

**Department
of
Mathematics and Statistics**
School of Mathematical and Physical Science



**Curriculum Framework
B.Sc./B.A. (Statistics)**

Based on National Education Policy- 2020

Date of BoS -16/09/2022

**Doctor Harisingh Gour Vishwavidyalaya
(A Central University)
Sagar-Madhya Pradesh-470003**

About the Department:

The Department of Mathematics & Statistics was established with the very inception of the University in the year of 1946. The founder of the university and the founder vice-chancellor Dr. Harisingh Gour had himself appointed Mr. R.B. Rabugunday as the first Head of the Department. Mr. Rabugunday was a scholar of Madras University and a Wrangler of Cambridge tradition.

Curriculum Framework based on National Education Policy-2020

NEP-2020 has conceptualized the idea to develop well rounded competent individuals for making the nation a self-reliant and global leader. In the same spirit, we at Department of Mathematics and Statistics have developed a curriculum framework to encompass the goals of NEP 2020. To this end, we have incorporated choice of subject/disciplines of study, creating academic pathways having constructive combinations of disciplines for study with multiple entry and exit points as well as focus on **experiential learning** for students by introducing **multidisciplinary and skill enhancement courses** and actual Hands-on training in the recent and trending aspects of

1. Statistical Methods

Under Graduate Curriculum Framework for Bachelor of Science

1. Name of the Programme : Certificate in Statistical Method

2. About the Programme:

Statistics is also a backbone of all discipline. Aim of this programme is to train young minds to handle the critical problems that occur in Statistical Sciences as well as in real life.

3. Objectives of the Programme

- To develop students' skills in Statistical science through various tools and techniques.
- To provide rigorous instruction in fundamental Statistical concepts and skills presented in the context of real-world applications.
- To introduce students to the enormous diversity and complexity of real life problems in Statistics.
- To provide the opportunity to gain familiarity with the applications of Statistics.

4. Programme Learning Outcomes :

The programme learning outcomes are attained by learners through the essential learnings acquired on completion of selected courses of study within a programme. The outcomes and attributes described in qualification descriptors are attained by students through learning acquired on completion of a programme of study.

- a) After completion of this program of study the students will have an enhanced knowledge and understanding of Statistics.
- b) The Statistical skills learned through this course will provide analytical understanding for approaching problems that the students encounter in real life situations.
- c) Students who will pass out this course be better able to draw inferences that rest on Statistical logics.

5. Structure of the Programme B.Sc./B.A. for : Certificate in Statistical Method

Semester I					
Level 5	Nature of Course	Course Code	Course Title	Credits	Course Coordinator
	Discipline Specific Major-1	STA-DSM-111	Descriptive Statistics	6	Prof. R.K.Gangele
	Multi-Disciplinary Major-3	MTS-MDM-111	Matrix Theory	6	Dr. K.S.Mathur
	Ability Enhancement Course	MTS-AEC-111	Graph Theory	2	Dr. K.Shrivastava
	Skill Enhancement Course (SEC)	MTS-SEC-111	Vector Calculus	2	Dr. U.K.Khedlekar
Semester II					
	Nature of Course	Course Code	Course Title	Credits	Course Coordinator
	Discipline Specific Major-1	STA-DSM-211	Probability & Distributions	6	Prof. D. Shukla
	Multi-Disciplinary Major-3	MTS-MDM-211	Numerical Methods	6	Dr. R.K. Pandey
	Ability Enhancement Course	MTS-AEC-211	Fundamentals of Computer	2	Dr. K.S.Mathur
	Skill Enhancement Course (SEC)	MTS-SEC-211	Business Statistics	2	Prof. D. Shukla

6. Exit: Certificate in Statistical Method

7. Teaching Learning Approach:

Mainly this programme will transact the under given pedagogic approach-

- Lecture/ Seminar format
- Demonstration
- Readings/written assignments and Field Projects
- Group discussions/tutorial Community visit
- Project work
- Field Visit/Survey/Dissertation

8. Assessment

The learner in the programme will be assessed throughout the duration of the programme in a formative and summative evaluations i.e. Mid (I&II) and End Semester examinations. To be eligible to appear in End semester examination a student must appear in Mid semester examinations along with 75 per cent attendance in classroom processes

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(Central University)

Department of Mathematics and Statistics

Syllabus as per NEP 2022

B.Sc./B.A.- Semester I (Statistics)

Level & Semester	Course Code	Title of the Course	Credits				Marks	Course Coordinator
			L	T	P	C		
L5 Sem I	STAT-DSM-111	Descriptive Statistics	4	0	0	4	IA (Mid) – 40 EA (End Sem) - 60	Prof. R.K.Gangele

Lecture/Hrs. 60

- Objectives:**
- (1) To learn the data types.
 - (2) To know how to measure standard statistical parameters.
 - (3) To study correlation and its analysis.
 - (4) To explore data pattern by curve fitting methods.
 - (5) To learn the various economic indices.

