.J., Snustad, D.P.(2008). *Principles of Genetics.* VIII Edition. Wiley India.
2. Snustad, D.P., Simmons, M.J.(2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition.
4. Benjamin Cummings.Russell, P. J. (2009).*Genetics- A Molecular Approach.* III Edition.
5. Benjamin Cummings.Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co
6. Ridley, M. (2004). *Evolution.* III Edition. Blackwell Publishing
7. Barton, N.H., Briggs, D.E.G., Eisen, J.A., Goldstein, D.B. and Patel, N.H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
8. Hall, B.K. and Hallgrimsson, B. (2008). *Evolution.* IV Edition.
9. Jonesand Bartlett Publishers Campbell, N.A. and ReeceJ. B. (2011). Biology. IX Edition,
10. Pearson, Benjamin, Cummings. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
11. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition.
12. Pearson Benjamin Cummings Publishing, San Francisco. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts,Peter Walter: Molecular Biology of the Cell, IV Edition.
13. Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V Edition, ASM Press and Sinauer Associates.
14. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
15. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI

SEC 2- SKILL ENHANCEMENT COURSE: APICULTURE

Objectives: To train and impart knowledge of Mulberry and silkworm, their culture practices, maintenance and management practices. Entrepreneur motivation for practicing sericulture as small scale cottage industry.

Unit 1: Biology of Bees

History, Classification and Biology of Honey Bees Social Organisation of Bee Colony

Unit 2: Rearing of Bees

Artificial Bee rearing (Apiary), Beehives-Newton and Langstroth, Bee Pasturage Selection of Bee Species for Apiculture, Bee Keeping Equipment, Methods of Extraction of Honey (Indigenous and Modern)

Unit 3: Diseases and Enemies

Bee Diseases and Enemies, Control and Preventive measures

Unit 4: Bee Economy

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc

Unit 5: Entrepreneurship in Apiculture

Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Bee hives for cross pollination in horticultural gardens.

SUGGESTED READINGS

1. Singh S., *Bee keeping in India*, Indian council of Agricultural Research, New Delhi.

2. Prost, P.J.(1962). Apiculture. Oxford and IBH, New Delhi.

3. Bisht D.S., Apiculture, ICAR Publication

PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc. General in Zoology

(Six Semester Course)

5TH SEMETER

DSE 1 A

BIOTECHNOLOGY

Unit 1: Basic steps of Gene Cloning

Unit 2: Molecular Techniques in Gene manipulation

Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics) Restriction enzymes: Nomenclature, detailed study of Type II. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization Southern, Northern and Western blotting; DNA sequencing: Sanger method Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

Unit 3: Genetically Modified Organisms

Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection

Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice.

EVOLUTION AND ANIMAL BEHAVIOUR

Unit 4: Introduction to Evolutionary Theories

Lamarckism, Darwinism, Neo-Darwinism

Unit 5:Processes of Evolutionary Change

Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection, Evolution of Man

Unit 6: Hardy-Weinberg equilibrium, Micro, Macro and Mega Evolution

ANIMAL BEHAVIOUR:

Unit 7: Types of Behaviour-Innate and Acquired, Instinctive and Motivated behaviour, Taxes, Reflexes, Tropisms, Physiology and phylogeny of learning, trial and error learning, Imprinting, habituation, Classical conditioning, Instrumental conditioning, Social behaviour, , Biological rhythms, Biological clocks

ZOOLOGY PRACTICAL –DSE 1 A PR

1. Basic experiments in Gene cloning:

Genomic DNA isolation from *E. coli*, Plasmid DNA isolation (pUC 18/19) from *E. coli*
Restriction digestion of plasmid DNA. [10 Marks]

OR,

To study following techniques through photographs

a) Southern Blotting

b) Northern Blotting

c) Western Blotting

d) DNA Sequencing (Sanger's Method)

e) PCR

f) DNA fingerprinting

2. Study of fossil evidences from plaster cast models and pictures

Study of homology and analogy from suitable specimens/ pictures [5 Marks]

3. Social behavior and organization in Honey Bee and Termites [5 Marks]

4. Record [5 Marks]

5. Viva [5 Marks]

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). *An Introduction to Genetic Analysis*. IX Edition. Freeman and Co., N.Y., USA.
4. Snustad, D.P. and Simmons, M.J. (2009). *Principles of Genetics.* V Edition, John Wiley and Sons Inc.
5. 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.
6. Beauchamp, T.I. and Childress, J.F. (2008). *Principles of Biomedical Ethics.* VI Edition, Oxford University Press
7. Organic Evolution: Veer Bala Rastogi
8. Evolution: Strickberger
9. Animal Behaviour: Reena Mathur
10. Animal Behaviour: P.S. Verma

SEC 3 - SKILL ENHANCEMENT COURSE: PISCICULTURE

Unit 1: Scope of Aquaculture. Importance of cultivable fresh water, marine ornamental species.

