

SHIVAJI UNIVERSITY, KOLHAPUR

SYLLABUS

For

M.Sc. Zoology
(Semester Pattern)
M. Sc. Sem. I to II



Estd. 1962

'A⁺⁺' Accredited by NAAC (2021)
with CGPA 3.52

Choice Based Credit System
(CBCS)

To be implemented
From

June, 2022 onwards

**Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020) M.Sc. Programme Structure
M.Sc. Part – I (Level-8) Zoology (2022-2023)**

SEMESTER-I (Duration- Six Month)											
CGPA	Sr. No.	Course Code	Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
	1	CC-101	4	4	4	80	32	3	20	8	1
	2	CC-102	4	4	4	80	32	3	20	8	1
	3	CC-103	4	4	4	80	32	3	20	8	1
	4	CCO-104	4	4	4	80	32	3	20	8	1
	5	CCPR-105	16	16	8	200	80 (\$40+40)	*	--	--	--
TOTAL (A)			--	--	24	520	--	--	80	--	--
Non-CGPA	1	AEC-106	2	2	2	--	--	--	50	20	2
SEMESTER-II (Duration- Six Month)											
CGPA	1	CC-201	4	4	4	80	40	3	20	8	1
	2	CC-202	4	4	4	80	40	3	20	8	1
	3	CC-203	4	4	4	80	40	3	20	8	1
	4	CCO-204	4	4	4	80	40	3	20	8	1
	5	CCPR-205	16	16	8	200	80 (\$40+40)	*	--	--	--
TOTAL (B)			--	--	24	520	--	--	80	--	--
Non-CGPA	1	SEC-206	2	2	2	--	--	--	50	20	2
TOTAL (A+B)			--	--	48	1040	--	--	160	--	--

<ul style="list-style-type: none"> • Student contact hour per week: 32 Hours. 	<ul style="list-style-type: none"> • Total Marks for Level 8 M. Sc. I 1200
<ul style="list-style-type: none"> • Theory and practical lectures: 60 minutes Each 	<ul style="list-style-type: none"> • Total credits for Level 8 M. Sc. I (Semester I &II): 48
<ul style="list-style-type: none"> • CC- Core Course • CCO- Core Course Optional • CCPR- Core Course Practical • AEC-Mandatory Non-CGPA compulsory Ability Enhancement Course • SEC- Mandatory Non-CGPA compulsory Skill Enhancement Course 	<ul style="list-style-type: none"> • Practical Examination is annual. • UA: University Assessment • IA: Internal Assessment • Examination for CCPR-105 shall be based on Semester I Practicals. • Examination for CCPR-205 shall be based on Semester II Practicals. • *Duration of Practical Examination as per respective BOS guidelines • <i>Separate passing is mandatory for Theory, Internal and Practical Examination</i>
<ul style="list-style-type: none"> • Requirement for Entry at Level 8: Completed all requirements of the relevant Bachelor's degree (Level 7) with the Principal/Major subject: Zoology 	
<ul style="list-style-type: none"> • Exit Option at Level 8: Students can exit after Level 8 with Post Graduate Diploma in Zoology if he/she completes the courses equivalent to a minimum of 48 credits. 	
<p>\$ For passing in Practical I, student must score minimum 40 marks out of 100 in practical examination based on CC101 & CC102 and minimum 40 marks out of 100 in practical examination based on CC103 & CCO104.</p> <p>For passing in Practical II, student must score minimum 40 marks out of 100 in practical examination based on CC201 & CC202 and minimum 40 marks out of 100 in practical examination based on CC203 & CCO204.</p>	

**M.Sc. Programme Structure of Zoology
Part – I (CBCS pattern) (2022-2023)**

Sr. No.	Course Code	Course Title	Credits
SEMESTER - I			
1	CC-101	Biosystematics and Biodiversity	4
2	CC-102	Applied Entomology	4
3	CC-103	Molecular Cell Biology	4
4	CCO-104	Ecology and Environmental Pollution	4
SEMESTER - II			
5	CC-201	Physiological Chemistry	4
6	CC-202	Bioinstrumentation and Biostatistics	4
7	CC-203	Anatomy and Physiology	4
8	CCO-204	Biology of Parasites	4
PRACTICAL ANNUAL			
9	CCPR-105	Practical – I (Based on CC-101, 102, 103 & CCO104)	8
10	CCPR-205	Practical – II (Based on CC-201, 202, 203 & CCO204)	8
Total Credits			48

M. Sc. Zoology
Choice Based Credit System
M. Sc. I, Sem.- I

CC-101: Biosystematics and Biodiversity

Unit I: (15 Hrs.)

