BHAKTA KAVI NARSINH MEHTA UNIVERSITY, JUNAGADH

BOARD OF STUDIES (ZOOLOGY)

FACULTY OF LIFE SCIENCE

SYLLABUS FOR

BACHELOR OF SCIENCE HONOURS WITH RESEARCH PROGRAMME

IN

SUBJECT: ZOOLOGY

(SEMESTER- VII)

MAJOR MINOR & RESEARCH PROJECT

EFFECTIVE FROM JUNE, 2026

BOARD OF ZOOLOGY STUDIES

FORWARD

In academics, syllabus serves as a roadmap for teaching various topics in a well-defined manner. Along with constant changes in the field of subject, it is always required to review and update the syllabus so as to meet changing scenario at regional, national and global levels. In science, higher education at degree level creates base for students to sharpen their skills and enable them for securing employment. Moreover, for a few this also opens a new realm of research and education at post-graduation level. Hence, finalizing degree level syllabus requires to keep all these facts in mind.

The NEP 2020 states, "Assessments of educational approaches in undergraduate education that integrate the humanities and arts with Science, Technology, Engineering and Mathematics (STEM) have consistently shown positive learning outcomes, including increased creativity and innovation, critical thinking and higher-order thinking capacities, problem-solving abilities, teamwork, communication skills, more in-depth learning and mastery of curricula across fields, increases in social and moral awareness, etc., besides general engagement and enjoyment of learning".

Here, the current syllabus is finalized after elaborate discussions amongst well qualified and experienced teachers. The syllabus is prepared according to the guidelines of UGC under NEP 2020. We are delighted to share the curriculum and credit framework for B.Sc. Zoology (Honours with Research) Sem-7. The present syllabus encompasses latest trends in the subject. We are hopeful that students will be able to enhance their knowledge and understanding of the subject well.

Board of Studies, Zoology
Bhakta Kavi Narsinh Mehta University,
Junagadh – 362 001

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

Syllabus of B.Sc. (Honours with Research) as per NEP-2020

Faculty of Lifesciences

Effective from June 2026

Subject: Zoology

SEMESTER- VII

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BHAKTA KAVI NARSINH MEHTA UNIVERSITY

Syllabus of B.Sc. (Honours with Research) as per NEP-2020

Faculty of Lifesciences

Effective from June 2026

Subject: Zoology

SEMESTER- VII

SUMMARY OF THE SYLLABUS : B.Sc. Zoology (Honours with Research)

Sem. No.	Sr. No.	Category of Course	Course Title	Course Level	Credit	Teaching Hrs.	SEE Marks	CCE Marks	Total Marks	Exam Duration
7	1	Major-17	Biochemistry and Molecular Biology	6	4	60 Hrs.	50	50	100	2:00 Hrs.
	2	Major-18	Biostatistics, Research Methodology and AI	6	4	60 Hrs.	50	50	100	2:00 Hrs.
	3	Major-19	Combine Practical : Biochemistry, Molecular Biology, Biostatistics, Research Methodology and AI	6	4	120 Hrs.	50	50	100	4:00 Hrs.
	4	Minor-7	Ecology and Climate Change	6	4 (3T+1P)	75 Hrs. (45T+30P)	50	50	100	4:00 Hrs.
	5	*Research Project (RP)	Research Project	6	6	90 Hrs.	--	--	--	---
				Total	**22**					

*Research Project shall be conducted as per NEP 2020 framework and Bhakta Kavi Narsinh Mehta University guidelines.

