Rayat Shikshan Sanstha's

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA

(AUTONOMOUS)

Lead college of

Karmaveer Bhaurao Patil University, Satara

Reaccredited by NAAC with 'A+' Grade

Proposed Syllabus For

Bachelor of Science

Part - II

STATISTICS

Syllabus to be implemented w. e. f. June 2024
As Per NEP - 2020

B.Sc. Part II

1. **Title:** Statistics
2. **Year of Implementation:** June, 2024
3. **Duration:** The course shall be full time
4. **Pattern:** Semester Pattern
5. **Medium of Instruction:** English
6. **Structure of Course:**

B.Sc. - II: Semester - III

Sr. No	Paper Title	Theory			Practical		
		Paper Code	Lecture per week	Credits	Paper Title	Lecture per week	Credits
1	Continuous Probability Distribution	BST 231	4	2	Major Practical-III BSP - 233	4	2
2	Statistical Methods	BST 232	4	2	Major Practical-IV BSP - 234	4	2

B.Sc. - II: Semester - IV

Sr. No	Paper Title	Theory			Practical		
		Paper Code	Lecture per week	Credits	Paper Title	Lecture per week	Credits
1	Probability Distribution	BST 241	4	2	Major Practical-III BSP - 243	4	2
2	Sampling Distributions and Statistical Tests	BST 242	4	2	Major Practical-IV BSP - 244	4	2

Semester – III

Theory Course V BST 231 CONTINUOUS PROBABILITY DISTRIBUTION

Course Objectives: Students should be able to …

1. define and differentiate between continuous sample space and discrete sample space.
2. explain the significance of uniform and exponential distributions in various real-world scenarios.
3. apply the properties of the normal distribution to calculate probabilities and percentiles.
4. apply the concept of transformation on univariate as well as bivariate random variables.

Credits (Total Credits 2)	**SEMESTER-III BST 231 CONTINUOUS PROBABILITY DISTRIBUTION**	**Total hours 30**
Sr. No.	**Title of Unit**	**No. of Hours**
UNIT - I	**Continuous Univariate Distributions**	**(08)**
	1.1: Definition of the continuous sample space with illustrations, Definition of a continuous random variable (r.v.), probability density function (p.d.f.), cumulative distribution function(c.d.f.), and its properties. 1.2: Expectation of r.v., the expectation of a function of r.v., mean, median, mode, quartiles, variance, harmonic mean, raw and central moments, Cumulants, skewness and kurtosis, examples 1.3: Moments generating function (m.g.f.): definition and properties (i) Standardization Property $M_X(0) = 1$, (ii) Effect of change of origin and scale, (iii) Uniqueness property of m.g.f., (statement only). Generation of raw and central moments. 1.4: Cumulant generating function (c.g.f.): definition, relations between cumulants and central moments (up to order four). Examples. 1.5 Mode, partition values: quartiles(Q, Q2, Q3), deciles, percentiles 1.6 Probability distribution of a function of r. v. Y=g(X): using i) Jacobian of g(.) transformation for monotonic function and one-to-one, on to functions, ii) Distribution function for $Y=X^2$,$Y=\|X\|$etc., iii) M.G.F. of g(X).	
UNIT - II	**Continuous Uniform and Exponential Distribution**	**(07)**
	2.1: Uniform distribution: Definition of Uniform distribution over (a, b) c.d.f., m.g.f., mean, variance, moments. Symmetry of Uniform Distribution, U(0, θ) as Scale Family of distributions. Distribution of (i) (X-a) / (b-a), ii) (b-X) / (b-a), (iii) Y = F(x) where F(x) is c.d.f. of any continuous r.v.	

	2.2: Exponential distribution: p.d.f. (one parameter), c.d.f., m.g.f., c.g.f., mean, variance, C.V., moments, Cumulants, Skewness and Kurtosis, median, quartiles, lack of memory property, distribution of $-(1/\theta)\log X$ where X~U (0, 1)	
UNIT - III	**Normal Distribution**	**(08)**
	3.1 Normal distribution with parameters μ & σ^2, Definition of standard normal distribution, properties of normal curve, m.g.f., c.g.f., mean, variance, median, mode, mean deviation, moments. 3.2 Cumulants, measures of skewness & kurtosis, distribution of linear combination of variates. Normal family as a location and scale family. 3.3 Probability distribution of $\bar{X}$ the mean of n . r. v s., computations of normal probabilities using normal probability integral tables. Central limit theorem (CLT) for i.i.d r.v.s. with finite positive variance (statement only), its illustration for Poisson and Binomial distributions	
UNIT - IV	**Continuous Bivariate Distributions**	**(07)**
	4.1: Definition of a bivariate continuous random variable (X, Y), Joint p.d.f., c.d.f with properties, marginal and conditional distribution, independence of random variables, evaluation of probabilities of various regions bounded by straight lines. 4.2. : Expectation of function of r.v.s means, variances, covariance, correlation coefficient, conditional expectation, regression as conditional expectation if it is a linear function of other variable and conditional variance, proof of i) E (X± Y) = E(X) ± E(Y) ii) E [E(X/Y)] = E(X). 4.3. : If X and Y are independent r.v.s. then (i) E (XY) = E(X) E(Y) (ii) Mx+y (t)=Mx(t)My (t) (iii) Probability distribution of transformation of bivariate r. v. U=$\emptyset_1(X,Y)$ and V=$\emptyset_2(X,Y)$ 4.4: Examples.	

Course outcomes: Students will be able to …

1. define probability density function (p.d.f.) and cumulative distribution function (c.d.f.) and their properties.
2. explain the characteristics and properties of the normal distribution, including mean, variance, and measures of skewness and kurtosis.
3. apply the properties of continuous uniform and exponential distributions to solve real-world problems.
4. analyze transformations of continuous random variables and their resulting distributions.

References:

1. Hogg, Robert V., Joseph W. McKean, and Allen T. Craig. Introduction to Mathematical Statistics. 9th ed., Pearson, 2021.
2. Evans, Merran, et al. Statistical Distributions. 4th ed., Wiley, 2020.
3. Wasserman, Larry. All of Statistics: A Concise Course in Statistical Inference. Springer, 2020.
4. Goon, A.M., Gupta M.K. and Dasgupta B, Fundamentals of Statistics Vol. I and Vol. II, World Press, Calcutta, 2016
5. Gupta S. C. & Kapoor V. K., Applied Statistics, Sultan Chand & Sons, New Delhi,2018
6. Gupta S. C. & Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2014
7. Hogg R.V. and Criag A.T., Introduction to Mathematical Statistics, Macmillan Publishing, New York, Seventh Edition, 2013
8. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011
9. Walpole R.E. &Mayer R.H., Probability& Statistics, MacMillan Publishing Co. Inc, New York.

Theory Course VI BST 232 STATISTICAL METHODS

Course Objectives: Students should be able to …

1. understand the components of time series and their utility in analyzing trends, seasonal variations, and forecasting.
2. interpret and analyze mortality and fertility rates, understanding their definitions, interpretations, and applications.
3. apply the principles of reliability theory to analyze binary systems, including series, parallel, and 2-out-of-3 systems.
4. construct and interpret Shewhart control charts for variables and attributes, including mean, range, fraction defective, and defects.

