Tribhuvan University
Institute of Science & Technology
Statistics

Level: B.Sc. | Full Marks: 50
Year: II | Pass Marks: 20
Course Title: Probability and Inference-I | Total Number of Periods:180
Course Code: STA 202 | Nature of the Course: Practical

Pre-requisites: Sound knowledge in the topics of Probability and Inference-I

Course objectives:

- To develop computational skills in probability and inference
- To understand and apply theoretical knowledge in practical and numerical problems and thus relate theory with practice confidently

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Title of the practical problems:

S. No.	Title of the practical problem	No. of problems
1	Discrete probability distributions (Negative binomial, hypergeometric and negative hypergeometric)	3
2	Continuous probability distributions (Beta, gamma, negative exponential)	3
3	Joint, marginal and conditional distributions, distributions of sum, product and ratio of random variables	3
4	Sampling distributions of the sample mean and sample variance (random sampling with and without replacement) and standard error of sampling mean and variance ct sampling	2
5	Computation of sample size	1
6	Exact sampling distributions (chi-square, t and F)	2
7	Problems of methods of estimation	2
8	Problem in interval estimation	1
9	Problems in hypothesis testing	2
10	One sample test (Wilcoxon signed rank test , Kolmogorov–Smirnov test and Anderson-Darling test)	2
11	Two sample test (Median test and Kolmogorov-Smirnov test)	2
12	Several sample test Cochran's Q test and Friedman two way analysis of variance test)	2
	Total number of practical problems	**25**

Tribhuvan University
Institute of Science & Technology
(**Applied Statistics, Compulsory Paper**)

Level: B.Sc.
Year: II
Course Title: Applied Statistics
Course Code: APS 203 — Full Marks: 50
Nature of the Course: Theory — Pass Marks: 17.5
Total Number of Periods: 75

Course objectives: To impart the knowledge of descriptive as well as inferential analysis exclusively in solving numerical problems in applied set up.

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1. **Methods of Data Summarization:** Review of basic concept of Statistics, Scales of measurement, data distribution, diagrammatical and graphical presentation of data, measures of central tendency, measures of dispersion, measures of skewness, measures of kurtosis. Numerical problems related to physical and biological sciences. **[10]**

2. **Correlation:** Karl Pearson's correlation, Spearman rank correlation, Kendal Tau correlation. Numerical problems related to physical and biological sciences. **[5]**

3. **Methods of Data Modeling:** Principles of Ordinary Least Squares (OLS), linear regression up to three variables, methods of fitting of first and second degree equations, exponential curves, partial and multiple correlations, analysis of residuals, Fisher decomposition of total sum of squares, coefficient of determination and its interpretation. Numerical problems related to physical and biological sciences. **[13]**

4. **Analysis of Categorical Data:** Class frequencies, relation between class frequencies, consistence of data, condition for consistency of data, independence and association of attributes, Yule's method and coefficient of contingency, Yule's coefficient of colligation, Pearson's coefficient of contingency and their interpretation. Numerical problems related to physical and biological sciences. **[8]**

5. **Introduction to Probability:** Basic concept of probability, fundamental rules of probability, marginal, joint and conditional probabilities (Concepts and applications only focusing on numerical problems related to physical and biological sciences) **[5]**

6. **Probability distributions:** Binomial distribution, Poisson distribution, Normal distribution (characteristics and applications without derivation focusing on numerical problems related to

physical and biological sciences) **[6]**

7. **Estimation:** Point & interval estimation, confidence interval for mean and proportion, determination of sample size, relationship of sample size with desired level of error Numerical problems related to physical and biological sciences **[3]**

8. **Hypothesis Testing :** Types of statistical hypotheses – null and alternative hypothesis, type I and type II errors, level of significance, critical value and critical region, concept of p–value and use of p-value in hypothesis testing, steps used in testing of hypothesis, one sample tests for mean of normal population (for known and unknown variance), test for proportion, test for difference between two means and two proportions, paired sample t-test, two independent sample tests for variances of normal populations, relationship between hypothesis testing and confidence interval, one way and two way ANOVA, test of significance of simple correlation and regression coefficients. Numerical problems related to physical and biological sciences **[20]**