Course Learning Outcomes:

- Co1: After completion of this course student will be able to learn data analysis wing Statistical methodologies.
- Co2: Student will understand the pattern of data for future projection of values
- Co3: Course will buildup capacity to measure the economic pressure over time.

Unit-wise learning outcome:

- Uo1: Completing Unit-I student will learn data compilation and graphical presentation.
- Uo2: By completing Unit-II, student will learn basic Statistical analysis tools.
- Uo3: End of Unit-III provides capacity to learn effect of correlation in two or more variables.
- Uo4: By completing Unit-IV, student will be able to understand the graphical pattern of data.
- Uo5: Unit-V makes student to identify sources of pressure on Economy.

UNIT I

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives.

UNIT II

Consistency and independence of data with special reference to attributes. Frequency Distribution Measures of central tendency : mean median mode GM, HM. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation.

UNIT III

Moments, absolute and central moments, factorial moments, skewness and its measurement, kurtosis and its measurement, Sheppard's corrections. Bivariate data: scatter diagram, simple, correlation, Karl Pearson coefficient with properties partial and multiple correlation with coefficient and properties (3 variables only), Rank correlation.

UNIT IV

Simple linear regression properties of regression coefficient principle of least squares and fitting of straight line polynomials and exponential curves.

UNIT V

Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyres's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.

Essential Readings:

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn. (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
2. Gupta S.C., Kapoor V.K., Fundamental of Mathematical Statistics, Sultan Chand,
3. Gupta S.C., Kapoor V.K., Fundamental of Applied Statistics, Sultan Chand and Sons.

Suggested Reading:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

E Book Link: National digital Library, e-pgpathshala

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR**(Central University)****Department of Mathematics and Statistics****NEP Syllabus 2022****B.Sc./B.A.- Semester I (Statistics)**

Level & Semester	Course Code	Title of the Course	Credits				Marks	Course Coordinator
			L	T	P	C		
L5 Sem I	STAT-DSM-112	Statistics Practical-I	0	0	2	2	IA (Mid) – 40 EA (End Sem) - 60	Prof. D. Shukla Prof. R.K. Gangele

Lecture/Hrs. 30

- Learning Objectives:**
- (1) To learn the calculation procedure of Statistical methods.
 - (2) To measure some standard statistical parameters.
 - (3) To calculate values of various Statistical coefficients
 - (4) To examine bivariate data pattern by curve fitting.
 - (5) To calculate various indices and to conclude about economic pressure.

Course Learning Outcomes:

Co1: After completion of this course student will learn how to calculate central tendency and variability present in data.

Co2: Student will learn to calculate various coefficients of correlation and regression.

List of Practical**(30 hours)**

1. Graphical representation of data.
2. Problems based on measures of central tendency.
3. Problems based on measures of dispersion.
4. Problems based on combined mean and variance and coefficient of variation.
5. Problems based on moments, skewness and kurtosis.
6. Fitting of polynomials, exponential curves.
7. Calculation Karl Pearson correlation coefficient.
8. Calculation Correlation coefficient for a bivariate frequency distribution.
9. Calculation Lines of regression, angle between lines and estimated values of variables.
10. Calculation Spearman rank correlation with and without ties.
11. Calculation Partial and multiple correlations.
12. Planes of regression and variances of residuals for given simple correlations.
13. Calculate price and quantity index numbers using simple and weighted average of price relatives.
14. To calculate the Chain Base index numbers.
15. To calculate consumer price index number.

Essential Readings:

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
2. Gupta S.C., Kapoor V.K., Fundamental of Mathematical Statistics, Sultan Chand,
3. Gupta S.C., Kapoor V.K., Fundamental of Applied Statistics, Sultan Chand and Sons.

