1.1.2

List of Employability/ Entrepreneurship/ Skill Development Courses with Course Contents

Colour Codes		
Name of the Subjects	Yellow	
Employability Contents	Green	
Entrepreneurship Contents	Light Blue	
Skill Development Contents	Pink	

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Zoology*

Programme Name : *M. Sc*

Academic Year : 2017-18

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	LZL 105: Lab Exercises	Cell Biology
02.	LZL 106: Lab Exercises	Mammalian Physiology
03.	LZL 205: Lab Exercises	Biochemistry, Molecular Biology and Regulatory Mammalian Physiology
04.	LZL 206: Lab Exercises	Bio-techniques and Bioinformatics
05.	LZT 303 C	Fish Culture and Pathology
06.	LZL 305: Lab Exercises	Biostatistics
07.	LZL 306 A	Biochemistry of Intermediary Metabolism and Molecular Biology of Information Pathway: Nucleic acids
08.	LZL 306 B	Neuroendocrinology and Non-classical Hormones, Male Reproduction and Female Reproduction
09.	LZL 306 C	Fish Biology
10.	LZL 404	Animal Behavior and Environmental Biology

Scheme and Syllabus

Department of Zoology, GGV, Bilaspur (CG)

Approved Scheme of Examination, 2017-18

M.Sc. Zoology

Semester-wise Theory Papers/ Practical/ Skill Component

Type of Course	Course Code	Title of the Course	Lecture-Tutorial-Practical/ week	No. of credits	Continuous Comprehensive Assessment (CCA)	End-Semester Examination (ESE) [University-Examination]	Total
Semester – I st							
Core Course 1	LZT 101	Comparative Anatomy of Vertebrates	4	4	40	60	100
Core Course 2	LZT 102	Cell Biology and Evolution	4	4	40	60	100
Core Course 3	LZT 103	Reproduction and Developmental Biology	4	4	40	60	100
Core Course 4	LZT 104	Basic Mammalian Physiology	4	4	40	60	100
Core Course Practical 1	LZL 105	Lab. Exercises based on courses LZT 101& 102	6	3	40	60	100
Core Course Practical 2	LZL 106	Lab. Exercises based on courses LZT 103 & 104	6	3	40	60	100
Skill Course 1	LZS 107	Scientific writing skills	2				
				22	240	360	600
Semester II nd							
Core Course 5	LZT 201	Biochemistry and Molecular Biology	4	4	40	60	100
Core Course 6	LZT 202	Regulatory Mammalian Physiology	4	4	40	60	100
Core Course 7	LZT 203	Endocrinology	4	4	40	60	100
Core Course 8	LZT 204	Biotechniques and Bioinformatics	4	4	40	60	100
Core Course Practical 3	LZL 205	Lab. Exercises based on course LZT 201 and 202	6	3	40	60	100

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Core Course Practical 4	LZL 206	Lab. Exercises based on course LZT 203 and 204	6	3	40	60	100
Skill Course II	LZS 207	Scientific Presentation skill (Oral & Poster)	2				
				22	240	360	600
Semester III[rd]							
Core Course 9	LZT 301	Molecular Genetics	4	4	40	60	100
Core Course 10	LZT 302	Histological Techniques and Biostatistics	4	4	40	60	100
Discipline Specific Elective - ***Biochemistry and Molecular Biology*** (A) - 1	LZT 303 A	Biochemistry of Intermediary Metabolism	4	4	40	60	100
Discipline Specific Elective - ***Biochemistry and Molecular Biology*** (A) - 2	LZT 304 A	Molecular Biology of Information Pathway: Nucleic Acids	4	4	40	60	100
Discipline Specific Elective - ***Mammalian Reproductive Physiology and Endocrinology*** (B)- 1	LZT 303 B	Neuroendocrinology and Non-Classical Hormones	4	4	40	60	100