Taxonomy:

Introduction to taxonomy, Stages and importance of taxonomy, Problems, Aim and Tasks of Taxonomy.

Modern Trends in Taxonomy:

Morphological approach, Immature stages and Embryological approach, Ecological, behavioural and Cytological approach, Biochemical and Numerical taxonomy.

Kinds of Classification.

Phenetic classification, Natural classification, Phylogenetic classification, Evolutionary classification, & Omnispective classification

Unit II: (15 Hrs.)

Concept of species:

Introduction, Typological, Biological, Nominalistic, Evolutionary and recognition species concept with conclusions, Species and their number, polytypic species, Subspecies, other infraspecific group, super species, taxonomic identification.

Zoological nomenclature:

Origin of the code, International Code of Zoological Nomenclatures, Rules of Nomenclature.

Unit III: Biodiversity Science (15 Hrs.)

Biodiversity- Concept, definition and types of biodiversity, Biodiversity at global, country and local levels, Endemism and Hotspots.

Major drivers of biodiversity change- Evolution of biodiversity, Factors promoting high diversity,

Biodiversity analysis: Measurement of Bio-diversity – Biodiversity indices, computation of biodiversity by computer software, Uses and Importance of Biodiversity.

Unit IV: Biodiversity Conservation (15 Hrs.)

Threats to Biodiversity - Causes of biodiversity loss, Listing of threatened biodiversity,

Strategic Species Concept: Keystone species, Indicator species, Umbrella species and Flagship species.

Conservation strategies- In-situ and Ex- situ conservation methods, conservation through gene banking preservation, Role of NGOs, Colleges and Universities in biodiversity conservation.

Recommended Books:

1. Alston, R.E. and B.L. Turner (1963): Biochemical systematic Prentices Hall Inc. Englewood Cliffs, N.J. 404 pp.
2. Avise, J.C. (1974): Systematic value of Electrophoretic data. Syst. Zool. 23 (4): 465 – 481.
3. Benazzi, M. (1973): Cytotaxonomy and evolution, General remarks vertebrate evolution. Ed. A.B. Chiarelli and Campus Academic Press, London and N.Y. pp. 1-

- 3.
4. Blomback, B and M. Blomback (1968): Primary structure of animal proteins as a guide in taxonomic studies. In chemitaxonomy and serotaxonomy (ed.) Hawkers pp. 3 – 20.
5. Camp, W.H. (1951): Biosystematics Britania 7: 113 – 127.
6. Huxley, J.S. (ed.) The New Systematics Oxford Univ. Press London 538 pp.
7. Jeffrey, C. (1977): Biological nomenclature Indian Ed. Oxford and IBH Pub. Co. NewDelhi 72 pp.
8. Mayr, E. (1969): Proinciples of systematics Zoology Mc. Graw Hill N.Y. 428 pp.
9. Mayr, E. and E.G. Linsley and R.L. Usinger (1953): Methods and Principles of systematic Zoology, Mc Graw Hill N.Y. 328 pp.

M. Sc. Zoology
Choice Based Credit System
M. Sc. I, Sem.- I
CC-104: Applied Entomology

Unit I: (15 Hrs.)

1. Study of generalized insect: Grasshopper (Morphology and Anatomy, brief Account).
2. Types of Insect pests: Definition with suitable examples.
3. Types of Forest pests: Defoliators, Sapsuckers, Borers of trees, spike disease of Sandal, Soil insects damaging forest trees, control methods of forest pests.

Unit II: (15 Hrs.)

1. Stored grain pests: Rice weevil, Rice moth, Khapra beetle, Pulse beetle, Rust red floor beetle, Angoumois grain moth.
2. Veterinary entomology: Farm animal pests- Horse fly, Blowfly, Stable fly, Louse fly, Warble fly, Screw worm, Cattle louse, bird louse, Flea

Unit III: (15 Hrs.)

Sericulture: History of Sericulture, Life cycles of Mulberry and Non-mulberry Silkworms, Rearing technology of mulberry silkworm, Diseases and pests of Mulberry silkworm, Moriculture and cultural practices, Diseases and pests of Mulberry.

Unit IV: (15 Hrs.)

