

SHIVAJI UNIVERSITY, KOLHAPUR

SYLLABUS

For

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



Choice Based Credit System
(CBCS)

To be implemented
From

June, 2019 onwards

M.Sc. Programme Structure of Zoology
Part – I (CBCS pattern) (2019-2020)

SEMESTER – I (Duration 6 months)

	Sr. No	Course Code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Internal Assessment		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam Hours
CGPA	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	CC-104	4	4	4	80	32	3	20	8	1
	5	CCPR-105	16	16	8	200	80	--	--	--	*
TOTAL (A)			--	--	24	520	--	--	80	--	--
Non-CGPA	1	AEC-106	2	2	2	--	--	--	50	20	2
SEMESTER – II (Duration 6 months)											
CGPA	1	CC-201	4	4	4	80	32	3	20	8	1
	2	CC-202	4	4	4	80	32	3	20	8	1
	3	CC-203	4	4	4	80	32	3	20	8	1
	4	CC-204	4	4	4	80	32	3	20	8	1
	5	CCPR-205	16	16	8	200	80	--	--	--	*
TOTAL (B)			--	--	24	520	--	--	80	--	--
Non-CGPA	1	SEC-206	2	2	2	--	--	--	50	20	2
Grand Total (A+B)			--	--	48	1040	--		160	--	--

<ul style="list-style-type: none"> • Student contact hour per week: 32 hrs (Min.) 	<ul style="list-style-type: none"> • Total Marks for M. Sc. I : 1200
<ul style="list-style-type: none"> • Theory lectures: 60 minutes Each 	<ul style="list-style-type: none"> • Total credits for M. Sc. I (Semester I &II): 48
<ul style="list-style-type: none"> • CC- core course • CCPR- core course practical • Course list as per enclosed Annexure. • 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. • 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</i>

M.Sc. Programme Structure of Zoology
Part – I (CBCS pattern) (2019-2020)

Sr. No.	Course Code	Course Title	Credits
SEMESTER - I			
1	CC-101	Biosystematics and Biodiversity	4
2	CC-102	Ecology and Environmental Pollution	4
3	CC-103	Molecular Cell Biology	4
4	CC-104	Applied Entomology	4
SEMESTER - II			
5	CC-201	Physiological Chemistry	4
6	CC-202	Bioinstrumentation and Biostatistics	4
7	CC-203	Anatomy and Physiology	4
8	CC-204	Biology of Parasites	4
PRACTICAL ANNUAL			
9	CCPR-105	Practical – I (Based on CC-101, 102, 103, 104)	8
10	CCPR-206	Practical – II (Based on CC-201, 202, 203, 204)	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.)

- 1. Taxonomy:** Introduction to taxonomy, Stages and importance of taxonomy; Problems, Aim and Tasks of Taxonomy.
- 2. Modern Trends in Taxonomy:** Morphological approach, immature stages and Embryological approach, Ecological, behavioural and Cytological approach, Biochemical and Numerical taxonomy.
- 3. Kinds of Classification.**

Unit II: (15 Hrs.)

- 1. 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.
- 2. Zoological nomenclature:** Origin of the code, international code of Zoological nomenclatures rules of nomenclature.

Unit III: (15 Hrs.)

- 1. Biodiversity Science.** Concept, definition and types of biodiversity, Biodiversity at global, country and local levels. Evolution of biodiversity, Factors promoting high diversity, Endemism and Hotspots, Measures of Bio-diversity, computation of biodiversity by computer software, Uses and Importance of Biodiversity.

Unit IV: Biodiversity Conservation. (15 Hrs.)

Listing of threatened biodiversity, causes of biodiversity loss, 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. New Delhi 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.

10. Strickland, H.E. (1842): Rules of Zoological nomenclature Report of the 12th meeting of British Association held at Manchester in 1842 Brit. Assoc. Adv. Sci. Rept. 1842: 7 – 18.
11. Ernst Mayr (1969): Principles of Systematics Zoology TMH Ed. Tata McGraw Hill Publishing company Ltd. Bombay New Delhi.
12. Ray Samit and Ray A.K. (2006): Biodiversity and Biotechnology New Central Book Agency (P) Ltd. Wilson, E.O.: Biodiversity.
13. Knudsen, J.W.: Biological techniques collecting preserving and illustrating plant and animals.
14. Black Welder, R.E. and Blair W.F. Guide to the Taxonomic literature of vertebrates.
15. Alexander, R.M. The Chordate.
16. Waterman, A.J. Chordate
17. K. V. Krishnamurthy. An advance Text book on Biodiversity
18. Ray and Ray. Biodiversity and Biotechnology
19. Mandal and Nandi. Biodiversity
20. Kaushik and Kaushik. Perspective in environmental studies.
21. K. C. Agarwal. Biodiversity.
22. V. C. Kapoor. Theory and practice of animal taxonomy.

