GOVT. COLLEGE FOR WOMEN, PARADE GROUND JAMMU
(AN AUTONOMOUS COLLEGE)

Syllabus and Course of Study in Zoology -- B.SC. Semester-IV
For examinations to be held in 2021-22, 2022-23, 2023-24

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- **Core Course No.: UZOTC 401**
- **Core Course Title: Principles of Genetics and Evolutionary Biology.**
- **CREDITS: 4**
- **Maximum Marks: 100**
  - **I) External: 80**
  - **II) Internal Assessment: 20**
- **Minimum Pass Marks**
  - **I) External: 29**
  - **II) Internal: 07**
- **Duration of external Exam. 3 Hours.**

Course Learning Objectives:

This paper deals with Principle of Genetics and Evolutionary Biology with an overview on cell biology topics like Mitosis, Meiosis and cell cycle checkpoints with an in-depth knowledge of Genetics like Mendelian and post-Mendelian Genetics, linkage and mutations. This paper also exposes the students to history of evolutionary thoughts, Darwinism and Neo-Darwinism and Evidences of Evolution.

Course Learning Outcome:

Upon the completion of the syllabus, a student will be able to understand:

- The key concepts of Population Genetics and Cell Biology in terms of Cell cycle, mitosis, meiosis and cell cycle checkpoints.
- The Hardy-Weinberg Law, Genetic Drift along with different Types of Natural Selection.
- The origin of Life on the earth.
- The theories of evolution comprising of Lamarckism, Darwinism and Neo-Darwinism.
- Will also get comprehensive knowledge regarding sources of Variation responsible for evolution and micro-evolutionary changes and Speciation.

Unit-I

1.1 Cell Cycle

1.1.1. Cell Cycle: Mitosis and Meiosis.
1.1.2. Cell cycle checkpoints (G1-S, G2-M).

1.2 Mendelian and Post-Mendelain Genetics

1.2.1. Concept of Mendelism and Neo-mendelism.
1.2.2. Principle of inheritance.
1.2.3. Incomplete dominance and Co-dominance
1.2.4. Multiple alleles, Lethal alleles, Pleiotropy
1.2.5. Blending inheritance (Non-Allelic inheritance)
1.2.6. Polygenic inheritance (Skin Color inheritance in humans)
1.2.7. Concept of Maternal effect.
    1.2.7.1 Kappa particles in paramecium.

Unit-II

2.1. Linkage

2.1.1. Linkage, types of linkage and Linkage groups
2.1.2. Crossing over and mapping
2.1.3. Cytological basis of crossing over
2.1.4. Recombination frequency
2.1.5. Two and three factor crosses, interference and coincidence.

Unit-III

3.1 Mutations
3.1.1. Chromosomal mutations: deletions, duplications, inversion and translocations and their significance.
3.1.2. Aneuploidy and Euploidy and their significance.
3.1.3. Concept of Gene mutations: Pont and Frameshift Mutations.
3.2. Sex determination
3.2.1. Chromosomal mechanism of sex determination.
3.2.2. Environmental determination of Sex.
3.2.2. Sex-linked, sex-influenced, and sex-limited characters.
3.2.3. Dosage compensation, Lyons's hypothesis and X-inactivation.

Unit-IV

4.1. History of life.
4.1.1. Major events in the history of life (Chemogeny and Biogeny)
4.1.2. Theories of evolution and extinction.
4.1.3. Darwinism and Neo-Darwinism
4.1.4. Mass extinction
4.2. Evidences of evolution
4.2.1. Concept of Evolution, divergent and Convergent.
4.2.2. Molecular and serial homology
4.2.3. Biochemical, serological and Physiological evidences
4.2.4. Evolution of man

Unit-V

5.1. Population Genetics.
5.1.1. Gene pool and Gene frequencies.
5.1.2. Genetic Drift, mutation pressure and gene flow.
5.1.3. Hardy-Weinberg equilibrium.
5.2. Species concept and Speciation.
5.2.1. Mode of speciation (allopatric and sympatric).