1. Apiculture: The honey bees, Social organization of honey bees, Life history of honey bees, Methods of bee keeping.
2. Lac culture: Lac insect- Taxonomy, distribution and life history, Host plants and lac insects, Strains of lac insect and their propagation, Cultivation practices, Lac extraction and uses.
3. Forensic entomology: History, Corpse associated arthropod classes, Role of arthropods in forensic entomology, Examples.
4. Nutritional entomology: Advantages of eating insects (Entomophagy), Examples of insects generally consumed, Nutritional value, Entomophagy as a source of income.

Suggested Readings:

1. A text book of Applied Entomology, vol.2 - K. P. Srivastava, 1996.
2. Modern Entomology. D. B. Tembhare 2013.
3. Sericulture and Pest Management – T.V. Sathe and A.D. Jadhav, 2001.
4. Introduction to General and applied entomology. V. B. Awasthi.2017
5. Agricultural Pests of India and South East Asia – A.S. Atwal, 1993.
6. Beekeeping in the tropics – G.S. Smith, 1960.
7. Beekeeping in India, ICAR, New Delhi, S. Singh, 1975.

8. Lac culture in India farm information unit, DEMOFA, New Delhi, S. Krishnaswami,

9. Elements of Entomology- Rajendrasingh.2004

M. Sc. Zoology
Choice Based Credit System
M. Sc. I, Sem.- I
CC-103: Molecular Cell Biology

Unit I: The Interphase Nucleus, Chromatin, and the Chromosome (15 Hrs.)

The ultrastructure of interphase nucleus, nuclear envelope, and nuclear pore complex, Nuclear import and export, Nucleolus.
The DNA structure, Histone proteins, Packaging of DNA into chromatin.
Euchromatin and Heterochromatin, The C-value paradox,
Fine structure and classification of chromosomes.

Unit II: Membrane transport, protein sorting and vesicular trafficking (15 Hrs.)

Biomembrane structure and functions
Transport of Ions and Small Molecules across the membrane
transcellular transport
Cell-cell junctions and their significance
Protein sorting and vesicular trafficking

Unit III: Cellular Respiration and Degradation (15 Hrs.)

Mitochondria: Biogenesis, membrane differences, structure, and functions.
Lysosomes: Origin, structural polymorphism and functions
Peroxisomes: Biogenesis, ultrastructure and functions.
Endosomes: Late and early endosomes, assembly structure, and functions
Proteasomes: Types, assembly structure and functions.

Unit IV: Cytoskeleton, Cell signalling and Cell division (15 Hrs.)

Cytoskeletal elements: microtubules, microfilaments, intermediate filaments and associated motor proteins

Cell signalling: Features of signal transduction, Molecular Mechanisms of Signal Transduction, Gated Ion Channels, Receptor Enzymes, G Protein-Coupled Receptors and Second Messengers, Regulation of Transcription by Steroid Hormones, Signalling by Mechanoreceptors, pain receptors, Taste receptors and olfactory receptors.

Cell Division: Cell cycle regulation, cyclin dependent kinases and check point pathways, Extracellular and Intracellular Cues Regulating Entry into Meiosis.

Reference books:

1. Molecular biology of the Cell –Bruce Alberts
2. Molecular Cell biology – Lodish
3. The cell: A molecular approach - Cooper
3. Molecular cell biology – Gerald carp

M. Sc. Zoology
Choice Based Credit System
M. Sc. I, Sem.- I

CCO-104: Ecology and Environmental Pollution

Unit I: Community Ecology: (15 Hrs.)

- 1. Habitat and Niche:** Concept and types of habitats, Ecological niche, Niche width and overlap.
- 2. Species interaction:** Types of interactions, Interspecific competition, Symbiosis.
- 3. Community ecology:** Types and nature of communities, composition of community, Community dominance, edge and ecotones.
- 4. Population Ecology:** Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection).

Unit II: Ecosystem Ecology: (15 Hrs.)

- 1. Ecological Succession:** Characteristics, Types and Patterns of succession, Climax.
- 2. Energy in ecosystem:** Productivity and energy flow, energy partitioning.
- 3. Environmental Impact Assessment:** concept process and evaluation methodology.

Unit III: (15 Hrs.)

- 1. Environmental Pollution-** Concept, sources of pollution and nature of pollutants, pollution monitoring.
- 2. Air Pollution:** Air pollutants, sources, effects of air pollution.
- 3. Smog-** formation, Classical smog and industrial pollution, photochemical smog and vehicular emission. Prevention and control of air pollutants.

