

# હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી

NAAC A (3.02) State University

પો.બો.નં.-૨૧, યુનિવર્સિટી રોડ, પાટણ (ઉ.ગુ.) ૩૮૪૨૬૫

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પરિપત્ર ક્રમાંક - ૨૬૬ / ૨૦૧૯

વિષય :- વિજ્ઞાન વિદ્યાશાખાના જૂલોજી વિષયના અનુસ્નાતક કક્ષાના સેમેસ્ટર-૧ અને ૨ ના નવા અભ્યાસક્રમ અંગે...

સંદર્ભ :- પરિપત્ર ક્રમાંક : ૪૪/૨૦૧૯

આ યુનિવર્સિટીના લાઈફ સાયંસ વિભાગના અધ્યક્ષશ્રી તથા સંલગ્ન વિજ્ઞાન વિદ્યાશાખાની તમામ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, આ યુનિવર્સિટીના તારીખ : ૧૪/૦૩/૨૦૧૯ ના પરિપત્ર નંબર - ૪૪/૨૦૧૯ , જાવક નંબર- એકે/અ×સ/૧૦૧૬૩/૨૦૧૯ થી જૂલોજી વિષયનો સેમેસ્ટર-૧ થી ૪ નો અનુસ્નાતક કક્ષાનો અભ્યાસક્રમ પરિપત્રીત કરેલ છે, જેમાં લાઈફ સાયંસ વિભાગના અધ્યક્ષશ્રીને સોંપવામાં આવેલ જવાબદારી અન્વયે તેઓશ્રીએ સુધારા સૂચવતો રજૂ કરેલ નવો એમ.એસસી. જૂલોજીનો સેમેસ્ટર-૧ અને ૨ નો સામેલ પરિશિષ્ટ પ્રમાણે નો સુધારેલ અભ્યાસક્રમ / સ્કીમ જૂન-૨૦૧૯ થી ક્રમશઃ અમલમાં આવે તે રીતે એકેડેમિક કાઉન્સિલવતી માન.કુલપતિશ્રીએ મંજૂર કરેલ છે. જેનો અમલ થવા સારૂ સંબંધિતોને આથી આ સાથે મોકલવામાં આવે છે.


આ બાબતની સંબંધિતોને આપના સ્તરેથી જાણ કરવા વિનંતી છે.

નોંધ: (૧) વિદ્યાર્થીઓની જરૂરીયાત માટે પરિપત્રની એક નકલ કોલેજ/વિભાગના ગ્રંથાલયમાં મૂકવાની રહેશે.

(૨) આ પરિપત્ર યુનિવર્સિટીની વેબ સાઈટ [www.ngu.ac.in](http://www.ngu.ac.in) પર પણ ઉપલબ્ધ કરાવવામાં આવનાર છે.

નં.-એ કે/અ× સં/૪૭૨૬ / ૨૦૧૯

તારીખ: ૪/૦૯/૨૦૧૯

  
કુલસચિવવતી

પ્રતિ

૧. અધ્યક્ષી, લાઈફ સાયંસ વિભાગ, હેમ. ઉ.ગુ.યુનિવર્સિટી, પાટણ
૨. સંલગ્ન સાયંસ કોલેજોના આચાર્યશ્રીઓ
૩. અધ્યક્ષશ્રી/ કો. ઓર્ડીનેટરશ્રી-વિજ્ઞાન વિદ્યાશાખા અંતર્ગત વિષયોના અનુસ્નાતક વિભાગો, હેમ. ઉ.ગુ. યુનિવર્સિટી, પાટણ.
૪. ડૉ. એમ. બી. પ્રજાપતિ (ડીનશ્રી), ગણિતશાસ્ત્ર વિભાગ, હેમ. ઉ.ગુ. યુનિવર્સિટી, પાટણ.
૫. પરીક્ષા નિયામકશ્રી, હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ. (પાંચ નકલ)
૬. ગ્રંથપાલશ્રી, હેમ.ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ. (વિદ્યાર્થીઓના ઉપયોગ સારૂ રેકર્ડ ફાઈલ માટે)
૭. સિસ્ટમ એનાલીસ્ટશ્રી, કોમ્પ્યુટર (રીઝલ્ટ) સેન્ટર, હેમ.ઉ.ગુ.યુનિવર્સિટી, પાટણ. તરફ પરિણામ માટે તથા વેબસાઈટ પર મૂકવા સારૂ.
૮. અનુસ્નાતક પ્રશાખા (એકેડેમિક શાખા) હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ.
૯. મુખ્ય હિસાબી અધિકારીશ્રી (મહેકમ), હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ તરફ → પરિપત્રની ફાઈલ અર્થે
૧૦. સિલેક્ટ ફાઈલે. (૨ નકલ)