Suggested Reading :

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

E Book Link: National digital Library, E-Pgpathshala

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(Central University)
Department of Mathematics and Statistics
Syllabus as per NEP 2022
B.Sc./B.A.- Semester I (Statistics)

Level & Semester	Course Code	Title of the Course	Credits				Marks	Course Coordinator
			L	T	P	C		
L5 Sem I	MTS-MDM - 111	Matrix Theory	5	1	0	0	IA (Mid) – 40 EA (End Sem) - 60	Dr. K.S. Mathur

Lecture/Hrs. 60

Learning Objectives:

- To understand the basic concept of matrices and their types
- To familiar with the application of Caley Hamilton theorem in finding inverse of matrix.
- To provide an introduction of Matrices to real life problems

Course Learning Outcomes:

- CO 1: Students should have an enhanced knowledge and understanding of Matrix theory.
CO 2: The course skills should provide several methods for approaching problems students encounter in their future endeavors.
CO 3: Students should be better able to understand matrix concept in terms of linear map.

Unit wise Learning Outcomes

- UO 1: Students should be able to determine the rank of matrix and elementary operation to convert into Echelon form, normal form, etc.
UO 2: Students should be able to evaluate eigen values and eigenvectors of various square matrices.
UO 3: Students should be able to solve system of linear equations through matrix methods.
UO 4: Students should be able to understand matrix into linear map and vice-versa.
UO 5: Students should be acquainted with the knowledge of MATLAB and applications matrices into real life problems.

Unit I: Matrix algebra, Row and column vectors of a matrix, row rank and column rank, Echelon matrix, reduced Echelon matrix, rank of a matrix, normal form of a matrix, inverse of matrix.
Unit II: Square matrices, square block matrices, eigen values and eigenvectors of a matrix, relationship between eigen values and eigenvectors, nature of eigen values of special types of matrices, the process of finding eigen values and the eigenvectors.
Unit III: Cayley-Hamilton theorem and its use in finding of inverse, application of matrices to system of linear equations, consistency and inconsistency,
Unit IV: Matrix as a linear map: subspace and span, basis and dimension, linear transformation, coordinate vectors, coordinate matrices, change of the basis matrix, equivalence and similarity.
Unit V: MATLAB basics, practical approach of matrices through MATLAB, applications of matrices in real world problems,

Essential Readings

1. Joel L. Franklin, Matrix theory, Dover Publication 2012.
2. David W.Lewis, Matrix theory. World scientific, 1991.

Suggested Readings

1. Fuzhen Zhang, Matrix theory, Basic results and Techniques, Springer 2011.
2. Leonard E Fuller, Basic Matrix theory, Dover Publication 2017.

Essential e-Resources

1. <https://www.scribd.com/book/271620206/Matrix-Theory>
2. <https://link.springer.com/book/10.1007/978-3-030-80481-7>

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(A Central University)
Department of Mathematics and Statistics
Syllabus as per NEP 2022
B.Sc./B.A.- Semester I (Statistics)

Level & Semester	Course Code	Title of the Course	Credits				Marks	Course Coordinator
			L	T	P	C		
L5 Sem I	MTS-AEC-111	Graph Theory	2	0	0	2	IA (Mid)-40 EA (End Sem)- 60	Dr. Kavita Shrivastava

Lectures/Hrs: 30

Learning Objectives:

Students will achieve command of the fundamental definitions and concepts of graph theory.
To study proof techniques related to various concepts in graphs.
To explore modern applications of graph theory.
Able to apply theoretical knowledge acquired to solve realistic problems in real life.

Course Learning Outcomes:

CO1: Understand the basic concepts of graphs, and different types of graphs.
CO2: Understand the properties, theorems and be able to prove theorems.
CO3: Apply suitable graph model and algorithm for solving applications.
CO4: Understand the Travelling Salesman's problem.
CO5: Form Dijkstra's algorithm and apply it in various situations.

Unit Wise Learning Outcomes:

UO1. To learn about graph and its properties.
UO2. To learn about types of graph .
UO3. To learn about travelling salesman problem and its application.
UO4. Aware about planar graph.
UO5. Aware about shortest path, trees and its properties.