Unit IV: (15 Hrs.)

- 1. Water pollution-** Sources of water pollution, Nature of water pollutants and their effects, sewage treatment.
- 2. Agricultural pollution-** Farm animal waste, Soil erosion plants residues, agrochemical- fertilizers and pesticides.
- 3. Radioactive pollution-** types, sources and effects of radiation.
- 4. Noise Pollution-** Concept, sources, effects, noise pollution act.

Suggested Readings:

1. Fundamentals of Ecology- Dash and Dash.
2. Basic Ecology- Odum E. P
3. Fundamentals of Ecology- Odum E. P
4. Modern concepts of ecology- K. D. Kumar.
5. Concepts of Ecology- H. D. Kumar.
6. Ecology - P. D. Sharma.
7. Environmental pollution Half, Rinehart and Winston, New York (1977) Laurent Hodges.
8. Pandey Kamleshwar., Shuklar J. P. and Trivedi S. P. (2005): Fundamental of Toxicology. New Central book agency PVT. LTD. Kolkata.
9. Santra S. C. (2008). Environmental Science. New central Book Agency (p) Ltd. Hawrda.

M. Sc. Zoology
Choice Based Credit System
M. Sc.-I, Sem.-II
CC-201: Physiological chemistry

Unit I: Chemical foundations of Biology (15 Hrs.)

Structure of atom,
Types of bonds, Van der Waal's electrostatic forces of attraction, hydrophobic interactions.
Chemical structure and properties of water, pH, pKa, buffers,
Thermodynamics in biological system: Enthalpy, Entropy and Gibb's free energy.

Unit II: Carbohydrate metabolism (15 Hrs.)

Structure, classification and functions of carbohydrates,
Glycolysis, regulation and energetics,
TCA cycle, regulation and energetics,
Electron transfer system structure and mechanism of action, oxidative phosphorylation and ATP generation,
Glycogenesis, glycogenolysis and gluconeogenesis
Pentose phosphate pathway and its significance

Unit III: Amino acids, Proteins and nucleic acids (15 Hrs.)

Amino acids: Classification of amino acids, biosynthesis and Oxidation of amino acids.

Proteins: Protein structure and functions: Primary, secondary, tertiary and quaternary structure
Nucleic acids: Structure of nucleotides. Structure of DNA and RNA, De novo and salvage pathway of synthesis of nucleotides

Unit IV: Lipid metabolism (15 Hrs.)

Lipids- structure, classification and functions, Steroidal hormones: structure and functions.
Catabolism of fatty acid – Beta oxidation, Carnitine shuttle, Significance of beta oxidation.
Bioenergetics of Beta oxidation
Biosynthesis of saturated and unsaturated fatty acids.
Biosynthesis of triglycerides,
Biosynthesis of membrane phospholipids.
Biosynthesis of cholesterol
Biosynthesis of prostaglandins and leukotriene Lipoprotein metabolism

Reference Books

1. Lehninger-Principles of Biochemistry: Nelson and Cox
2. Biochemistry:, Tymoczko, Berg, Stryer
3. Review of physiological chemistry: H. Harper

M. Sc. Zoology
Choice Based Credit System
M. Sc.-I, Sem.-II
CC-202: Bioinstrumentation and Biostatistics

Unit I: (15 Hrs.)

Separation techniques:

1. **Centrifugation techniques.** Basic principles of sedimentation and centrifuges and their uses, differential centrifugation, density gradient centrifugation.
2. **Chromatographic techniques** – Chromatography theory & practices, Molecular Sieve chromatography, affinity chromatography, ion exchange chromatography, HPLC, GLC, Thin layer chromatography.
3. **Electrophoretic techniques** – General principles, support media, electrophoresis of proteins and nucleic acids, Isoelectric focusing.

Unit II: (15 Hrs.)

1. **Spectroscopic techniques:** UV and Visible light Spectroscopy, Spectrofluorimetry.
2. **Microscopic techniques:** Light microscope, phase contrast microscope, fluorescence microscope, Electron Microscope (SEM & TEM).
3. **Immunological techniques-**Immunoprecipitation, Labelling antibodies, immunoblotting, immunoassays, immunohisto/cytochemistry.

Unit III: Descriptive statistics (15 Hrs.)