Credits (Total Credits 2)	SEMESTER – III BST 232 STATISTICAL METHODS	No. of hours per unit
UNIT – I	**Time Series**	**(07)**
	1.1: Meaning and need of time series analysis, components of times (i) Secular trend (ii) Seasonal Variation (iii) Cyclical Variation (iv) Irregular Variation, Additive and Multiplicative model, Utility of time series. 1.2: Measurement of trend: (i) Moving averages method (ii) Progressive average method (iii) Least square method. (iv) linear, parabolic, exponential, Parato curve fitting by least squares principle (v) exponential smoothing. 1.3: Choosing parameters for smoothing and forecasting. Forecasting based on exponential smoothing. 1.4 Measurement of seasonal variations: i) simple average method, ii) ratio to moving average method, iii) ratio to a trend where the linear trend is calculated by method of least squares.	
UNIT – II	**Demography**	**(07)**
	2.1: Introduction and need of vital statistics 2.2: Mortality rates: Crude death rate (CDR), Specific Death Rate (SDR), Standardized Death Rate (STDR). 2.3: Fertility Rates: Crude Birth Rate (CBR), Age Specific Fertility Rate (ASFR), General Fertility Rate (GFR), Total Fertility Rate (TFR). 2.4: Reproduction Rate: Gross Reproduction rate (GRR), Net Reproduction Rate (NRR). Interpretations of different rates, uses and applications. 2.5 Life Table – Concept and construction of Life Tables	
UNIT – III	**Reliability Theory**	**(08)**

	3.1: Binary Systems: Block diagrams, the definition of binary coherent structure, and illustrations. Coherent systems of at most three components (a) Series, (b) Parallel, (c) 2 out of 3: Minimal cut, minimal path representation of system. 3.2: Reliability of binary System: reliability of above systems h(p), when components are independent and identically distributed with common probability p of operating. 3.3: Ageing Properties: definitions: Hazard rate, hazard function, survival function, concept of distributions with increasing and decreasing failure rate (IFR, DFR). Relationship between survival function and hazard function, density function and hazard rate, derivations results (1) Hazard rate of a series system of components having independent lifetimes is a summation of component hazard rates.(2) The lifetime of a series system of independent components with independent IFR lifetimes is IFR.	
UNIT – IV	**Statistical Quality Control**	**(08)**
	4.1: Meaning and purpose of S.Q.C., Process control, Product control, chance causes, assignable causes, Shewhart's control chart-construction & working, lack of control situation. 4.2: Control charts for variables - control chart for mean, control chart for range, construction, and working of mean & range charts for unknown standards, revised control limits. 4.3: Control charts for Attributes – Defects, defectives, fraction defective, control chart for fraction defective (p-chart) for fixed sample size and unknown standards, construction and working of the chart. Control charts for several defects (C-chart), for unknown standards, construction, and working of C-chart.	

Course outcomes: Students will be able to …

1. understand of the meaning and need of time series analysis, including the components such as secular trend, seasonal variation, cyclical variation, and irregular variation.
2. comprehend and interpret reproduction rates, including gross reproduction rate (GRR) and net reproduction rate (NRR).
3. demonstrate proficiency in analyzing the reliability of binary systems and understanding aging properties such as hazard rate and survival function.
4. apply statistical quality control methods to monitor processes and products, identifying and addressing lack of control situations.

References:

1. Gupta S. C. & Kapoor V.K. Applied Statistics, Sultan Chand & Sons, New Delhi. 2018
2. Rockwell, Peter J., and Richard A. Davis. Introduction to Time Series and Forecasting. Springer,

2016.

3. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011.
4. Montgomery, Douglas C. Introduction to Statistical Quality Control. 8th ed., Wiley, 2012.
5. Montgomery, Douglas C., et al. Introduction to Time Series Analysis and Forecasting. 2nd ed., Wiley, 2008.
6. Preston, Samuel H., et al. Demography: Measuring and Modeling Population Processes. Blackwell Publishing, 2001.
7. Stuart, Alan, and J. Keith Ord. Kendall's Advanced Theory of Statistics, Volume 1: Distribution Theory. 6th ed., Edward Arnold, 1994.
8. Sinha S.K., Reliability and Life Testing, Wiley Eastern Publishers, New Delhi, Second Edition,1987
9. Barlow R.E. and Proschan Frank, Statistical Theory of Reliability and Life Testing, Holt Rinebart and Winston Inc., New Yark, 1981

Practical Course III, BSP 233, Major Statistics Practical – III

Course Objectives: Students should be able to …

1. Understand the principles of fitting discrete distributions and modeling sampling from them using Microsoft Excel.
2. Gain proficiency in fitting various discrete distributions including uniform, binomial, hypergeometric, Poisson, geometric, and negative binomial distributions.
3. Develop skills in generating random samples from these distributions using Excel functions.
4. Analyze the goodness of fit of the fitted distributions to the observed data.

Credits (Total Credits 2)	**SEMESTER – III** **BSP 233** **Major Statistics Practical – III**	**No.of hours 60**
	List of Practicals	
	1. Fitting of Discrete Uniform Distribution 2. Fitting of Binomial Distribution. 3. Fitting of Hypergeometric distribution. 4. Fitting of Poisson distribution. 5. Fitting of Geometric distribution. 6. Fitting of Negative Binomial distribution. 7. Model sampling from Discrete Uniform distribution. 8. Model sampling from Binomial distribution. 9. Model sampling from Hypergeometric distribution. 10. Model sampling from Poisson distribution. 11. Model Sampling from Geometric distribution. 12. Model sampling from Negative Binomial distribution. 13. Sketching of the Binomial distribution. 14. Sketching of the Hypergeometric distributions. 15. Sketching of the Poisson distributions. 16. Sketching of the Geometric distributions. 17. Sketching of the Negative Binomial distributions. 18. Sketching of the Discrete uniform distributions. 19. Computations of Probability of Discrete Distribution – I using MS Excel. 20. Computations of Probability of Discrete Distribution – II using MS Excel.	

Course Outcomes: Students will be able to …

1. demonstrate proficiency in using Microsoft Excel to fit discrete distributions and generate

random samples.

2. fit the discrete uniform, binomial, hypergeometric, Poisson, geometric, and negative binomial distributions to given data sets.
3. analyze the goodness of fit of the distributions through a test of goodness of fit
4. interpret the results of fitting and sampling experiments, concluding the suitability of different distributions for modeling real-world phenomena.