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

NAAC A (3.02) State University

PATAN- 384265

**Faculty of Science**

**M. Sc. Zoology**

Syllabus/ scheme

**Sem. – 2**



Sem./CBCS/Grading pattern

**w. e. f. June-2019**

Date: 01/08/2019

Total page: 27

<b>HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY PATAN</b>	
<b>M. Sc. (Zoology) CBCS Syllabus 2019</b>	
<b>Document code</b>	<b>Syllabus ZOO- 2019</b>
<b>Name of faculty</b>	<b>Science</b>
<b>Faculty code</b>	<b>SCI</b>
<b>Programme name</b>	<b>ZOOLOGY</b>
<b>Programme code</b>	<b>ZOO</b>
<b>Effective from</b>	<b>June-2019</b>

The proposed new structure for M. Sc. course is based on Choice Based Credit System (CBCS) which is in force June-2019.

### **CBCS Course Pattern**

1. This programme is divided into **Four Semesters** (Two Years). The duration of an academic year consists of two semester, each of 15 weeks for teaching. The academic session in each semester will provide 90 teaching days. Each semester has 24 credit and the programme is comprised of total 96 credits.
2. There will be three categories of courses/papers in this programme:
  - A. Four Compulsory – **Core** theory **courses** with 4 credits each in every semester.
  - B. One choice based elective course (disciplinary/interdisciplinary) with 2 credits in each semester.
  - C. Two practical each of 3 credits in each semesters.
  - D. In the semester IV, courses similar to the above A, B, C and / or Dissertation work;
3. Detailed course pattern for each semester is given below.

**Note:**

1. For four credit course: each syllabus is of 4 units having equal weightage.
2. For two credit course: each syllabus is of 2 units having equal weightage.
3. For question paper of 70 marks: each question paper shall have 2 sections and having 3 questions each.

<b>Section I</b>	<b>Must be drawn from Unit 1 and 2</b>
Q. 1	One long question of 14 marks OR two short questions of 7 marks each from Unit 1.
Q. 2	One long question of 14 marks OR two short questions of 7 marks each from Unit 2.
Q. 3	Short questions of 7 marks from Unit 1 & 2
<b>Section II</b>	<b>Must be drawn from Unit 3 and 4</b>
Q. 4	One long question of 14 marks OR two short questions of 7 marks each from Unit 3.
Q. 5	One long question of 14 marks OR two short questions of 7 marks each from Unit 4.
Q. 6	Short questions of 7 marks from Unit 3 & 4

4. For question paper of 35 marks: each question paper shall have 3 questions: Q-1 from unit-1 of 15 marks, Q-2 from unit-2 of 15 marks and Q-3 is of objective type having 05 marks from all the units of the paper.

