DEPARTMENT OF MATHEMATICS AND STATISTICS,

DDU GORAKHPUR UNIVERSITY GORAKHPUR-273009 (U.P.) INDIA

National Education Policy-2020

Syllabus of Minor Elective

Offered by

Department of Mathematics and Statistics

(Effective from Session 2021-2022)

For

Three Years UG Programme

S.No	Minor Elective	Page No.	Prerequisitefor Paper	Elective for Minor Subjects
1.	Mathematics	2-6	Mathematics in 10th	Open to All Except the students who have Mathematics as a core subject in B.A. /B.Sc.
2.	Statistics	7-11	Mathematics in 10th	Open to All Except the students who have Statistics as a core subject in B.A. /B.Sc.

Course Structure of Mathematics and Statistics as Minor Subjects in UG Programme

SEMESTER-WISE TITLES OF THE PAPERS OF MATHEMATICS AS MINOR SUBJECT IN UG PROGRAMME				
YEAR	**COURSE CODE**	**PAPER TITLE**	**THEORY**	**CREDITS**
FIRST	**SEMESTER-I**			
	MAT 100	FOUNDATION OF MATHEMATICS-I	THEORY	**2**
	SEMESTER-II			
	MAT 200	FOUNDATION OF MATHEMATICS-II	THEORY	**2**

Subject Prerequisites:
To study this subject a student must had the subject(s) Mathematics in class 10^{th}.

Program Outcomes (POs)

PO1: It is to give foundation knowledge for the students to understand basics of mathematics includingapplied aspects for the same.

PO2: It is to develop enhanced quantitative skills in pursuing higher study and research as well.

PO3: Students will be able to develop solution-oriented approach towards various issues related to theirenvironment.

PO4: Students will become employable in various government and private sectors.

PO5: Scientific temper in general and mathematical temper in particular will be developed in students.

Year	Semester	Courses	Program Specific Outcomes (PSOs)
First	SEM-I	Minor Elective Course-I in Mathematics	**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.
	SEM-II	Minor Elective Course-II in Mathematics	

SEMESTER WISE PAPER TITLES WITH DETAILS					
Year	**Semester**	**Paper**	**Paper Title**	**Prerequisite for Paper**	**Elective for Minor Subjects**
FIRST	**SEM-I**	Theory Paper - I	FOUNDATION OF MATHEMATICS-I	Mathematics in 10th	Open to All Except the students who have Mathematics as a core subject in B.A./B.Sc.
	SEM-II	Theory Paper - I	FOUNDATION OF MATHEMATICS-II		

UG -I YEAR (SEMESTER-I) PAPER-I

FOUNDATION OF MATHEMATICS-I

Class: UG PROGRAMME	**Year: FIRST**	**Semester: FIRST**
Subject: MATHEMATICS		
Course Code: MAT 100	**Course Title: FOUNDATION OF MATHEMATICS-I**	

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 and research as well.

CO2: By the time students complete the course; they will have wide ranging application of the subject and have the knowledge of set theory.

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.

CO4: 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 mathematics.

Credits: 2	**Minor Elective**
Max. Marks: 25+75	**Min. Passing Marks: As per UGC/ University CBCS norm.**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0

Unit	Topics	No. of Lectures
	FOUNDATION OF MATHEMATICS-I	
I	Set theory: Definition of sets, representation of sets, universal set, empty set, singleton set, finite and infinite set, equal set, subsets, proper subset, superset, power set, improper set, comparibility of sets, union and intersection of sets, complement of sets, de morgan's law, disjoint sets, difference and symmetric difference, venn diagram and its applications.	8
II	An overview of number theory: Natural number, whole number, integers, rational number, irrational number, real number, complex number, binary operation on a set, law of binary operation, prime and composite number, relatively prime number, problem based on greatest common divisor (gcd) and least common multiple(lcm).	7
III	Polynomials, Linear polynomial, quadratic polynomial, cubic polynomial, biquadratic polynomial, roots of polynomial, Linear Equations in two variables, Quadratic equations, Factorization, Arithmetic progression, geometric progression.	8
IV	Rectangular coordinate axes, Cartesian coordinates of point, quadrants, Linear Programming Problem (LPP), Mathematical Model of Linear Programming Problem in two variables, Objective function, Constraint, Non-negative Restrictions, Feasible	7

	solution and Optimal solution, Graphical method for Linear Programming Problem in two variables.	