References:

1. Gupta S.P, Statistical Methods, Sultan Chand and Sons, New Delhi, 2019
2. Gupta S. C. &Kapoor V.K.: Applied Statistics, Sultan Chand & Sons, New Delhi, 2018
3. Hogg R.V. and Criag A.T, Introduction to Mathematical Statistics, Macmillan Publishing, New York, Seventh Edition, 2013
4. Gupta S.C.& Kapoor V.K., Fundamentals of Mathematical Statistics Sultan Chand& sons, New Delhi, 2014
5. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011

5. Boes D.C and Mood A. M., Introduction to the Theory of Statistics, Tata, McGraw-Hill, New Delhi. Third Edition,1973

Practical Course IV, BSP 234, Major Statistics Practical – IV

Course Objectives: The students should be able to …

1. understand different methods for analyzing and forecasting time series data.
2. calculate and interpret mortality, fertility, and reproduction rates in demographic studies
3. analyze reliability in systems with multiple components
4. develop proficiency in fitting different types of curves to data

Credits (Total Credits 2)	**SEMESTER – III** **BSP 234** **Major Statistics Practical – IV**	**No.of hours 60**
	List of Practical	
	1. Estimation of Trend by Progressive averages and Moving average Method 2. Estimation of Trend by Least square estimation method. 3. Forecasting by using the exponential smoothing method. 4. Time Series (Trend by Progressive averages, Moving average, least square methods) using MS EXCEL. 5. Time Series Measurement of Seasonal Variation. 6. Demography: Mortality rates – I 7. Demography: Mortality rates – II 8. Demography: Computation of Fertility rates 9. Demography: Reproduction Rates. 10. Construction of the Life Table. 11. Reliability Theory-I: Block diagram. 12. Reliability Theory-II: Structure Function. 13. Reliability Theory III: Reliability of the System 14. Finding Survival function and Hazard rate. 15. Fitting of Straight line 16. Fitting of Parabola. 17. Fitting of Exponential curves. 18. Construction of Variable Charts. 19. Construction of np Chart. 20. Construction of P and C charts.	

Course Outcomes: Students will be able to …

1. demonstrate proficiency in trend analysis and forecasting techniques using progressive averages, moving averages, and exponential smoothing methods.
2. comprehend fertility and reproduction rates and their implications in demographic analysis.
3. construct control charts for quality control purposes.
4. demonstrate the ability to fit straight lines, parabolas, and exponential curves to data.

Refrences:

1. Gupta S. C. & Kapoor V.K. Applied Statistics, Sultan Chand & Sons, New Delhi. 2018
2. Rockwell, Peter J., and Richard A. Davis. Introduction to Time Series and Forecasting. Springer, 2016.
3. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011
4. Montgomery, Douglas C. Introduction to Statistical Quality Control. 8th ed., Wiley, 2012.
5. Montgomery, Douglas C., et al. Introduction to Time Series Analysis and Forecasting. 2nd ed., Wiley, 2008.
6. Preston, Samuel H., et al. Demography: Measuring and Modeling Population Processes. Blackwell Publishing, 2001.
7. Stuart, Alan, and J. Keith Ord. Kendall's Advanced Theory of Statistics, Volume 1: Distribution Theory. 6th ed., Edward Arnold, 1994.
8. Sinha S.K., Reliability and Life Testing, Wiley Eastern Publishers, New Delhi, Second Edition,1987
9. Barlow R.E. and Proschan Frank, Statistical Theory of Reliability and Life Testing, Holt Rinebart and Winston Inc., New Yark, 1981

B. Sc. Part-II (Semester-III)
Statistics Minor
BST-235: Statistical Techniques-I (Credits: 02)
Theory: 30 Lectures (30 Hours)

Course Objectives: Students should be able to …

1. understand the fundamental concept of continuous distributions.
2. explain the relationship among the different distributions.
3. differentiate between Continuous probability distributions and discrete probability distributions.
4. compute various measures of central tendencies and measures of dispersion.

Credits (Total Credits 2)	**SEMESTER – III BST 235 Statistical Techniques-I**	**No.of hours per unit**
Unit - I	**Continuous Univariate Distributions**	**(07)**
	1.1 Definition of the continuous sample space with illustrations, Definition of a continuous random variable (r.v.), probability density function (p.d.f.), 1.2 Expectation of r.v. , raw and central moments. Cumulants, skewness and kurtosis, examples.	
Unit - II	**Standard Distribution**	**(08)**
	2.1 Uniform Distribution: Definition, p.d.f Mean and Variance, Properties (Without Proof). 2.2 Exponential Distribution: Definition, p.d.f Mean and Variance, Properties (Without Proof). 2.3 Normal Distribution: Definition, p.d.f Mean and Variance, Properties (Without Proof).	
Unit - III	**Time Series**	**(07)**
	3.1: Meaning and need of time series analysis, components of times (i) Secular trend (ii) Seasonal Variation (iii) Cyclical Variation (iv) Irregular Variation, Additive and Multiplicative model, Utility of time series. 3.2: Measurement of trend: (i) Moving averages method (ii) Progressive average method (iii) Least square method. (iv) Measurement of seasonal indices by simple average method	
Unit - IV	**Statistical Quality Control**	**(08)**
	4.1 : Meaning and purpose of S.Q.C., Process control, Product control, chance causes, assignable causes, Shewhart's control chart- construction & working, lack of control situation. 4.2 : Control charts for variables - control chart for mean, control chart for range, construction and working of mean & range charts for unknown standards, revised control limits.	

	4.3 : Control charts for Attributes – Defects, defectives, fraction defective, control chart for fraction defective (p- chart) for fixed sample size and unknown standards, construction and working of the chart. Control charts for a number of defects (C-chart), for unknown standards, construction, and working of C-chart.	

Course Outcomes: Students will be able to…

1. apply the concept of continuous distributions with real-life situations
2. determine the probabilities of normal distributed random variables.
3. describe the need for vital statistics and the concept of mortality and fertility
4. measure the trend and seasonality of time series.

References:

1. Agarwal B. L, Statistics, New Age International P Ltd. Delhi, 2015
2. Goon A. M, Gupta M. K. and Dasgupta B, Fundamentals of Statistics Vol. I and II, Calcutta World Press, 2016
3. Gupta S. P, Statistical Methods, Sultan Chand and Sons, Delhi, 2002
4. Barlow R.E. and Proschan Frank, Statistical Theory of Reliability and Life Testing, Holt Rinebart and Winston Inc., New Yark, 1981
5. Gupta S. C. & Kapoor V.K. Applied Statistics, Sultan Chand & Sons, New Delhi. 2018
6. Hogg R.V. and Criag A.T., Introduction to Mathematical Statistics, Macmillan Publishing, New York, Seventh Edition,2013.

Practical Course III, BSP 236, Statistics Minor Practical – III

Course Objectives: Students should be able to …

1. understand the principles of fitting discrete distributions and modeling sampling from them using Microsoft Excel.
2. gain proficiency in fitting various discrete as well as continuous distributions.
3. develop skills in generating random samples from these distributions using Excel functions.
4. analyze the goodness of fit of the fitted distributions to the observed data.

Credits (Total Credits 2)	**SEMESTER – III BSP 236 Statistics Minor Practical – III**	**No.of hours 60**
	List of Practicals	
	1. Fitting of Discrete Uniform Distribution 2. Fitting of Binomial Distribution 3. Fitting of Hypergeometric Distribution. 4. Fitting of Poisson Distribution 5. Fitting of Geometric distribution 6. Fitting of Negative Binomial distribution. 7. Fitting of Continuous Uniform distribution. 8. Fitting of Exponential distribution. 9. Fitting of Normal distribution. 10. Model sampling from Discrete Uniform Distribution. 11. Model sampling from Binomial distribution. 12. Model sampling from Poisson distribution. 13. Model sampling from Continuous Uniform Distribution. 14. Model sampling from Exponential distribution. 15. Model sampling from Normal distribution. 16. Estimation of Trend by Progressive Average Method. 17. Estimation of Trend by Moving Average Method. 18. Estimation of Trend by Least square estimation method. 19. Construction of Variable Charts. 20. Construction of Attribute Charts.	

