Mathematics & Statistics (Theory)

Total: 6 hours /week
Lecture: 4 hours/week
Tutorial: 1 hour/week
Practical: 0 hours/week
Lab: 1 hours/week

Course Description

The course is divided into three parts: (a) Elementary Mathematics, (b) Elementary Statistics and (c) Practical on elementary Statistics and Computer. Part one of this course prepares the student to use mathematical skills necessary for application of medical computations, application of research and statistical interpretations, and for managing the mathematical questions of everyday life. Part two provides a basic overview of the purpose and process of research, a discussion of scientific process, and principles of research methodology in statistics. Part three enables the students to apply statistical methods to the interpretation of data related to public health services using basic computer skills.

Course Objectives

On completion of this course the student will be able to:

- Apply mathematical Skills to solve medical problems and interpret research data.
- Use vital statistic terminology to discuss public health issues.
- Explain the function and value of research.
- Describe the process and methodology of research.
- Apply mathematical formulas to interpret research data.
- Demonstrate the process of report writing.

Course Content

Part 1 Elementary Mathematics **66 hrs**

Unit1: Set theory and real number system **6 hrs**

- Define and denote sets.
- Find subsets of a set and represent the sets in Venn diagrams.
- Find the union, intersection, complement and difference of given sets.
- Define cardinality of a finite set
- Define real numbers, absolute value, open and closed intervals and inequalities.
- Proof of the Algebra of sets, De-Morgan's law
- Cartesian products and relation,
- Domain and range of relation.

Unit 2: Function and graph **6 hrs**

- Define a function
- Classify functions.
- Identify the different functions.
- Define domain and range of relation(excluding inverse and composite function)
- Functions and their inverse and related problems.
- Composite function and related problems(Algebraic only)

- Exponential and Logarithmic functions

Unit 3: Permutation, combination and binomial theorem. 9 hrs

- Concept of Basic principles of counting.
- Define the permutation and combination
- Use different cases of permutation and combination (simple cases only).
- Define binomial expression and Binomial theorem.
- Binomial theorem(without proof)
- Finding general term, term, middle term/s, binomial coefficients.

Unit 4: Matrices and determinants 9 hrs

- Matrix, its notation and order.
- Types of matrices and simple algebra of matrices.
- Addition, subtraction, multiplication of matrices.
- Transpose, Adjoint and inverse of a matrix and related problems.
- Definition of a determinant.
- Minors and cofactors
- Properties of determinants.
- Application of matrix and determinant to solve linear system of equation (inverse of matrix and Cramer's Rule)

Unit 5: Algebra& Straight Line (Revision only) 2 hrs

- Recall the formula of distance between two points and its slope.
- Find the angle between two lines and derive the condition of perpendicularity and parallelism.
- Distance between two parallel lines.
- Area of triangle.
- Section formula

Unit 6: Co-ordinate Geometry (Equation of a pair of lines) 6hrs

- Define line pair equation, express two equations of straight lines as a single equation
- Condition required for general equation representing a pair of lines.(**Without prove)**
- Separate equations from general equation of second degree.
- Prove that the equation $ax^2 + 2hxy + by^2 = 0$ always represents a pair of straight lines passing through the origin.
- Find the angle represented by $ax^2 + 2hxy + by^2 = 0$. (Without prove)
- Find the angle of bisectors represented by $ax^2 + 2hxy + by^2 = 0$. (**Without prove)**

Unit 7: Limits and limiting values 6 hrs

- Indeterminate forms $\left(\frac{0}{0}, \frac{\infty}{\infty}\ and \infty - \infty\right)$
- Define the term *limit* and *limiting* value.
- Evaluate the limiting values of simple algebraic & trigonometric function.
  - Using $\lim_{x \to a} \frac{x^n - a^n}{x-a}$ and $\lim_{x \to 0} \frac{sinx}{x}$.(Without prove)
- Define continuity and discontinuity
- Identify continuous and discontinuous function.

Unit 8: Derivatives and their Applications (Maxima and Minima) 6 hrs

- Definition of the term derivatives.
- Geometrical meaning of derivatives.
- Find the derivative $(ax+b)^n$, sin $(ax+b)$, e^{ax+b}, log $(ax+b)$ from definition(first principle)
- Sum, difference, product, quotient and chain rule (derivate of algebraic function only)
- Application of derivative: - increasing, decreasing and stationary points.
- Maximum, minimum values of a given algebraic function and point of inflection.
- Concave upward and concave downward **(algebraic only**)

Unit 9: Integration 10 hrs

- Definition of integral as anti-derivative,
- Application of techniques of integration as anti-derivative, substitution method, integration by parts and definite integral **(algebric only).**
- Using definite integral to calculate area enclosed by algebric curve, X-axis and ordinate at x = a to x = b

Unit 10: Probability 6 hrs

- Definition of probability (classical and empirical)
- Application and use of addition and multiplication law of probability
- Explanation and use of binomial probability distribution formula $P(r) = C(n,r)p^r q^{n-r}$

Part B: **Elementary Statistics 46 hrs**

Unit 11: Introduction to Statistics (Revision only) 3 hrs

- Define statistics
- State the utility, functions and limitations of statistics.