<b>Section I</b>	<b>Must be drawn from Unit 1</b>
Q. 1	Two long question of 15 marks OR three short questions of 5 marks each from Unit 1.
	<b>Must be drawn from Unit 2</b>
Q. 2	Two long question of 15 marks OR three short questions of 5 marks each from Unit 2.
Q. 3	Short questions of 5 marks from Unit 1 & 2

## M. Sc. Semester II

Course	Course code	Paper title	Exam duration (Hours)	External marks	Internal marks	Total marks	Teaching hours per week	Credit points
Paper-I	ZOCC-201	Biochemistry	2.30	70	30	100	4	4
Paper-II	ZOCC-202	Instrumentation and Analytical Techniques	2.30	70	30	100	4	4
Paper-III	ZOCC-203	Biostatistics and Research Methodology	2.30	70	30	100	4	4
Paper-IV	ZOCC-204	Animal Taxonomy -2	2.30	70	30	100	4	4
Practical Paper-I	ZOOPR-201	Biochemistry, Instrumentation and Analytical Techniques	More than 4 hours	75		75	6	3
Practical Paper-II	ZOOPR-202	Biostatistics, Research Methodology and Animal taxonomy -2	More than 4 hours	75		75	6	3
Elective Course	ZOOEC-201 <b>OR</b> ZOOEC-202 <b>OR</b> ZOOEC-203	Wildlife and Conservation Biology - 2  Fisheries and Aquaculture -2  Environmentally Sound Technologies-2	2.00	35	15	50	2	2
Total				465	135	600	30	24

# ZOCC- 201 BIOCHEMISTRY

## UNIT I- Fundamentals of Biochemistry

- Chemical bonds and Stabilizing interactions: Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction
- Water: weak interactions in aqueous systems, ionization of water, weak acids, and weak bases,
- pH and buffer: pH and buffer and Buffering against pH changes in biological systems.
- Energy flow: principles of thermodynamics, free energy and chemical potential, redox reactions, structure and function of ATP.

## UNIT II - Biomolecules and Metabolism-1

- Carbohydrates: Classification, Occurrence, Structure, properties and functions of Monosaccharides (Triose, Pentose and Hexose), Disaccharides and Polysaccharides (Starch, glycogen and Cellulose).
- Carbohydrate metabolism: Glycolysis, Glycogenesis, TCA cycle, Electrone transport system, Oxidative phosphorylation and photophosphorylation, Hexose monophosphate shunt.
- Lipids: Classification of Lipids, Occurrence, Structure, properties and Function of Simple lipids (Triglycerides and Waxes) and Complex lipids (Phospholipids and Sphingolipids).
- Lipid metabolism: Biosynthesis of fatty acids and Phospholipids, Catabolism of fatty acids and  $\beta$ - Oxidation of fatty acids.

## UNIT III- Biomolecules and Metabolism-2

- Amino Acids: Structure, Properties, and Classification of Amino Acids.
- Amino acid metabolism: Biosynthesis and break down of amino acids, transamination and deamination.
- Protein: Classification of Proteins, properties, Function and Conformation of Proteins (primary, secondary, tertiary and quaternary structure), Ramachandran Plot, protein domains and folds, Protein denaturation and stability
- Interrelationship between metabolism of Carbohydrate, Lipid and Protein.

## UNIT IV- Enzymes and Vitamins

- Enzymes: An introduction to Enzymes, Nomenclature, Classification of Enzymes. Properties of enzymes, Apo-enzymes, coenzymes, cofactors and prosthetic groups.
- Mechanisms of enzyme action, Kinetics of an enzyme- catalyzed reaction and inhibition.
- Enzyme regulation: Allosteric enzyme regulation, Covalent modification.
- Vitamins: Occurrence, Classification, Structure and function of various Vitamins and their deficiency diseases.

## References

1. Harper H. A. 1993 Review of Physiological Chemistry (Lange Publications).
2. Lehninger A. I., Nelson D. L. and Cox M.M. 1993. Principles of Biochemistry (CBC Publishers).
3. Rastogi S. C. 2003 Biochemistry (Tata Mc GrawHill Publishing Co. Ltd.).

# ZOCC-202 INSTRUMENTATION AND ANALYTICAL TECHNIQUES

## UNIT I– Basic Laboratory Instruments

- Principle and working of pH meter, Laminar-air flow.
- Centrifugation: Types of centrifuge machines, preparative and analytical centrifuges, differential centrifugation, sedimentation velocity, sedimentation equilibrium, density gradient methods and their applications.