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Discipline Specific Elective - *Mammalian Reproductive Physiology and Endocrinology* (B)- 2	LZT 304 B	Male and Female Reproduction	4	4	40	60	100
Discipline Specific Elective - *Fish Biology* (C)-1	LZT 303 C	Fish Culture and Pathology	4	4	40	60	100
Discipline Specific Elective - *Fish Biology* (C)-2	LZT 304 C	Fish Anatomy and Physiology	4	4	40	60	100
Discipline Specific Elective - *Neuroscience* (D)1	LZT 303 D	Brain and Neuron	4	4	40	60	100
Discipline Specific Elective - *Neuroscience* (D)2	LZT 304 D	Developmental Neurobiology	4	4	40	60	100
Discipline Specific Elective - (E) *Toxicology* 1	LZT 303 E	An Introduction to Toxicology	4	4	40	60	100
Discipline Specific Elective - (E) *Toxicology* 2	LZT 304 E	Occupational and Environmental Toxicity	4	4	40	60	100

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Core Course Practical 5	LZL 305	Lab. Exercises based on courses LZT 301 & 302	6	3	40	60	100
Discipline Specific Elective Practical – 1 (elective)	LZL 306	Lab. Exercises based on courses LZT 303 & 304 (A to E)	6	3	40	60	100
				22	240	360	600
Semester IVth							
Core Course 11	LZT 401	Animal Behaviour and Environmental Biology	4	4	40	60	100
Discipline Specific Elective - ***Biochemistry and Molecular Biology*** (A) - 3	LZT 402 A	Proteins and Enzymology	4	4	40	60	100
Discipline Specific Elective - ***Biochemistry and Molecular Biology*** (A) - 4	LZT 403 A	Medical Biochemistry	4	4	40	60	100
Discipline Specific Elective - ***Mammalian Reproductive Physiology and Endocrinology*** (B)- 3	LZT 402 B	Hormone Receptors and Signaling Mechanisms.	4	4	40	60	100

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Core Course Practical 6	LZL 405	Lab. Exercises based on courses LZT 401	6	3	40	60	100
Discipline Specific Elective Dissertation	LZL 404	Project work/Dissertation	12	6	80	120	200
				21	220	380	600

1. Each student will opt any one out of the five elective papers (A,B,C,D & E). Elective papers will be distributed among the students on the basis of merit/choice
2. The project work/dissertation will be carried out only in the field of respective elective papers (A,B,C,D & E) opted by the students.

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LZL 105: LAB EXERCISES

(Based on papers LZT 101 and LZT 102)

Comparative anatomy of vertebrates

1. Study of histological slides of Pisces.
2. Study of histological slides of Amphibians.
3. Study of histological slides of Reptiles.
4. Study of histological slides of Birds.
5. Study of histological slides of Mammals.
6. Study of Afferent and efferent arteries of available fish/ amphibia
7. Study of Cranial nerve of fish

Evolutionary Biology

1. Study of quantitative inheritance in *Drosophila*: sternopleural bristle phenotypes in *D. melanogaster*
2. Demonstration of natural selection under laboratory conditions by making competition between red eyed and white eyed *D. melanogaster*
3. Demonstration of Hardy-Weinberg equilibrium in human populations by taking examples of MN and ABO blood group systems
4. Study of inversion polymorphism in *Drosophila*
5. Study of sexual isolation between two closely related and sympatric species of *Drosophila*: *D. bipectinata and D. malerkotliana.*

Cell Biology

1. Preparation of permanent slide to demonstrate
   - DNA by Feulgen reaction
   - DNA and RNA by MGP
   - Mucopolysaccharides by PAS reaction
   - Proteins by Mercurobromophenol blue/Fast green
2. Study of mitosis in onion root tip
3. Study of meiosis in grasshopper testis

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LZL 106: LAB EXERCISES

(Based on papers LZT 103 and LZT 104)

Developmental Biology

1. Study of frog embryonic development through models
2. Collection of frog spawns and observation of different developmental stages
3. Study of spiral cleavage in eggs of snail
4. Effect of vitamin A in tadpole tail regeneration
5. Study of embryonic development in chick through slides
6. Window preparation to study chick embryo development
7. Whole mount preparation of chick embryos at various stages of development
8. Study of expression of developmental genes in larval imaginal discs.

