



PROGRAMME STRUCTURE

M.Sc. Zoology Semester: IV

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| Programme Outcome (PO) - For M.Sc. Zoology Programme | Upon successful completion of Masters of Science in Zoology students will be able to : <ul style="list-style-type: none">● Develop an understanding to associate theoretical concepts and practical skills of Zoological Sciences in day-to-day life● Gain the expertise in operating laboratory instruments with their basic mechanisms and applications● Analyze critically, think holistically and apply the knowledge of various dimensions of Animal Sciences in teaching and research● Correlate the impact of dynamics of ecology with evolution, embryology and development of specific behavior patterns in animals and humans● Accomplish different specialized tasks devotedly suiting to the needs to wildlife conservation, industry, research laboratories and academic institutions |
| Programme Specific Outcome (PSO) - For MSc Zoology Semester - II | <ul style="list-style-type: none">● To understand methods and applications of analytical techniques for characterization and separation● To study complexities of behavioral patterns in captivity and in wild● To learn about immune system, defense mechanisms and related abnormalities |
| To Pass | (1) At least 40% marks in each paper at the University Examination and 40% aggregate marks in Internal and External Assessment. (2) At least 33% Marks in each paper in Internal Assessment. |





SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
 (Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
 Syllabus with effect from the Academic Year 2022-2023

| Course Type | Course Code | Name Of Course | Theory/ Practical | Credit | Exam Duration in hrs | Component of Marks | | |
|---------------------------------|-------------|--|----------------------|--------|----------------------------|--------------------|----------|-------|
| | | | | | | Internal | External | Total |
| | | | | | | Total | Total | Total |
| Core Course | PS04CZOO51 | Animal Biotechnology | T | 4 | 3 | 30 | 70 | 100 |
| | PS04CZOO52 | Molecular and Applied Endocrinology | T | 4 | 3 | 30 | 70 | 100 |
| | PS04CZOO53 | Practical | P | 4 | 3 | 30 | 70 | 100 |
| | PS04CZOO54 | Viva-Voce | = | 1 | = | = | 50 | 50 |
| Elective Course (Any Two) | PS04EZOO51 | Genetics | T | 4 | 3 | 30 | 70 | 100 |
| | PS04CZOO52 | Research Ethics and Scientific Writing | T | 4 | 3 | 30 | 70 | 100 |
| | PS04EZOO53 | Nutritional and Clinical Biochemistry | T | 4 | 3 | 30 | 70 | 100 |
| | PS04EZOO54 | Biomaterials and Tissue Engineering | T | 4 | 3 | 30 | 70 | 100 |
| | PS04EZOO55 | Biodiversity and Conservation | T | 4 | 3 | 30 | 70 | 100 |
| | | OR | | | | | | |
| Core Course | PS04CZOO51 | Animal Biotechnology | T | 4 | 3 | 30 | 70 | 100 |
| | PS04CZOO52 | Molecular and Applied Endocrinology | T | 4 | 3 | 30 | 70 | 100 |
| | PS04CZOO53 | Practical | P | 4 | 3 | 30 | 70 | 100 |
| | PS04CZOO54 | Viva-Voce | = | 1 | = | = | 50 | 50 |
| Elective Course | PS04EZOO56 | Dissertation | = | 12 | = | = | 300 | 300 |





Master of Science (Zoology)
M.Sc. Zoology Semester IV

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|-----------------------------|------------|---------------------|----------------------|
| Course Code | PS04CZOO51 | Title of the Course | Animal Biotechnology |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives: | Students should be able to : (1) Learn maintenance of subculture and cell lines (2) Understand the pharmaceutical importance and toxicological aspects of cell culture |
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| Course Content | | |
|----------------|---|----------------|
| Unit | Description | Weightage* (%) |
| 1. | Introduction to animal tissue culture (Background, Advantages and limitations of tissue culture, major differences between in vivo and in vitro, types of tissue culture) Biology of cultured cells (Brief description on cell adhesion, cell proliferation, energy metabolism and origin of cultured cells) General out-line of cell types (epithelial tissue, connective tissue, muscular tissue and nervous tissue) Stem cells, germ cells and amniocytes (Culture of embryonic stem cells, culture of amniocytes, applications of stem cells) Aseptic Techniques (Objectives of aseptic techniques, elements of aseptic environment, sterile handling) Sterilization (Different types- dry heat (hot air oven, wet heat (autoclaving), various chemical agents used in sterilization, irradiation techniques (UV and Gamma Ray) Culture of specialized cells (liver, epidermal, astrocytes, testis and ovary) | 25 |
| 2. | Defined media and supplements (Physicochemical properties, balanced salt solutions, serum, selection of medium and serum) Serum- Free Media (Disadvantages of serum, advantages of Serum-free media, Preparation of serum free media, Animal protein free media) Primary culture (Initiation of primary cell culture, isolation of tissue, types of primary culture, mechanical and enzymatic disaggregation) Sub culture and cell lines (Subculture and propagation, routine maintenance, subculture of monolayer and suspension cultures) Monitoring for contamination- Visible microbial contamination, mycoplasma, Viral contamination, Eradication of contamination | 25 |
| 3. | Cell cloning and selection (Feeder layer, suspension cloning, separation of clones) | 25 |





