DDU GORAKHPUR UNIVERSITY GORAKHPUR

DEPARTMENT OF MATHEMATICS AND STATISTICS

National Education Policy-2020

Syllabus of Skill Enhancement Course (SEC)

Offered by

Department of Mathematics and Statistics

(Effective from Session 2024-2025)

For

UG Programme

Course Title	Course Code	Pre-requisite for Course	Elective for SEC
Basic Arithmetic	**SECMAT- 101**	Mathematics in10th	Open to all
Basics of Reasoning and Logic	**SECMAT- 102**	Mathematics in10th	Open to all
Data Science	**SECSTAT- 101**	Mathematics in10th	Open to all
Programming with R	**SECSTAT- 102**	Mathematics in10th	Open to all
Machine Learning	**SECSTAT- 103**	Completed **SECSTAT- 101 & SECSTAT- 102** **or** Opted Statistics/ Mathematics/ Computer Science as a Subject in UG Programme	Open to all

Course Structure of Skill Enhancement Course (SEC) Offered by Department of Mathematics and Statistics in UG Programme

TITLE OF THE COURSES OF SKILL ENHANCEMENT COURSE (SEC) IN UG PROGRAMME			
COURSE CODE	**COURSETITLE**	**THEORY**	**CREDITS**
SECMAT- 101	Basic Arithmetic	THEORY	**3+0**
SECMAT- 102	Basics of Reasoning and Logic	THEORY	**3+0**
SECSTAT- 101	Data Science	THEORY	**3+0**
SECSTAT- 102	Programming with R	THEORY	**3+0**
SECSTAT- 103	Machine Learning	THEORY	**3+0**

Program Outcomes (POs)

PO1: It is to develop enhanced quantitative skills in pursuing higher study.
PO2: Students will be able to develop solution-oriented approach towards various issues related to their environment.
PO3: Students will become employable in various government and private sectors.

Program Specific Outcomes (PSOs)

PSO1: Student should be able to possess/recall basic idea about mathematics which can be displayed by them.
PSO2: Student should have adequate exposure to many aspects of mathematical sciences.
PSO3: Student is equipped with critical mathematical thinking, problem solving skills, etc. and apply his/her skill and knowledge in various field of studies including Science, Social Science, Engineering, Commerce and Management etc.

COURSE TITLES OF SKILL ENHANCEMENT COURSE (SEC) WITH DETAILS			
Course Title	**Course Code**	**Prerequisite for Course**	**Elective for SEC**
Basic Arithmetic	**SECMAT- 101**	Mathematics in10th	Open to all
Basics of Reasoning and Logic	**SECMAT- 102**	Mathematics in10th	Open to all
Data Science	**SECSTAT- 101**	Mathematics in10th	Open to all
Programming with R	**SECSTAT- 102**	Mathematics in10th	Open to all
Machine Learning	**SECSTAT- 103**	Completed **SECSTAT- 101** & **SECSTAT- 102** **or** Opted Statistics/ Mathematics/ Computer Science as a Subject in UG Programme	Open to all

BASIC ARITHMETIC

Class: UG PROGRAMME	**Course Type:** Skill Enhancement Course (SEC)
Subject: MATHEMATICS	
Course Code: SECMAT- 101	**Course Title:** BASIC ARITHMETIC
Credits: 3+0	Elective/ Skill Enhancement Course (SEC)
Max. Marks: 100	**Min. Passing Marks:** As per University CBCS Norm
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-0-0	

Course outcomes:

CO1: The program outcome is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for developing enhanced quantitative skills and pursuing higher study.

CO2: By the time students complete the course; they will have wide ranging application of the subject and have the knowledge of Arithmetic, Reasoning and Logic.

CO3: The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of basic mathematics, he/she learns to solve a variety of practical problems in science, social science, engineering, Commerce and Management etc.

Course prerequisites:
To study this course, a student must have the subject Mathematics in class10^{th}.

Unit	Topics
	BASIC ARITHMETIC
I	Numbers, H.C.F and L.C.M., Decimal Fraction, Simplification, Square roots and cube roots, Average, Problems of Numbers, Problems on Age.
II	Surds and Indices, Percentage, Profit and Loss, Ratio and Proportion, Partnership, Time and Work, Time and Distance, Problems on Trains, Simple Interest, Compound Interest.
III	Area, Volume and Surface area, Polygons, True Discount, Banker's Discount, Calendar, Clock, Pie Chart, Line Chart and Bar Diagrams.