1. Application of statistics in Biology.
2. Measures of Central tendency: Arithmetic mean, mode and median.
3. Measures of dispersion: Range, quartile deviation, mean deviation, Standard deviation, coefficient of variation.
4. **Correlation:** Types and methods of correlation.
5. **Regression:** Regression lines and coefficients.

Unit IV: Inferential Statistics (15 Hrs.)

1. **Probability-** Introduction, addition and multiplication theory.
2. **Probability distribution-** Binomial, Poisson and Normal.
3. **Hypothesis testing:**
 - a. Tests of Significance.
 - b. Null hypothesis.
 - c. Alternative hypothesis.
 - d. Level of significance and Confidence interval.
4. **Student t-test, Chi- square test (χ^2).**
5. **Analysis of Variance (ANOVA) and Analysis of Molecular Variance (AMOVA).**

References Books:

1. Practical Biochemistry By Wilson and Walker
2. Cell : A molecular approach By Cooper
3. Molecular Biology of the Cell by Lodish et al.
4. Fundamentals of Statistics- Gupta S. C.
5. Basic Biostatistics and its applications- Datta A. K
6. Biostatistics and Biometry- Parihar and Parihar.
7. An Introduction to statistical Methods- C. B. Gupta.
8. Introduction to Biostatistics by Larry Winner, Department of Statistics, University of Florida.

M. Sc. Zoology
Choice Based Credit System
M. Sc.-I, Sem.-II

CC-203: Anatomy and Physiology

Unit I: Physiology of Digestive System: (15 Hrs.)

- 1.1 Anatomy and physiology of gastrointestinal tract, Salivary gland, Pancreas and Liver.
- 1.2 Digestion and absorption in gastrointestinal tract
- 1.3 Balanced diet, obesity and starvation.
- 1.4 Vitamins and their role in nutrition.

Unit II: Physiology of Respiration: (15 Hrs.)

- 2.1 Anatomy and physiology, respiratory tract and pulmonary ventilation.
- 2.2 Pulmonary air volumes and capacities.
- 2.3 Exchange of Oxygen and carbon dioxide.
- 2.4 Control of respiration.

Unit III: Physiology of Circulation: (15 Hrs.)

- 3.1 Blood, Composition of blood, blood coagulation.
- 3.2 Blood groups and blood transfusion.
- 3.3 Anatomy and physiology Heart and blood vessels, Heart blood supply.
- 3.4 Conduction system and pace maker.
- 3.5 Electrocardiogram, Cardiac Cycle and heart sound.

Unit IV: Physiology of Excretion and Endocrine System: (15 Hrs.)

- 4.1 Anatomy and physiology of the kidneys, nephron and mechanism of urine formation.
- 4.2 Urinary bladder, process of micturation, Hemodialysis and Artificial kidney.
- 4.3 Anatomy and physiology of Pituitary gland and Adrenal gland.
- 4.4 Anatomy and physiology of Thyroid and Parathyroid gland.

Reference:

1. Human Physiology – by A.C. Guyton. Saunders Company London, Toronto.
2. Shepherd G.M. Neuro Biology, New York Oxford University Press 1987.
3. Hurst J.W et al (eds) The Heart 7th ed. New York McGraw- Hill Book Co. 1990.
4. Hand Book of Physiology Vols. Circulation. Renkin, E.M. & Michel, C.C. (eds) American Physiological Society, 1984.
5. Guyton A.C. et al. Circulation Overall regulation Annu Re. Physiol. 34: 13 1972.
6. Guyton A.C. 1980 Arterial pressure & Hypertension Philadelphia, W.B. Saunders Co- Cartiar output & its regulation 1973.
7. Kaplan N.M. et al 1989- The Kidney in Hypertension (Perspectives in hypertension vol.2) New York. Raven Press.
8. Guyton A.C. et al 1975 Dynamics & Control of the Body fluids Philadelphia, W.B. Saunders, Co., 1975.
9. Brenner B.M. & Rector, F.C. (Jr) 1986. The kidney 3rd ed. Philadelphia, W.B. Saunders Co., 1986.
10. Brooks V.B. 1986. The neural Basis of motor control New York, Oxford University press.
11. Johnson L.R. et al Physiology of the gastrointestinal tract 1987 New York Raven press.
12. Thompson J.C. et al (eds) Gastrointestinal Endocrinology. New York McGraw Hill book co., 1987.