## UNIT II– Chromatographic and Electrophoresis Techniques

- Principle and applications of Native-PAGE, SDS-PAGE, Agarose and 2D gel Electrophoresis. Capillary electrophoresis and its applications.
- Principle, methodology and applications of gel – filtration, ion –exchange and affinity Chromatography; Thin layer and High Performance Thin Layer Chromatography (HPTLC). Gas chromatography, High performance liquid chromatography (HPLC) and FPLC.

## UNIT III– Spectroscopy and Microscopy

- Spectroscopy Technique: Principle and application of UV- visible spectrometer, AAS and Plasma Emission Spectroscopy.
- Mass Spectroscopy: Principle of MALDI, Types of Detectors
- Microscopic Techniques: Principle and applications of Light, Phase contrast and Fluorescence Microscopy, Principle and applications of SEM and TEM

## UNIT IV– Immuno Techniques and Radio-isotopic Technique

- Antibody generation, detection of molecules using ELISA, RIA, Western blot, immunoprecipitation, Immunofluorescence microscopy, detection of molecules in living cells- in-situ localization by FISH.
- Principle and applications of Flow cytometry.
- Radiolabeling techniques: Properties of different types of radioisotopes used in Biology, their detection and measurement, Autoradiography.

## Reference

1. Wilson, K. and Walker, J., (2010). Principles and Techniques of Biochemistry and Molecular Biology, 7th edition, Cambridge University Press (Low price edition), New York.
2. Webster J. G., (2009). Bioinstrumentation, Student edition, Wiley India (P) Ltd. New Delhi.
3. Sharma, B. K., (2005). Instrumental methods of chemical analysis, 24th edition, GOEL publishing house, Meerut.



# ZOCC-203 BIOSTATISTICS AND RESEARCH METHODOLOGY

## UNIT I – Parametric statistics

- Definition and scope, Organizing a statistical survey and presentation of statistically analyzed information
- Basic statistical methods: Measures of central tendency, dispersion and standard error; Probability distributions: binomial, poisson and normal distribution
- Statistical significance: Hypothesis testing, types of error, level of significance, Student's t test, F test and Chi square goodness of fit
- Simple linear regression and correlation analysis

## UNIT II – Non parametric statistics

- Comparing Parametric and Non parametric statistics, Rank test, F-max test, Mann – Whitney (U) test, and Sign test
- Applications of non parametric statistics in biological research
- Basic computing: MS Office ®, Internet
- Data base management, Use of computers in statistical analysis

## UNIT III – Research methodology

- Characteristics and types of scientific research
- Basics of research methodology
- Research and Experimental design
- Method of Data collection

## UNIT IV – Scientific deliveries

- Scientific Deliveries and Communications: Writing Research proposal, Paper, Thesis, Report and Citations
- Citations, H-Index, I10-Index, Impact factor and selection criteria of scientific journals for research publications
- Presenting scientific research: Power point presentations, Posters, Flyers, etc.
- Publication processes, Review Processes and Significance of scientific communications

## References

1. Milton, J.S 1992 Statistical Methods in Biological and Health Science. McGraw-Hill Inc, New York.
2. Scheffler, W.C. 1963 Statistics for biological sciences. Addition - Wesley Publication Co., London.
3. Snedecor, G. Wand Cocham, W. G. 1967 Statistical Methods. Oxford Publication Co., New Delhi.
4. Spiegel, M.R. 1981 Theory and problems of statistics, Schaum's Outline Series McGraw -Hill International Book Co., Singapore.
5. Day R.A. 7<sup>th</sup> Edition. How to write and publish a scientific paper

## ZOCC-204 ANIMAL TAXONOMY -2

### UNIT I– Classification of non chordates-2 (up to classes)

- Classification, characteristics and diversity of Annelida
- Classification, characteristics and diversity of Nematoda
- Classification, characteristics and diversity of Arthropoda
- Classification, characteristics and diversity of Echinodermata.
- Classification, characteristics and diversity of Hemichordata