Course Outcomes: Students will be able to …

1. understand different methods for analyzing and forecasting time series data.
2. construct control charts for quality control purposes.
3. analyze the goodness of fit of the distributions through a test of goodness of fit

4. interpret the results of fitting and sampling experiments, concluding the suitability of different distributions for modeling real-world phenomena.

References:

1. Gupta S.P, Statistical Methods, Sultan Chand and Sons, New Delhi, 2019
2. Gupta S. C. &Kapoor V.K.: Applied Statistics, Sultan Chand & Sons, New Delhi, 2018
3. Hogg R.V. and Criag A.T, Introduction to Mathematical Statistics, Macmillan Publishing, New York, Seventh Edition, 2013
4. Gupta S.C.& Kapoor V.K., Fundamentals of Mathematical Statistics Sultan Chand& sons, New Delhi, 2014
5. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011
6. Boes D.C and Mood A. M., Introduction to the Theory of Statistics, Tata, McGraw-Hill, New Delhi. Third Edition,1973

VSC Semester – III
BSPVSC 1: Introduction to Power BI

Course Objective: Students should be able to…

1. introduce the concept of business intelligence and data analysis.
2. describe the Power BI interface and basic functionalities.
3. perform data visualization using Power BI.
4. construct a dashboard to solve real-life data.

Credits = 2	**SEMESTER-III** **BSP-VSC-I**	**No. of hours** **60 hours**
	List of Practicals 1. Installation of Power BI Desktop 2. Navigating the Power BI Interface 3. Importing Data into Power BI. 4. Creating Basic Visualizations. 5. Designing Interactive Reports. 6. Exploring Data Sources. 7. Customizing Data Import Options 8. Switching Between Data View and Report View 9. Customizing the Ribbon Interface 10. Creating a Sample Report in 11. Creating Many-to-Many Relationships 12. Handling Role-Playing Dimensions 13. Use of Custom Visuals 14. Implementing Geographic Mapping 15. Applying Time Intelligence Functions 16. Creating Advanced Calculations 17. Optimizing Data Models 18. Implementing Data Security Measures 19. Data modelling techniques 20. Identifying and addressing performance bottlenecks in the data model.	

Course Outcomes: Students will be able to…

1. understand the importance of data analysis in decision-making processes.
2. navigate the Power BI interface and perform basic tasks.
3. gain proficiency in creating simple visualizations and reports using Power BI.
4. develop an appreciation for the role of data visualization in conveying insights effectively.

References:

1. Errin O'Connor and Patrick LeBlanc, Power BI Step by Step, 2022
2. Dan Clark, Beginning Power BI: A Practical Guide to Self-Service Data Analytics with Excel 2016 and Power BI Desktop, 2019
3. Ken Puls and Miguel Escobar, M is for (Data) Monkey: A Guide to the M Language in Excel Power Query, 2019
4. Brett Powell, "Mastering Power BI: Power BI's Advanced Features and Techniques for Experienced Power Users",2018
5. Marco Russo, Alberto Ferrari, and Daniele Perilli, "The Definitive Guide to DAX: Business intelligence with Microsoft Excel, SQL Server Analysis Services, and Power BI", 2014
6. Martijn Evers and Hendrik den Ouden, "Dashboarding and Reporting with Power BI Desktop and Excel: How to Design and Create a Financial Dashboard with PowerPivot – End to End" ,2012

Skill Enhancement Course (SEC) Semester – III
BSPSEC 2: Fundamentals of MATLAB - I

Course Objective: Students should be able to …

1. learn the features of MATLAB as a programming tool.
2. promote a new teaching model that will help to develop programming skills and techniques to solve mathematical problems.
3. understand MATLAB graphic features and their applications.
4. use MATLAB as a simulation tool.

Credits = 2	**SEMESTER-III** **BSPSEC 2**	**No. of hours per 60**
	List of Practicals 1. Statistical Operations in MATLAB 2. Mathematical Operations in MATLAB 3. Reading from in MATLAB 4. Writing to files in in MATLAB 5. Variable handling in MATLAB 6. Array Operation-I using MATLAB 7. Array Operation-II using MATLAB 8. Matrices Operation-I using MATLAB 9. Matrices Operation-II using MATLAB 10. For Loop in MATLAB, While Loop in MATLAB, Conditional in MATLAB 11. Function Debugging, Script Debugging in MATLAB 12. Error Handling, Script Profiling, Script Optimization in MATLAB 13. Statistical Functions - Descriptive Statistics-I in MATLAB 14. Statistical Functions - Descriptive Statistics-I in MATLAB 15. Plotting Techniques 2D Plots-I: in MATLAB 16. Plotting Techniques 2D Plots-II: in MATLAB 17. Plotting Techniques 3D Plots-I: in MATLAB 18. Plotting Techniques 3D Plots-II: in MATLAB 19. Customizing Plots and Annotations-I in MATLAB	

	20. Customizing Plots and Annotations-II in MATLAB	

Course Outcomes: Students will be able to …

1. understand the competence in navigating and utilizing the MATLAB environment.

2. gain proficiency in implementing control structures and employing debugging techniques for efficient MATLAB programming.

3. learn to import and export data from various file formats and enhance their ability to work with real-world datasets.

4. acquire a comprehensive understanding of numerical computing concepts and their applications in MATLAB.

References:

1. Heath, M. T., Scientific Computing: An Introductory Survey. McGraw-Hill Education, 2017
2. Attaway, S. , MATLAB: A Practical Introduction to Programming and Problem Solving (5th ed.). Butterworth-Heinemann, 2019
3. Lohninger, H. , Getting Started with MATLAB. Springer, 2014
4. Higham, N. J. , Accuracy and Stability of Numerical Algorithms (2nd ed.). Society for Industrial and Applied Mathematics, 2002
5. Hahn, B. D., Essential MATLAB for Engineers and Scientists (7th ed.). Academic Press, 2018
6. Knight, A. J. MATLAB Programming for Biomedical Engineers and Scientists. Academic Press, 2017
7. Moon, T. K., & Stirling, W. C., Mathematical Methods and Algorithms for Signal Processing. Prentice Hall, 2000

VEC Semester – III
BSTVEC 2: Environmental Awareness for Statistics

Course Objectives: Students should be able to…

1. understand the role of Statistics in achieving sustainable goals of development.
2. protect and conserve critical environmental resources and invaluable natural and man-made heritage which are essential for life-supporting livelihoods and welfare of the society.
3. gain an awareness of the environmental issues and challenges that can arise in the practice of Statistics.
4. Think critically about complex issues related to sustainable development, such as climate change, poverty, and inequality.

Credits=2	SEMESTER-III BST-VEC-II: Environmental Awareness for Statistics	No. of hours per unit
UNIT I	**Environmental Issues:**	**(08)**
	Pollution (Air, Water and Land), Fresh-water overuse, Natural disasters, Fuel and Energy shortage due to overuse, Increase in wasteland, Biodiversity loss, Global warming and climate change (Causes and intensity of the problem), role of Statistics in creation of environmental issues.	
UNIT II	**Environmental laws and ethics:**	**(07)**
	Environmental Protection Act, Wildlife Protection Act, Forest Conservation Act, Prevention and Control of Pollution Act (Air, Water and Land), from unsustainable to sustainable development, Responsibilities of an Environmentally aware citizen.	
UNIT III	**Sustainable Development Goals:**	**(07)**
	Overview of the Sustainable Development Goals, Sustainable Development Goals in India, Global Indicator Framework, National Indicator Framework Policy and Guidelines,	
UNIT IV	**Role of Statistics in meeting the sustainable development goals (SDGs):**	**(08)**
	Role of data and Statistics in sustainable development goal implementation, official Statistics for SDGs.	