13. Setchell K.D.R. et al eds 1988. The Bile Acids New York Plenum Pub. Corp.
14. Guthrie H.A. 1988. Introductory Nutrition 7th ed. St.Louis C.V. Mosby Co.,
15. Felig P et al (eds) 1987. Endocrinology & Metabolism New York MacGraw- Hill Book Co.,
16. DeGroot L.J. et al 1989. Endocrinology 2nd ed. Philadelphia, W.B. Saunders Co. 1989.
17. Kannan, C.R. 1988. The adrenal gland New York Plenum Pub. Corp.

M. Sc. Zoology
Choice Based Credit System
M. Sc. I, Sem. II
CC-204: Biology of Parasites

- Unit I: General parasitology** (15 Hrs.)
- i. Animal association, Types of Parasites, Types of Hosts,
 - ii. Mode of transmission of parasite, Host specificity and parasitic adaptation.
 - iii. Molecular, cellular and physiological basis of host-parasite interactions with special emphasis on malarial, dengue and chicken guinea.
- Unit II: Vector parasitology:** (15 Hrs.)
- i) Definition, types, Epidemiology,
 - ii) Arthropods as vectors of medical and veterinary importance: Human louse, bed bug, Triatomid bugs, Black flies, Sand flies, Mosquitoes, Horse flies, House flies, Tsetse fly, Stable fly, Hippobosca, Warble fly, Crew worm fly, Rat flea, ticks and mites.
 - iii) Chemical, biological and environmental control of vectors.
- Unit III: Study of parasites with respect to their general life cycle from-** (15 Hrs.)
1. Protozoa: Body fluid parasites: Trypanosoma and Leishmania of humans.
Intestinal parasites: Giardia, Trichomonas, Gregarina.
 2. Cestoda: Taenia, Diphilobothrium, Diphyliidium, Echinococcus.
- Unit IV: Study of parasites with respect to their general life cycle from-** (15 Hrs.)
- i. Trematoda : Schistosomo, Faciola, paragonimus, Opisthorchis.
 - ii. Nematoda: Wuchereria, Ancylostoma, Strongyloides, Entrobilus.
 - iii. Plant & Soil nematodes: Cyst nematode, citrus nematode.
 - iv. Entomo Pathogenic Nematodes (EPNs).

Recommended Books:

1. Parasitology – By Ramnik sood, C.B.S. Publisher, New Delhi –1993.19
2. Parasitology – By K.D. Chaterjee, Medical Pulisher Calcutta, 1987.
3. Physiology of parasites – By L.S. Chapell, John, Willey & Sions N.Y. (1980).
4. Parasitology – By Hobler, E.R. and Noble, G.A. (1982) 2nd Ed. Lea & Febieger U.S.A.
5. Parasitism & Symbiology – By C.P. Read (1970) Ronald Press New York.
6. Foundation of Parasitology – By Schmidt, G.D. & Robert, L.S. (1981) 2nd Ed. C.V. Mosby Co. St. Lohis ISSR.
7. Introduction Animal Parasitology – By Smit. D.G. (19977) 2nd Ed. Johns Willey Sons New York.
8. The Biology of parasitism and introduction to the study of associate organism- by White field, P.J. (1977) University Parks Press Baltimore.
9. Animal Parasitism – by Read C.P. Prenters Hall of India Pvt. Ltd., New Delhi.
10. Helminths, Arthropods & Protozoo of domesticated Animals. By E.J.L. soulsby, ELBS publication London Ed. 1969 ed.
11. Parasitology – by Chandler and Chands, A Text book of Parasitology by S.S. Kelkar and Rohini S. Kelkar, Bombay popular prakashan.
12. Parasitology – By Ramnik sood, C.B.S. Publisher, New Delhi – 1993.
2. Parasitology – By K.D. Chaterjee, Medical Pulisher Calcutta, 1987.
3. Physiology of parasites – By L.S. Chapell, John, Willey & Sions N.Y. (1980).