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M. Sc. I, Sem.- I

CC-102: Ecology and Environmental Pollution

Unit I: (15 Hrs.)

- 1. Habitat and Niche:** Concept and types of habitat, 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.

Unit II: (15 Hrs.)

- 1. Ecological Succession:** characteristics, Types and Patterns of succession, Climax.
- 2. Ecosystem:** Structure and Functions of ecosystem, Primary production.
- 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.

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M. Sc.-I, Sem.- I
CC-103: Molecular Cell Biology

Unit I: Nucleus, chromatin, chromosome and nuclear transport (15 Hrs.)

Ultrastructure of nucleus: Interphasic nucleus, Nuclear envelope and nuclear pore complex, nucleolus, Nuclear import and nuclear export

Structure of DNA, Packaging of DNA into chromatin and Fine structure of chromosome

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

Biomembrane structure and functions

Transmembrane Transport of Ions and Small Molecules

Cell-cell junctions, transcellular transport

Protein sorting and vesicular trafficking

Unit III: Cellular respiration & degradation: (15 Hrs.)

Mitochondria: Ultra Structure and functions.

Peroxisomes: Ultrastructure and functions.

Endosomes : Late and early endosomes, structure, assembly & functions

Lysosomes: Structure, polymorphism and functions

Proteasomes: Types, structures & functions.

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

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

Cell signalling: Molecular Mechanisms of Signal Transduction, Gated Ion Channels, Receptor Enzymes, G Protein-Coupled Receptors and Second Messengers Regulation of Transcription by Steroid Hormones

Cell cycle regulation, cyclin dependent kinases and check points

Reference Book:

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

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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

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M. Sc.-I, Sem.-II
CC-201: Physiological chemistry

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

Structure of atoms, molecules and chemical bonds, Van der Waal's electrostatic forces of attraction, hydrogen bonding and hydrophobic interactions. Chemical structure and properties of water, pH, pKa, buffers, reaction kinetics, dissociation and association constants, Physical constants, thermodynamics in biological system: Enthalpy, Entropy and Gibb's free energy

Unit II: Carbohydrate metabolism (15 Hrs.)

Structure, classification and functions of carbohydrates, Glycolysis, TCA cycle, Electron transfer system structure and mechanism of action, oxidative phosphorylation and ATP generation, Bioenergetics of glucose catabolism, glycogenesis, glycogenolysis, gluconeogenesis and Pentose phosphate pathway

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, Biosynthesis of purine and pyrimidine nucleotides

Unit IV: Lipid metabolism (15 Hrs.)

Lipids- structure, classification and function, Catabolism of fatty acid – Beta oxidation, 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, Steroidal hormones- structure and functions.
 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

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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. **Probability**- Introduction, addition and multiplication theory.
5. **Probability distribution**- Binomial, Poisson and Normal.

Unit IV: Inferential Statistics (15 Hrs.)

1. **Correlation:** Types and methods of correlation.
2. **Regression:** Regression lines and coefficients.
3. **Hypothesis testing:**
 - 3.1 Tests of Significance.
 - 3.2 Null hypothesis.
 - 3.3 Alternative hypothesis.
 - 3.4 Level of significance and Confidence interval.
4. **Student t-test.**
5. **Chi-square test (χ^2).**
6. **Analysis of Variance (ANOVA).**

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.