Course Outcomes: Students will be able to…

1. evaluate data and results using Environmental issues in Statistics.
2. create an awareness of the environmental issues that can arise in the practice of Statistics.

3. develop critical thinking and problem-solving skills that are essential for success in the modern world.

References:

1. V Barnett, Environmental Statistics - Methods and Applications, Wiley Series in Probability and Statistics, 2003
2. Environment, Shankar IAS Academy 9th Edition, 2023
3. Sharma, S., and Sharma, K., Environment and society: Climate change and sustainable development. Routledge India, 2023
4. Verma, S. K, and Kumar M. Environmental Ethics and Law, VL Media, 2020
5. Environment and Sustainable Development Goals, Ministry of Statistics & Programme Implementation.
6. http://moef.gov.in/wp-content/themes/moef-green/ebook/ncmefcc/ncmefcc.html
7. Wilson M., Environmental and Ecological Statistics, Murphy & Moore Publishing, 2022

Statistics Major
SEMESTER- IV

Course VII BST 241 PROBABILITY DISTRIBUTIONS

Course Objectives: Students should be able to …

1. understand the properties and applications of Gamma and Beta distributions.
2. comprehend the bivariate normal distribution and multinomial distribution and their applications.
3. differentiate between Univariate and bivariate normal distribution
4. demonstrate the use of different moment inequalities.

Credits (Total Credits 2)	SEMESTER-IV BST 241 Probability Distributions	No. of hours per unit/credits
UNIT – I	**Gamma Distributions**	**(07)**
	1.1 Gamma distribution with scale parameter θ and shape parameter n, Nature of probability curve, special case θ = 1, n =1, m.g.f., c.g.f., mean, mode, variance, moments, cumulants, β1,β2, γ1, and γ2 coefficients. 1.2 additive property: distribution of a sum of i.i.d. exponential variates. 1.3 Relation between distribution function of Poisson and Gamma variates. 1.4 Properties of gamma	
UNIT – II	**Beta distribution**	**(08)**
	2.1 Beta distribution of the first kind: Beta distribution of the first kind with parameters m & n. mean, mode, variance, symmetric when m = n, Uniform distribution as a particular case when m = n = 1, distribution of (1-X). 2.2 Beta distribution of the second kind: Beta distribution of the second kind with parameters m & n. mean, mode, variance, relation between the beta distribution of first kind and second kind, distribution of X+Y, X/Y, and X/(X+Y) where X and Y are independent gamma variate.	
UNIT – III	**Bivariate Normal Distribution & Multinomial Distribution**	**(08)**
	3.1. P.d.f. of bivariate Normal Distribution, BN($\mu_1, \mu_2 \sigma_1^2, \sigma_2^2,$ ρ), marginal and conditional distributions, identifications of parameters, conditional expectation, and conditional variance. 3.2. Distribution of aX+bY+c, where a, b, and c are real numbers. And Examples. 3.3. Multinomial Distribution: Probability mass function	

	(p.m.f.), Joint MGF of (X1,X2, ….Xk), use of MGF to obtain means, variances, covariances, total correlation coefficients, variance-covariance matrix, rank of variance-covariance matrix and its interpretation. 3.4. Additive property of multinomial distribution, univariate marginal distribution, distribution of Xi + Xj, the conditional distribution of Xi even Xj =r, the conditional distribution of Xi given Xi + Xj = r, real-life situations, and applications.	
UNIT – IV	**Order Statistics and Moment Inequalities**	**(07)**
	4.1: Order statistics for a random sample of size n from a continuous distribution, definition, derivation of the distribution function and density function of the i-th order statistic, particular cases for i=1 and i=n. 4.2 : Derivation of joint p. d. f. of i -th and j- th order statistics, statement of distribution of the sample range. 4.3 : Distribution of the sample median when n is odd. 4.4 Chebyshev's inequality for discrete and continuous distributions, Markov Inequality, Chuchy-Schwarz Inequality, Jensen's Inequality, and Lyapunov's Inequality without proof and applications.	

Course outcomes: Students will be able to …

1. understand the bivariate normal distribution, including its probability density function, marginal and conditional distributions, and applications in real-life situations.
2. explain the probability density function of the bivariate normal distribution and its marginal and conditional distributions.
3. describe the probability curve and properties of Gamma distributions, including mean, mode, variance, and additive property.
4. demonstrate an understanding of moment inequalities such as Chebyshev's inequality, and Markov Inequality, and their applications in statistical analysis.

References:

1. Goon, A.M., Gupta M.K. and Dasgupta B, Fundamentals of Statistics Vol. I and Vol. II, World Press, Calcutta, 2016
2. Gupta S. C. & Kapoor V. K., Applied Statistics, Sultan Chand & Sons, New Delhi,2018
3. Gupta S. C. & Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2014
4. Hogg R.V. and Criag A.T., Introduction to Mathematical Statistics, Macmillan Publishing, New York, Seventh Edition, 2013
5. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011

6. Johnson, Norman L., Samuel Kotz, and N. Balakrishnan. Continuous Univariate Distributions. Vol. 1, 2nd ed., Wiley, 1994.
7. Stuart, Alan, and J. Keith Ord. Kendall's Advanced Theory of Statistics, Volume 1: Distribution Theory. 6th ed., Edward Arnold, 1994.

SEMESTER- IV

Course VII BST 242 Sampling Distributions and Statistical Tests

Course Objectives: Students should be able to …

1. understand the concepts and properties of chi-square, t-distribution, and F-distribution.
2. learn the basics of hypothesis testing, including population parameters, types of hypotheses, errors, critical regions, and p-values.
3. perform hypothesis tests for large samples using z-tests and for means, proportions, and correlation using t-tests.
4. comprehend hypothesis tests based on the chi-square distribution for variance, goodness of fit, and independence of attributes.