Unit 2: Fish farm Maintenance – Farm management technique, water quality, temperature and accessories in Farm management viz Aerator, Filter, paddler

Unit 3: Fish culture technique, Monoculture, Polyculture and monosex culture, Induced fish breeding, Integrated fish farming

Unit 4: Fish nutrition and fish formulations live fish live fish transport.

Unit 5: Prevention and control of fish diseases.

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PROPOSED SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

B.Sc. General in Zoology

(Six Semester Course)

6TH SEMETER

DSE 1B

IMMUNOLOGY

UNIT-1 . Introduction to Immunity

UNIT-2. Cell and organs of immune system

Types of immune cells, lymphoid and myeloid, Primary and secondary lymphoid organs .

UNIT-3. Humoral immunity

Antigen, Function of B cell

UNIT- 4. Cell mediated immunity

Types and Function of T-Cells

UNIT- 5. Antibodies

Structure, Classes and function of antibodies, Monoclonal antibodies
Antigen antibody interaction as tools for research and diagnosis.

UNIT- 6. Working of the immune system

Structure and function of MHC **,** Exogenous and endogenous pathways of antigen presentation and processing**,** Basic properties and function of Cytokines **,** Complement system : Components and pathways .

UNIT- 7. Vaccines

General introduction to vaccines , various types of vaccines

REPRODUCTIVE BIOLOGY

Unit 8: Reproductive Endocrinology

Gonadal hormones, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation, Uterine Cycles and their hormonal regulation.

Unit 9: Functional anatomy of male reproduction

Outline and histological of male reproductive system in; Testis: Cellular functions, germ cell, Spermatogenesis: kinetics and hormonal regulation; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract.

Unit 10: Functional anatomy of female reproduction

Outline and histological of female reproductive system in; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis

Mechanism of parturition and its hormonal regulation; Lactation and its regulation.

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ZOOLOGY PRACTICAL –DSE 1B

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1 . Demonstration of

a) ELISA

b) Immunoelectrophoresis OR

Examination of vaginal smear rats from live animals. [10 Marks]

2. Histological study of spleen, thymus and lymph nodes through slides/ photographs, Histological study of Testes, Ovary of Mammals [5 Marks]

3. Preparation of stained blood film to study various types of blood cells.
ABO blood group determination., Cell counting and viability test from splenocytes of farm bred animal's/cell lines. [5 Marks]

4. Record [5 Marks]

5. Viva [5 Marks]

SUGGESTED READINGS

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 Lechtman H. Andrew (2003.) *Cellular and Molecular Immunology.* V Edition. Saunders Publication.

4.Endocrine and Reproductive Physiology: White and Porterfield, Elsevier Pubn.

SKILL ENHANCEMENT COURSE SEC 4: PUBLIC HEALTH AND HYGIENE

1. Medical fitness–Determine the following: BMI, Blood Pressure, Cholesterol (LDL, HDL) Hemoglobin Complete Blood Picture; Complete urine examination
2. Qualitative identification of carbohydrates, Lipids, vitamins, lipids and minerals,

3. Estimation of fat content and tests milk adulteration.

4. Qualitative and quantitative survey methods in public health sciences.

5. Identification of parasitic stages of malaria and filaria through permanent slides

6. Estimation of blood glucose level in normal and diabetic persons.

7. Project report on Epidemiological survey, different diseases such as Malaria; Chicken gunya; AIDS, Diarrhoea
8. Epidemiological survey of a slum area to identify the diseases due to poor sanitation and contaminated drinking water.
9. Visit to a community water purification and treatment plant.

10. Visit to an industry to study occupational health hazard and safety of industrial workers (sugar/milk dairy/textile/cement).
11. Visit to agricultural fields to study occupational health of farmers and agricultural laborers.

- **Laboratory Record work shall be submitted at the time of practical examination**

Computer aided techniques should be adopted as per UGC guide lines

PUBLIC HEALTH AND HYGIENE (PRACTICAL)

1. Epidemiological survey report of a slum area health status
2. Estimation of ------- from food or water or milk
3. Project work
4. Certified practical record
5. Viva-Voce

Best Wishes for the Students and Teachers……