### UNIT II– Introduction to vertebrates-1

- Classification and characteristics of subphylum vertebrata
- Classification, characteristics and diversity of different classes of fishes
- Structural and functional adaptation of fishes
- Evolution of terrestrial vertebrates

### UNIT II– Introduction to vertebrates-2

- Classification, characteristics and diversity of class amphibia
- Classification, characteristics and diversity of class reptilian
- Classification, characteristics and diversity of class Aves
- Classification, characteristics and diversity of class mammals

### UNIT IV– UNIT IV– Methods inTaxonomy

- Zoological nomenclature and ICZN rules and regulation
- Type concept
- DNA barcoding of animal species
- Procedure of collection, preservation and identification of species

### References

1. Hickman C. P., et al. 2006 Integrated principals of Zoology, McGraw Hill Higher Education. 931pp. 14<sup>th</sup> edition.
2. Ekambarantha Ayyar, M and T.N. Ananthakrishnan. 1992. A manual of Zoology Vol. II[Chordata]. S. Viswanaathan (Printers and Publishers] Pvt. Ltd., Madras. 2.
3. Jordan E.L. and P.S. Verma 1995. Chordata Zoology and Elements of Animal Physiology. S. Chand and Co., New Delhi. 3.
4. Kotpal R.L. 1992. Vertebrata, Rastogi Publications, Meerut

## **ZOOEC-201 WILDLIFE BIOLOGY – 2**

### **UNIT I**

- Estimating number of wildlife (Census techniques)
- Measuring habitat use and occupancy
- Wildlife habitat evaluation techniques
- Wildlife population monitoring techniques

### **UNIT II**

- Human-wildlife Interaction
- Management and mitigation of conflicts
- Conservation outreach programmes
- Immobilization and rescue of wildlife

### **References:**

1. T A Bookhout 1996. Research and Management Techniques for Wildlife and Habitats. The Wildlife Society, ML
2. D E Wilson 2002. Measuring and Monitoring Biological Diversity: Standard Methods. The Smithsonian Institution, USA
3. J P Sands et al. 2012. Wildlife Science: Connecting Research with Management. CRC Press, Taylor and Francis Group

## **ZOOEC-202 FISHERIES AND AQUACULTURE -2**

### **UNIT I**

- Digestive system of fish
- Respiratory system of fish
- Blood vascular system of fish
- Nervous system of fish
- Urinogenital system of fish

### **UNIT II**

- Introduction to fishing methods
- Fisheries research institutes in India
- Composite fish culture and poly culture
- Integrated fish farming
- Sewage fed fish culture, cage culture and pen culture

### **References**

1. Day, F. 1981. Fishes of India, Vol.I and Vol. II. William Sawson& Sons Ltd., London. 2.
2. Jhingran, C.G. 1981. Fish and Fisheries of India. Hindustan Publishing Co., India.
3. Maheswari, K. 1993. Common fish diseases and their control. Institute of Fisheries Education, Powakads, M.P.
4. Santhanam,R. 1980. Fisheries Science. Daya Publishing House, New Delhi.
5. Yadav, B.N. 1997. Fish and Fisheries. Daya Publishing House, New Delhi
6. FAO Volumes for fish identification.
7. Bal D.V. and Rao, K.V. 1990. Marine Fisheries of India. Tata McGraw Hill Publishing Co. Ltd., New York.
8. Biswas, K. P. 1996. A Text Book of Fish, Fisheries and Technology. Narendra Publishing House, Delhi.
9. Srivastava, C.B.L. 1999. Fish Biology. Narendra Publishing House, Delhi.