Unit I: Definition, examples and basic properties of graphs, graph terminology, types of graph, path, trail, circuit, cycle, complementary graph.
Unit II: Sub graphs, Spanning Subgraph, Isomorphic Graph, Homoeomorphic graph, Connected graph, Disconnected graph, Cut set, Cut point, Complete graph, Labeled graph, Weight graph, Regular graph, Bipartite graph, Complete bipartite graph.
Unit III: Definitions: Directed and undirected graphs. Hand shaking property and its problems. Real life applications Applications- Konigsberg bridge problem, Utility problem and travelling salesman problem. Euler graphs and Hamiltonian graphs (no theorems) problems
Unit IV: Planar graph, Properties of planar graph, Non- planar graph, Euler formula, Kuratowski's theorem, Graph coloring.
Unit V: Shortest path, Dijkstra's algorithm, Trees and their properties, Spanning tree, Kruskal's algorithms.

Essential Reading:

1. Narasingh Deo, Graph Theory with applications to engineering and computer Science, Edition, Printice hall of India Private Limited, 2009.
2. Ralph P. Grimaldi., Discrete and Combinatorial Mathematics, 5th Edition , Pearson, 2006.

Suggested Reading

1. Geir Agnarsson and Raymond Greenlaw, Graph Theory, Modeling, Applications and Algorithms, 1st Edition, Pearson Education, Inc, New Delhi 2009.
2. John Clark and Holton D.A, A First Look at Graph Theory, Edition, Allied Publishers, 2001.
3. Douglas B West, Introduction to Graph Theory, 2nd Edition, Printice hall of India Private Limited, New Delhi.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(A Central University)
Department of Mathematics and Statistics
Syllabus as per NEP 2022
B.Sc./B.A.- Semester I (Statistics)

Level & Semester	Course Code	Title of the Course	Credits				Marks	Course Coordinator
			L	T	P	C		
L5 Sem I	MTS-SEC-111	Vector Calculus	2	0	0	2	IA (Mid)-40 EA(End Sem)- 60	Dr.U.K.Khedlekar Dr. Bhupendra

Lectures/Hrs: 30

Learning Objectives:

To understand the concept of differentiation of vector function, and applications of Scalar and vector product. To understand the aspects of gradient, divergence and curl.

Course Learning Outcomes:

CO1: Students capable to understand the vector valued function.

CO2: After completion of this course, students should be able to manipulate vectors to perform geometrical calculations in three dimensions.

CO3: They will also able to calculate and interpret derivatives in up to three dimensions.

Unit Wise Learning Outcomes:

UO1. To learn about vectors and Scalar

UO2. To learn about partial differentiation of vector function.

UO3. To learn about derivative of sum and dot product.

UO4. To find out the derivative of cross product of two vectors.

UO5. To discuss about gradient, divergence and curl.

Unit – I: Differentiation of a vector function and Partial differentiation of a vector function.
Unit – II: Derivative of sum and dot product of two vectors and their properties.
Unit – III: Derivative of cross product of two vectors and their properties.
Unit – IV: Work done and moment by force.
Unit – V: Gradient, divergence and curl.

Essential Readings :

1. P.C. Matthew's, *Vector Calculus*, Springer Verlag London Limited, 1998.

Suggested Readings :

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.

E-resource :

https://onlinecourses.nptel.ac.in/noc22_ma03/preview

<https://www.youtube.com/watch?v=M0H1UJbn-V4>

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(Central University)
Department of Mathematics and Statistics
Syllabus as per NEP 2022
B.Sc./B.A.- Semester II (Statistics)

Level & Semester	Course Code	Title of the Course	Credits				Marks	Course Coordinator
			L	T	P	C		
L5 Sem II	STAT-DSM-211	Probability and Distributions	4	0	0	4	IA (Mid) – 40 EA (End Sem) - 60	Prof. D. Shukla Prof. R.K. Gangele

Lecture/Hrs. 60

- Learning Objectives:**
- (1) To study concept of probability.
 - (2) To study nature of random variables & its probability function.
 - (3) To learn average and variability under probability phenomenon
 - (4) To learn about moments of a random variable by various approaches.
 - (5) To study different nature of probability distributions.

Course Learning Outcomes:

- Col : After completion of this course student will learn the concept of joint and conditional probabilities.
 Co2 : Student can identify the random variables with their distributions.
 Co3 : Student will be capable enough to understand properties of probability distributions.