Pattern of Examination for Major-17/18

EVALUATION OF 100 MARKS (4 CREDIT PAPER)

Continuous and Comprehensive Evaluation (CCE)-50 Marks		Semester End Evaluation (SEE)-50 Marks
Mid Semester Exam (Mandatory)-25 Marks	1. Class assignment -- 05 2. Home assignment -- 05 3. Field assignment -- 05 4. Viva/Oral exam -- 05 5. Attendance -- 05	Semester End Theory Examination 50 Marks
Total 25 Marks	Total 25 Marks	Total 50 Marks

Pattern of Examination for Major-19

EVALUATION OF 100 MARKS (4 CREDIT PAPER-PRACTICAL BASED)

Continuous and Comprehensive Evaluation (CCE)-50 Marks		Semester End Evaluation (SEE)-50 Marks
Mid Semester Exam (Mandatory)-25 Marks	1. Class assignment -- 05 2. Home assignment -- 05 3. Field assignment -- 05 4. Viva/Oral exam -- 05 5. Attendance -- 05	Semester End Practical Examination 50 Marks
Total 25 Marks	Total 25 Marks	Total 50 Marks

Pattern of Examination for Minor-7

EVALUATION OF 100 MARKS (3+1 CREDIT PAPER)

Continuous and Comprehensive Evaluation (CCE)-50 Marks		Semester End Evaluation (SEE)-50 Marks
Practical Exam (Mandatory)-25 Marks	1. Class assignment -- 05 2. Home assignment -- 05 3. Test -- 10 4. Attendance -- 05	Semester End Theory Examination 50 Marks
Total 25 Marks	Total 25 Marks	Total 50 Marks

Course Level	6		**Internal Marks**	50
Programme	B.Sc. Zoology (Honours with Research)		**External Marks**	50
Semester	VII		**Practical Internal**	--
Category of Course	Discipline Specific Major Courses (Major-17)		**Practical External**	--
Course Credit	04		**Prac. External Exam Duration**	--
Teaching Hours	60		**Total**	100
Course Code			**Exam Duration**	2.0 hrs
Course Title	Biochemistry and Molecular Biology			

Course Objectives:

- Understand the classification, mechanism of action, regulation, and biological significance of enzymes, and analyze factors affecting enzyme activity through enzyme kinetics.
- Explain the molecular organization of genes and genomes, including gene structure, regulation of gene expression, and mechanisms controlling transcription and translation in prokaryotic and eukaryotic systems.
- To understand gene mutations, chromosomal variations, and their biological significance.

Course Learning Outcomes: After completion of the course:

- Analyze enzyme kinetic parameters and evaluate factors influencing enzyme-catalyzed reactions.
- Examine the organization of genes and genomes, and describe the molecular mechanisms governing gene expression in prokaryotes and eukaryotes.
- Assess the impact of mutations, chromosomal abnormalities, and defects in DNA repair pathways.

Course Contents **Major-17**

Sem.	Unit No.	Syllabi	Teaching Hours
7	1	**Advanced Metabolic Biochemistry** 1.1 Macronutrients and micronutrients: vitamins and major minerals; their roles in enzyme function, nerve conduction, and oxygen transport. 1.2 Photosynthesis: light reactions, photophosphorylation, electron transport, and Calvin cycle. 1.3 Biosynthesis and functions of plant secondary metabolites: alkaloids, flavonoids, terpenoids; ecological and medicinal roles. 1.4 Bioenergetics: ΔG, ATP as energy currency, high-energy phosphate compounds (e.g., phosphoenolpyruvate, 1,3-bisphosphoglycerate, creatine phosphate).	15
	2	**Enzymes and enzyme kinetics** 2.1 Enzyme nomenclature, active site, cofactors, coenzymes, and isoenzymes. 2.2 Michaelis–Menten kinetics, Lineweaver–Burk plots, and kinetic parameters (Km, Vmax); inhibition types: competitive, non-competitive, uncompetitive, and mixed inhibition. 2.3 Allosteric regulation, feedback inhibition, and cooperativity (e.g., hemoglobin and aspartate transcarbamoylase). 2.4 Microbial enzyme production and industrial applications: amylases, proteases, lipases, cellulases, and pectinases. 2.5 Recombinant microbial systems for production of human proteins (e.g., insulin, growth hormone) using bacteria and yeast.	15
	3	**Gene Structure and Expression** 3.1 Concept of Gene: classical to molecular definition, fine structure of gene (cistron–recon–muton), gene organization, split genes, gene families, pseudogenes, overlapping genes, and transposable elements. 3.2 Gene expression I: genetic code and its properties, transcription in prokaryotes and eukaryotes, RNA polymerases, transcription factors, and RNA processing (capping, splicing, polyadenylation, RNA editing and transport). 3.3 Gene expression II: translation in prokaryotes and eukaryotes, ribosome structure and function, genetic code interpretation, translational regulation, protein folding, targeting, and post-translational modifications.	15

