



**Hindi Vidya Prachar Samiti's
Ramniranjan Jhunhunwala College
of Arts, Science & Commerce
(Empowered Autonomous College)**

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus of Statistics Major for the T.Y.B.Sc. Semester- VI (under NEP)

Program: B.Sc. STATISTICS

Program Code: RJSUSTA

(REVISED in 2025-2026 in alignment with the NEP2020 facilitating the inter-and multidisciplinary learning and multiple entry and exit of the students)

(CBCS 2025-2026)

Preamble

The National Education Policy 2020 aims at imparting skill-based learning and caters to the multiple entry and exit facility for the students thus empowering them to acquire knowledge at their pace. In the three-year UG program, the student has two exit options. Students also have the option of choosing the Honors program of four years study in a given discipline and later converting it to a five-year integrated PG degree program. As an undergraduate student, he/she learns the core subject (Major), subject complementing the core subject (Minor), a course from another discipline (OEC or GEC), Vocational and Skill Enhancement course from the Major (VSEC). The remaining verticals under NEP 2020 are IKS (Indian Knowledge System), AEC (Ability Enhancement Course), VEC (Value Enhancement Course) and with progressive three years of UG, student also completes at different levels OJT (On Job Training), FP (Field Projects), CEP (Community Engagement Program), RP (Research Project) which helps him/her in understanding their roots, application of the knowledge for the benefit of self and the society. Vertical CC (Co-curricular activities and activities related to yoga and human well-being) helps in preparing youth with good character and interpersonal relationships.

**Credit Structure for B Sc Semester V as per NEP 2020 Implemented
from the academic year 2025-2026****Course Code: RJDSESTA****Semester VI****Level 5.5 Major Statistics**

Courses	Credits	Total Credits	Course Code
Discipline Specific Core -I Distribution Theory and Stochastic Processes	4	12	RJDSCSTA361
Discipline Specific Core -II Testing of Hypothesis	4		RJDSCSTA362
Discipline Specific Core -III Practical on DSC-I and DSC-II	4		Practicals related to DSC I and II RJDSCSTAP361
Discipline Specific Elective- I Elements of Actuarial Science	4	4	RJDSESTA361
Discipline Specific Elective- II Introduction to Six Sigma			RJDSESTA362
Vocational Skill Course (VSC) Foundations of Python Programming	2	2	RJVSCSTAP361
On Job Training (OJT)	4	4	RJOJTSTA361
Total Credits	22	22	

***As per University Grid**

DISTRIBUTION OF TOPICS AND CREDITS**T.Y.B.Sc. STATISTICS SEMESTER VI**

Vertical	Course Code	Nomenclature	Topics	Credits
DSE (4 credits)	RJDSESTA361	Elements of Actuarial Science	Unit-I Mortality Tables Unit- II Compound Interest And Annuities Certain Unit- III Life Annuities Unit- IV Assurance Benefits	04
	OR			
	RJDSESTA362	Introduction to Six Sigma	Unit-I Introduction to Basic Statistics Unit-II Six Sigma Unit-III Control Charts -I Unit- IV Control Charts -II	04

SEMESTER	:	VI (ELECTIVE SUBJECT)
TITLE OF THE SUBJECT/COURSE	:	Elements of Actuarial Science
COURSE CODE	:	RJDSESTA361
CREDITS	:	04
DURATION	:	60 HOURS

LEARNING OBJECTIVES	
1.	To study the different concepts of mortality, fertility rate, death rate, various mortality tables and life tables.
2.	Explain the function and responsibilities of actuaries in the insurance, finance, and risk management industries.
3.	To solve the problem based on compound interest, present value & accumulated value & different types of annuities.
4.	Understand and use commutation functions to evaluate life assurance benefits.
5.	Calculate the present value of various assurance plans and net level annual premiums, including for limited premium payment terms.

COURSE OUTCOME NUMBER	On completing the course, the student will be able to:	PSO Addressed	BLOOMS LEVEL
CO1	define and compute key demographic and fertility indicators such as crude death rate, specific death rates, fertility rates, reproduction rates, and Pearl's index.	2, 3	BT Level II understand
CO2	understand and apply vital statistics and mortality measures, construct and interpret life tables, analyze mortality functions and laws, and evaluate demographics.	3, 4	BT Level I, II and III remember, understand and apply
CO3	apply time value of money concepts to compute present and future values of annuities and insurance benefits.	2, 3, 4	BT level III and IV apply and analyze
CO4	calculate net premiums and net premium reserves for various life insurance and annuity products.	2, 3, 4,7	BT level II III and IV understand, apply and analyze