Mammalian Physiology:

1. Total and differential leucocytes counting in blood
2. Erythrocyte counting
3. Determination of blood groups (ABO and Rh factor)
4. Estimation of ascorbic acid content in lemon extract using titration method
5. Preparation of casein from milk
6. Glucose estimation
7. Study of histological slides

LZS 107: SCIENTIFIC WRITING SKILLS

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LZL 205: LAB EXERCISES

(Based on papers LZT 201 and LZT 202)

Biochemistry:

1. Preparation of extract for enzyme assay (alkaline phosphatase)
2. Study of alkaline phosphatase activity
3. Standard curve preparation
4. Effect of enzyme concentration and determination of total and specific activity
5. Effect of temperature on enzyme activity
6. Effect of time on enzyme activity
7. Effect of substrate concentration on enzyme activity
8. Determination of Km and Vmax by Michaelis-Menten and Lineweaver-Burk Plot

Molecular Biology

1. DNA isolation
2. RNA isolation
3. Reverse transcriptase polymerase chain reaction
4. Western blotting
5. Northen blotting

Regulatory Mammalian Physiology

1. Total and differential leucocytes counting in blood
2. Study of histological slides
3. Study and axial and appendicular skeleton
4. Study of brain by model/chart

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LZL 206: LAB EXERCISES
(Based on papers LZT 203 and LZT 204)

Endocrinology

1. Handling, sexing, numbering and maintenance of rat
2. General survey of endocrine glands in rat
3. Study of vaginal smear preparation in rat
4. Demonstration of the following surgical operations in rat: orchidectomy, ovariectomy
5. Study of histological slides of the following endocrine glands in rat: pituitary, thyroid, adrenal, endocrine pancreas, testis and ovary Demonstration of endocrine glands in cockroach
6. Demonstration of frog metamorphosis by models and charts

Biotechniques

1. Principle and working of Centrifuges.
2. Principle and working of Chromatography (Paper chromatography)
3. Principle and working of colorimeter and spectrophotometer
4. Cell counting using haemocytometer (by using suitable stain)
5. Working and principle of Ocular micrometer
6. Measuring of pH using a pH meter
7. Electrophoresis: Nucleic acid and Protein electrophoresis.

Bioinformatics

1. Familiarization with computer operations and TCP/IP
2. Data archiving systems: FASTA format, BankIT, Accession and GI numbers
3. Use of search engines (Google, Altavista, Dogpile, Meta-crawler)
4. Demonstration of web-pages related to biological information (NCBI, ExPasy)
5. Hands on practice to features of following databases GenBank, PDB, DIP, PubMed, Toxnet, OMIM, Fly Base, AceDB, MGDB, HGMD, LSD, KEGG, RNAdb
6. Hands on practice to features of following software packages/tools: BLAST, Clustal-W, PHYLIP, M-fold

LZS 207: SCIENTIFIC PRESENTATION SKILLS (ORAL AND POSTER)

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Major Elective Course C: *Fish Biology*

LZT 303 C: Fish Culture and Pathology

Unit 1: Fish culture systems: Different ponds of a fish farm, Formulation and operation of different types of hatcheries, Fish culture in paddy fields, Sewage-fed fisheries, Larvivorous fishes, Weed fishes, Hill stream adaptations in fishes.

Unit 2: Pond management: Physico-chemical properties of pond water and their maintenance, Manuring (organic and inorganic) and liming, Composite fish farming, Predatory and weed fishes and their eradication, Aquatic vegetation and its control.