		3.4 Regulation of gene expression: operon models in prokaryotes, transcriptional regulation in prokaryotes and eukaryotes, epigenetic regulation, RNA-mediated regulation, chromatin remodeling, and gene regulatory networks.	
	4	**Mutation, Chromosomal Variation, DNA Repair, and Cytoplasmic Inheritance** 4.1 Molecular basis of mutations: spontaneous and induced mutations, types of gene mutations, mutagenic agents, mechanisms of mutagenesis, and effects on gene function. 4.2 Structural and numerical chromosomal aberrations: mechanisms, causes, and genetic consequences. 4.3 DNA damage: sources, types, and molecular mechanisms of DNA repair systems in prokaryotes and eukaryotes. 4.4 Cytoplasmic inheritance: mitochondrial and chloroplast genomes, maternal inheritance, and non-Mendelian inheritance patterns.	15

Suggested Reading:

1. Lehninger Principles of Biochemistry by David L. Nelson & Michael M. Cox
2. Harper's Illustrated Biochemistry by Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly & P. Anthony Weil
3. Introduction to Plant Biochemistry by Trevor Palmer
4. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry by Palmer & Bonner
5. Industrial Microbiology by L. E. Casida Jr.
6. Genes XII by Benjamin Lewin
7. Biochemistry by U. Satyanarayana & U. Chakrapani
8. Cell and Molecular Biology by P. K. Gupta
9. Molecular Biology by Veer Bala Rastogi.
10. The physiology and Biochemistry of Prokaryotes, 2nd edition By. David white
11. Outlines of biochemistry By- Conn E.E. and Stumpt P.K.: 4th Ed
12. General microbiology by Stanier R.Y.: 5th Ed.
13. General microbiology by Powar and Daginawala Vol-1
14. Molecular Biology of the Gene
15. Molecular Biology of the Cell
16. Lewin's Genes
17. Molecular Cell Biology

Course Level	6		**Internal Marks**	50
Programme	B.Sc. Zoology (Honours with Research)		**External Marks**	50
Semester	VII		**Practical Internal**	--
Category of Course	Discipline Specific Major Courses (Major-18)		**Practical External**	--
Course Credit	04		**Prac. External Exam Duration**	--
Teaching Hours	60		**Total**	100
Course Code			**Exam Duration**	2.0 hrs
Course Title	Biostatistics, Research Methodology and AI			

Course Objectives:
This course aims to:

- Provide students with an understanding of biostatistical concepts, data classification, probability distributions, and statistical measures commonly used in biological sciences.
- Develop knowledge of statistical tools such as correlation, regression, t-test, chi-square, ANOVA, and multivariate analysis for biological data interpretation.
- Familiarize students with scientific research methodology, including research design, hypothesis testing, sampling methods, data validation, plagiarism, and referencing tools.
- Introduce the fundamentals of artificial intelligence, machine learning concepts, and their applications in biology, healthcare, and modern scientific research.

Course Learning Outcomes: After completion of the course, students will be able to:

- Organize and interpret biological data using descriptive statistics, probability distributions, and measures of variation.
- Apply statistical tests and analytical methods for interpretation of biological and experimental data.
- Design basic research studies, formulate hypotheses, validate data, and follow ethical scientific research practices.
- Explain fundamental concepts of artificial intelligence and evaluate its applications in biology, healthcare, and interdisciplinary sciences.