Course Learning Outcomes:

- Uo1 : After completion of this unit I, the student will learn the basics of joint probability, conditional probability and probability of union of events.
 Uo2 : This unit II will make students capable for dealing with random variables.
 Uo3 : Unit III will help to understand average and variability under probability setup.
 Uo4 : At end of unit IV student will learn m.g.f., characteristic function and cumulates and their uses.
 Uo5 : Student will learn the various popular probability distributions with properties.

UNIT I Probability: Introduction, random experiments, sample space, events, Definitions of Probability – classical, statistical, and axiomatic. Joint and Conditional Probability, laws of addition and multiplication, independent events, Bayes' theorem.
UNIT II Random variables: discrete and continuous random variables, p.m.f., p.d.f. of random variables, Two dimensional random variable, discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f.
UNIT III Independence of random variables, bivariate distributions. Expectation of single and bivariate random variables and its properties. Conditional Expectation and conditional variance, Theorems on expectation and variance.
UNIT IV Moment generating function, Cumulant generating function and Characteristic function. Uniqueness and inversion theorems (without proof) along with applications.
UNIT V Standard probability distributions: Binomial, Poisson, geometric, negative binomial, uniform, normal, exponential and gamma along with their mean, variance and other properties.

Essential Readings:

1. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
2. Gupta S.C., Kapoor V.K., Fundamental of Mathematical Statistics, Sultan Chand,
3. Gupta S.C., Kapoor V.K., Fundamental of Applied Statistics, Sultan Chand and Sons.

Suggested Reading:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Mary lees (2006): John E. Freund's Mathematical Statistics with Applications (7th Edn.), Pearson Education, Asia.

E Book Link: National digital Library, E. Pgpathshala.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(Central University)
Department of Mathematics and Statistics
Syllabus as per NEP 2022
B.Sc./B.A.- Semester II (Statistics)

Level & Semester	Course Code	Title of the Course	Credits				Marks	Course Coordinator
			L	T	P	C		
L5 Sem II	STAT-DSM-212	Statistics Practical-II	0	0	2	2	IA (Mid) – 40 EA (End Sem) - 60	Prof. D. Shukla Prof. R.K. Gangele

Lecture/Hrs. 30

- Learning Objectives:**
- (1) To calculate probability of events.
 - (2) To know how to create random variables & its probability function.
 - (3) To study expectations with average and variability under probability setup.
 - (4) To moments of a random variable by various approaches.
 - (5) To fit different nature of distributions on real data.

Course Learning Outcomes:

- Co1: After completion of this course student will learn the calculation of joint and conditional probabilities of events
- Co2: Student will learn to fit probability distribution over real data
- Co3: Student will understand the effect of variations of parameter over shape of probability distributions.

List of Practical	(30 hours)
1. Two coin, three coin, four coin toss experiments and calculation of joint probabilities and conditional probabilities. 2. One dice, two dices thrown experiments and calculation of joint, conditional probabilities. 3. Calculation of $P(A \cup B)$, $P(A \cup B \cup C)$, $P(A \cup B \cup C \cup D)$ probabilities 4. Practical calculation based on Bayes theorem 5. Calculation of univariate and bivariate expectations for discrete and continuous random variables. 6. Calculation of conditional variance in bivariate discrete probability distributions. 7. Fitting of binomial distributions for n and $p = q = \frac{1}{2}$. 8. Fitting of binomial distributions for given n and p. 9. Application problems and fitting of Poisson distribution. 10. To calculate the ordinate for a given value for normal distribution. 11. Application based problems using normal distribution. 12. Fitting of normal distribution when parameters are given. 13. Fitting of normal distribution when parameters are not given. 14. Practical on geometric distribution. 15. Practical on exponential and Uniform distributions.	

Essential Readings:

1. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
2. Gupta S.C., Kapoor V.K., Fundamental of Mathematical Statistics, Sultan Chand,
3. Gupta S.C., Kapoor V.K., Fundamental of Applied Statistics, Sultan Chand and Sons.

Suggested Reading:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications (7th Edn.), Pearson Education, Asia.