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| | <p>Cell separation (Centrifugation, Antibody based techniques, FACS) Cell differentiation (Stem cell plasticity, markers of differentiation, induction of differentiation, differentiation and malignancy) Transformation and Immortalization (Immortalization with viral genes, Immortalization of human fibroblasts, telomerase induced immortalization, Aberrant growth control, tumorigenicity) Characterization (Need for characterization, characterization based on cell morphology, DNA and RNA content, enzyme activity and antigenic markers)</p> | |
| 4. | <p>Reproductive biotechnology: artificial insemination, super ovulation, embryo recovery and in vitro fertilization, ISCI, ZIFT, GIFT, 3 D culture and Idmoc, culture and cryopreservation of embryos, applications of transgenic animal biotechnology; animal cloning- basic concept, cloning for conservation of endangered species. Vaccinology: conventional methods of animal vaccine production, recombinant approaches to vaccine production, modern vaccines.</p> | 25 |

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| Teaching-Learning Methodology | <p>Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information.</p> |
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| Evaluation Pattern | | |
|--------------------|--|-----------|
| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written / Practical Examination (As per CBCS R.6.8.3) | 15% |
| 2. | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15% |
| 3. | University Examination | 70% |

| Course Outcomes: Having completed this course, the learner will be able to | |
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| 1. | Student should be able to maintain and work in animal cell culture as well as vaccine production lab |





Suggested References:

| Sr. No. | References |
|---------|---|
| 1. | Freshney, R., I., (2015). Culture of Animal cells: a manual of basic technique and specialized applications. 6 th Edn. John Wiley & Sons, Chicago. |
| 2. | Masters, J., R., (2000). Animal Cell Culture: a practical approach. 3 rd Edn. Oxford University Press, United Kingdom |
| 3. | Davis, J., M., (Ed.) (2000). Animal Cell Culture: essential methods. John Wiley and Sons, United Kingdom. |
| 4. | Barresi, M., J., F., Gilbert, S., F., (2019). Developmental biology. 12 th Edn. Sunderland, Mass: Sinauer Associates, United States |

On-line resources to be used if available as reference material

On-line Resources

Relevant review articles/research papers/handouts of latest development in the subject





Master of Science (Zoology)
M.Sc. Zoology Semester IV

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|-----------------------------|------------|---------------------|-------------------------------------|
| Course Code | PS04CZOO52 | Title of the Course | Molecular and Applied Endocrinology |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives: | <ol style="list-style-type: none">1. To explain characteristics of different endocrine glands and their secretions2. To examine the structural and functional relationships amongst hypothalamus, pituitary and other glands3. To study the chemical classes of hormones and mechanism of hormone action4. To correlate the normal vs pathophysiological conditions of endocrine organs and glands5. To review the bioanalytical techniques for hormone estimation |
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| Course Content | | |
|----------------|---|----------------|
| Unit | Description | Weightage* (%) |
| 1. | Introduction: A brief history of discovery of hormones. An overview of vertebrate endocrine system. Structural features and hormones of endocrine glands- hypothalamus, pituitary, pineal, thyroid, parathyroids, GI tract, pancreatic islets, adrenals and gonads. Endocrine methodologies: Ablation and replacement, bioassays, immunoassays, Immunocytochemistry, autoradiography, electrophysiological and pharmacological methods, hormone-receptor interactions, cloning techniques. | 25 |
| 2. | General classes of hormones: Peptide, Thyroid, Steroid, Neurotransmitters, Neuropeptides, Chalone, Peptide-growth stimulating factors, Eicosanoids and pheromones Hormones and endocrine glands: Synthesis and control of synthesis, Storage, Metabolism and functions. Endocrinology of pregnancy, Parturition and Lactation. | 25 |
| 3. | Mechanisms of hormone action: Receptors and types- Membrane receptors, Nuclear receptors; Receptor regulation and signal transduction, Second messengers, Permissive actions of hormones and termination of hormone action. | 25 |
| 4. | Pathophysiology of hypothalamic, pituitary, pineal, thyroid, parathyroid, GI tract, pancreatic islets, adrenal and gonadal hormones. Imaging and nuclear medicine in endocrine disease and hormone-replacement therapies. | 25 |