SEMESTER VI (THEORY)		L	Cr
DSE I: Elements of Actuarial Science	Paper Code: RJDSESTA361	60	4
<i>UNIT I</i>		15	
<i>MORTALITY TABLES</i>			
1	Introduction to Vital Statistics, Use of Vital Statistics, Methods of obtaining Vital Statistics - Registration Method, Census Method. Definitions of (i) Crude Death Rate (ii) Specific Death Rates (iii) Standardised Death Rates (iv) Crude Birth Rate (v) General Fertility Rate (vi) Specific Fertility Rate (vii) Total Fertility Rate.		
2	Mortality Table or Life Table - Introduction & Assumption Various mortality functions. Probabilities of living and dying. The force of mortality. Estimation of μ_x from the mortality table. Laws of mortality: Gompertz's and Makeham's first law. Select, Ultimate and Aggregate mortality tables. Stationary population. Central Mortality Rate Expectation of life and Average life at death. Uses of Mortality table.		
<i>UNIT II</i>		15	
<i>COMPOUND INTEREST AND ANNUITIES CERTAIN</i>			
1	Accumulated value and present value, nominal and effective rates of interest. Varying rates of interest. Discount and Discounted Value. Equation of value. Equated time of payment. Present and accumulated values of annuity certain (immediate and due) with and without deferment period.		
2	Present value for perpetuity (immediate and due) with and without deferment Period. Present and accumulated values of (i) increasing annuity (ii) increasing annuity when successive instalments form arithmetic progression (iii) annuity with		

	frequency different from that with which interest is convertible.		
UNIT III		15	
LIFE ANNUITIES			
	Present value in terms of commutation functions of Life annuities and Temporary life annuities (immediate and due) with and without deferment period. Present values of Variable, increasing life annuities and increasing Temporary life annuities (immediate and due).		
UNIT IV		15	
ASSURANCE BENEFITS			
	Present value of Assurance benefits in terms of commutation functions of : (i) pure endowment assurance (ii) temporary assurance (iii) endowment assurance (iv) whole life assurance (v) double endowment assurance (vi) special endowment assurance (vii) deferred temporary assurance Net premiums: Net level annual premiums (including limited period of payment) for various assurance plans. Natural and Office premiums.		

References:

1. Neill A. : Life Contingencies, First edition, Heineman educational books London
2. Dixit S.P., Modi C.S., Joshi R.V.: Mathematical Basis of Life Assurance, First edition Insurance Institute of India.
3. S.C. Gupta and V.K. Kapoor : Fundamentals of Applied Statistics, sultan chand and sons.

SEMESTER	:	VI (ELECTIVE SUBJECT)
TITLE OF THE SUBJECT/COURSE	:	Introduction to Six Sigma
COURSE CODE	:	RJDSESTA362
CREDITS	:	04
DURATION	:	60 HOURS

LEARNING OBJECTIVES
1. Understanding the fundamentals of Six Sigma, including its principles and methodologies
2. Identifying and reducing process variations to improve quality and efficiency.
3. Utilizing statistical tools for data-driven decision-making and process improvement.
4. Enhancing cost reduction strategies by optimizing resources and minimizing defects.

COURSE OUTCOME NUMBER	On completing the course, the student will be able to:	PSO Addressed	BLOOMS LEVEL
CO1	understand the principles and significance of Six Sigma in quality management and process improvement.	1, 3	BT Level II understand
CO2	gain proficiency in using statistical tools such as control charts and process capability analysis to measure and improve quality.	3, 4	BT Level I , II and III remember, understand and apply
CO3	identify process inefficiencies, reduce variation, and minimize defects using Six Sigma techniques.	3, 4, 6	BT level II III and IV understand apply and analyze
CO4	develop an understanding of Lean Six Sigma, which integrates Lean principles with Six Sigma to eliminate waste and enhance productivity.	3, 7	BT level II III and IV understand, apply and analyze