Unit 3: Exotic fishes and their role in fish farming, Criteria of selection of cultivable fishes, Age and growth: Growth rate and aging, Length weight relationship, gonadosomatic index.

Unit 4: Fish pathology, prophylaxis and therapy: Main causes of disease in farmed fish, Preventing diseases through proper management, Common disease symptoms in fish, Protozoan diseases: Cyclochaetiasis, Costiasis, (sliminess of skin), Helminth parasites: *Gyrodactylus*, *Dactylogyrus*.

Unit 5: Crustacean parasites: *Ergasilus*, Fungal diseases: Branchiomycosis (gill rot), Bacterial diseases: Tail and Fin rot, Furunculosis, Viral diseases: Papillomatosis (cauliflower disease). Nutritional diseases: Avitaminoses.

Books Recommended

1. Chakroff, M.: Freshwater Fish Pond Culture and Management, Scientific Publishers, 1987.
2. Davis.H. S.: Culture and Diseases of Game Fishes, University of California Press, 1956
3. Duijn, C. V.: Diseases of Fishes, London Iliffe Books Ltd, 1967.
4. Hall,C. B.: Ponds and Fish Culture, Agro Botanical Publishers, 1994
5. Hora, S. L. and Pillay, T.V. R.: Handbook on Fish Culture in the Indo-Pacific Region, Fisheries Division, Biology Branch, FAO, 1962.
6. Jhingran, V.G.: Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi. 1985.
7. Khanna S. S. and H. R. Singh.: A textbook of Fish Biology and Fisheries, Narendra Publishing House, 2003
8. Ribelin, W. E. & Migaki, G.: The Pathology of Fishes, The Univ. of Wisconsin Press, 1975.

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LZL 305: Lab exercises based on papers LZT 301 and LZT 302

Genetics:

1. Handling of *Drosophila* and study of its life cycle
2. Study of meiosis in grasshopper testes by squashing method
3. Temporary squash preparation of polytene chromosomes from salivary glands of *Drosophila* larvae
4. Study of colchicinised metaphase chromosomes in bone marrow of rodent by air dry method
5. Preparation of human karyotype
6. Study of sex chromatin in human female from buccal epithelial and hair bud cells
7. Examination of wild type (males and females) and mutants of *Drosophila*
8. Sex linked inheritance in *Drosophila melanogaster*
9. Linkage and crossing over in *Drosophila melanogaster*

Histology and Histochemistry

1. Paraffin sectioning: Fixation of tissue (intestine and stomach of rat), dehydration, clearing and embedding of tissue. Sectioning and spreading of sections. Histological staining of paraffin sections using haematoxylin and eosin method.
2. Histochemical staining of paraffin sections for demonstration of acidic glycoproteins by Alcian Blue pH 2.5 method. Histochemical staining for lipids using: Sudan black B method, Sudan III method, Sudan IV method.

Biostatistics

1. Analysis of Mean, Median and Mode in given exercise.
2. Analysis of Standard Deviation and Standard Error in given exercise.
3. Analysis of Variance in given exercise.
4. Exercise to find out statistical significance of an experimental data using T-Test, Newmann Keuls and Tukey's test for significance.

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MAJOR ELECTIVE LABORATORY EXERCISES

Major Elective Course A: ***Biochemistry***

LZL 306 A: ***Lab. Exercises based on courses LZT 303 A & 304A***

Part A: Biochemistry of Intermediary Metabolism

1. Effect of starvation on liver glycogen content in rat/mouse
2. Estimation of blood glucose level using glucose oxidase method
3. Estimation of total cholesterol, HDL-cholesterol and triacyl glycerol
4. Estimation of amino acid concentration
5. Assay of adenine deaminase (ADA) in rat/mouse tissues