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| Teaching-Learning Methodology | Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information. |
|-------------------------------|---|

| Evaluation Pattern | | |
|--------------------|--|-----------|
| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written / Practical Examination (As per CBCS R.6.8.3) | 15% |
| 2. | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15% |
| 3. | University Examination | 70% |

| Course Outcomes: Having completed this course, the learner will be able to | |
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| 1. | Awareness about the structure and function of endocrine glands and organs |
| 2. | Learn about Hypothalamo-pituitary axis and interactions with other endocrine secretions |
| 3. | Examine the hypo- and hyper- levels of hormones leading to endocrine pathologies |
| 4. | Understand electrophysiological and endocrine methodologies |

| Suggested References: | |
|-----------------------|--|
| Sr. No. | References |
| 1. | Bolander, F., F., (1989). Molecular Endocrinology. 3 rd Edn. Academic Press, Elsevier, United States |
| 2. | Lodish, H., Berk, A., Kaiser, C., Kreiger, M., Scott, M., Bretscher, A., et al., (2008). Molecular Cell Biology. 6 th Edn. WH Freeman and Company, New York |
| 3. | Norris, D. O., Carr, J., A., (2013). Vertebrate Endocrinology. 5 th Edn. Academic Press, New York |
| 4. | Tortora, G. J., & Grabowski, S. R. (2017). Principles of Anatomy and Physiology (15 th Edn). HarperCollins College, New York. |





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| 5. | Brook, C., G., D., Marshall, N. J., (2001). Essential Endocrinology. 4 th Edn. Wiley-Blackwell Publishing, United States |
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On-line resources to be used if available as reference material

On-line Resources

Relevant review articles/research papers/handouts of latest development in the subject





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|-----------------------------|------------|---------------------|-------|
| Course Code | PS04CZOO53 | Title of the Course | Lab-1 |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives: | <ol style="list-style-type: none">1. To learn lab lay out for animal cell culture laboratory.2. To maintain sterile conditions and culture cell lines.3. To estimate various biochemical parameters in clinical specimens.4. To study histology of endocrine tissues and organs |
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PS04CZOO53 (Lab-1)

1. Lab instruments (CO₂ incubator, biosafety, inverted microscope)
2. Viable count (trypan blue)
3. MTT assay
4. Primary and secondary culture of animal cells
5. Comparative studies of endocrine glands of selected invertebrates and vertebrates
6. Estimation of serum glucose and serum cholesterol
7. Determination of serum calcium and serum inorganic phosphorous
8. Estimation of hepatic glycogen
9. Dissection of pituitary gland and HE staining
10. Histological observations of endocrine glands
11. Study of pathology of endocrine glands
12. Study of oestrous cycle and menstrual cycle

| Evaluation Pattern | | |
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| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Practical Examination (As per CBCS R.6.8.3) | 15% |
| 2. | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15% |
| 3. | University Examination | 70% |

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| Course Outcomes: Having completed this course, the learner will be able to | |
| 1. | Culture and maintain cell lines |
| 1. | Perform cell viability studies |





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| 2 | Learn structure and function relationships of endocrine glands and tissues |
| 3. | Understand different stages of reproductive cycles |

References:

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| 1 | Freshney, R., I., (2015). Culture of Animal cells: a manual of basic technique and specialized applications. 6 th Edn. John Wiley & Sons, Chicago. |
| 2. | Lavin, N., (2018). Manual of Endocrinology & Metabolism. 5 th Edn. Wolters Kluwer India Private Limited, Pune, Maharashtra |





