Pokhara University
Faculty of Science and Technology

Course Code: MTH 216 (2 – 2 - 0 Credit)
Course Title: Probability and Statistics
Nature of the Course: Theory
Level: Bachelor

Full Marks: 100
Pass Mark: 45
Total Lectures: 30 hours
Program: BE

1. Course Description

This course is designed to familiarize students with various statistical methods and techniques for analyzing data. The contents include descriptive statistics, probability, probability distributions, sampling and estimation, hypothesis testing, simple correlation and regression analysis with emphasis on engineering field.

2. General Objectives

The general objectives of this course are;

- To familiarize students with various statistical methods and techniques for analyzing data.
- To impart analytical skills in the students required for the application of statistical methods for analyzing data in the field of engineering.
- To enable students with the skills to use of real data in the practical engineering-based applications.

3. Methods of Instruction

Lecture, Tutorial, Discussion and Readings

4. Contents in Detail

Specific Objectives	Contents
• Identify concepts of statistics and its application in the field of engineering • Summarize, present and compute various descriptive statistics	**Unit I: Introduction and Descriptive Statistics (3 hrs)** 1.1 Introduction of statistics and its applications in engineering 1.2 Collection and presentation of data (Diagrammatic as well as graphical presentation) 1.3 Measure of central tendency, location and Measures of variability
• Identify basic probability concepts • Define conditional probability and use Bayes' theorem to revise probabilities • Define random variable and compute expected value and variance of a probability distribution	**Unit II: Probability (5 hrs)** 2.1 Basic probability, additive law, multiplicative law and Bayes' theorem 2.2 Random variables (Discrete and Continuous) and probability distribution function, 2.3 Mathematical expectation of random variables

• Explain and apply discrete probability distributions (Binomial, Poisson distribution, Negative Binomial and Hyper geometric distribution)	**Unit III: Discrete Probability Distributions (3 hrs)** 3.1 Binomial distribution, 3.2 Poisson distribution 3.3 Negative Binomial distribution 3.4 Hyper geometric distribution
• Explain and apply the Normal distribution and other continuous probability distributions (uniform distribution, Gamma and Beta distributions, and Exponential distribution)	**Unit IV: Continuous Probability Distributions (4 hrs)** 4.1 Rectangular or uniform distribution 4.2 Normal distribution 4.3 Gamma and Beta distributions 4.4 Exponential distribution
• Define the concept of bivariate random variables and joint probability distribution • Explain and calculate joint probability mass, marginal probability and density function	**Unit V: Bivariate Random Variables and Joint Probability Distribution (2 hrs)** 5.1 Joint probability mass function, marginal probability mass function, 5.2 Joint probability density function, marginal probability density function
• Define and apply sampling, sampling distribution, and central limit theorem • Construct and interpret confidence interval estimate for the means and proportion	**Unit VI: Sampling Distribution and Estimation (5 hrs)** 6.1 Review of terms used in sampling 6.2 Probability and non-probability sampling 6.3 Sampling distribution of mean and standard error 6.4 Central limit theorem 6.5 Concept of point and interval estimation 6.6 Sample size determination 6.7 Confidence interval for single mean and difference of two population means and population proportion
• Describe and apply the procedures hypothesis testing of various tests.	**Unit VII: Hypothesis Testing (5 hrs)** 7.1 Basic concept in hypothesis testing 7.2 One sample test for mean and proportion 7.3 Two sample tests for mean and proportions 7.4 Paired t – test 7.5 Chi-square test of independence
• Define and apply correlation and regression in the field of engineering	**Unit VIII: Correlation and Regression (3 hrs)** 8.1 Simple correlation and its properties 8.2 Simple linear regression

Note: The figures in the parentheses indicate the approximate periods for the respective units.

5. List of Tutorials (30 Hours)

Numerical problems as demanded by the theory of each chapter will be assigned for the students and they are encouraged to solve the problems.

Unit No.	Unit Name	List of Tutorials	Tutorial hours
I	Introduction and Descriptive Statistics	1.1 Collection and presentation of data (Diagrammatic as well as graphical presentation)	1 hr.
		1.2 Measure of central tendency, location and Measures of variability	1 hr.
II	Probability	2.1 Basic probability, additive law, multiplicative law and Bayes' theorem	2 hr.
		2.2 Random variables (Discrete and Continuous) and probability distribution function,	1 hr.
		2.3 Mathematical expectation of random variables	1 hr.
III	Discrete Probability Distributions	3.5 Binomial distribution,	1 hr.
		3.6 Poisson distribution	1 hr.
		3.7 Negative Binomial distribution	1 hr.
		3.8 Hyper geometric distribution	1 hr.
IV	Continuous Probability Distributions	4.1 Rectangular or uniform distribution	1 hr.
		4.2 Normal distribution	2 hr.
		4.3 Gamma and Beta distributions	2 hr.
		4.4 Exponential distribution	2 hr.
V	Bivariate Random Variables and Joint Probability Distribution	5.1 Joint probability mass function, Marginal probability mass function,	1 hr.
		5.2 Joint probability density function, Marginal probability density function	2 hr.
VI	Sampling Distribution and Estimation	6.1 Sampling distribution of mean and standard error	1 hr.
		6.2 Central limit theorem	1 hr.
		6.3 Concept of point and interval estimation and Sample size determination	1 hr.
		6.4 Confidence interval for single mean and difference of two population means and population proportion	1 hr.
VII	Hypothesis Testing	7.1 One sample test for mean and proportion	1 hr.
		7.2 Two sample test for mean and proportions	1 hr.
		7.3 Paired t – test	1 hr.
		7.4 Chi-square test of independence	1 hr.
VIII	Correlation and Regression	8.1 Simple correlation and its properties	1 hr.
		8.2 Simple linear regression	1 hr.

6. Evaluation system and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, project work, class participation, etc. The tabular presentation of the internal evaluation is as follows.

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Attendance & Class Participation	10%	50	Semester-End Examination	50
Assignments	20%			
Presentations/Quizzes	10%			
Term Exam	60%			
Total Internal				
Full Marks: 50 + 50 = 100				

Student's Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Prescribed Books

1. Johnson, R. A. (2018). *Probability and Statistics for Engineers*. New Delhi: Pearson Education Limited.

Reference Books

1. Devore, J. L.(2010). *Probability and Statistics for Engineering and Sciences*. New Delhi: Cengage learning.
2. Sheldom, M. R. (2014). Probability *and Statistics for Engineers and Scientist*. New Delhi: Cengage learning.
3. Gupta, S.C & V.K. Kapoor. (2000). *Fundamentals of Mathematical Statistics: A Modern Approach*. Sultan Chand & Sons Educational Publishers.