Suggested Readings:

1. Senior Secondary School Mathematics, R S Agrawal, Bharti Bhawan, 1995.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley, 2015.
3. Mathematics ,R.D.Sharma,Dhanpat Rai Publications,1998.
4. Mathematics,Sudhir Kumar Pundir,Shri Balaji Publication,2013.
5. Taha, Hamdy H, Opearations Research- An Introduction, Pearson Education.
6. Course Books published in Hindi may be prescribed by the Universities.

Suggestive Digital Platforms/ Web Links:

- National Programme on Technology Enhanced Learning (NPTEL)
- SWAYAM
- Massachusetts Institute of Technology (MIT) Open Learning
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- National Digital Library of India (NDLI)

This course can be opted as an elective by the students of following subjects: Open to All Except the students who have Mathematics as a core subject in B.A./B.Sc.

Internal Evaluation Methods (Max. Marks: 25)

Internal Evaluation shall be based on Class test, Presentation and Assignment. The marks shall be as follows:

S.No.	Assessment Type	Max. Marks
1	Class Test-I (Descriptive Questions)	5
2	Class Test-II (Objective Questions)	5
3	Presentation/ Class Interaction	5
4	Assignment	10

Course prerequisites:

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

UG -I YEAR (SEMESTER-II) PAPER-I

FOUNDATION OF MATHEMATICS-II

Class: UG PROGRAMME	**Year: FIRST**	**Semester: SECOND**
Subject: MATHEMATICS		
Course Code: MAT 200	**Course Title: FOUNDATION OF MATHEMATICS-II**	

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 and research as well.

CO2: By the time students complete the course; they will have wide ranging application of the subject and have the knowledge of matrix theory.

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, agriculture, engineering, Commerce and Management etc.

CO4: 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 mathematics.

Credits: 2	**Minor Elective**
Max. Marks: 25+75	**Min. Passing Marks: As per UGC/ University CBCS norm.**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0

Unit	Topics	No. of Lectures
	FOUNDATION OF MATHEMATICS-II	
I	Relations, equivalence relation, functions or mapping, domain, co-domain and range of a function, Introduction to Indices and Logarithms, principle of mathematical induction.	8
II	Limit, continuity and differentiability of a single variable, Differential coefficients of x^n , sin x, cos x, e^x , $\log_e x$, constant, Differential coefficients of sum, product and quotient of two functions, Differential coefficient of a function of a function, Problems related to business, Economics and Social Sciences.	7
III	Some standard integrals of functions, Integral of a sum, Methods of integration: Substitution, Integration by parts, Definite Integral and Fundamental Theorem of calculus (without proof), Introduction to differential equations, Order and degree of a differential equation, Equations of first order and first degree (separation of variables and linear), Problems related to Sciences and Social Sciences.	8
IV	Determinants and its properties, matrix theory, types of matrices: Horizontal matrix, vertical matrix, square matrix, row matrix, column matrix, null matrix, identity matrix, diagonal matrix, scalar matrix, triangular matrix, Operation on	7

	matrices: Matrix addition, subtraction, product of matrices, difference of two matrices, transpose of a matrix, inverse of a matrix by adjoint method	

Suggested Readings:

1. Senior Secondary School Mathematics, R S Agrawal, Bharti Bhawan, 1995.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley, 2015.
3. Mathematics ,R.D.Sharma,Dhanpat Rai Publications,1998.
4. Mathematics,Sudhir Kumar Pundir,Shri Balaji Publication,2013.
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Internal Evaluation shall be based on Class test, Presentation and Assignment. The marks shall be as follows:

S.No.	Assessment Type	Max. Marks
1	Class Test-I (Descriptive Questions)	5
2	Class Test-II (Objective Questions)	5
3	Presentation/ Class Interaction	5
4	Assignment	10

Course prerequisites:

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

SEMESTER-WISE TITLES OF THE PAPERS OF STATISTICS AS MINOR SUBJECT IN UG PROGRAMME				
YEAR	**COURSE CODE**	**PAPER TITLE**	**THEORY**	**CREDITS**
FIRST	**SEMESTER-I**			
	STAT 100	DATA SCIENCE-I	THEORY	**2**
	SEMESTER-II			
	STAT 200	DATA SCIENCE-II	THEORY	**2**

Subject Prerequisites:
To study this subject a student must had the subject(s) Mathematics in class 10^{th}.

Program Outcomes (POs)

PO1: It is to give foundation knowledge for the students to understand basics of statistics includingapplied aspects for the same.

PO2: It is to develop enhanced quantitative skills in pursuing higher study and research as well.