Master of Science (Zoology)
M.Sc. Zoology Semester IV

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|-----------------------------|------------|---------------------|----------|
| Course Code | PS04EZOO51 | Title of the Course | Genetics |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives: | <ol style="list-style-type: none">1. To learn about principles of genetics and mendelian laws2. To correlate the effects of various mutagenic agents on genotype3. To understand and interpret the pedigree chart and correlate inheritance4. To study the molecular mechanisms, testing methods and remedial measures of disorders |
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| Course Content | | |
|----------------|--|----------------|
| Unit | Description | Weightage* (%) |
| 1. | Mendelian principles and its extensions: Dominance, segregation, independent assortment; Codominance, incomplete dominance, gene interactions, Pleiotropy, genomic imprinting, penetrance and expressivity, Linkage and crossing over, sex linkage, sex limited and sex influenced characters; Autosomal and sex linked inheritance | 25 |
| 2. | Mutation and mutagenesis, DNA repair, Types of mutations; Silent mutations; Mutagens; Mutations from mispairing and recombination. DNA repair system; Repair by recombination; Repair system in bacteria and eukaryotes | 25 |
| 3. | Fundamentals of chromosomes, structure and inheritance Chromosome organization, Chromosomal abnormalities; autosomal and recessive disorders, Pedigree analysis; Mendelian and non-Mendelian pedigrees; Mosaicism, Chimerism, Polygenic and Multifactorial inheritance, inborn errors of metabolism | 25 |
| 4. | Structure and molecular genetics of Mitochondria; mitochondrial, muscle and neurological disorders, Cancer- Diagnosis, Testing. Features of human genome: Mapping of human genome. Human genome project. Manipulation of human genes. Creating animal models of diseases. Gene therapy and other molecular genetic based therapeutic approaches. | 25 |

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| Teaching-Learning Methodology | Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a |
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| | suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information. |
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| Evaluation Pattern | | |
|--------------------|--|-----------|
| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written / Practical Examination (As per CBCS R.6.8.3) | 15% |
| 2. | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15% |
| 3. | University Examination | 70% |

| Course Outcomes: Having completed this course, the learner will be able to | |
|--|---|
| 1. | Understand role of genes in growth, development and diseases |
| 2. | Learn about pedigree charts and prediction of congenital abnormalities |
| 3. | Comprehend the importance of causative factors in progression of carcinogenesis |

| Suggested References: | |
|-----------------------|--|
| Sr. No. | References |
| 1. | Karp, G., Iwasa, J., Marshall, W., (2016). Cell and molecular biology-concepts and experiments. 8 th Edn. John Wiley & Sons, New York. |
| 2. | Brown, T., A., (2017). Genomes. 4 th Edn. John Wiley & Sons, New York |
| 3. | Hartl, D., L., Clark, A., G., (2006). Principles of population genetics. 4 th Edn. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts |
| 4. | Emery, A., E., H., Mueller, R. F., (1988). Elements of medical genetics. Reprint Edition. Churchill Livingstone, Edinburgh. |





On-line resources to be used if available as reference material

On-line Resources

Relevant review articles/research papers/handouts of latest development in the subject





Master of Science Zoology
M.Sc. Zoology Semester (IV)

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|-----------------------------|------------|---------------------|--|
| Course Code | PS04EZOO52 | Title of the Course | Research Ethics and Scientific Writing |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives: | <ol style="list-style-type: none">1. To inculcate professional ethics in students of Science, especially in Biology2. To familiarize types of plagiarism and tools for their detection3. To teach various modes of data collection and its processing4. To impart professional, scientific writing skills |
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| Course Content | | |
|----------------|---|----------------|
| Unit | Description | Weightage* (%) |
| 1. | Definition and significance of ethics; Professional ethics in Scientific research and development: Common ethical breaches; data fabrication; data falsification. Plagiarism: redundant publication; duplicate publication. | 25 |
| 2. | Types of plagiarism; tools and techniques for detection of plagiarism. Conflict of interest; salami slicing and authorship issues. Good Laboratory Practices (GLP): Instrument validation, reagents and materials certification, documentation and its record, Quality assurance and certification of laboratory facilities. | 25 |
| 3. | Data collection methods: Primary data and secondary data. Internet, online data collection, journals and books. References: Basic types of referencing; Quoting, paraphrasing and citing. APA, MLA and the Chicago/ Turabian styles of listing references. | 25 |
| 4. | Scientific writing: Basic differences between popular and scientific writing; fundamental rules of scientific writing; structure and content of research papers, thesis and dissertations. Do's and don'ts for scientific writing. Tools and techniques for correction and editing of manuscripts. Selection and publication in journals. | 25 |