E Book Link: National digital Library, E-pgpathshala

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(A Central University)
Department of Mathematics and Statistics
Syllabus as per NEP 2022
B.Sc./B.A.- Semester II (Statistics)

Level & Semester	Course Code	Title of the Course	Credits				Marks	Course Coordinator
			L	T	P	C		
L5 Sem II	MTS-MDM-211	Numerical Methods	4	2	0	6	IA (Mid)-40 EA (End Sem)- 60	Dr. R.K.Pandey

Lectures/Hrs: 90

Learning Objectives

1. To explain the construction of numerical method for the solution of algebraic and transcendental equations.
2. To introduce convergence and stability criteria for various numerical method.
3. To explain the numerical methods for solution of system of linear and nonlinear equations.
4. To explain the relaxation and iterative methods.
5. To explain the concept of interpolation, Lagrange and Newton's interpolation.

Course Learning Outcomes: This course will enable the students to:

CO-1 Obtain numerical solutions of algebraic and transcendental equations.

CO-2 Find numerical solutions of system of linear equations and to check the accuracy of the solutions.

CO-3 Learn about various interpolating methods to find numerical solutions initial value problems in differential equations

Unit wise Learning Outcomes: After completion of this course students will be able to:

UO1: Obtain the approximate solution of algebraic and transcendental equations.

UO2: Know the alternative numerical method to find the solutions of system of linear equations and able to know the way to check the accuracy of the solutions.

UO3: Interpret the interpolation to find the missing value form the given set of points. They should also know the concept of finite difference.

UO4: Know the derivation of trapezoidal and Simpson's rule and capable to evaluate the integrals numerically using these methods.

UO5: Understand application of various numerical methods to find the solution of differential equations.

Unit-I: Round-off error and computer arithmetic, Local and global truncation errors, Algorithms and convergence; Intermediate value theorem and Fixed point theorem (without proof). Bisection method, method of false position, fixed point iteration method.
Unit-II: Newton Raphson and secant method for solving equations. Partial and scaled partial pivoting, LU decomposition and its applications, Gauss Elimination, Gauss Jordan method, Indirect method: Jacobi and Gauss-Seidel methods.
Unit-III: Finite differences; Interpolation; Newton's forward and backward interpolation, Lagrange's interpolation, Newton's divided difference; Piecewise interpolation, Spline.
Unit-IV: First order and second order approximation for first derivative, Approximation for second derivative; Numerical integration: Trapezoidal rule, Simpson's rule and error, Gauss Quadrature.
Unit-V: Picard method, Euler's method (Forward, Backward and Modified), Runge-Kutta methods (explicit); Error term of Euler method.

Essential Readings:

1. Brian Bradie (2006), A Friendly Introduction to Numerical Analysis. Pearson.
2. M.K. Jain, S. R. K. Iyengar & R. K. Jain (2012). Numerical Methods for Scientific and Engineering Computation (6th edition), New Age International Publishers.
3. Robert J. Schilling & Sandra L. Harris (1999). Applied Numerical Methods for Engineers Using MATLAB and C. Thomson-Brooks/Cole.
4. Melvin J. Maron, Numerical Analysis A Practical Approach, Macmillan Publishing Company Inc., New York, 1982.

Suggested Readings:

1. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, New Delhi, 2010.
2. C. F. Gerald & P. O. Wheatley (2008). Applied Numerical Analysis (7th edition), Pearson Education, India

E- Resource :

[Numerical methods - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/106/06/2019)

[Introduction to Numerical Methods | Mathematics | MIT OpenCourseWare](https://ocw.mit.edu/courses/mathematics/18.06-introduction-to-numerical-methods/)

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(Central University)
Department of Mathematics and Statistics
Syllabus as per NEP 2022
B.Sc./B.A.- Semester II (Statistics)

Level & Semester	Course Code	Title of the Course	Credits				Marks	Course Coordinator
			L	T	P	C		
L5 Sem II	MTS-AEC - 211	Fundamentals of Computer	2	0	0	2	IA (Mid) – 40 EA (End Sem) - 60	Dr. K.S. Mathur

Lecture/Hrs. 60

Learning Objectives:

- To confidently operate computers to carry out computational tasks
- To understand working of Hardware and Software, the importance of programming languages, number systems.
- To describe the organization and operation of a computer processor, primary and secondary memory, peripheral devices and to give computer specifications

Course Learning Outcomes:

- CO 1:** Students should enhance knowledge of computer, structure of computer and its generation.
CO 2: Students should be familiar with conversion of number systems.
CO 3: Students should be able to understand the basic concept of programming languages.

Unit wise Learning Outcomes: After the completion of course students should be able

- UO 1:** To enhance the basic knowledge of computer and its generation.
UO 2: To understand the basic structure and types of computer.
UO 3: To familiar with the number system and conversion from one to another.
UO 4: To understand various types of computer memory.
UO 5: To gain the basic knowledge of computer programming.