Unit 12: Collection, Classification and Tabulation diagrams and graphs (Revision only) 3 hrs

- Collect data (primary and secondary)
- Classify and tabulate data
- Prepare frequency table (ungrouped and grouped form)
- Represent data on simple, multiple, sub-divided, percentage bar diagram and Pie-diagrams.
- Represent data on histogram, frequency polygon, frequency curve and Ogive curve

Unit 13: Central tendency 5 hrs

- Definition of central tendency
- Mean, median, mode Quartiles, Deciles and Percentiles.(for ungrouped and grouped data mathematically)

Unit 14: Measure of dispersion 8 hrs

- Range and coefficient of range
- Quartile deviation and coefficient of Q.D.
- Mean deviation from mean, median and mode.
- Standard deviation and C.V.

Unit15: Correlation Coefficient 9 hrs

- Concept of correlation and its type.
- Method of studying correlation by drawing Scatter diagram
- Calculations of Karl Pearson's coefficient of correlation between two variables.
- Sparman's rank correlation.

Unit16: Vital statistics **10 hrs**

- Vital Statistics
  - Definition of the term vital statistics.
  - Utility of vital statistics.
  - Different sources of vital statistics.
- Measure of Fertility
  - Meaning of Fertility
  - Different measures of fertility
  - Different indicators related to fertility (crude birth rate, specific fertility rate, General Fertility rate, total fertility rate)
- Measures of mortality
  - Meaning of mortality
  - Different measures of mortality
  - Different indicators related to mortality(crude death rate, specific death rate, infant mortality rate, maternal mortality rate and still birth rate)
- Measures of morbidity (sickness)
  - Meaning of morbidity
  - Different measures of morbidity
  - The incidence rate and prevalence rate

Unit 17: Research methodology **4 hrs**

- Definition of research
- Research methodology.
- Steps of research.
- Discuss the importance of interpreting research results Scientific method.
- Statistical tools for measuring reliability of results.
- Interpreting and understanding research data.
- Applications of research in medical science.

Unit 18: Introduction to Report Writing **4 hrs.**

- Explain the concept of report writing.
- Familiarize with standard research report format.
- Purposes and goals of research reports.
- Significance of research reporting

Part C: **Basic Computer Skills**

Unit 19: Computer **13 hrs**

- Define computer and its parts.
- Uses of computer in various field.

- Utilities for virus protection.
- Operation of virus utilities.
- Computer and secretarial skills

Unit 20: Statistics and Computer **15hrs**

The paper on elementary statistics is designed to supplement the theoretical knowledge. In this subject the students themselves will solve different problems with different types of data and Information, which helps them to learn the subject quickly and enjoy the real, need of learning it and apply their knowledge in real life situations, for an effective health care delivery and administration.

Students will be required to maintain a note book to keep the records of fully practical work duly Signed by the instructor which should contain a minimum of practical and this should be submitted on the date of examination.

All the portion of Computer skill should be done in a practical room having individual computer to practice. Here first 1 hour should be devoted for theory description and procedure and second 1 hour should be for practice in the computer. It is better to have statistics practical done in computer as far as practicable.

- **Statistics:**
  - Prepare individual (discrete) and grouped frequency distribution table.
  - Prepare histogram, frequency polygon and curve, and cumulative frequency curve.
  - Draw bar diagram, subdivided, percentage and multiple bar diagram
  - Draw pie diagram.
  - Find mean for individual and grouped series.
  - Find mean by shortcut or graphical method.
- Computer:
  - Open MS-WORD and create a document explaining statistical methods like function,
  - Limitations, graph, diagram and table construction.
  - Open MS-EXCEL and create a frequency table and apply formula to calculate mean value,
  - Create graph and diagrams from MS-EXCEL.
  - Operate POWER POINT and prepare presentation.
  - Operate VIRUS scanning on hard and removable disks.
  - (Note: The statistical tools should be introduced from an applied perspective using health
  - Related examples. Microsoft excel software will be used throughout the course to aid in
  - statistical analysis)

Recommended Texts

- Bajracharya, D.R. & et al., Basic Mathematics, for grade XI and XII National Book Centre, Kathmandu.
- Mahajan B.K.Method of Biostaticstics, (16th edition) park's text book of PSM 2003
- Advance Mathematic & Statistics, Surya Publication.

- Pradhan, J. B. & Pantha, B. R. Integrated Mathematics for Health Science. Sukunda Pustak Bhavan,Bhotahity, Kathmandu.
- MS-DOS Manual, Microsoft.
- MS-Windows Manual, Microsoft.

Final written exam marking scheme

Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	**Total**
Unit Hours	6	6	9	9	2	6	6	6	10	6	3	3	5	8	9	10	4	4	13	15	**140**
Marks	3	3	5	5	1	3	3	3	6	3	2	2	3	5	5	6	3	3	7	9	**80**