4. Parasitology – By Hobler, E.R. and Noble, G.A. (1982) 2ndEd. Lea & Febieger U.S.A.
5. Parasitism & Symbiology – By C.P. Read (1970) Ronald Press New York.
6. Foundation of Parasitology – By Schmidt, G.D. & Robert, L.S. (1981) 2nd Ed. C.V. Mosby Co. St.Lohis ISSR.
7. Introduction Animal Parasitology – By Smit. D.G.(19977) 2ndEd. John Willey Sons, New York.
8. The Biology of parasitism and introduction to the study of associate organism- by White field, P.J. (1977) University Parks Press Baltimore.
9. Animal Parasitism – by Read C.P. Prenters Hall of India Pvt. Ltd., New Delhi.
10. Helminths, Arthropods & Protozoo of domesticated Animals. By E.J.L. souls by, ELBS publication London Ed. 1969 ed.
11. Parasitology – by Chandler and Chands,
12. A Text book of Parasitology by S.S. Kelkar and Rohini S. Kelkar, Bombay popular prakashan.

M. Sc. Zoology
Choice Based Credit System
M. Sc.-I, Sem.-I
CCPR-105: Practical – I

A) Practical based on CC-101 & CC-102

1. Study of museum specimens and slides invertebrates phyla (one representative from each class) for biosystematics & biodiversity.
2. Study of museum specimens of chordates phylum (one representative from each class) for biosystematics and biodiversity.
3. Study of plant groups with respect to biodiversity.
4. Identification of insects/ molluscs with the help of keys up to orders.
5. Identification of insects/ molluscs with the help of keys up to families.
6. Identification of animals with the help of keys up to families (fish/ amphibian with the help of preserved specimens / models / pictures).
7. Methods of collection and preservation of animals.
8. Visit to ZSI/ fields.
9. Study of endangered species. (Models, pictures, charts.).
10. Study of adaptations in animals from pieces, amphibian, reptilian, birds & mammals (2-3 examples from each).
11. Visits to sanctuaries and National parks to study wild life management.
12. Harnessing information through Internet regarding Biodiversity.
13. Study of generalized insect. Identification economic importance of following insect pests (6-8 pests from each category)
14. Pests of stored gains.
15. Household pests.
16. Pests of medical importance.
17. Pests of veterinary importance.
18. Forest pests.
19. Types of silk moths.
20. Rearing appliances of mulberry silk worm and demonstration.
21. Study of forensic insects
22. Study of nutritional insects.
23. Life cycle and types of honey bees.
24. Lac insect economic importance.

25. Field visit for demonstration of pest damage.
26. Field visit for collection of insects.
27. Any other practical set by concern teacher.

B) Practical based on CC-103 & CCO-104

1. Demonstration of extracellular material
 - a. Collagen
 - b. Elastin
2. Demonstration of Glycosaminoglycans in the extracellular material using
 - a. AB-1
 - b. AB-2.5
 - c. PAS
 - d. AF +AB 2.5 (Sialic Acid)
 - e. Influence of MgCl₂ on alcinophilia.
3. Demonstration of Nucleus by
 - i) Basic Dyes: TB, HE, Methylene blue.
 - ii) Feulgen reaction Effect of temperature
4. Lysosome demonstration (Acid phosphatase and any other method)
5. Golgi bodies demonstration (Cajal Method)
6. Demonstration of mitochondria
7. Effect of tonicity of solutions on plasma membrane –
 - a) Isotonic, Hypotonic, Hypertonic
 - b) Fragility test of RBC & Osmotic Resistance.
8. Study of community character by Quadrant & transect method.
9. Study of ecosystem (Soil, water, forest).
10. Study of inter relationships parasitism, symbiosis, commensalisms (2-3 examples from each).
11. Determination of DO, CO₂ Hardness, Chloride, Alkalinity of freshwater and sewage water.
12. Determination of COD of sewage water.
13. Determination of BOD of sewage water.
14. Estimation of inorganic phosphate and nitrate from water sample.
15. Qualitative and quantitative estimation of Zooplankton.
16. Detection of heavy metal from the water sample.
17. Any other experiment set by the concerned teacher

M. Sc. Zoology

Choice Based Credit System

M. Sc.-I, Sem.-II

CCPR-205: Practical - II

A) Practical based on CC-201 & CC-202

1. Estimation of glycogen.
2. Estimation of lipids & phospholipids.
3. Estimation of Vitamin C.
4. Estimation of Cholesterol.
5. To find saponification value for a given fat.
6. Preparation of phosphate buffer pH measurement.
7. To estimate free amino acids by Ninhydrin method.
8. To estimate protein content by Biuret method/ Lowry et.al./ Bradford method.
9. Estimation of glucose.
10. Estimation of casein from milk.
11. Estimation of Uric acid
12. Extraction of Starch.
13. Extraction of Glycogen.
14. Determination of λ max of given solution.
15. Separation of amino acids from mixture by paper chromatography.
16. Separation of nuclei by differential centrifugation.
17. Estimation of DNA by UV absorption.
18. Separation of proteins by electrophoresis.
19. Separation of lipids by thin layer chromatography.
20. Examples based on Chi-square test & student t-test.
21. Examples based on regression.
22. Examples based on Correlation coefficient.
23. Examples based on Coefficient of variance.
24. Examples based on ANOVA.
25. Examples based on Probability.
26. Any other practical set by the department.