9. **Nonparametric tests:** Needs of applying non-parametric tests, short introduction of the alternative tests of parametric tests, Chi-square test for independence of attributes and test for goodness of fit (Focusing on numerical problems related to physical and biological sciences). **[5]**

References:

1. Harry Frank & Steven C. Althoen (1995). *Statistics concepts and applications*, Cambridge University Press (Low price edition).
2. Murray R. Spiegel & Larry J. Stephens (2000). *Statistics (Schaum's outlines),* Tata McGraw-Hill Publishing Company Ltd, New Delhi, India
3. Sidney Siegel & N. John Castellan (1988). *Nonparametric Statistics for Behavioral Sciences*, McGraw-Hill Publications
4. S.C. Gupta & V.K. Kapoor (2001). *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi India
5. Shrestha, S.L. (2010). *Statistical Methods, for environment, Biological and Health Sciences*, Ekta Books, Kathmandu, Nepal
6. Sthapit Azaya, Yadav Rashinder, Khanal Shankar, Dangol Prakash(2014). *Applied Statistics*, Ashmita Publication, Kathmandu, Nepal
7. J. N. Kapoor & H.C. Saxena (2001). *Mathematical Statistics*, S.Chand & Company Ltd., New Delhi, India.

Tribhuvan University
Institute of Science & Technology
B.Sc. Zoology Course of Study

Course Title : Non-chordata and Protochordata
Course No: Zoo101 **Full Marks**: 100
Nature of the Course: Theory **Pass Marks**: 35
Lecture: 150 **Year** : 1

Course Objectives:
At the end of course students will be able to:
- Classify the non-chordates with their examples.
- Know the functional anatomy of typical representative/s of each Phylum.
- Understand polymorphism, parasitism, social life etc. of some non-chordates.
- Know the economic importance of non-chordate animals.
- Know the structures, affinities and development of Protochordates.

Group A : Lower Non-chordata

Taxonomy: Concept, trends, species, keys, characters, procedures and significance of taxonomy. ICZN. Phylogeny of invertebrates. Classification of Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes and Annelida with characters and examples. **(10 hrs.)**

Protozoa: Status of protozoa and concept of portista. Locomotion, nutrition, reproduction and osmoregulation in protozoa. Structure and reproduction of *Vorticella*. Structure, life cycle, pathogenicity and control measures of *Leishmania donovani*, *Entamoeba histolytica and Trichomonas vaginalis*. Radiolaria and suctoria. **(14 hrs.)**

Porifera: Metazoa and their origin. Organization of bilateria. Structure, reproduction of sponges and embryogeny of *Scypha*. Canal and skeletal systems. Origin and affinities. Economic importance of Porifera. **(7 hrs.)**

Coelenterata: Structure, reproduction and development of *Obelia*. Polymorphism. Distribution, types and formation of corals and coral reefs. Coral and dinoflagellate symbiosis and coral bleaching. Human intrusion in coral reefs. Economic importance of Coelenterates. **(12 hrs.)**

Platyhelminthes: Body wall, digestive, excretory, reproductive and nervous systems, & sense organs. Structure, life cycle, pathogenicity and control measures of *Fasciola hepatica, Taenia solium* and *Echinococcus granulosus*. Morphological and physiological adaptations of helminth parasites. Larval forms. **(12 hrs.)**

Aschelminthes: Body wall, digestive, excretory and reproductive and nervous systems, & sense organs. Structure, life cycle, pathogenicity and control measures of *Ancylostoma duodenale, Enterobius vermicularis*, *Wuchereria bancrofti* and phyto-nematode (*Meloidogyne incognita*). Economic importance of Aschelminthes. **(10 hrs.)**

Annelida: Coelom and Nephridia in Annelida. Structure, organ systems, life cycle and parasitic adaptations of *Hirudinaria granulosa*. Introduction to vermicomposting. Classification, structure and affinities of Archiannelida. Adaptive radiation in Polychaeta. Economic importance of annelids. **(10 hrs.)**

Group B: Higher Non-chordata and Protochordata

Classification of Arthropoda, Mollusca, Echinodermata and Protochordata with characters and examples. **(6 hrs.)**