Course Contents **Major-18**

Sem.	Unit No.	Syllabi	Teaching Hours
7	1	**Basics and Concepts of Biostatistics** 1.1 Data classification, Frequency distribution and Graphs. 1.2 Measure of Central Tendency: Meaning, Objectives, Merits, Demerits & Uses. 1.3 Measure of Dispersion – Range, Variance, Standard deviation, Coefficient of Variation 1.4 Probability distributions (Binomial, Poisson and normal), Sampling distribution; Parametric and non-parametric statistics; Errors; Levels of significance, Confidence limit and confidence interval.	15
	2	**Statistical tests in Biology** 2.1 Regression and Correlation analysis. 2.2 Student's t-test: Paired and Unpaired. 2.3 Degree of Freedom, Chi-square test; Analysis of Variance (ANOVA) 2.4 Basics of Multivariate statistics.	15
	3	**Basic Research Methodology** 3.1 Research problem, Aims & Objectives, types of scientific research 3.2 Hypothesis formulation and testing, Literature survey and review, scientific writing, and research ethics 3.3 Sampling techniques, optimization of protocol, graphical data analysis, data validation 3.4 Plagiarism, Referencing tools	15
	4	**Artificial Intelligence Foundation** 4.1 Introduction to Artificial Intelligence, AI fundamentals, use-cases and applications of AI, ethical concerns in AI, research ethics, algorithmic bias, career opportunities, and future scope. 4.2 Brief history of AI and ML in Healthcare and biology, Machine Learning workflow and basic terminologies, computational models of intelligence. 4.3 Applications of AI in genomics, bioinformatics, disease diagnosis, drug discovery, and biological data analysis	15

Suggested Readings

1. Introduction to Bio-Statistics, Banerjee Pranab Kumar, S Chand & Company
2. Biostatistics, Veer Bala Rastogi, Medtech
3. Biostatistics Analysis, Zar, Pearson
4. Biostatistics for health and life sciences, Rao K Surya, Himalaya Publishing house
5. An Introduction to Biostatistics, Gurumani
6. Research methodology, C R Kothari, New Age Publishers
7. Principles of Biostatistics by Marcello Pagano, Duxbury Thomson Learning
8. Russell, Norvig, Artificial Intelligence: A Modern Approach, Third edition, Prentice Hall, 2010
9. Artificial Intelligence in Healthcare
10. Foundations of Artificial Intelligence in Healthcare and Bioscience

Course Level	6	**Internal Marks**	50
Programme	B.Sc. Zoology (Honours with Research)	**External Marks**	--
Semester	VII	**Practical Internal**	--
Category of Course	Discipline Specific Major Courses (Major-19)	**Practical External**	50
Course Credit	04	**Prac. External Exam Duration**	4 hrs
Teaching Hours	120	**Total**	100
Course Code		**Exam Duration**	4 hrs
Course Title	Combine Practical : Biochemistry, Molecular Biology, Biostatistics, Research Methodology and AI		

Course Objectives: This course aims to:

- Develop practical understanding of biochemical and molecular biology techniques for estimation of biomolecules and enzyme analysis.
- Provide hands-on training in biotechnology techniques including plant tissue culture, animal cell culture, and nucleic acid estimation.
- Familiarize students with statistical methods for analysis, interpretation, and validation of biological data.
- Introduce research methodology, proposal preparation, and application of AI tools in biological research.

Course Learning Outcomes: After completion of the course, students will be able to:

- Perform biochemical and molecular biology experiments for estimation of biomolecules and enzyme kinetics.
- Apply biotechnology techniques including tissue culture, cell culture, and basic aseptic laboratory procedures.
- Analyze biological data using statistical tools such as correlation, regression, t-test, ANOVA, and chi-square test.
- Apply research methods, data analysis tools, and AI platforms such as ChatGPT and Google Gemini for scientific research and literature search.