Credits (Total Credits 2)	SEMESTER-IV BST 242 Sampling Distributions and Statistical Tests	No. of hours per unit/credits
UNIT – I	**Sampling Distributions**	**(07)**
	1.1: Chi-Square distribution: Definition of chi-square, derivation of p.d.f. of the chi-square distribution with n degrees of freedom using m.g.f.. c.g.f., mean, variance, moments, cumulants, mode, skewness and kurtosis, additive property. 1.2: Student's t- t-distribution: Definition of student's t variate. Derivation of p.d.f., mean, mode, variance, moments, $\beta 1$, $\beta 2$, $\gamma 1$ and $\gamma 2$ coefficients. 1.3: Snedecor's F distribution: Definition of F variate, derivation of p.d.f., mean, variance and mode. Distribution of 1/F. Interrelation between t, F and $\chi 2$ (Without Proof).	
UNIT – II	**Basics of Testing of Hypothesis**	**(08)**
	1.1: Notion of Population, Sample, Parameter, Statistic, Sampling distribution of Statistic, hypothesis, Simple and composite hypothesis, Null and alternative hypothesis, type I and type II errors, Critical region, level of significance, p-value. One and two-tailed test, power of the test. 1.2. Large Sample Tests: General procedure of testing of hypothesis. a) Tests for means: i) testing of population mean; H_0: $\mu = \mu_0$ ii) testing equality of population means; H_0: $\mu_1 = \mu_2$ b) Tests for Proportion: i) testing of population Proportion; H_0: $P = P_0$ ii) testing equality of population Proportion; H_0:$P_1 = P_2$ c) test for population correlation: i) H_0: $\rho = \rho_0$ ii) H_0: $\rho_1 = \rho_2$ (by Z-transformation)	
UNIT – III	**Tests based on t and F distribution**	**(08)**
	3.1. Test for means:	

	i) H0: $\mu = \mu_0$ ii) H0: $\mu_1 = \mu_2$, ($\sigma_1^2 = \sigma_2^2$) iii) Paired t-test 3.2. Test for equality of variance: Test for Ho: $\sigma_1^2 = \sigma_2^2$ against one-sided and two-sided alternatives when i) means are known ii) means are unknown.	
UNIT – IV	**Tests based on $\chi 2$ distribution**	**(07)**
	4.1 Test for population variance Ho: $\sigma^2 = \sigma_0^2$ 4.2 Test for goodness of fit 4.3 Test for independence of attributes; a) m x n contingency table b) 2 x 2 contingency table, Yate's correction for continuity	

Course Outcomes: Students will be able to ….

1. understand the fundamental concept of hypothesis testing.
2. differentiate between population, sample, parameter, and statistic, as well as understand the concepts of hypothesis, errors, critical regions, and p-values.
3. apply the procedures for conducting hypothesis tests for means, proportions, and correlation, and interpret the results.
4. demonstrate proficiency in understanding the properties and applications of chi-square, t-distribution, and F-distribution, including their probability density functions, moments, and interrelationships.

References:

1. E. L. Lehmann, Joseph P. Romano, Testing Statistical Hypotheses, Springer New York, Third Edition, 2005
2. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011
3. Gibbons, Jean Dickinson, and Subhabrata Chakraborti. Nonparametric Statistical Inference. 5th ed. Chapman and Hall/CRC, 2011.
4. Hogg R.V. and Criag A.T., Introduction to Mathematical Statistics, Macmillan Publishing, New York, Seventh Edition, 2013
5. Gupta S.C. & Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2014

Practical Course V, BSP 243, Major Statistics Practical – V

Course Objectives: The students should be able to …

1. understand and be able to articulate the practical applications of probability distributions in real-world scenarios.
2. apply statistical techniques to estimate parameters of probability distributions and assess the goodness of fit.
3. assess the fit of continuous distribution on given data.
4. visualize probability distributions through sketches and understand their key characteristics

Credits (Total Credits 2)	**SEMESTER – IV** **BSP 243** **Major Statistics Practical – V**	**No. of hours 60**
	List of Practicals	
	1. Fitting of Continuous Uniform distribution. 2. Fitting of Exponential distribution. 3. Fitting of Normal distribution. 4. Model sampling from Continuous Uniform Distribution. 5. Model sampling from Exponential distribution. 6. Model sampling from Normal distribution by using a Normal table. 7. Model sampling from Normal distribution by using Box-Muller transformation. 8. Application of Exponential distribution. 9. Application of Normal distribution. 10. Application of Bivariate Normal distribution. 11. Application of Multinomial distribution 12. Sketching of Continuous uniform distribution 13. Sketching of Exponential distribution. 15. Sketching of Gamma distribution. 16. Sketching of Beta Distribution. 17. Sketching of Normal Distribution. 18. Application of Order Statistics. 19. Application of Moment Inequalities-I 20. Applications of Moment Inequalities – II	

Course Outcomes: Students will be able to……

1. learn the applications of Continuous Uniform distribution, Exponential distribution, Normal distribution, and Bivariate Normal distribution.
2. assess the fit of continuous distribution.

3. simulate data from various continuous distributions.

4. demonstrate proficiency in generating random numbers following various probability distributions using different methods.

References:

1. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011
2. Hogg R.V. and Criag A.T, Introduction to Mathematical Statistics, Macmillan Publishing, New York, SeventhEdidtion,2013
3. Gupta S.C.& Kapoor V.K., Fundamentals of Mathematical Statistics Sultan Chand& sons, New Delhi, 2014
4. Gupta S. C. &Kapoor V.K.: Applied Statistics, Sultan Chand &Sons, New Delhi, 2018
5. Boes D.C and Mood A. M., Introduction to the Theory of Statistics, Tata, McGraw-Hill, New Delhi. Third Edition,1973

Practical Course VI, BSP 244, Major Statistics Practical VI

Course Objectives: The students should be able to…

1. understand the use of R software for inferential statistics
2. learn large sample tests for means, proportions, and correlation coefficients, and understand their applications in practical scenarios.
3. compute probabilities for the continuous distribution using R – software .
4. conduct hypothesis tests for means, proportions, population correlation coefficients, population variances, goodness of fit, and independence using appropriate distributions.

Credits (Total Credits 2)	**SEMESTER – IV** **BSP 244** **Major Statistics Practical VI**	**No. of hours 60**
	List of Practical	
	1. Application of Chi-square distribution. 2. Application of t- distribution. 3. Application of snedecore -F distribution. 4. Large sample tests for means. 5. Large sample tests for proportions. 6. Tests for population correlation coefficients. (Using Fisher's Z transformation.) 7. Tests based on Chi square distribution. (Test for population variance,). 8. Tests based on Chi square distribution(Test for goodness of fit) 9. Tests based on Chi square distribution (Tests for independence) 10.Tests based on t distribution ($\mu = \mu 0$) 11. Tests based on t distribution ($\mu 1 = \mu 2$) 12. Tests based on t distribution (Paired t-test) 13. Tests based on F distribution. ($\sigma_1^2 = \sigma_2^2$) 14. Use of basic R software commands c( ), scan( ), rep( ), seq( ), min, max, sort, extract, and data. frame, matrix, accessing resident data sets, etc 15. Computation of probabilities of negative binomial, multinomial, normal, exponential, and gamma distribution using R software. 16. Computation of probabilities of t, F, $\chi 2$ distribution using R software. 17. Small Sample tests using R Software 18. Large Sample test using R Software 19. Find probabilities of Type-I and Type-II errors Using R software.	

	20. Sketiching of distribution Using R Software	

Course Outcomes: Students wil be able to……

1. understand use of R software in inferential statistics.
2. perform small sample test on real life data.
3. apply Chi-square, t-distribution, and Snedecor-F distribution in various statistical analyses, including hypothesis testing and estimation.
4. conduct hypothesis tests for both small and large samples using appropriate statistical techniques and software.