SEMESTER VI (THEORY)		L	Cr
DSE II: Introduction to Six Sigma	Paper Code: RJDSESTA362	60	4
<i>UNIT I</i>		15	
<i>INTRODUCTION TO BASIC STATISTICS</i>			
1	Descriptive Statistics, Data Distribution, Skewness, Kurtosis, Box and Whisker plots, Inferential Statistics (Sample, Population, Normal Distribution, CLT theorem, Sampling distribution of mean), Hypothesis testing with Normal and Non-Normal data : [1 and 2 sample tests, 1 sample variance, One way ANOVA, Mann-Whitney U test, Kruskal-Wallis test, Mood's median test, Chi-square test], Regression analysis, Designed experiments.		
<i>UNIT II</i>		15	
<i>SIX SIGMA</i>			
1	History and concept, Basic Principles, Goals, six sigma v/s TQM, ISO 9000, Traditional Management, Quality defined, VOC and CTQ, Quality measurement to six sigma, Seven tools of quality and its application: 1) Histogram or Stem and Leaf display. 2) Check sheet. 3) Pareto Chart. 4) Cause and Effect diagram (Fish bone Diagram) 5) Defect concentration diagram. 6) Scatter diagram. 7) Control charts (Only concept of control chart), DMAIC with case study, introduction to Lean Six Sigma.		
<i>UNIT III</i>		15	
<i>CONTROL CHARTS I</i>			
1	Introduction, Chance and assignable causes, Statistical basis of the control chart: Basic principles of control chart (Shewhart control charts), Choice of control limits, Sample size and sampling frequency, Rational subgroups, Analysis of patterns on control charts, Discussion of sensitizing rules for control chart. Introduction to the concept of attribute, Defect. P, np, c and u		

	charts, their uses. p-chart with variable sample size. Operating-Characteristic function, Average run length. Applications of variable control charts.(In addition problems involving setting up standards for future use is also expected), Guidelines to implement control charts. (In addition problems involving setting up standards for future use is also expected).		
UNIT IV			
CONTROL CHARTS II		15	
1	Control chart for variables variables. X-Bar, R, S [sample standard deviation] (Construction, charts based on standard values, Interpretation), OperatingCharacteristic function, Average run length. Applications of variable control charts. Introduction to process capability concept, Specification limits, natural tolerance limits and their comparisons, estimate of percent defectives, Capability ratio and Capability indices(Cp), Capability performance indices Cpk with respect to machine and process interpretation, relationship between i) Cp and Cpk ii) Defective parts per million and Cp.		

References:

1. Fundamental of Mathematical Statistics, Gupta and Kapoor.
2. Probability and Random process by T. Veerarajan.
3. Six Sigma For Business Excellence, (2005), Penelope Przekop, McGraw-Hill Six Sigma Handbook, by Pyzdek, McGraw Hill Education; 4 edition (1 July 2017).
4. The Certified Six Sigma Green Belt Handbook, Roderick A. Munro and Govindarajan Ramu , American Society for Quality (ASQ),
5. What Is Design For Six Sigma,(2005), Roland Cavanagh, Robert Neuman, Peter Pande, Tata McGraw-Hill
6. The Six Sigma Way: How GE, Motorola, And Other Top Companies Are Honing Their Performance, (2000), Peter S. Pande, Robert P. Neuman, Roland R. Cavanagh, McGrawHill
7. What Is Lean Six Sigma,(2004), Mike George, Dave Rowlands, Bill Kastle, McGrawHill
8. Six Sigma Deployment,(2003), Cary W. Adams, Charles E Wilson Jrs, Praveen Gupta, Elsevier Science.
9. Six Sigma For Beginners: Pocket Book (2018), Rajiv Tiwari Kindle Edition
10. Introduction to Statistical Quality Control(2009), Montgomery, Douglas, C ,Sixth Edition, John Wiley & Sons.Inc.:
11. Statistical Quality Control: E.L.Grant. 2nd edition, McGraw Hill, 1988.
12. Quality Control and Industrial Statistics: Duncan. 3rd edition, D.Taraporewala sons & company.
13. Quality Control: Theory and Applications: Bertrand L. Hansen, (1973),Prentice Hall of IndiaPvt. Ltd..
14. Introduction to Statistical Quality Control(2009), Montgomery, Douglas, C. , Sixth Edition,

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John Wiley & Sons, Inc.:

15. Quality Control (1976), I.V. Burr, Mardekkar, New York, 16. Fundamentals of Applied Statistics , Gupta and Kapoor

Scheme of Examinations

1. Evaluation will be for 100 marks based on both internal and external assessment.
2. Internal examination of 40 Marks based on MCQ/ True or false/ Short answers / Assignments / Projects / Seminar.
3. External examination (Semester End Examination) of 60 marks based on all units.
4. Minimum marks for passing the examination is 40 %.
5. Students must appear for at least one Internal to be eligible for the Semester End Examination.
6. Students must appear for the Semester End Examination to be able to complete total credits for a given Semester.
7. HOD's decision, in consultation with the Principal, shall remain final and abiding to all.