Course Contents **Major-19**

Sem.	Practical no.	Syllabi	Teaching Hours
7	1.	Estimation of sugar by DNSA method	60
	2.	Extraction and estimation of protein by Folin-Lowry method	
	3.	To determine the saponification value of fats and oils	
	4.	Perform the qualitative test of plant secondary metabolites	
	5.	Perform the amylase activity	
	6.	Determination of Vmax and Km for the amylase enzyme by performing a substrate curve with a Lineweaver-Burk plot.	
	7.	Determination of Vmax and Km for phosphatase by performing a substrate curve with the Lineweaver-Burk plot	
	8.	Preparation of plant tissue culture media	
	9.	Perform the surface sterilization of explants	
	10.	Preparation of animal cell culture media	
	11.	Quantitative estimation of DNA by the diphenylamine method	
	12.	Quantitative estimation of RNA by orcinol method	
	13.	Frequency Distribution.	
	14.	Standard Deviation and Coefficient of Variation	
	15.	Confidence limits for the population mean.	
	16.	Student’s t-test.	
	17.	Analysis of Variance.	
	18.	Regression and Correlation	
	19.	Chi Square Test	
	20.	Research proposal preparation.	
	21.	Multivariate tools and its application	
	22.	Data validation using statistical tools	
	23.	Graphical data analysis	
	24.	Introduction to AI tools for biological data analysis	
	25.	Use of ChatGPT / Gemini / AI tools in scientific literature search	

Suggested Reading:

1. Practical Biochemistry – 5th edition – Keith Wilson, John Walker – Cambridge University Press, Cambridge
2. An Introduction to Practical Biochemistry – 3rd edition – David T. Plummer – McGraw Hill Education Publishers
3. Biochemical Methods – 3rd edition – S. Sadasivam, A. Manickam – New Age International Publishers, New Delhi
4. Laboratory Manual in Biochemistry, Immunology and Biotechnology – 1st edition – P. K. Gupta – Rastogi Publications, Meerut
5. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications – 7th edition – R. Ian Freshney – Wiley-Blackwell Publishers
6. Plant Tissue Culture: Theory and Practice – Revised edition – S. S. Bhojwani, M. K. Razdan – Elsevier Science Publishers, Amsterdam
7. Fundamentals of Biostatistics – 8th edition – Bernard Rosner – Cengage Learning Publishers
8. Biostatistical Analysis – 5th edition – Jerrold H. Zar – Pearson Education Publishers
9. Research Methodology: Methods and Techniques – 3rd edition – C. R. Kothari, Gaurav Garg – New Age International Publishers, New Delhi
10. Artificial Intelligence in Life Sciences and Healthcare – 1st edition – P. V. Lakshmi – Academic Press Publishers

Course Level	6		**Internal Marks**	25
Programme	B.Sc. Zoology (Honours with Research)		**External Marks**	50
Semester	7		**Practical Internal**	25
Category of Course	Discipline Specific Minor Courses (Minor-7)		**Practical External**	--
Course Credit	04 (3+1)		**Prac. External Exam Duration**	2 Hrs.
Teaching Hours	60		**Total**	100
Course Code			**Exam Duration**	2 Hrs.
Course Title	Ecology and Climate Change			

Course Objectives: This course aims to:

- Provide students with an understanding of population and community ecology, including ecological organization, species interactions, community structure, and ecological succession.
- Develop knowledge of ecosystem functioning through productivity, biogeochemical cycles, ecosystem services, resilience, and sustainable management practices.
- Familiarize students with the Earth's climate system, causes of climate change, climate indicators, and scientific approaches to climate monitoring.
- Introduce the ecological impacts of climate change and build understanding of mitigation, adaptation, and climate governance frameworks.