Books Recommended:

1. Arithmetic, R S Agrawal, S Chand and Company Limited.
2. A modern approach to Verbal and Non-Verbal Reasoning, R S Agrawal, S Chand and Company Limited.

Evaluation Methods:

As prescribed by the University (as per common ordinance for examination and assessment).

BASICS OF REASONING AND LOGIC

Class: UG PROGRAMME	**Course Type:** Skill Enhancement Course (SEC)
Subject: MATHEMATICS	
Course Code: SECMAT- 102	**Course Title:** BASICS OF REASONING AND LOGIC
Credits: 3+0	Elective/ Skill Enhancement Course (SEC)
Max. Marks: 100	**Min. Passing Marks:** As per University CBCS Norm
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-0-0	

Course outcomes:

CO1: The program outcome is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for developing enhanced quantitative skills and pursuing higher study.

CO2: By the time students complete the course; they will have wide ranging application of the subject and have the knowledge of Arithmetic, Reasoning and Logic.

CO3: The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of basic mathematics, he/she learns to solve a variety of practical problems in science, social science, engineering, Commerce and Management etc.

Course prerequisites:
To study this course, a student must have the subject Mathematics in class10th.

Unit	Topics
	BASIC OF REASONING AND LOGIC
I	**Verbal Reasoning:** Series Completion, Analogy, Classification, Coding –Decoding, Blood Relations, Puzzle test, Sequential Output tracing, Direction Sense test, Logical Venn diagram, Alphabet test.
II	**Verbal Reasoning:** Alpha-Numeric Sequence Puzzle, Mathematical Operations, Logical Sequence of Words, Arithmetical Reasoning, Eligibility Test, Logical Reasoning, Logical Deduction.
III	**Non-Verbal Reasoning:** Series, Analogy, Classification, Mirror Images, Water Images, Spotting Out the Embedded Figure, Figure Matrix, Rule Detection, Grouping of Identical Figures, Dot Situation**.**

Books Recommended:

1. Arithmetic, R S Agrawal, S Chand and Company Limited.
2. A modern approach to Verbal and Non-Verbal Reasoning, R S Agrawal, S Chand and Company Limited.

Evaluation Methods:

As prescribed by the University (as per common ordinance for examination and assessment).

DATA SCIENCE

Class: UG PROGRAMME	**Course Type:** Skill Enhancement Course (SEC)
Subject: STATISTICS	
Course Code: SECSTAT- 101	**Course Title:** DATA SCIENCE
Credits: 3+0	Elective/ Skill Enhancement Course (SEC)
Max. Marks: 100	**Min. Passing Marks:** As per University CBCS Norm
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-0-0	

Course outcomes:

CO1: The program outcome is to give foundation knowledge for the students to understand basics of statistics including applied aspect for developing enhanced quantitative skills and pursuing higher study and research as well.

CO2: The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of basic statistics, he/she learns to solve a variety of practical problems in science, social science, engineering, Commerce and Management etc.

CO3: The student is equipped with standard concepts and tools at an intermediate to advance level that will serve him/her well towards taking more advance level course in statistics.

Course prerequisites:
To study this course, a student must have the subject Mathematics in class 10^{th}.

Unit	Topics
	DATA SCIENCE
I	Introduction to Statistics and Data Science, Data to Decision, Data and information. Introduction to Statistical Softwares. Role of Data Science in modern era. Descriptive Statistics: Types of statistical data, Attributes and variables. Measurement and measurement scales. Diagrammatic representation of data: histogram, frequency polygon, frequency curve, ogives, pie chart etc. Measures of central tendency: Arithmetic geometric and harmonic mean, median, mode, quartiles, deciles and percentiles. Box-plot.
II	Measures of dispersion: Mean Deviation, and Variance, Moments, skewness and kurtosis and their measures based on quantiles and moments. Principle of Least Squares, fitting of Linear and Polynomial equations by the principle of Least Squares. Correlation coefficient and its Properties, Spearman's Rank correlation coefficient, Correlation and Regression Analysis- Bivariate and Multivariate.
III	Probability, conditional probability, Bayes theorem, Random variables (discrete and continuous). Distribution Function and its properties. Mathematical Expectation. Binomial, Poisson and exponential Normal distributions. Need of Inferential Statistics. Notion of Testing of Hypotheses. Tests of hypotheses for a single mean, testing equality of two means.

Books Recommended:

1. Fundamental of Mathematical Statistics, S.C.Gupta and V.K.Kapoor. Sultan Chand and Sons,2000.
2. Fundamental of Mathematical Statistics, Vol-I and Vol II, A.M.Goon, M.k.Gupta, B.Dasgupta, World Press, Kolkata.