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Year	Semester	Courses	Program Specific Outcomes (PSOs)
First	SEM-I	Minor Elective Course-I in Statistics	**PSO1**. Student should be able to possess/ recall basic idea about statistics which can be displayed by them. **PSO2**. Student should have adequate exposure to many aspects of statistical sciences. **PSO3**. Student is equipped with critical statistical 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.
	SEM-II	Minor Elective Course-II in Statistics	

SEMESTER WISE PAPER TITLES WITH DETAILS					
Year	**Semester**	**Paper**	**Paper Title**	**Prerequisite for Paper**	**Elective for Minor Subjects**
FIRST	**SEM-I**	Theory Paper - I	DATA SCIENCE-I	Mathematics in 10th	Open to All Except the students who have Statistics as a core subject in B.A./B.Sc.
	SEM-I	Theory Paper - I	DATA SCIENCE-II		

B.A. /B.Sc. I (SEMESTER-I) PAPER-I

DATA SCIENCE -I

Class: UG Programme	Year: FIRST	Semester: FIRST
Subject: STATISTICS		
Course Code: STAT 100	**Course Title: DATA SCIENCE -I**	

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: By the time students complete the course; they will have wide ranging application of the subject and have the knowledge of statistics and statistical data.

CO3: 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.

CO4: 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.

Credits: 2	**Minor Elective**
Max. Marks: 25+75	**Min. Passing Marks: As per UGC/ University CBCS norm.**

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0

Unit	Topics	No. of Lectures
	DATA SCIENCE -I	
I	Descriptive Statistics: Meaning, need and importance of statistics. Types of statistical data: primary and secondary data, Attributes and variables. Measurement and measurement scales. Collection and tabulation of data. Diagrammatic representation of frequency distribution: histogram, frequency polygon, frequency curve, ogives, stem and leaf plot, pie chart.	8
II	Measures of central tendency: Arithmetic geometric and harmonic mean, median and mode. Measures of dispersion: Mean Deviation, and Variance, Box-plot.	7
III	Moments, skewness and kurtosis and their measures based on quantiles and moments. Introduction to exploratory data analysis. Principle of Least Squares, fitting of Linear and Polynomial equations by the principle of Least Squares.	8
IV	Data on two attributes, independence and association of attributes in 2x2 tables. Simple linear regression and correlation. correlation coefficient and its properties, Spearman's rank correlation.	7

Suggested Readings:

1. Fundamental of Mathematical Statistics, S.C.Gupta and V.K.Kapoor. Sultan Chand and Sons,2000.
2. Fundamental of Mathematical Statistics,Vol-I,A.M.Goon,M.k.Gupta,B.Dasgupta, Vol I, World Press, Kolkata,2011.
3. Fundamental of Mathematical Statistics,Vol-I,A.M.Goon,M.k.Gupta,B.Dasgupta, Vol II, World Press, Kolkata,2013.
4. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill, and D.C. Boes, 3rd Edn., Tata McGraw-Hill Pub. Co. Ltd,2011.
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Course prerequisites:

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

UG - I YEAR (SEMESTER-II) PAPER-I

DATA SCIENCE -II

Class: UG Programme	Year: FIRST	Semester: SECOND
Subject: STATISTICS		
Course Code: STAT 200	**Course Title: DATA SCIENCE -II**	

Course outcomes:

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Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 2-0-0

Unit	Topics	No. of Lectures
	DATA SCIENCE -II	
I	Random experiments, sample spaces (finite and infinite), events, algebra of events, three basic approaches to probability, combinatorial problems. Axiomatic approach to probability. Product sample spaces.	8
II	Conditional probability, Bayes' formula. Random variables (discrete and continuous). Distribution Function and its properties. Mathematical Expectation, Variance and Moments, Simple Theorems on expectation. Discrete Distributions: Bernoulli, Binomial and Poisson.	7
III	Continuous Distributions: Uniform, normal and exponential. Meaning of parameters, test statistic and their sampling distributions. Need of Inferential Statistics. Testing of Hypotheses: Null and Alternative hypotheses, Types of Errors, Critical Region, Level of Significance and Power of a test, p- values.	8
IV	Tests of hypotheses for a single mean, a single variance of a Normal Distribution, testing equality of two means and the equality of two variances of two Normal distributions. Chi square test for 2x2 contingency table	7

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1. Fundamental of Mathematical Statistics, S.C.Gupta and V.K.Kapoor. Sultan Chand and Sons,2000.
2. Fundamental of Mathematical Statistics,Vol-I,A.M.Goon,M.k.Gupta,B.Dasgupta, Vol I, World Press, Kolkata,2011.
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