Evaluation and Assessment
(Based on the centralised guidelines given by EC under NEP 2020)

Internal examination : 40 Marks

Internal examination consists of 2 types of assessments as follows:

Internal Assessment	Max Marks	Duration	Evaluation Particulars
1	20 /25	30 Minutes	MCQ / True or False / Short Answers
2	20/15	Based on set of rules	Projects / Assignments / Seminar

External examination : 60 Marks

Duration: 2 hours.

Theory question paper pattern at the end of the semester for each course is as follows:

Question no.	Max Marks	Question based on
1	15 (with internal option)	Unit I
2	15 (with internal option)	Unit II
3	15 (with internal option)	Unit III
4	15 (with internal option)	Unit IV
Total	60	

Key to set effective Question paper:

Question	Knowledge	Understanding	Application and Analysis	Total marks- Per unit
Unit 1	06	05	04	15
Unit 2	06	05	04	15
Unit 3	06	04	05	15
Unit 4	06	04	05	15
-TOTAL- Per objective	24	18	18	60
% WEIGHTAGE	40%	30%	30%	100%

Mapping of the course to Local/ Regional/National/International relevance

Class	Course Name	Course Code	Local relevance	Regional relevance	National relevance	International relevance
T Y B Sc Statistics DSE-I	Elements of Actuarial Science	RJDSESTA361	It helps in insurance, pensions, and public planning by equipping students with skills to analyze risk, mortality, and demographic trends.	It lies in its application to local insurance, pension systems, and risk management, tailored to demographic and economic conditions.	The elements of Actuarial Science are nationally relevant for managing risk, designing insurance products, and ensuring financial stability in sectors like healthcare, pensions, and social security.	It lies in its application to global insurance, pension systems, and risk management practices, ensuring financial stability and sustainability across diverse economies.
T Y B Sc Statistics DSE-II	Introduction to Six Sigma	RJDSESTA362	It is a methodology aimed at improving business processes by reducing variability and eliminating defects. When we talk about its <i>local relevance</i> , we mean how Six Sigma principles and	Six Sigma's regional relevance lies in its ability to adapt to the specific needs of different areas based on their dominant industries. Across regions, Six Sigma supports local industries in achieving	Six Sigma holds strong National relevance as industries across India adopt it to improve quality and efficiency. Manufacturing hubs like Pune, Chennai, and Gujarat use Six Sigma to	Six Sigma has global relevance as a widely recognized methodology for improving processes, reducing defects, and ensuring high quality across industries. From manufacturi

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			practices are adapted, adopted, and valued within a specific local context.	higher efficiency, quality, and global competitiveness.	enhance production standards, while IT and service sectors in Bengaluru and Hyderabad apply it for process optimization.	ng to healthcare and IT, Six Sigma's data-driven approach helps businesses meet international quality standards and achieve operational excellence, making it essential for companies aiming for global success.
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Mapping of the course to Employability/ Entrepreneurship/Skill development

The courses in Statistics have been designed to impart one or more skills to make students employable.

Class	Course Name	Course Code	Topic focussing on Employability/ Entrepreneurship/s skill development	Employability/Entrepreneurship/Skill development	Specific activity
TYBSC SEM VI	Elements of Actuarial Science	RJDSESTA361	Unit-I Mortality Tables Unit- II Compound Interest And Annuities Certain Unit- III Life Annuities Unit- IV Assurance Benefits	1. Strong foundation for careers in actuarial science, insurance, pension management, risk management, and financial consulting. 2. Ability to design and launch actuarial consultancy services, advising clients on risk management, insurance, and pension planning. 3. Develop strong problem-solving, analytical thinking, and decision-making skills in high-pressure scenarios.	
	Introduction to Six Sigma	RJDSESTA362	Unit-I Introduction to Basic Statistics Unit-II Six Sigma Unit-III Control Charts -I Unit- IV Control Charts -II	1. Six Sigma enhances employability by improving skills in process optimization, quality management, and problem-solving. 2. Entrepreneurs in manufacturing, services, and startups can build a culture of continuous improvement from the beginning.	

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				3. Six Sigma provides essential skills in problem-solving, statistical analysis, data-driven decision-making, and project management.	
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Integration of Cross cutting Issues

Class	Course Code	Cross Cutting Issues
T Y B Sc Statistics Major	RJDSESTA361 RJDSESTA362	Equity and inclusion, Human values, Innovation UNSDG 4, 5, 8, 9,11,17