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| Teaching-Learning Methodology | Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of |
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| Evaluation Pattern | | |
|--------------------|--|-----------|
| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written / Practical Examination (As per CBCS R.6.8.3) | 15% |
| 2. | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15% |
| 3. | University Examination | 70% |

| Course Outcomes: Having completed this course, the learner will be able to | |
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| 1. | Understand the significance of professional ethics in Scientific research |
| 2. | Appreciate the types and pitfalls of plagiarism |
| 3. | Learn how to collect data from primary and secondary sources |
| 4. | Understand the differences between, common, popular and scientific writing and learn the basics of scientific writing |

| Suggested References: | |
|-----------------------|--|
| Sr. No. | References |
| 1. | Govindrajan, M., Senthilkumar, S., Natarajanv, M., S., (2013). Professional Ethics and Human Values. PHI Publishers, India |
| 2. | Alley, M., (1998). The craft of Scientific writing. 3 rd Edn. Springer Publications, Germany |
| 3. | Spier, R., E., (2003). Science and Technology ethics. 1 st Edn. Routledge Publications. Singapore |
| 4. | Kumar, P., Kumar, P., (2020). Scientific writing and Research Quality. Discovery Publishing House Pvt Ltd, New Delhi |

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| On-line resources to be used if available as reference material |
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On-line Resources

Relevant review articles/research papers/handouts of latest development in the subject





Master of Science (Zoology)
M.Sc. Zoology Semester IV

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|-----------------------------|------------|---------------------|---------------------------------------|
| Course Code | PS04EZOO53 | Title of the Course | Nutritional and Clinical Biochemistry |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives: | Students should be able to: 1. Relate nutrition to the metabolism 2. Understand pathological conditions of diabetes, obesity and protein calorie malnutrition |
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| Course Content | | |
|----------------|--|----------------|
| Unit | Description | Weightage* (%) |
| 1. | Basic concept- composition of human body: Energy content of food. Measurements of energy expenditure. Energy requirements of man, woman and factor affecting energy requirements, Basal metabolic rate, factors affecting BMR. Carbohydrates- Dietary requirements and sources of available and unavailable carbohydrates and action of dietary fibres. Disorders of carbohydrate metabolism: Glycosuria, Diabetes mellitus. | 25 |
| 2. | Proteins: protein reserves of body. Nitrogen balance studies and factor affecting it. Protein quality and essential amino acids. Cereal proteins requirement at different stages of development Protein energy malnutrition (PME)-Marasmus and Kwashiorkor disease. Starvation –protein metabolism in prolonged fasting, high proteins, low caloric weight reducing diets. | 25 |
| 3. | Lipids-major classes of dietary lipids. Properties and composition of plasma lipo-proteins. Essential fatty acid and their physiological function. Clinical inter-relationship of lipids, lipoproteins and apolipoproteins. Tests for apolipoproteins, HDL, LDL, cholesterol and Triglyceride disorder. Obesity-factor leading to obesity –environmental and genetic. Role of leptin in regulation of body mass. | 25 |
| 4. | Electrolytes and water balance Clinical Nutrition: Role of diet & nutrition in prevention and treatment of diseases. Dental caries, Fluorosis, Renal failure, Hyperlipidaemia, atherosclerosis. Inherited metabolic disorders: Phenylketonuria, Maple syrup disease, Homocystinuria, Galactosemia, Gout, Diabetes Insipidus and Diabetes mellitus. | 25 |





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| | Anti-nutrients-naturally occurring food born toxicants, Protease inhibitors, hepatotoxins, allergens, toxins from mushroom, animal and sea foods. | |
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| Evaluation Pattern | | |
|--------------------|--|-----------|
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| 2. | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15% |
| 3. | University Examination | 70% |

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| Course Outcomes: Having completed this course, the learner will be able to | |
| 1. | Understand, follow and advise nutritional principles for maintenance of health |

| Suggested References: | |
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| Sr. No. | References |
| 1. | Swaminathan, M., (2017). Food and Nutrition. 2 nd Edn. The Bangalore Printing and Publishing Co. Ltd., Bangalore. |