Course Learning Outcomes: After completion of the course, students will be able to:

- Analyze population characteristics, species interactions, community organization, and ecological succession in natural ecosystems.
- Evaluate ecosystem productivity, nutrient cycling, ecosystem services, and approaches for ecosystem restoration and sustainability.
- Interpret climate system processes, assess causes and evidence of climate change, and apply climate monitoring concepts.
- Assess climate change impacts on ecosystems and explain mitigation, adaptation, and climate governance strategies.

Course Contents **Minor-7**

Sem.	Unit No.	Syllabi	Teaching Hours
7	1	**Population and Community Ecology** 1.1 Ecological Foundations: Levels of ecological organization; habitat, ecological niche and ecological adaptations; Gause's principle of competitive exclusion and resource partitioning 1.2 Population Ecology: Population characteristics and growth patterns; carrying capacity and population regulation 1.3 Population Interactions: Competition, predation, parasitism, mutualism and commensalism 1.4 Community Ecology: Community structure and organization; species diversity, richness and evenness; ecotone and edge effect 1.5 Ecological Succession: Types and processes; climax concept	10
	2	**Ecosystem Ecology** 2.1 Ecosystem Productivity: Primary and secondary productivity; factors affecting productivity 2.2 Biogeochemical Cycles: Carbon, nitrogen, phosphorus and hydrological cycles 2.3 Ecosystem Services: Provisioning, regulating, supporting and cultural services 2.4 Ecosystem Resilience and Sustainability: Ecosystem resilience; ecological restoration; sustainable ecosystem management	11
	3	**Climate Change and Earth System Processes** 3.1 Climate System and Basics: Weather and climate; atmospheric structure; solar radiation; Earth's heat budget; greenhouse effect 3.2 Causes of Climate Change: Natural climate variability; human activities; greenhouse gases; land-use change and deforestation 3.3 Evidence of Climate Change: Global warming; glacier retreat; sea-level rise; ocean acidification; extreme weather events 3.4 Climate Monitoring: Climate indicators; basic ideas of climate monitoring and modelling; carbon footprint and ecological footprint	12
	4	**Climate Change Impacts, Responses and Governance** 4.1 Impacts of Climate Change: Effects on terrestrial, freshwater, coastal and marine ecosystems; species distribution shifts; phenology 4.2 Climate Change Mitigation: Carbon cycle; carbon sequestration; carbon budgeting; renewable energy; nature-based solutions 4.3 Climate Change Adaptation: Climate-smart agriculture; ecosystem-based adaptation; water resource management; disaster risk reduction 4.4 Climate Governance (India and Global Context): Overview of UNFCCC and Paris Agreement; India's climate policy	12

		framework with special reference to NAPCC and regulatory role of National Green Tribunal (NGT)**;** climate resilience and community participation	

Suggested Reading:

1. Fundamentals of Ecology by Eugene P. Odum and Gary W. Barrett.
2. Ecology: From Individuals to Ecosystems by Michael Begon, Colin R. Townsend and John L. Harper.
3. Elements of Ecology by Thomas M. Smith and Robert L. Smith.
4. Ecology by Michael L. Cain, William D. Bowman and Sally D. Hacker.
5. Ecological Methodology by Charles J. Krebs.
6. A Primer of Ecology by Nicholas J. Gotelli.
7. Community Ecology by Peter J. Morin.
8. The Economy of Nature by Robert E. Ricklefs and Rick Relyea.
9. Environmental Biology by P. D. Sharma.
10. Introduction to Modern Climate Change by Andrew E. Dessler.
11. Climate Change: The Science of Global Warming and Our Energy Future by Edmond A. Mathez and Jason E. Smerdon.
12. Climate Change Biology by Lee Hannah.
13. Principles of Environmental Science by William P. Cunningham and Mary Ann Cunningham.
14. Environmental Science: Earth as a Living Planet by Daniel B. Botkin and Edward A. Keller.