Part B: Molecular biology of Information pathway: Nucleic acids

1. Sterilization techniques, media preparation and agar plate preparation
2. Measurement of growth curve of *E.coli*., calculation of its generation time and viable cell counting
3. Rapid isolation of plasmid DNA (mini prep. alkaline lysis method)
4. Restriction digestion of plasmid and analysis by agarose gel electrophoresis,
5. Cloning of a DNA fragment
6. Preparation of competent cells, transformation and screening of colonies (blue-white selection)
7. Demonstration: Southern hybridization, PCR

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MAJOR ELECTIVE LABORATORY EXERCISES

Major Elective Course B: Mammalian Reproductive Physiology and Endocrinology

LZL 306 B: Lab. Exercises based on courses LZT 303 B & 304B

Neuroendocrinology and Non-classical Hormones

1. *In situ* study of pituitary (portal circulation) and pineal (associated epithalamic complex) gland
2. Study of pituitary and pineal cell types through prepared slides
3. Transplantation of pituitary in kidney capsule
5. Anatomical mapping of hypothalamic centres (SON, PVN, AR, VMO, mammillary nucleus, median eminence)
6. Ascorbic acid depletion bioassay for LH
7. ELISA/RIA of TSH or gonadotropins

Male Reproduction

1. Preparation and study of permanent slides of reproductive organs
2. Study of stages of spermatogenesis and spermiogenesis using histological slides of testis
3. Biochemical estimation of fructose and alkaline and acid phosphatases in seminal vesicle and prostate
4. Androgen bioassay by sialic acid assay
5. Biochemical estimation of 3β-hydroxysteroiddehydogenase
6. Operations in rat: induction of cryptorchidism; vasectomy
7. Study of sperm motility, sperm morphology, and sperm count in rat
8. Effect of cadmium chloride treatment on testis

Female Reproduction

1. Studies on permanent slides of female reproductive organs
2. Tubectomy and hysterectomy
3. Induction of superovulation in mouse/rat
4. Induction of PCOS condition in rat
5. Biochemical estimation of succinate dehydrogenase and catalase activity
6. Study of rat oestrous cycle using vaginal smear preparations
7. Isolation of large antral follicle and corpus luteum
8. Isolation of egg, granulosa and theca cells
9. Demonstration of implantation sites by pontamine blue (blue dye reaction) in mouse

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10. Demonstration of SDS-PAGE for ovarian proteins

MAJOR ELECTIVE LABORATORY EXERCISES

Major Elective Course C: *Fish Biology*

LZL 306 C: Lab. Exercises based on courses LZT 303 C & 304C

1. Display of afferent and efferent branchial vessels.
2. Study of available histological slides of different structures/organs.
3. Determination and comparison of hemoglobin content of water-breathing and air breathing fish
4. Study of ventilation rate and surfacing activity of an air-breathing fish under different experimental conditions.
5. Determination of feeding habit of important edible fishes by morphological analyses of their buccopharyngeal region
6. Determination of feeding habit of carps and catfishes by analyses of their gut contents
7. Dissection of carp showing interrelationship between the gas (swim or air) bladder and Weberian ossicles.
8. Preparation of permanent stained slides of different endocrine glands and kidney of a teleost
9. Determination of protein and lipid contents in a fresh and preserved fish
10. Analysis of physical and chemical properties of water
11. Visit to a fish farm and hatchery
12. Survey of fish fauna of Chattisgarh.

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LZL 404: Practical based on LZL 401

Animal Behaviour:

1. Study the behavior of monkeys.
2. Courtship behavior in the fruit fly.
3. Study the different behavior of laboratory rats.
4. Nest making behaviour of birds.
5. Habitat preference behaviour in insects.

Environmental biology

1. Study of Zoo and Phytoplanktons in pond water
2. Preparation of temporary slides of Zooplanktons
3. Calculation of biodiversity indices
4. Physiochemical analysis of water
5. Estimation of aquatic: primary productivity using dark and light bottles
6. Study of species interactions

LZL 405: Project work/ Dissertation

Topic will be based on the major elective opted by students. Project will include laboratory/field based work followed by submission of report and presentation.

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