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Note 1: There shall be one written theory paper of 100 marks. 20% mark shall be reserved for internal assessment. Theory paper will be set for 80 marks.

Internal Assessment Test.

One long answer type question of 10 marks and five short answer type questions of 02 marks each.

Note 2: For paper setters

External End Semester Exam.

Section A: 05 short answer type questions representing all units/syllabi i.e., at least one from each unit having 70-80 words and having 03 marks each. (All Compulsory).

Section B: 05 medium answer type questions representing all units/syllabi i.e., at least one from each unit having 250-300 words and having 07 marks each. (All Compulsory).

Section C: 05 long answer type questions representing all units/syllabi (02 to be attempted) with detailed analysis/ explanation to be stated within 500-600 words having 15 marks each.

Suggested readings

- Cytology and Cytogenetics- C.P. -Swanson. Pentice – Hall of India Pvt. Ltd., New Delhi.
- Fundamental concepts of Cell biology. Purohit.
- Gardner et. al: Principles of Genetics (2006, John Wiley)
- Griffith et al: An introduction to Genetic Analysis (2008, Freeman
- Gene and Genetic Code – the chemical basis of life- J. D. Cherayil.
- Hart and Jones: Essential Genetics – A Genomic perspective (2009, Jones and Bartlet)
- Pierce: Genetics- A Conceptual Approach (2012.Freeman)
- Russell: Genetics (2010, Benjamin Cummings)
- Snustad & Simmons: Principles of Genetics (2012, John Wiley)
- Moody: Introduction to Evolution (1978, Kalyani).
- Rastogi: Organic Evolution (2007, Kedarnath & Ramnath)
- Evolution-Lull. Organic Evolution, Richard Swanson, Light & Life Publishers.
- Genetics – Verma, P.S. & V.K. Agarwal, S Chand and Co.
- Biology of Genetics- Lewis, C.D. & Lewin, R. McGraw hill, Toppan Co. Ltd.
- Molecular Genetics - Gunther S, Sten Mcmillian Pub. Co. Inc.
- Genetics- Goodenough, V.N. Y. holt, Rinchart & Winston.
- Principles of Genetics – Gradner, Wiley Easten (P) Ltd.John Wiley and Sons, Inc.
- Genetics – stickberger, ayala, Stebbins& Valentine (W.H. Freeman). MacMillan Press.
- Genetics and Origin of species- Dobzhansky (Columbia univ. Press).
- Animal Cytology and evolution – White, M.J.D. Cambridge Univ, Press. 1973.

Practical Core Course
Core Course No. UZOPC 401
Core Course Title: PRINCIPLES OF GENETICS AND EVOLUTIONARY BIOLOGY
Credits: 2
Max. Marks: 50

1. Study of various stages of mitosis from permanent slides
2. Study of various stages of meiosis from permanent slides.
3. Preparation of permanent slides of mitosis from onion root tip.
4. Preparation of permanent slides of meiosis from grasshopper/tradescantia.
5. To study the Mendelian Laws and their verification by Chi- square analysis using suitable examples.
6. Study of Human Karyotypes (normal and abnormal).
7. Study of fossil evidences from plaster cast models and pictures.
8. Study of living fossil through specimen (Latimeria and Sphenodon)
9. Charts:
   a) Phylogeny of horse with diagram /cut outs of limbs and teeth.
   b) Darwin`s Finches with diagrams/ cut out of beaks of different species.
10. Zoogeographical study through charts/ photographs.
11. Study of homology and analogy from suitable specimens/ pictures.
12. Preparation of geological time scale chart / report with special reference to dominant species of each division.
13. Study of human evolution.
14. Evidences of evolution through models.
15. Viva- Voice.

Note: There will be one practical paper of 50 marks. 50% (25 marks) shall be reserved for internal assessment.