Suggested Practical **Minor-7**

No.	Syllabi	Teaching hours
1.	Ecological Sampling and Vegetation Analysis: Study of vegetation using quadrat methods for determination of frequency, density, abundance and Importance Value Index (IVI).	30
2.	Biodiversity Assessment: Assessment of species richness, diversity and evenness using Shannon-Wiener and Simpson's diversity indices.	
3.	Community Structure Analysis: Study of community composition, dominance and species associations in selected ecosystems.	
4.	Population Ecology: Determination of population characteristics including density, dispersion patterns and growth patterns using field data.	
5.	Estimation of Primary Productivity: Determination of primary productivity using light and dark bottle method or suitable ecosystem models.	
6.	Ecosystem Structure and Energy Flow Analysis: Construction and analysis of food chains, food webs and ecological pyramids from field observations.	
7.	Carbon Stock and Biomass Estimation: Estimation of above-ground biomass and carbon sequestration potential of selected plant communities.	
8.	Climate Data Analysis: Analysis of long-term climatic data (temperature, rainfall, humidity and CO_2 concentration) using IMD/IPCC datasets.	
9.	Climate Change Vulnerability Assessment: Assessment of ecological vulnerability of selected ecosystems using standard indicators.	
10.	GIS and Remote Sensing Applications: Introduction to GIS software for land-use and land-cover analysis and interpretation of satellite images for environmental monitoring.	
11.	Ecological Niche and Species Distribution Mapping: Mapping species distribution and habitat suitability using available GIS datasets.	
12.	Biodiversity Documentation: Preparation of biodiversity inventory of a selected ecosystem using field survey methods.	
13.	Carbon Footprint Assessment: Calculation of individual, household or institutional carbon footprint.	
14.	Field Study: Field visit to a protected area, wetland, coastal ecosystem, forest ecosystem or biodiversity hotspot and submission of a field report.	

Course Level	6		**Internal Marks**	--
Programme	B.Sc. Zoology (Honours with Research)		**External Marks**	--
Semester	VII		**Practical Internal**	--
Category of Course	Research Project (RP)		**Practical External**	--
Course Credit	6		**Prac. External Exam Duration**	--
Teaching Hours	90		**Total**	--
Course Code			**Exam Duration**	--
Course Title	Research Project (RP)			

Course Objectives:

This course aims to:

- Develop understanding of scientific research methodology through independent research work.
- Train students in literature survey, experimental design, data collection and analysis.
- Develop scientific writing, presentation skills and ethical research practices.

Course Learning Outcomes: After completion of the course, students will be able to:

- Identify and formulate a research problem in zoological sciences.
- Conduct experimental or field-based research using scientific methods.
- Analyze data and prepare a scientific project report.
- Present research findings through seminar and viva-voce examination.

Research Project Broad Themes

Theme	Topics
1. Ecology, Environment and Climate Change Studies	• Biodiversity assessment and faunal diversity documentation • Population ecology and community ecology studies • Habitat analysis and ecosystem monitoring • Climate change impacts on terrestrial, freshwater and marine ecosystems • Ecological restoration and environmental monitoring • Pollution and biomonitoring studies

2. Wildlife Biology and Conservation Research	• Biodiversity assessment and habitat utilization studies • Conservation biology and protected area management • Human-wildlife interactions and conflict studies • Species distribution and ecological adaptation studies • Threatened species assessment and biodiversity conservation
3. Marine, Freshwater and Fisheries Biology	• Plankton diversity and abundance analysis • Water quality assessment and aquatic ecosystem studies • Fisheries biology and fish diversity assessment • Aquaculture and fish health studies • Coastal ecosystem ecology and marine biodiversity studies
4. Animal Behaviour, Physiology and Applied Zoology	• Behavioural ecology and animal communication studies • Feeding, reproductive and migratory behaviour studies • Nutritional physiology and stress physiology • Entomology, parasitology and vector biology • Toxicological and ecophysiological studies
5. Biochemistry and Laboratory-based Zoological Research	• Enzyme assays and biochemical analysis • Protein, carbohydrate and lipid estimation • Physiological and metabolic investigations • Comparative biochemical adaptations in animals • Experimental studies in animal physiology
6. Cell Biology, Molecular Biology, Biotechnology and Computational Biology	• Cell biology, DNA/RNA isolation and biomolecular analysis • Molecular diagnostic approaches in biological sciences • Biotechnology applications in zoological sciences • Bioinformatics and computational biology applications • Artificial intelligence and data analysis in biological research