Unit I: Introduction to Computers - Computer Characteristics, Concept of Hardware, Software, Evolution of computer and Generations,

Unit II: Types of Computer – Analog and Digital computers, Hybrid Computers, General Purpose and Special Purpose Computer, Limitations of Computer, Functional Block Diagram of Computer. CPU, ALU, Memory Unit.

Unit III: Number Systems – different types, conversion from one number system to another, Input Device – Keyboard, Mouse, Scanner, MICR, OMR. Output Devices – VDU, Printers – Dot Matrix, Daisy-wheel, Inkjet, Laser, Line Printers and Plotters.

Unit IV: Memory Concept, Memory Cell, Memory Organization, Semiconductor Memory – RAM, ROM, PROM, EPROM, Secondary Storage Devices – Magnetic Tape, Magnetic Disk (Floppy Disk and Hard Disk.), Compact Disk.

Unit V: Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler.

Essential Readings

1. P.K. Sinha and P. Sinha, Computer Fundamentals, BPB Publishers, 2007.
2. Sheema Thareja, Fundamental of Computers Oxford University Press, 2019.

Suggested Readings

1. E. Balagurusamy, Fundamental of Computers and Programming, McGraw Hill Education 2011.
2. A. Geol, Computer Fundamentals, Pearson Education, 2010.

Essential e-Resources

- <https://www.amazon.in/Fundamentals-Computers-Manaullah-Abid-ebook/dp/B07YZ36XHM>
- <https://www.mheducation.co.in/fundamentals-of-computers-9780070141605-india>

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(A Central University)
Department of Mathematics and Statistics
B.A./ B.Sc. -II Semester

Level	Course Code	Title of Course		L	T	P	C
L 5 Sem II	STAT-SEC-121	Business Statistics		2	0	0	2
				Max. Marks: 100			

30 Hours

Learning Objective: (I) To understand business indicators.

(II) To understand fluctuations in business

(III) To visualize the pattern of demand and supply in business

(IV) To strengthen the power of taking business decision

Course Learning Outcome

Co1 : After completion of this course student will learn about the business indicators.

Co2 : Student will understand the business variations over time.

Co 3 : Student will be capable enough for taking business decisions over different situations.

Unit wise Learning outcomes

Uo1 : Unit I will enable students to understand construction of economic indicators.

Uo2 : Unit II will make student capable to choose the best economic indicator among all.

Uo3 : Unit III will establish a foundation of understanding business variations.

Uo4 : Unit IV provides a platform to know about effect of inter-relationship of business variables.

Uo5 : This Unit V develops capacity to understand demand-supply laws and their relative rate of variations.

UNIT I Need of Index number, problems in construction of index number, weighted average and price relative indices Laspeare, Paasche, indices, practical examples of eancellation.
UNIT II Fixed base and Chain base indices, test of a good index number, time reversal, factor reversal and circular test Classification of index numbers, cost of living index number. Error in measurement of indices.
UNIT III Need of time series, components of time Series, Trend, Seasonal, Cyclic and Random fluctuations, models for time series, Applications in business forecasting.
UNIT IV Measurement of Trend of time series, Graphic and Semi-average methods, moving average method, measurement of seasonal variations, Ratio to trend, Ratio to moving average and Link relative methods.
UNIT V Basics of Demand analysis, Law of demand and Supply, price elasticity, partial and cross elasticity, Leontief and Pigou method, Engel's Law and Engel curve.

Essential Reading:

1. Gupta S.C, Kapoor V.K., Fundamental of Applied Statistics, Sultan Chand and Sons.
2. Goon, A.M, Gupta M.K. and Dasgupta B. (2002) : Fundamental of Statistics, Vol I and II, 8th Edn.
3. S.P. Gupta, Fundamental of Statistics, Sultan Chand and Sons.
4. A.K. Sharma, Text book of Index number and Time series, DPH Mathematics Series.
5. S.P. Gupta and M.P. Gupta, Business Statistics, Sultan chand and Sons.
6. D.R. Aderson and Thomas A Williams, Statistics for Business and Economics, Cengage Learning Publication.

e-resource: epgpathshal (Forecasting & time series)

Swayam: Applied Time series Analysis

National Digital Library