References:

1. Gupta S.P, Statistical Methods, Sultan Chand and Sons, New Delhi, 2019
2. Gupta S. C. &Kapoor V.K.: Applied Statistics, Sultan Chand &Sons, New Delhi, 2018
3. Gupta S.C.& Kapoor V.K., Fundamentals of Mathematical Statistics Sultan Chand& sons, New Delhi, 2011
4. Hogg R.V. and Criag A.T, Introduction to Mathematical Statistics, Macmillan Publishing, New York, SeventhEdidtion,2013
5. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011
6. Boes D.C and Mood A. M., Introduction to the Theory of Statistics, Tata, McGraw-Hill, New Delhi. Third Edition,1973

B. Sc. Part-II (Semester-IV)
Statistics Minor
BST-245: Statistical Techniques-II (Credits: 02)
Theory: 30 Lectures (30 Hours)

Course Objectives: Students should be able to…

1. understand the fundamental concept of continuous distributions.
2. explain the relationship among the different distributions.
3. differentiate between Continuous probability distributions and discrete probability distributions.
4. compute various measures of central tendencies and measures of dispersion.

Credits (Total Credits 2)	**SEMESTER – IV BST 245 Statistical Techniques-II**	**No.of hours per unit**
Unit - I	**Testing of Hypothesis**	**(08)**
	The notion of Population, Sample, Parameter, Statistic, Sampling distribution of Statistic, hypothesis, Simple and composite hypothesis, Null and alternative hypothesis, type I and type II errors, Critical region, level of significance, p-value. one and two-tailed test, power of test. Illustrations.	
Unit - II	**Sampling Distribution**	**(07)**
	2.1 Chi-Square distribution: Definition of chi-square, derivation of p.d.f. of chi-square distribution with n degrees of freedom using m.g.f.. c.g.f., mean, variance, moments, cumulants, mode, skewness and kurtosis, additive property. 2.2 Student's t- t-distribution: Definition of student's t variate. Derivation of p.d.f., mean, mode, variance, moments, $\beta 1$, $\beta 2$, $\gamma 1$ and $\gamma 2$ coefficients. 2.3 Snedecor's F distribution: Definition of F variate, derivation of p.d.f., mean, variance and mode. Distribution of 1/F. Interrelation between t, F and $\chi 2$ (Without Proof).	
Unit - III	**Large Sample and Small Sample Test.**	**(08)**
	3.1. Large Sample Tests: General procedure of testing of hypothesis. a) Tests for means: i) testing of population mean; H0: $\mu = \mu 0$ ii) testing equality of population means; H0: $\mu 1 = \mu 2$ 3.2. Small Sample i) H0: $\mu = \mu 0$ ii) H0: $\mu 1 = \mu 2$, iii) Paired t-test	
Unit - IV	**Demography**	**(07)**
	4.1 : Introduction and need of vital statistics 4.2 : Mortality rates: Crude death rate (CDR), Specific Death Rate (SDR), Standardized Death Rate (STDR). 4.3 : Fertility Rates: Crude Birth Rate (CBR), Age Specific Fertility Rate	

	(ASFR), General Fertility Rate (GFR), Total Fertility Rate (TFR). 4.4 : Reproduction Rate: Gross Reproduction rate (GRR), Net Reproduction Rate (NRR).	

Course Outcomes: Students will be able to…

1. understand the concept of continuous distributions with real-life situations
2. determine the probabilities of normal distributed random variables.
3. understand the need for vital statistics and the concept of mortality and fertility
4. measure the trend and seasonality of time series.

References:

1. Agarwal B. L, Statistics, New Age International P Ltd. Delhi, 2015
2. Goon A. M, Gupta M. K. and Dasgupta B, Fundamentals of Statistics Vol. I and II, Calcutta World Press, 2016
3. Gupta S. P, Statistical Methods, Sultan Chand and Sons, Delhi, 2002
4. Barlow R.E. and Proschan Frank, Statistical Theory of Reliability and Life Testing, Holt Rinehart and Winston Inc., New Yark, 1981
5. Gupta S. C. & Kapoor V.K. Applied Statistics, Sultan Chand & Sons, New Delhi. 2018
6. Hogg R.V. and Criag A.T., Introduction to Mathematical Statistics, Macmillan Publishing, New York, Seventh Edition,2013.

Practical Course IV, BSP 246, Statistics Minor Practical IV

Course Objectives: The students should be able to…

1. understand the use of R software for inferential statistics
2. learn large sample tests for means, proportions, and correlation coefficients, and understand their applications in practical scenarios.
3. calculate and interpret mortality, fertility, and reproduction rates in demographic studies.
4. conduct hypothesis tests for means, proportions, population correlation coefficients, population variances, goodness of fit, and independence using appropriate distributions.

Credits (Total Credits 2)	**SEMESTER – IV** **BSP 244** **Statistics Minor Practical IV**	**No. of hours 60**
	List of Practical	
	1. Application of Chi-square distribution. 2. Application of t- distribution. 3. Application of snedecore -F distribution. 4. Large sample tests for means. 5. Large sample tests for proportions. 6. Tests based on t distribution ($\mu = \mu 0$) 7. Tests based on t distribution ($\mu 1 = \mu 2$) 8. Tests based on t distribution (paired t-test) 9. Use of basic R software commands c( ), scan( ), rep( ), seq( ), min, max, sort, extract, and data. frame, matrix, accessing resident data sets, etc 10. Computation of probabilities of negative binomial, multinomial, normal, exponential and gamma, distribution using R software. 11. Computation of probabilities of t, F, $\chi 2$ distribution using R software. 12. Applications of Chi-square distribution. 13. Small Sample tests using R Software 14. Large sample tests for means using R Software. 15. Large sample tests for proportions using R Software. 16. Find probabilities of Type-I and Type-II errors Using R software. 17. Sketching of distribution using R-software. 18. Demography I Mortality rates 19. Demography II Fertility rates 20. Demography III Reproduction Rates.	

Course Outcomes: Students will be able to……

1. understand use of R software in inferential statistics.
2. comprehend fertility and reproduction rates and their implications in demographic analysis.
3. apply Chi-square, t-distribution, and Snedecor-F distribution in various statistical analyses, including hypothesis testing and estimation.
4. conduct hypothesis tests for both small and large samples using appropriate statistical techniques and software.

References:

1. Gupta S.P, Statistical Methods, Sultan Chand and Sons, New Delhi, 2019
2. Gupta S. C. &Kapoor V.K.: Applied Statistics, Sultan Chand &Sons, New Delhi, 2018
3. Gupta S.C.& Kapoor V.K., Fundamentals of Mathematical Statistics Sultan Chand& sons, New Delhi, 2011
4. Hogg R.V. and Criag A.T, Introduction to Mathematical Statistics, Macmillan Publishing, New York, SeventhEdidtion,2013
5. Parimal Mukhopadhyaya, An Introduction to the Theory of Probability, World Scientific Publishing, 2011
6. Boes D.C and Mood A. M., Introduction to the Theory of Statistics, Tata, McGraw-Hill, New Delhi. Third Edition,1973

VSC Semester – IV
BSPVSC 2: Data Integration in Power BI

Course Objective: Students should be able …

1. introduce students to data integration techniques in Power BI.
2. familiarize students with data transformation options using Power Query.
3. provide an understanding of data flows for data preparation.
4. draw insights from data by visualization.