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| 2. | Rodwell, V., Bender, D., Botham, K., Kennelly, P., Weil, A., P., (2018). Harper's Illustrated Biochemistry. 31 st Edn. McGraw-Hill Education, Ahmedabad. |
| 3. | Brody. T., (1998). Nutritional Biochemistry. 2 nd Edn. Academic Press, United States. |
| 4. | Nelson, D., L., Cox, M., M., (2017). Lehninger Principles of Biochemistry. 7 th Edn. W. H. Freeman & Co Ltd, Macmillan Publishers, United States. |

On-line resources to be used if available as reference material

On-line Resources

Relevant review articles/research papers/handouts of latest development in the subject





Master of Science Zoology
M.Sc. Zoology Semester (IV)

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|-----------------------------|------------|---------------------|-------------------------------------|
| Course Code | PS04EZOO54 | Title of the Course | Biomaterials and Tissue Engineering |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives: | <ol style="list-style-type: none">1. To impart knowledge on the types and properties biomaterials used in medicine.2. Understand the composition of implants and their pros and cons.3. Learn tissue engineering and its applications4. Gain an understanding of stem cells and their emerging role in treatment of genetic and somatic disorders. |
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| Course Content | | |
|----------------|--|----------------|
| Unit | Description | Weightage* (%) |
| 1. | Biomaterials: Introduction-definition of biomaterials, applications of biomaterials, classification of biomaterials, Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials. Biological responses (extra and intra-vascular system). Surface properties, physical properties and mechanical properties of materials. Types of implant materials: Metallic, polymeric, ceramic and composite materials. | 25 |
| 2. | Properties of commonly used implant materials: Stainless steel and alloys; importance of stress- corrosion cracking; role of passive films in tissue adhesion. Polymeric implant materials: general classification; Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. Biodegradable polymers and synthetic polymers and their applications. Ceramic implant materials: Bioceramics; Common types of bioceramics. Bio -reabsorbable and bioactive ceramics Host tissue reactions: importance of interfacial tissue reaction (e.g. ceramic/bone tissue reaction). Composite implant materials: different reinforcement materials, Composite theory of fiber reinforcement. | 25 |
| 3. | Tissue engineering: Introduction, stem cells, morphogenesis, generation of tissue in the embryo, Tissue homeostasis, Cellular signaling, Extracellular matrix as a biologic scaffold for tissue engineering, Scaffold fabrication, bioactive scaffold, Natural polymers in tissue engineering applications, Degradable polymers for tissue engineering. | 25 |





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| 4. | Basic Biology Of Stem Cells: Stem Cells: Introduction, hematopoietic differentiation pathway; Potency and plasticity of stem cells, sources, embryonic stem cells, hematopoietic and mesenchymal stem cells, Stem Cell markers, FACS analysis and differentiation. Stem cell systems- Liver, neuronal stem cells, Types and sources of stem cell with characteristics: embryonic, adult, haematopoetic, fetal, cord blood, placenta, bone marrow, primordial germ cells, cancer stem cells induced pluripotent stem cells. | 25 |
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|-------------------------------|---|
| Teaching-Learning Methodology | Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information. |
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| 3. | University Examination | 70% |

| Course Outcomes: Having completed this course, the learner will be able to | |
|--|--|
| 1. | Understand about various types of biomaterials for a wide range of biomedical applications. |
| 2. | Basic functions and performance of implant materials as well as corrosion and degradation mechanisms of biomaterials. |
| 3. | Choice of biomaterials based on function, biological environments, toxicity, bioadhesion and implant surface interaction with tissues. Scaffolds for tissue-engineering, growth factor, stem cell signaling. |





Suggested References:

| Sr. No. | References |
|---------|---|
| 1. | Palsson, B., O., Bhatia, S., N., (2003). Tissue Engineering. Pearson Publishers, India |
| 2. | Meyer, U., Meyer, T., Handschel, J., Wiesmann, H., P., (2009). Fundamentals of Tissue Engineering and Regenerative Medicine. Springer Publications, Germany |
| 3. | Park, J., (1984). Biomaterials Science and Engineering. Springer Publications, Germany |
| 4. | Bhat, S., V., (2017). Biomaterials. 3 rd Edn. Alpha Science International Ltd, Ahmedabad |

On-line resources to be used if available as reference material

On-line Resources

Relevant review articles/research papers/handouts of latest development in the subject





Master of Science (Zoology)
M.Sc. Zoology Semester IV

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|-----------------------------|------------|---------------------|-------------------------------|
| Course Code | PS04EZOO55 | Title of the Course | Biodiversity and Conservation |
| Total Credits of the Course | 04 | Hours per Week | 04 |