## ZOOEC-203 ENVIRONMENTALLY SOUND TECHNOLOGIES-2

### UNIT I

- Scope and need of Environmental Sustainable Technologies
- Characteristics of Environmental Sustainable Technologies
  - ◆ Reduction in pollution
  - ◆ Reduction in wastes

### UNIT II

- Transferring Technologies
  - ◆ Benefits
  - ◆ Barriers
- Role of government in development of Environmental Sustainable Technologies
- Role of Non Government Organizations in development of Environmental Sustainable Technologies

### References

1. Caldwell, Lynton K., "An Ecological Approach to International development: Problems of Policy and Administration", in Farvar, M. Taghi and John P. Milton, eds, *The Careless Technology: Ecology and International Development*, Garden City, N.J., Natural History Press, 1972.
2. Clark, W.C., and R.E. Munn, eds, *Sustainable Development of the Biosphere*, Cambridge, the Press Syndicate of the University of Cambridge, 1986.
3. Milbrath, Lester W., *Envisioning a Sustainable Society*, Albany, State University of New York Press, 1989.
4. *Work-Book for Training in Environmental Technology Assessment for Decision-Makers: A Pilot Programme*, Technical Publication Series [5], UNEP International Environmental Technology Centre, Osaka/Shiga, 1997.
5. Falkenmark M, Lindh G. 1976. *Water for a starving world*. Westview Press, Boulder, CO, USA.
6. Falkenmark M, Rockström R. 2004. *Balancing water for humans and nature: The new approach in ecohydrology*. Earthscan Publications, London.

## **ZOOPR-201 Biochemistry, Instrumentation and Analytical Techniques**

### **Biochemistry**

1. Estimation of reducing and non-reducing sugars from given sample
2. Estimation of total carbohydrates from given tissue sample
3. Estimation of glycogen from given tissue sample
4. To estimate total protein content from given tissue sample
  - a. Folin-lawry method
  - b. Bradford method
5. Colorimetric quantification of amino acids by Ninhydrin method
6. Estimation of ascorbic acid from given tissue sample
7. Estimation of total lipid content from given tissue samples
8. Estimation of cholesterol content from given tissue samples
9. Enzymatic assay of Catalase, peroxidase etc.

### **Instrumentation and analytical Techniques**

10. Agarose gel electrophoresis
11. Preparation of native and SDS-PAGE
12. Thin Layer chromatography
13. Paper chromatography
14. Principle and application of Instruments available in your department

## ZOOPR-202 Biostatistics, Research Methodology and Animal taxonomy -2

### Biostatistics

- 1 Computation of different measures of central tendency
  - a. Arithmetic Mean
  - b. Harmonic Mean
  - c. Geometric Mean
  - d. Median
  - e. Mode
- 2 Computation of various measures of dispersion
  - a. Range and Co efficient of Range
  - b. Mean Deviation
  - c. Standard Deviation
- 3 Estimating standard error and coefficient of variation
4. Estimating confidence intervals for population mean
- 5 To perform Student's t test
  - a. Paired t test
  - b. Unpaired t test
- 6 To perform single factor Analysis of Variance (ANOVA) or F test
- 7 To study and perform regression analysis and prediction of future events
- 8 To study and perform correlation analysis
- 9 To perform Chi Square test of goodness of fit
- 10 To perform different non-parametric test
  - a. Sign test
  - b. Rank test
  - c. F max test
  - d. U test

### Research Methodology

- 1 Defining Goal, Objectives, Stakeholders and parameters of research
- 2 Risk identification and analysis
- 3 Scientific writing practice –I (Log frame and Review writing)
- 4 Scientific writing practice –II (Citation)
- 5 Scientific reference management

### Notes:

1. *All the calculations of examples have to perform through manual method*
2. *For each experiment, perform 3-4 examples*
3. *Write your interpretation of data analysis and then write your conclusion*

### Animal Taxonomy-2

1. Study of Classification of annelida using laboratory specimens.
2. Study of Classification of nematoda using laboratory specimens.

3. Study of Classification of arthropoda using laboratory specimens.
4. Study of Classification of echinodermata using laboratory specimens.
5. Study of Classification of hemichordata using laboratory specimens.
6. Study of Classification of fishes using laboratory specimens/ photographs.
7. Study of Classification of amphibians using laboratory specimens/ photographs.
8. Study of Classification of reptiles using laboratory specimens/ photographs.
9. Study of Classification of mammals using laboratory specimens/ photographs.
10. Study of collection and preservation animals for museum.
11. Study tour to different areas of Gujarat and study tour report preparation.