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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:

Human Physiology – by A.C. Guyton. Saunders Company London, Toronto.
 Shepherd G.M. Neuro Biology, New York Oxford University Press 1987.
 Hurst J.W et al (eds) The Heart 7th ed. New York McGraw- Hill Book Co. 1990.
 Hand Book of Physiology Vols. Circulation. Renkin, E.M. & Michel, C.C.
 (eds) American Physiological Society, 1984.
 Guyton A.C. et al. Circulation Overall regulation Annu Re. Physiol. 34: 13 1972.
 Guyton A.C. 1980 Arterial pressure & Hypertension Philadelphia, W.B. Saunders Co-
 Cardiac output & its regulation 1973.
 Kaplan N.M. et al 1989- The Kidney in Hypertension (Perspectives in hypertension
 vol.2) New York. Raven Press.
 Guyton A.C. et al 1975 Dynamics & Control of the Body fluids
 Philadelphia, W.B. Saunders, Co., 1975.
 Brenner B.M. & Rector, F.C. (Jr) 1986. The kidney 3rd ed. Philadelphia, W.B. Saunders
 Co., 1986.

Brooks V.B. 1986. The neural Basis of motor control New York, Oxford University press.
 Johnson L.R. et al Physiology of the gastrointestinal tract 1987 New York Raven press.
 Thompson J.C. et al (eds) Gastrointestinal Endocrinology. New York McGraw Hill book

co., 1987.

Setchell K.D.R. et al eds 1988. The Bile Acids New York Plenum Pub. Corp.

Guthrie H.A. 1988. Introductory Nutrition 7th ed. St.Louis C.V. Mosby Co.,

Felig P et al (eds) 1987. Endocrinology & Metabolism New York MacGraw- Hill Book Co.,

DeGroot L.J. et al 1989. Endocrinology 2nd ed. Philadelphia, W.B. Saunders Co. 1989.

Kannan, C.R. 1988. The adrenal gland New York Plenum Pub. Corp.

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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, Diphylobothrium, Diphylidium, Echinococcus.

Unit IV: Study of parasites with respect to their general life cycle from- (15 Hrs.)

- i. Trematoda : Schistosoma, Fasciola, Paragonimus, Opisthorchis.
- ii. Nematoda: Wuchereria, Ancylostoma, Strongyloides, Enterobius.
- iii. Plant & Soil nematodes: Cyst nematode, citrus nematode.
- iv. Entomopathogenic Nematodes (EPNs).

Recommended Books:

1. Parasitology – By Ramnik sood, C.B.S. Publisher, New Delhi –1993.19
2. Parasitology – By K.D. Chatterjee, Medical Publisher Calcutta, 1987.
3. Physiology of parasites – By L.S. Chapell, John, Wiley & Sons 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. Louis ISSR.
7. Introduction Animal Parasitology – By Smit. D.G. (1997) 2nd Ed. John Wiley 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 & Protozoa 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
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M. Sc.-I, Sem.-I
CCPR-205: 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 inter relationships parasitism, symbiosis, commensalisms (2-3 examples from each).
10. Study of endangered species. (Models, pictures, charts.).
11. Study of adaptations in animals from pieces, amphibian, reptilian, birds & mammals (2-3 examples from each).
12. Visits to sanctuaries and National parks to study wild life management.
13. Study of community character by Quadrant & transect method.
14. Study of ecosystem (Soil, water, forest).
15. Use of software for identification of plants & animals.
16. Assessing existing data base on www.
17. Harnessing information through Internet regarding Biodiversity.
18. Preparation of culture media isolation of DNA from plants & animals.
19. Study of microbes isolation, culture and staining from soil & water.
20. Determination of DO, CO₂ Hardness, Chloride, Alkalinity of freshwater and sewage water.
21. Determination of COD of sewage water.
22. Determination of BOD of sewage water.
23. Estimation of inorganic phosphate and nitrate from water sample.

24. Qualitative and quantitative estimation of Zooplanktons.
25. Detection of heavy metal from the water sample.
26. Practical set on the network – internet, protein information, Genome & Chromosome database set by teacher.
27. Any other experiment set by the concerned teacher

B) Practical based on CC-103 & CC-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. MgCl_2 influence on alcinopoilia.
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 generalized insect. Identification economic importance of following insect pests (6-8 pests from each category)
9. Pests of stored gains.
10. Household pests.
11. Pests of medical importance.
12. Pests of veterinary importance.
13. Forest pests.
14. Types of silk moths.
15. Rearing appliances of mulberry silk worm and demonstration.

16. Study of forensic insects
17. Study of nutritional insects.
18. Life cycle and types of honey bees.
19. Lac insect economic importance.
20. Field visit for demonstration of pest damage.
21. Field visit for collection of insects.
22. Any other practical set by concern teacher.

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M. Sc.-I, Sem.-II
CCPR-206: 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.