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| Course Objectives: | <ol style="list-style-type: none">1. To impart knowledge of fundamental concepts of biodiversity, the range of its extant and the need for conservation.2. To provide information of the main threats to biological diversity and the ability to evaluate the effects of human influences on biodiversity.3. To demonstrate the differences between the different categories of red listed species.4. To understand different modes of biodiversity conservation, their merits and limitations.5. To integrate the information generated from scientific investigations and use findings to address conservation and biodiversity issues. |
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| Course Content | | |
|----------------|---|----------------|
| Unit | Description | Weightage* (%) |
| 1. | Biodiversity: Concepts, levels and types, changes in time and space, evolution, species concept; significance of biodiversity for life security. Biogeography. Terrestrial, Marine, Aquatic and Agricultural biodiversity: Changing patterns and practices. Influence of modern lifestyle on biodiversity. Pros and cons of genetically modified species | 25 |
| 2. | Global conservation measures, institutions and conventions; IUCN concept of threatened and endangered species. The Red Data Books of Indian plants and animals. Causes and consequences of loss of biodiversity. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): aims, major ratifications and amendments. Exotic and invasive species: A few case studies of intentional and non-intentional introduction of exotic species and their influence on local biodiversity. | 25 |
| 3. | Principles and strategies of biological diversity conservation: <i>in-situ</i> conservation and <i>ex-situ</i> conservation. Biosphere reserves, major protected areas (sanctuaries, national parks, biosphere reserves) of India and Gujarat. Wetlands, mangroves and coral reefs for conservation of wild biodiversity. Concept of Sacred groves and their role in biodiversity conservation. | 25 |





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| | Role of botanical gardens, field gene banks, seed banks, in vitro repositories, cryobanks in conservation of plants and animal sperms. Role of Zoos, breeding centers in conservation of animals. | |
| 4. | <p>Biodiversity hot spots in India and world; Indian Biodiversity Act 2002; Major objectives of biodiversity authority board; Biodiversity and economics with special reference to India; People's Biodiversity register: Objectives, importance and modality of preparation.</p> <p>General account of the activities of Botanical Survey of India (BSI) and Zoological Survey of India (ZSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Council of Scientific & Industrial Research (CSIR), Department of Biotechnology (DBT) and Department of Environment and Forest, Wild life Protection Society of India, Wildlife Institute of India (WII), Animal Welfare Board of India and Bombay Natural History Society (BNHS) in the context of Indian biodiversity conservation.</p> | 25 |

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| Teaching-Learning Methodology | Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information. |
|-------------------------------|---|

| Evaluation Pattern | | |
|--------------------|--|-----------|
| Sr. No. | Details of the Evaluation | Weightage |
| 1. | Internal Written / Practical Examination (As per CBCS R.6.8.3) | 15% |
| 2. | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15% |
| 3. | University Examination | 70% |

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| Course Outcomes: Having completed this course, the learner will be able to | |
| 1. | Understand the concept of biodiversity, its role for our survival, different direct and indirect threats on biodiversity. |





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| 2. | Appreciate the global and national initiatives and local traditions for biodiversity conservation. |
| 3. | Become familiar with different modes of conservation, institutes involved in biodiversity conservation. |
| 4. | Learn various guidelines and regulations for utilizing the biodiversity judiciously. |

Suggested References:

| Sr. No. | References |
|---------|---|
| 1. | Wilson, E., O., (1988). Biodiversity. The National Academies Press. Harvard. Washington, DC. |
| 2. | Hunter, M., L., Gibbs, J. P., (2007). Fundamentals of Conservation Biology. 3 rd Edn. Blackwell Publishing, Malden. |
| 3. | Myers, N., Mittermeier, R., A., Mittermeier, C. G., Fonseca, G., A., da, Kent, J., (2000). Biodiversity Hotspots for Conservation Priorities. Nature, 403, 853-858. |
| 4. | Rodgers, N. A., Panwar, H. S. Planning a Wildlife Protected Area Network in India. Vol. 1. The Report Wildlife Institute of India, Dehradun. |

On-line resources to be used if available as reference material

On-line Resources

Biodiversity: **Author:** John Spicer

Brian W. van Wilgen: Biological Invasions in South Africa

Relevant review articles/research papers/handouts of latest development in the subject