B) Practical based on CC-203 & CC-204

1. Determination of Bleeding time
2. Determination of Clotting time

3. Estimation of Hemoglobin (Hb) concentration and oxygen carrying capacity
4. Enumeration of Red blood corpuscles (R.B.C)
5. Enumeration of white blood corpuscles (W.B.C)
6. Differential count of W.B.C.
7. Erythrocyte sedimentation rate (E.S.R)
8. Detections of digestive enzymes
9. Anatomy and histology of digestive and endocrine glands
10. To estimate amylase from saliva
11. To study normal constituents of urine
12. Measurement of breathing rate, heart beat and study of heart sound.
13. Collection of parasites: Protozoans/ Nematodes/ Helminthes/ Insects.
14. Preservation and Identification of parasites: Protozoans
15. Preservation and Identification of parasites: Nematodes
16. Preservation and Identification of parasites: Helminthes
17. Preservation and Identification of parasites: Insects
18. Lifecycle studies of parasites: Protozoans
19. Lifecycle studies of parasites: Nematodes
20. Lifecycle studies of parasites: Helminthes
21. Lifecycle studies of parasites: Insects
22. Any other practical set by concern teacher.

**Examination Pattern:
Pattern of Theory paper**

There will be five descriptive questions, each carrying 16 marks.

Que. 1 Descriptive Question from Unit I	16
OR	
Descriptive Question from Unit I	
Que. 2 Descriptive Question from Unit II	16
OR	
Descriptive Question from Unit II	
Que. 3 Descriptive Question from Unit III	16
OR	
Descriptive Question from Unit III	
Que. 4 Descriptive Question from Unit IV	16
OR	
Descriptive Question from Unit IV	
Que. 5 Write notes on (Any two)	16
a. From Unit I	
b. From Unit II	
c. From Unit III	
d. From Unit IV	

Practical I based on CC101, CC102, CC103 and CCO 104 **200 marks**

Practical examination Based on CC101 and CC102 **100 marks**

Que. 1 Experiment/Experiments Based on CC101	20
Que. 2 Experiment/Experiments Based on CC101	20
Que. 3 Experiment/Experiments Based on CC102	20
Que. 4 Experiment/Experiments Based on CC102	20
Que. 5 <i>Viva voce</i>	10
Que. 6 Journal	10

For passing, student must score minimum 40 marks out of 100 in practical examination based on CC101 and CC102.

Practical examination Based on CC103 and CCO 104 **100 marks**

Que. 1 Experiment/Experiments Based on CC103	20
Que. 2 Experiment/Experiments Based on CC103	20
Que. 3 Experiment/Experiments Based on CCO 104	20
Que. 4 Experiment/Experiments Based on CCO 104	20
Que. 5 <i>Viva voce</i>	10
Que. 6 Journal	10

For passing, student must score minimum 40 marks out of 100 in practical examination based on CC103 and CCO104.

Practical II based on CC201, CC202, CC203 and CCO 204 200 marks

Practical examination Based on CC201 and CC202 100 marks

Que. 1 Experiment/Experiments Based on CC201	20
Que. 2 Experiment/Experiments Based on CC201	20
Que. 3 Experiment/Experiments Based on CC202	20
Que. 4 Experiment/Experiments Based on CC202	20
Que. 5 <i>Viva voce</i>	10
Que. 6 Journal	10

For passing, student must score minimum 40 marks out of 100 in practical examination based on CC201 and CC202.

Practical examination Based on CC203 and CCO 204 100 marks

Que. 1 Experiment/Experiments Based on CC203	20
Que. 2 Experiment/Experiments Based on CC203	20
Que. 3 Experiment/Experiments Based on CCO204	20
Que. 4 Experiment/Experiments Based on CCO204	20
Que. 5 <i>Viva voce</i>	10
Que. 6 Journal	10

For passing, student must score minimum 40 marks out of 100 in practical examination based on CC203 and CCO204.