Arthropoda: Body wall, digestive, excretory, reproductive and nervous systems, and sense organs. Organ systems of freshwater prawn (*Palaeomon*). Structure, life history and economic importance of *Periplaneta americana*, *Phlebotomus argentipus*, *Culex quinquefasciatus, Aedes aegypti* and *Sitophilus oryzae*. Mouthparts of insects. Metamorphism in insects. Social behavior of insects. Characteristics and affinities of Onychophora. Insect Hormones and Pheromones. Economic importance of Arthropods**.(25 hrs.)**

Mollusca: Foot and Shells in Mollusca. Structure and organ systems of Apple Snail (*Pila globosa),* fresh water mussel: *Lamellidens* (=*Unio*). Pearl and its formation. Dispersal, damage and control measures of African Giant Land Snail (*Lissachatina fulica*). Torsion and detorsion in Gastropoda. Economic importance of molluscs. Diversity of molluscs in Nepal. **(22 hrs.)**

Echinodermata: Origin and Evolution Structure, organ systems and development of *Asterias*. Larval forms in Echinodermata. Water vascular system. **(8 hrs.)**

Minor Phyla: Salient features of Acanthocephala, Nemartina, Rotifera, Gastroitricha, Mesozoa and Ctenophora. **(5 hrs.)**

Protochordata: Origin and Evolution. Structure, organ systems and affinities of *Balanoglossus, Herdmania and Branchiostoma*. Development of *Herdmania*. (9 **hrs.)**

Text Books (latest eds.):

Jordan, E.L. & Verma, P.S. Invertebrate Zoology. S. Chand & Co. Pub., 857 pp.
Jordan, E.L. & Verma, P.S., Chordate Zoology & Animal Physiology. S. Chand,New Delhi.
Kotpal, R.L. Modern textbook of Zoology: Invertebrates. Rastogi Pub., Meerut,India.
Kotpal, R.L. Modern textbook of Zoology: Vertebrates. Rastogi Pub., Meerut,India.
Parker, T.J. & Haswell, W.A. A text book of Zoology, Vol.1. The McMillan Press Ltd.London, UK.

Suggested Readings:

Barnes, R.D. Invertebrate Zoology. Saunders College Pub.,1089 pages
Dhami, P.S. and Dhami, J.K. Invertebrate Zoology. R. Chand & Co. Pub., NewDelhi, India.
http//:www.archive.org
http://www.biodiversitylibrary.org
Prasad, S.N. Life of Invertebrates. Vikas Publishing House Pvt. Ltd., New Delhi, India.

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Institute of Science & Technology
B.Sc. Zoology Course of Study

Course Title : Non-chordata and Protochordata
Course No: Zoo102 **Full Marks**: 50
Nature of the Course: Pratical **Pass Marks**: 20
Year : 1

Course Objectives:
At the end of this course students will be able to:
- Identify representatives of different Phyla of Non-chordates and Protochordates.
- Know the pathogenic animals; histology of different organs of non-chordate animals.
- Know the structure of mouth-parts of insects and structure of larval forms of different arthropods.
- Know the basic differences in general anatomy of different animals.

Techniques: Collection and preservation of Non-chordates.
Taxonomy: Identification of Non-chordates (collection, museum specimens and permanent slides).
Culture: Protozoan culture.
Permanent histological slides: Sections of *Fasciola, Ascaris, Hirudinaria, Balanoglosus* and *Amphioxus*.

Slide preparations:
1. Temporary slide preparation:
   Any cultured organism, Statocyst of prawn, Jaw of snail/slug, Jaw of *Hirudinaria,* Mosquito larva and Nematodes of animals.
2. Permanent slide preparation:
   Radula of snail; mosquito larva; mouthparts of mosquitoes, cockroach, honeybee, house fly and butterfly; *Daphnia/Cyclops/Cypris*.

Morphology and anatomy (Dissection):
1. Leech – General Anatomy, Excretory and Reproductive.
2. Prawn - Appendages, Nervous system and Digestive organs.
3. Cockroach – General anatomy, digestive organs, nervous system and reproductive organs
4. Apple snail (*Pila*) – General anatomy and Nervous system.

Case study and report writing (any one)
i) Medical diseases
ii) Veterinary diseases
iii) Agriculture pests
iv) Faunal survey/ Field trip (one day).

Practical note book preparation as regular study.