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Skill Enhancement Course

Course No.: UZOTS 401
Course Title: Aquarium Fish Keeping
CREDITS: 4

Course learning Objective:

This course has been designed to enable the students to give a hands-on training in all aspects of Aquarium industry. This shall enable the students to set up their own Aquarium cottage industry and establish themselves as entrepreneurs instead of job seekers.

Course Learning Outcome:

After completion of the course the students will be able to:

- Know about different Aquarium Accessories
- Set up an Aquarium
- Maintain and clean an Aquarium
- Comprehend Aquascaping
- Understand the basics of stocking an Aquarium
- Know about the physic-chemical parameters of aquarium water
- Know about various plants that can be used in Aquaria

Skill Theory Course
Credits = 2 **Maximum marks 50**
(Internal 10, External 40)

Unit I: Setting up of an Aquarium
1.1 Essentials to set up an Aquarium
1.2 Aquarium Accessories
1.3 Physico-chemical requirements of water in Aquarium
1.4 Aquascaping: Plants, ornaments, decoration used in aquaria

Unit II: Maintenance of an Aquarium
2.1 Aquarium Lighting
2.2 Aeration in an Aquarium
2.3 Temperature maintenance in an Aquarium
2.4 Filteration materials; types of Aquarium filters; Mechanical, Chemical and Biological Filtration
2.5 Cleaning an Aquarium with special reference to control of snail and algal growth

Skill Practical Course
Credits = 2 **Maximum marks 50**
(Internal 25, External 25)

1. Set up an aquarium
2. To study different substrate material used in an aquarium
3. To study different types of lighting material used in an Aquarium
4. To study and maintain physico-chemical parameters of aquarium water
5. To study different types of filters used in Aquaria
6. To study various plants used in aquaria
7. Aquascaping

Books Recommended:

1. George Farmer (2020). Aquascaping. A Step-by-Step Guide to Planting, Styling, and Maintaining Beautiful Aquariums. Skyhorse Publishers
2. Moe Martin. (2013). Aquascaping. Ubiquitous Publishing
3. Koneman. (2000). The Complete Aquarium Guide - Fish, Plants and Accessories for your Aquarium. **ISBN-13 :** 978-3829017367

Online reads

1. https://www.lkouniv.ac.in/site/writereaddata/siteContent/20200415093521427 7sptrivedi_MAINTENANCE_OF_FISHES.pdf
2. https://www.diskuszucht-stendker.de/plugins_en/pdfs/3.1._Aquarium_Ausstattung_Filter_und_Deko_Tipps_en.pdf
3. http://usa.hagen.com/File/a546488f-6dfa-42cc-9a76-5d8aa8853bd2
4. https://fdocuments.in/reader/full/the-complete-aquarium-guidea

Evaluation strategy

Skill theory course

A) Internal assessment

1. Internal assessment (10 Marks) as per the adopted procedure for other courses.
2. No marks have been earmarked for attendance, however the eligibility criterion for appearing in the end semester examination shall remain the same as is followed in other courses.

B) External end semester Examination

1. Maximum Marks = 40.
2. Question paper shall have three (A, B and C) sections :-

Section A shall comprise of 4 questions of 2 marks each.

i) 2 questions shall be set from each unit of the prescribed course content.

ii) All questions shall be compulsory.

Section B shall comprise of 4 questions of 5 marks each

i) 2 questions shall be set from each unit of the prescribed course content.

ii) All questions shall be compulsory.

Section C shall comprise of 3 questions of 12 marks each.

i) 1.5 questions shall be set from each unit of the prescribed course content.

ii) Students shall be asked to attempt only one question of 12 marks from this section.

Skill Practical course

A) Internal assessment

1. Internal assessment (25 Marks) as per the adopted procedure for other courses.
2. 5 marks have been earmarked for attendance, and the eligibility criterion for appearing in the end semester examination shall remain the same as is followed in other courses.

B) External end semester Examination

Maximum Marks =25.

Procedure of the external examination shall be same as is followed in other practical courses.