Evaluation Methods:

As prescribed by the University (as per common ordinance for examination and assessment).

PROGRAMMING WITH R

Class: UG PROGRAMME	**Course Type:** Skill Enhancement Course (SEC)
Subject: STATISTICS	
Course Code: SECSTAT- 102	**Course Title:** PROGRAMMING WITH R
Credits: 3+0	Elective/ Skill Enhancement Course (SEC)
Max. Marks: 100	**Min. Passing Marks:** As per University CBCS Norm
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-0-0	

Course outcomes:

CO1: The program outcome is to give foundation knowledge for the students to understand basics of programming with R including applied aspect for developing enhanced quantitative skills and pursuing higher study.

CO2: By the time students complete the course; they will have wide ranging application of the subject and have the knowledge of the graph plotting of mathematical functions.

CO3: The main objective of the course is to equip the student with necessary analytic and technical skills.

Course prerequisites:
To study this course, a student must have the subject Mathematics in class10th.

Unit	Topics
	PROGRAMMING WITH R
I	Data types in R: numeric/character/logical; real/integer/complex, creation of new variables, vectors, matrices, data frames, lists, accessing elements of a vector or matrix, import and export of files, Basic mathematical functions, R as calculator, Basics of R programming : Operators, Control constructs : if , if else and switch statements.
II	Loops: for loop, repeat loop, while loop, break and next statements Function in R Concept of package. Graphics in R: Plotting of mathematical functions, curve command, the plot command, histogram, boxplot, bar-plot, points, lines, segments, arrows, customization of plot setting. Descriptive statistics and simple computations related to probability distributions (binomial and normal only).
III	Vector matrix operations: matrix operations such as addition, subtraction, multiplication, matrix transpose, determinant, matrix inverse, solution of linear equations, eigen values and vectors, matrix decompositions. R programs for numerical integration, roots of algebraic and transcendental equation, solution of ordinary differential equation (ODE).

Books Recommended:

1. Garrett Grolemund Hands–On Programming with R: Write Your Own Functions and Simulations, O'Reilly Publication (2014).
2. Michael J. C. (2015): An Introduction Using R, 2nd Edition John Wiley and Sons.

Evaluation Methods:

As prescribed by the University (as per common ordinance for examination and assessment).

Note:
The question paper will be in English language only.

MACHINE LEARNING

Class: UG PROGRAMME	**Course Type:** Skill Enhancement Course (SEC)
Subject: STATISTICS	
Course Code: SECSTAT- 103	**Course Title:** MACHINE LEARNING
Credits: 3+0	Elective/ Skill Enhancement Course (SEC)
Max. Marks: 100	**Min. Passing Marks:** As per University CBCS Norm
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 3-0-0	

Course outcomes:

CO1: The program outcome is to give foundation knowledge for the students to understand basics of machine learning for developing enhanced quantitative skills and pursuing higher study.

CO2: By the time students complete the course; they will have wide ranging application of the subject and have the knowledge of Machine learning terminology for model.

CO3: The main objective is to familiarize the students with some basic learning algorithms and techniques and their applications.

Course prerequisites:
To study this course, a student must have completed **SECSTAT- 101** & **SECSTAT- 102 or** opted Statistics/ Mathematics/ Computer Science as one of the subjects in UG programme.

Unit	Topics
	MACHINE LEARNING
I	Introduction to Machine Learning (ML): Basic definitions. Types of learning: Supervised learning: Classification problem, Regression problem.
II	Unsupervised learning: Dimensionality reduction, Clustering and Reinforcement learning. Steps in machine learning model development and deployment, Statistical fundamentals and terminology for model building and validation.
III	Machine learning terminology for model, building and validation, Machine learning losses, Train, validation, and test data, Machine learning model overview ,Linear regression, Decision trees, overfitting. Logistic Regression and K-means clustering.

Books Recommended:

1. Alpaydin, E. (2014), Introduction to Machine Learning, 3rd Ed. MIT Press.
2. Bishop, S. (2011). Pattern Recognition and Machine Learning, Springer.
3. Brett Lantz (2019). Machine Learning with R: Expert techniques for predictive modeling, Packt Publishing.
4. Murphy, K.P. (2012). Machine Learning: a Probabilistic Perspective. MIT Press.

Evaluation Methods:

As prescribed by the University (as per common ordinance for examination and assessment).

Note:
The question paper will be in English language only.