Research Project Guidelines

1. Each student shall undertake an individual research project under the supervision of a faculty member.
2. The research topic shall be selected in consultation with the supervisor and approved by the department.
3. The project may involve laboratory experiments, field studies, survey-based investigations, computational analysis, literature-based systematic review, or interdisciplinary biological studies.
4. Students shall conduct literature survey and prepare a research proposal before commencement of the project.

5. Students shall maintain a project record book containing methodology, observations, data collection and progress reports.
6. Experimental work or field work shall be conducted following laboratory safety rules, biosafety guidelines and research ethics.
7. Data generated during the study shall be analyzed using appropriate statistical or analytical methods.
8. Students shall prepare a dissertation/report based on scientific writing format.
9. Each student shall present research findings through seminar presentation before internal and/or external examiners.
10. Final evaluation shall be based on research work, dissertation quality, presentation and viva voce examination as per the guidelines of NEP 2020 and BKNMU.

Theory Examination Paper Style NEP 2020
SEMESTER – VII
Major- 17,18/Minor-7 (Theory)

Time: 2 Hours **Total Marks: 50**

Instructions:
1. Illustrate your answer with neat and labelled diagrams.
2. Figure to the right side indicates full marks of questions.

EXTERNAL ASSESSMENT BY UNIVERSITY			
Que. No.	**Particulars**	**Unit**	**Marks**
Que. 1	(1) …….	Unit 1	05
	(2) …….		05
	Or		
	(1) …….		05
	(2) …….		05
Que. 2	(1) …….	Unit 2	05
	(2) …….		05
	Or		
	(1) …….		05
	(2) …….		05
Que. 3	(1) …….	Unit 3	05
	(2) …….		05
	Or		
	(1) …….		05
	(2) …….		05
Que. 4	(1) …….	Unit 4	05
	(2) …….		05
	Or		
	(1) …….		05
	(2) …….		05
Que. 5	(1) …….	Unit 1 & 2	05
	(2) …….		05
	Or		
	(1) …….	Unit 3 & 4	05
	(2) …….		05
Total			**50**

Practical Examination Paper Style NEP 2020

Major-19: Combine Practical: Biochemistry, Molecular Biology, Biostatistics, Research Methodology and AI

Time: 4 Hours **Total Marks: 50**

Que. No.	Particulars	Marks
Que-1	Do as per instruction and show it to examiner.	**08**
Que-2	Do as per instruction and show it to examiner.	**08**
Que-3	Do as per instruction and show it to examiner.	**08**
Que-4	Do as per instruction and show it to examiner.	**08**
Que-5	Do as per instruction and show it to examiner.	**08**
Que-6	Certified Journal.	**05**
Que-7	Viva-voce.	**05**

Practical Examination Paper Style NEP 2020

Minor-07: Practical: Ecology and Climate Change

Time: 2 Hours **Total Marks: 25**

Que. No.	Particulars	Marks
Que-1	Do as per instructions and show it to examiner.	**04**
Que-2	Do as per instructions and show it to examiner.	**04**
Que-3	Do as per instructions and show it to examiner.	**04**
Que-4	Do as per instructions and show it to examiner.	**04**
Que-5	Certified Journal.	**04**
Que-6	Viva-voce.	**05**

Pattern of Research Project Evaluation

As per NEP 2020 and BKNMU guidelines