Credits = 2	**VSC SEMESTER-IV** **BSPVSC 2**	**No. of hours 60**
	List of Practicals 1. Exploring Data Sources and Formats 2. Data Extraction Techniques 3. Data Transformation Using Power Query 4. Data Cleansing and Standardization 5. Data Enrichment and Augmentation 6. Exploring Data Integration Strategies 7. Data Loading Techniques 8. Addressing Data Integration Challenges 9. Designing Data Integration Workflows 10. Performance Optimization Exercise 11. Real-Time Data Integration 12. Big Data Integration 13. Data Virtualization 14. Master Data Management (MDM) 15. Cloud Data Integration 16. Data Governance and Compliance 17. Data Quality Management 18. Data Integration Architecture and Design Patterns 19. Emerging Trends and Technologies in Data Integration 20. Case Study and Solution Implementation in Data Transformation	

Course Outcomes: Students should be able to …

1. understand various data integration techniques and their applications.
2. proficient in performing data transformation tasks using Power Query.
3. capable of creating and managing data flows for data preparation and reuse.
4. implement best practices for ensuring data governance and compliance within Power BI projects.

References :

1. Brett Powell, "Power BI Cookbook: Creating Business Intelligence Solutions of Analytical Data Models, Reports, and Dashboards", 2018
2. Gordon S. Linoff and Daniel T. Vodoo,"Data Analysis Using SQL and Excel", 2016
3. Alberto Ferrari and Marco Russo, "Analyzing Data with Power BI and Power Pivot for Excel", 2017
4. Chris Webb, "Power Query for Power BI and Excel",2014
5. Leila Etaati and Matt Allington, "Advanced Analytics with Power BI and R", 2017
6. Phil Seamark, "Power BI Desktop Advanced", 2019
7. Grant Paisley, "Mastering Power BI: Unlock deeper insights with the buildout of BI reporting and dashboards from distributed data sources", 2023
8. Teo Lachev, "Applied Power BI: Bring Your Data to Life!", 2018

Skill Enhancement Course (SEC), Semester IV

BSPSEC 3 Fundamentals of MATLAB - II

Course Objective: Students should be able to…

1. learn features of MATLAB as a programming tool.
2. promote new teaching model that will help to develop programming skills and techniques to solve mathematical problems.
3. understand MATLAB graphic features and their applications.
4. use MATLAB as a simulation tool.

Credits = 2	**SEMESTER-IV** **BSP-SEC-I**	**No. of hours 60**
	List of Practicals 1. Basic visualization in MATLAB 2. Generate a random sample from a specified probability distribution and calculate descriptive statistics. 3. Generates random numbers from Normal distribution using MATLAB 4. Generates random number from Binomial distribution using MATLAB 5. Generates random numbers from Poisson distribution using MATLAB. 6. Plot a histogram and a density plot to visualize the Poisson distribution 7. Confidence intervals and their interpretation using MATLAB-I 8. Confidence intervals and their interpretation using MATLAB-II 9. Correlation and Visualizing Correlation: using MATLAB-I 10. Correlation and Visualizing Correlation: using MATLAB-II 11. Regression and Visualizing Correlation: using MATLAB-I 12. Regression and Visualizing Correlation: using MATLAB-II 13. Fitting Multiple Linear Regression Model using MATLAB. 14. The t-test on a paired dataset and interpret the results in MATLAB 15. The t-test on a independent dataset and interpret the results	

	in MATLAB 16. The Wilcoxon signed-rank test on a paired dataset and interpret the results in MATLAB 17. The Mann-Whitney U test and interpret the results in MATLAB 18. Parametric ANOVA using MATLAB 19. Non- Parametric ANOVA using MATLAB 20. Two way ANOVA using MATLAB	

Course Outcomes: Students should be able to …

1. demonstrate proficiency in basic data visualization techniques in MATLAB and gain an understanding of various probability distributions.
2. understand the concept of confidence intervals and how to interpret them.
3. gain an introduction to correlation analysis and performing correlation analysis in MATLAB.
4. knowledge of both parametric and non-parametric statistics, including performing non-parametric tests in MATLAB.

References:

1. Moore, D. S., McCabe, G. P., & Craig, B. A., Introduction to the Practice of Statistics 8th edition, W. H. Freeman, 2015
2. Peck, R., Olsen, C., & Devore, J. L, Introduction to Statistics and Data Analysis, 6th edition, Cengage Learning, 2019
3. Field, A., Miles, J., & Field, Z. , Discovering Statistics Using R. Sage Publications, 2012
4. Kinney, J. B., & Atwal, G. S. , Equations of Life: How Physics Shapes Evolution. W. W. Norton & Company, 2018
5. Wackerly, D., Mendenhall, W., & Scheaffer, R. L., Mathematical Statistics with Applications, 7th edition, Cengage Learning, 2014
6. Ott, R. L., Longnecker, M., & Witt, R., An Introduction to Statistical Methods and Data Analysis 7th edition, Cengage Learning, 2015
7. Faraway, J. J. , Extending the Linear Model with R: Generalized Linear, Mixed Effects and Nonparametric Regression Models 2nd edition, Chapman and Hall/CRC, 2016
8. Zar, J. H. , Biostatistical Analysis 5th edition, Pearson Education, 2013.

BSTCC 2, Semester IV

BSTCC 2 Value education through cultural programs

Course objectives:
Students should be able to …

1. examine the role of cultural programs in promoting values education.
2. enhance critical thinking skills through the analysis of cultural data.
3. understand the role of statistics in evaluating the effectiveness of cultural programs.
4. encourage social responsibility through the application of statistical knowledge to address societal challenges.

Credits = 2	**SEMESTER-IV** **BSTCC 2**	**No. of hours30**
Unit I	**Introduction to Value Education** Definition of values, Importance of values in personal and societal life,need of value education, Historical and cultural perspectives on values, Ethical Theories and Perspectives, Moral Development, and Character Education.	7
Unit II	**Value education through cultural programs** Definition, types of cultural programs in college, values like empathy, brotherhood, faith, care, love, and affection inculcated through cultural programs.	8
Unit III	**Value Education and Statistics** Theoretical Foundations of Value Education, Statistical Analysis of Values, Ethical Foundations in Data Analysis, Ethical Considerations in Values Research, Applications of Statistics in Values Education, Future Directions and Challenges.	8
Unit IV	**Role of Statistics in value education through cultural programs** Statistical Analysis of Cultural Programs, PracticalApplications of Statistics in Cultural Programs, Cultural Impact, Exampleson Cultural Program Evaluation.	7

Course outcomes:

Students will be able to…

1. explores the role of statistics in understanding and promoting values through cultural programs.
2. learn statistical techniques to analyze cultural data, evaluate the impact of cultural initiatives on societal values, and develop strategies for effective value education through cultural activities.
3. explore the relationship between cultural participation and value education.

4. analyze statistical methods for measuring the impact of cultural programs on societal values.
5. evaluate ethical considerations in using statistics to inform value education through cultural programs.

References

1. Kalliopi Zervanou, et al., Ethical Data and Information Management: Concepts, Tools, and Methods, 2020
2. Smith, K., Statistics for Value Education: Applications in Cultural Programs, 2022
3. Jons, A., Data-Driven Culture: Leveraging Statistics for Value Education in Cultural Programs, 2020
4. Garcia, M., Statistical Methods for Cultural Analysis, 2019
5. Wilson, J., Values and Education: A Statistical Perspective, 2018
6. Brown, R., Cultural Programming and Value Education: A Statistical Approach, 2021
7. Miller, L., Data-Driven Decision-Making in Cultural Programming, 2020